

Draft Basic Assessment Report for the Proposed Piet Retief X22, Mpumalanga Province

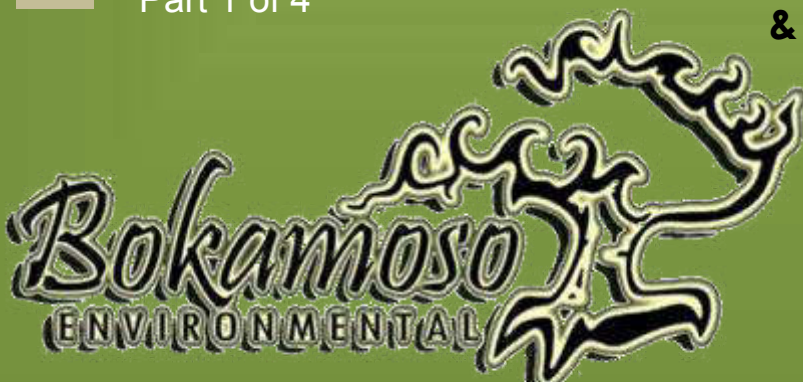
A Portion of Portion 100 of the farm Piet Retief Town and
Townlands 149-HT



MDEDET Reference No: 17/2/3/GS-239

March 2015

Part 1 of 4



**BOKAMOSO LANDSCAPE ARCHITECTS
& ENVIRONMENTAL CONSULTANTS**

P.O. BOX 11375

MAROELANA

0161

TEL: (012) 346 3810

Fax: 086 570 5659

Email: Lizelle@mweb.co.za

TABLE OF CONTENTS

BASIC ASSESSMENT REPORT

1.	DESCRIPTION OF THE ENVIRONMENT	1
1.1	Geographic Aspects	3
1.1.1	Geographical Location	3
1.1.2	Locality	4
1.2	Biophysical Aspects	4
1.2.1	Geology and Soils	4
1.2.2	Climate	8
1.2.3	Topography	9
1.2.4	Hydrology	10
1.2.5	Agricultural Potential	14
1.2.6	Flora and Fauna	15
1.3	Social Aspects	17
1.3.1	Archaeology	17
1.3.2	Existing and Proposed Zoning and Land-Use	18
1.3.3	Proposed Zoning and Land-Use	24
1.3.4	Qualitative Environment	27
1.3.5	Services	34
1.3.5.1	Water Supply	34
1.3.5.2	Sewage	36
1.3.5.3	Storm water	37
1.3.5.4	Solid Waste Removal	37
1.3.5.5	Electricity	38
1.3.5.6	Road Access	38
2.	APPLICABLE LEGISLATION AND GUIDELINES	39
2.1	Activities applied for in terms of NEMA	39
2.2	Relevant Legislations and Regulations	45
2.2.1	International Legislations and Regulations	45
2.2.2	National Legislations and Regulations	45
3.	DETAILS OF THE PUBLIC PARTICIPATION PROCESS	53

4.	LONGTERM SUSTAINABILITY, NEED AND DESIRABILITY	54
4.1	Need	54
4.2	Desirability	55
4.2.1	The Site	55
4.2.2	General	56
4.3	Feasibility Study	57
5.	IDENTIFIED ALTERNATIVES	59
5.1	No-Go Alternative	58
5.2	Locality Alternative	59
5.3	Land-Use Alternative	59
5.3.1	Agricultural	59
5.3.2	Residential	60
5.3.3	The Development of a Shopping Centre (Preferred Option)	60
5.3.4	Conservation Area	60
5.4	Layout Alternatives	61
5.4.1	The Original Layout	61
5.4.2	Final Layout	61
6.	DESCRIPTION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS	61
6.1	Environmental Impact Description, Environmental Management & Mitigation Measures	61
6.1.1	Construction Related Impacts	62
6.1.2	Operational Related Impacts	72
6.2	Significance Description Methodology	77
6.3	Significance Assessment	80
6.4	Discussion of Significance Assessment	87
7.	INPUTS AND RECOMMENDATIONS BY SPECIALISTS	88
8.	ENVIRONMENTAL MANAGEMENT PLAN	88
9.	ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE	88

9.1	Assumptions	88
10.	ENVIRONMENTAL IMPACT STATEMENT	89
10.1	The Physical and Biological Environment	89
10.2	The Socio-Economic Environment	90
11.	CONCLUSION AND RECOMMENDATIONS	91

TABLES

Table 1: Property Description of the Application Site	2
Table 2: Visual Impact Assessment Criteria	27
Table 3: Listed activities in terms of Notice R544 & R546	40
Table 4: 2014 Amended NEMA EIA Regulations: Listed Activities that will most probably be triggered:	42
Table 5: Severity Ratings	79
Table 6: Calculation and Result of the Significance Assessment of Impacts Identified to be Associated with the Proposed Development	80

APPENDICES

Appendix A: Site plan(s)
Appendix B: Photographs
Appendix C: Facility illustration(s)
Appendix C1: The Original Layout
Appendix C2: Final Layout-The Preferred Layout
Appendix D: Specialist Reports
Appendix D1 – Geotechnical Report
Appendix D2 – Wetland Delineation
Appendix D3 – Ecological Assessment
Appendix D4 – Services Report
Appendix D5 – Traffic Impact Study

Appendix D6 – Floodline Study
Appendix D7 – Feasibility Report

Appendix E: Other Information
Appendix E1 - Environmental Management Plan (EMP)

Appendix F: Public Participation
Appendix F1 - Site Notice
Appendix F2 – Public Notice
Appendix F3 – Emails to I&APs and Councilors
Appendix F4 – Newspaper Advertisements
Appendix F5 – List of all registered persons, organisations & organs of state
Appendix F6 – Comments & Response Report
Appendix F7 – Correspondence to and from I&APs

Appendix G: Enlarged Figures

Figure 1 - Locality Map
Figure 2 -Aerial Map
Figure 3 - Geology
Figure 4 – Contour Elevation Map
Figure 5 – Hydrology Map Study Area
Figure 6 - Hydrology Map Larger Area
Figure 7 – Wetland Delineation Map
Figure 8 - Agricultural Potential Map
Figure 9 - Sensitivity Map
Figure 10 - Photograph Municipal Buildings – Brand Street
Figure 11- Municipal Buildings on Corner of Brand Street and Kerk Street
Figure 12 - Municipal Buildings Brand Street
Figure 13 - Photograph Disaster Management Facility
Figure 14- Open Space Area Associated With the Study Area As
Viewed From Kerk Street
Figure 15- Cashbuild as Viewed from Kerk Street
Figure 16 - Surrounding Land-Use Map compiled by NUPLAN
Development Planners

Figure 17 - Proposed Land-Use

Figure 18 - Layout Map as Designed by Paragon Architects

Figure 19 - Visibility Map

Figure 20 – Services Map (Water and Sewer)

Figure 21 – Road Improvements Map

Appendix H: Application Form and correspondence to and from Mpumalanga
Provincial Government

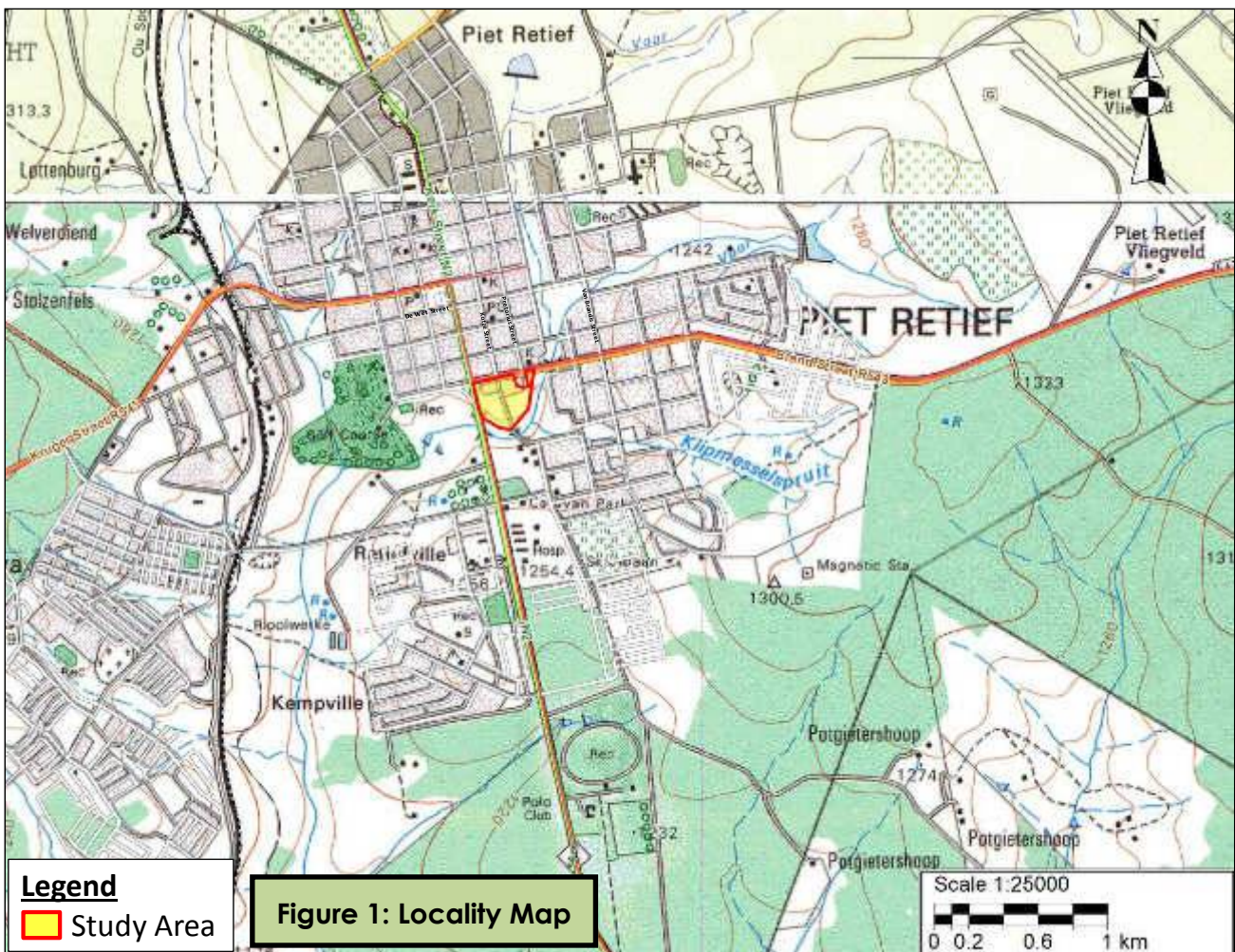
Appendix I: Company Profile & CV

DRAFT BASIC ASSESSMENT REPORT

1. DESCRIPTION OF THE ENVIRONMENT

Zarafusion (Pty) Ltd is planning the proposed **Piet Retief Extension 22** Shopping Mall development that is situated on a Portion of Portion 100 (Portion of Portion 1) of the farm Piet Retief Town and Townlands 149 HT (to be known as Portion 126). The study area is furthermore situated on the south-eastern quadrant of the intersection between Brand Street (R543) (which runs in a west-east direction) and Kerk Street (N2) (which runs in a south-north direction). Brand Street runs along the northern boundary of the study area and Kerk Street runs along the western boundary of the study area. One of the proposed accesses to the study area will be from Brand Street and the other access point will be in Kerk Street.

(Refer to Figure 1 and Figure 2 below and Appendix G for Enlarged Figures)



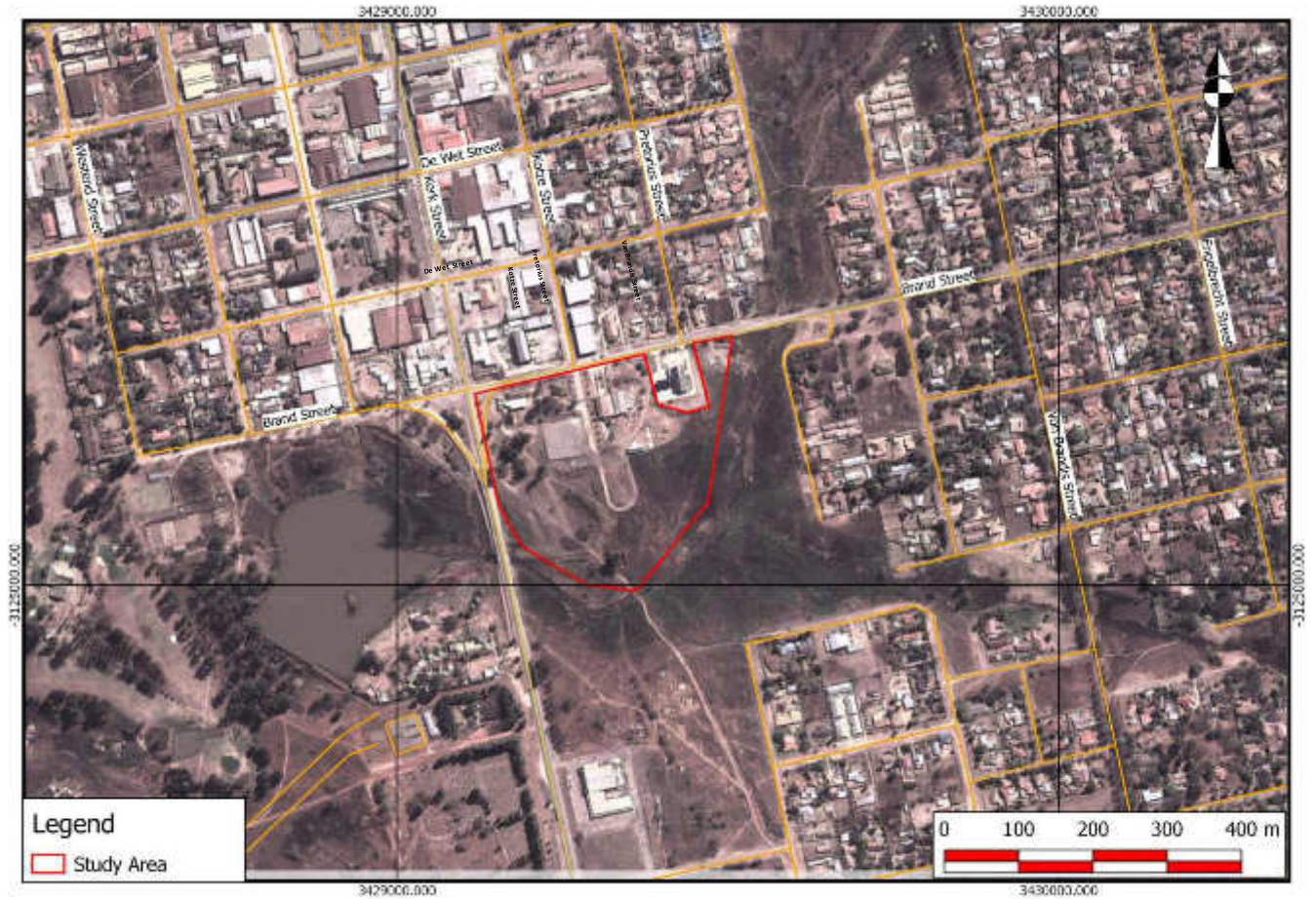


Figure 2: Aerial Map

The study area is approximately 7.516 ha in size and is situated near the geographical centre of Piet Retief Town, which falls under the **Mkhondo Local Municipality** and within the area of the **Gert Sibande District Municipality, Mpumalanga Province**.

The property descriptions of the application site are presented in **Table 1**.

Table 1: Property Description of the application site

Property Description:	Surveyor-General 21 Digit Site Reference Number	Title Deed Number
Portion 100 (A Portion of Portion 1) of the farm Piet Retief Town & Townlands 149-HT	TOHT00000000014900100	T 50461/1990

The proposed zoning for the property is as follows:

The proposed development buildings erected will be used for purposes of shops, businesses, offices places of refreshments, dry cleaners, motor dealers and motor display, as well as related uses subservient to the above.

The proposed development will entail the following:

The proposed height	:	Not exceed 2 storeys
FAR	:	The floor area ratio shall not exceed 0.6.
Coverage	:	Not exceed 60%
Parking	:	Parking shall be in accordance with provision Clause 19, Table E of the Piet Retief Town-planning Scheme, 1980.

Aspects affecting the proposed development will be described in terms of the geographical, biophysical, social, economical and cultural aspects:

1.1 Geographic Aspects**1.1.1 Geographical Location**

Piet Retief is located in the south eastern part of Mpumalanga province, next to Swaziland. Piet Retief is considered to be a centrally placed town that services not only the formal towns but surrounding smaller towns and rural villages as well. The position of the activity has been indicated below, using the latitude and longitude of the centre point of the site.

	Latitude (S):	Longitude (E):
Piet Retief x 22	27° 0'38.90"S	30°48'22.07"E

1.1.2 Locality

➤ **Local Context (Refer to Figure 1 & 2 above and Appendix G for Enlarged Figures)**

The area investigated forms a portion of Portion 100 of the farm Piet Retief Town and Townlands 149 HT in Piet Retief, Mpumalanga. The area identified is approximately 7.516 ha in size and is situated near the geographical centre of the town.

The site is situated on the corner of the N2 highway (Church Street) and the R543 (Brand Street) that leads to the Piet Retief landing strip. To the west of the site is the town's golf course and south west is the public cemetery. The site is bordered to the north by the R543, while the western boundary is formed by N2 highway (national road between Ermelo and Richardsbay). To the south and east of the site are open veld areas.

➤ **Regional Locality**

Piet Retief is located in the south eastern part of Mpumalanga province, next to Swaziland. Piet Retief is considered to be a central place town that services not only the formal towns but surrounding smaller towns and rural villages as well.

1.2 Biophysical Aspects

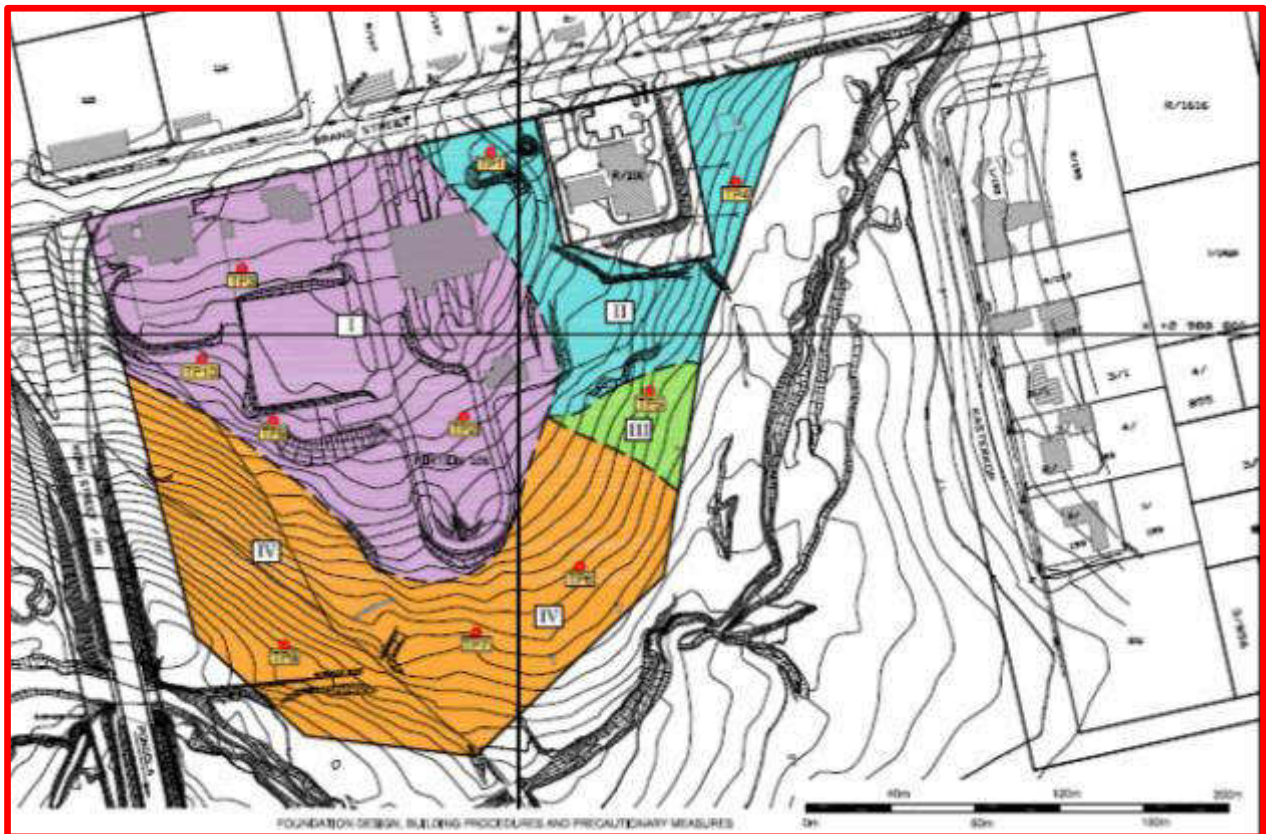
1.2.1 Geology and Soils

Study 1: (Refer to Appendix D1 for a copy of the Geotechnical Report compiled by Soilkraft CC)

A Geotechnical Site Investigation was compiled by **Soilkraft CC** for the proposed Piet Retief X22. The aim of the investigation was to determine the geological and engineering properties of soil material present on the site, as well as to report on the stability of soil materials, prevailing founding conditions, drainage, topography and general characteristics of the site.

➤ **General Geology:**

Regional geological information indicates that the site is situated on the Mozaan or Nsuzu Groups, associated with the Pongola Sequence. These Groups contain materials which are largely derivatives of granite. Parent materials include medium to coarse grained biotite granite, porphyritic biotite or coarse grained hornblende granite.



ZONE	GEOTECHNICAL CLASS	% OF TOTAL AREA	ESTIMATED SOIL MOVEMENT	SOIL PROFILE	DEVELOPMENT POTENTIAL	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS
I	P _{SH} /S1/H1	45,0	Up to and exceeding 20mm settlement and up to 15mm unrestrained heave	Problematic fill underlain by residual granite	Intermediate	Modified	Reinforced strip footings	Corrosive soils Problematic fill Difficult excavation (R)
II	P _{SH} /S1/H1	15,9	Up to 15mm unrestrained heave	Problematic fill underlain by residual dolerite	Intermediate	Modified	Reinforced strip footings	Corrosive soils Corestones Bedrock outcrop Problematic fill
III	HSP Marsh	3,2	Up to 20mm unrestrained heave	Colluvium overlying residual dolerite	Not suitable	N/A	N/A	Corrosive soils Corestones Marshes
IV	S1/H1	35,9	Up to and exceeding 20mm settlement and up to 15mm unrestrained heave	Limited soil cover overlying residual granite	Intermediate	Modified	Reinforced strip footings	Corrosive soils

Figure 3: Geology

➤ **Soils:**

Trial holes revealed that the soil profile is deeply weathered. As a result, no bedrock was encountered in any of the trial holes. Majority of the site are found to be underlain by imported fill materials and residual granite dominates in situ soils. In minority, residual dolerite and colluvial soils are found on the site.

➤ **Site Classification:**

The following must be taken into consideration:

- Properties of heave: Tests have indicated that that the residual dolerite soils have the potential to be moderately to very highly expansive. The residual granite made up thick horizons of the soil profile of the site.
- Properties of Settlement: The results of both samples of the consolidation settlement show an over-consolidated state. The one has a pre-consolidation pressure of 250kPa and the other 100kPa. These high pre-consolidated pressures imply that significant volumes of historical overlying material had been removed from the site.
- Problematic Fill: Fill materials around the existing facilities are considered problematic. The fill material on site differs in composition, origin and compaction and this poses a great effect on future structures.

Implications for the development:

- Precautionary measures is recommended to protect exposed and buried steel objects;
- It is recommended that uPVC pipes be used for the sewage and water supply;
- It is recommended that mass earthworks be undertaken on the site to create construction terraces as well as to import suitable soil replacement platforms for construction;
- All materials for the construction of layer works should be imported;
- The minimum pre-consolation pressure of 100kPa suggest that little settlement will take place if this figure is not exceeded;
- It is recommended that the area occupied by existing structures or buildings be investigated in more detail once the buildings are demolished or not in use;
- Site drainage should be planned cautiously in order to warrant that surface runoff does not drain towards the newly proposed structures;

- Surface water must be channelled away from the structures and the accumulation of surface water should not be allowed within 1.5m from structures;
- Due to the probable marshy conditions and surface seepages it is recommended that a network of sub-surface drains be installed. Instead, bulk earthworks can be manipulated to reclaim the saturated area; and
- A professional engineer must be appointed for the structural and services designs and this must be made a prerequisite for building plan approval.

Study 2: (Refer to Appendix D1 for a copy of the Geotechnical Report compiled by Geo Simplicity Geotechnical Engineering (Pty) Ltd)

A Geotechnical Site Investigation was compiled by **Geo Simplicity Geotechnical Engineering (Pty) Ltd** for the proposed Piet Retief X22. The aim of the investigation was to determine the geological and engineering properties of soil material present on the site, as well as to identify any problematic soils which may influence the pile type, determine design parameters for pile design purposes and to provide the most effective pile types.

➤ **General Geology and Soils:**

Regional geological information indicates that the site is underlain by medium to coarse grained biotite granite, porphyritic biotite granite or coarse grained hornblende granite of the Pongola Sequence. Majority of the site are found to be underlain by imported fill materials and residual granite dominates in situ soils. Other test holes revealed alluvium transported, pedogenic soils.

➤ **Site Results:**

- No collapsible grain structure was noted on the site.
- Areas with higher load cases, time related settlement in excess of acceptable tolerances (>20mm) are expected to occur, should conventional foundations be placed on top or within the fill, transported, reworked residual and residual soils encountered on site.
- There is low to medium activity as far as potential heave is concerned.
- Groundwater seepage was not generally encountered on the site. The

assessment was conducted in the dry period and it is therefore possible that groundwater seepage may form part of the permanent works.

- Excavatability varies across the site. Side walls do become unstable in areas where there is high in-situ moisture content and poor soil consistency, therefore, allowance should be made for temporary casings.
- The soils on the site classifies as being not corrosive.

Implications for the development:

- Subsurface services should be treated/ sleeved to prevent possible damages due to corrosion.
- A piled foundation solution should preferably be adopted.
- All recommendations for piling in the Geotechnical report should be followed.
- A professional engineer must be appointed for the structural and services designs and this must be made a prerequisite for building plan approval.

1.2.2 Climate

Climatically the area may thus be described as sub-humid. The area receives summer rainfall with a mean annual precipitation of 746mm. Frost is not commonly found in Piet Retief. The average maximum summer temperature is at its highest in January at 26.2°C and the coldest in June at 19.4°C. Winters are cool to cold with an average minimum in June of 3.2°C.

Implications for the development:

- The climatic character of the region will not have a significant impact on the development potential of the study area;
- Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes construction and environmental rehabilitation works extremely difficult;
- Such wet conditions often cause delays to building projects and the draining of water away from the construction works (in the case of high water tables) into the nearby water bodies, could (if not planned and managed correctly) have an impact on the water quality of these water bodies; and
- If dry and windy conditions occur during the construction phase, dust pollution could become a problem. Recommendations to mitigate dust pollution will be

made in the Environmental Management Plan (EMP) **(Refer to Appendix E1 for the EMP)**

1.2.3 Topography

(Refer to Figure 4 below and Appendix G for Enlarged Figures)

The application site is characterised by a fairly steep slope towards a drainage feature, which runs along the south-western, southern and south-eastern boundaries of the study area. The site varies in altitude from 1215m and 1233m above mean sea level and the natural gradient of the site has been altered through earthworks and imported materials. The gradients on site vary between 2% and 12%.

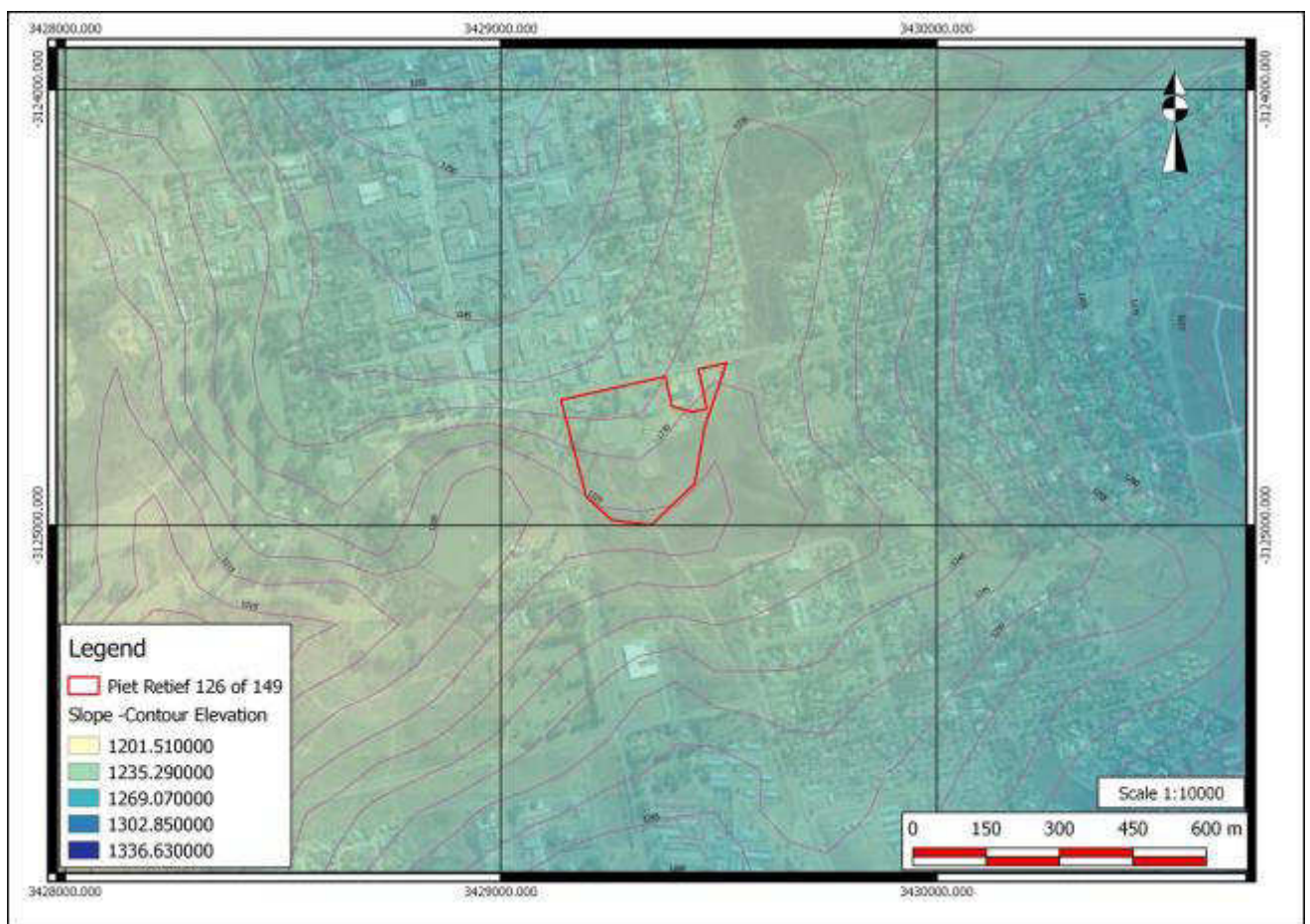


Figure 4: Contour Elevation

Implications for the development:

- The current topographical character of the study area will have no detrimental effect on the development potential of the site;

- Stormwater management across the study area (during the construction and operational phases of the development) will be extremely important. The storm water management measures to be implemented must prevent erosion, siltation and water pollution. It must also incorporate effective flood attenuation and management measures;
- Earthworks must preferably be planned in such a way to create terraces and to import suitable replacement platforms for construction; and
- No cut and fill exercises should be allowed below the 1:100 year flood line.

1.2.4 Hydrology

(Refer to Figure 5, 6 & 7 below, Appendix G for Enlarged Figures and Appendix D2 and D6 for specialist reports)

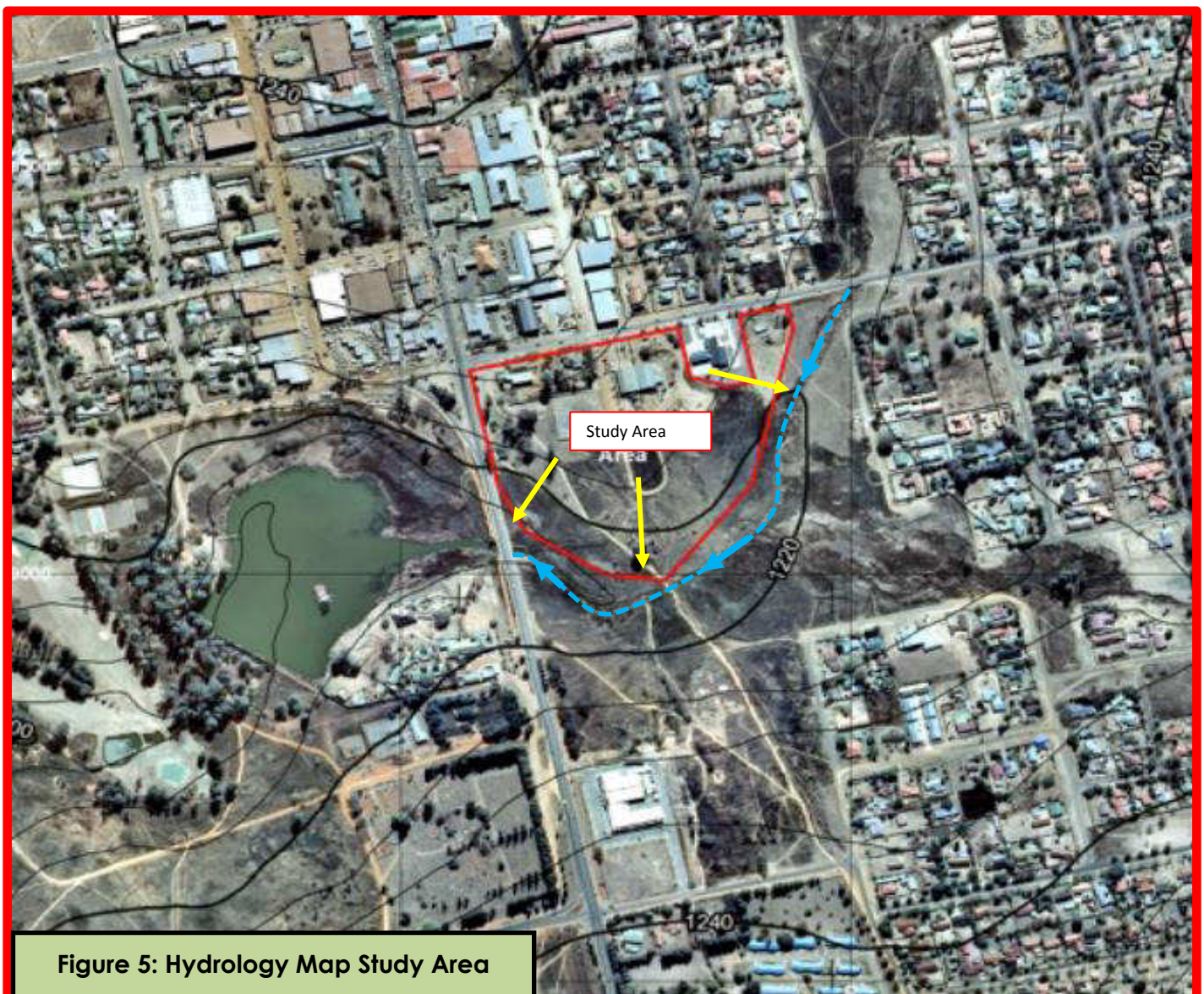


Figure 5: Hydrology Map Study Area

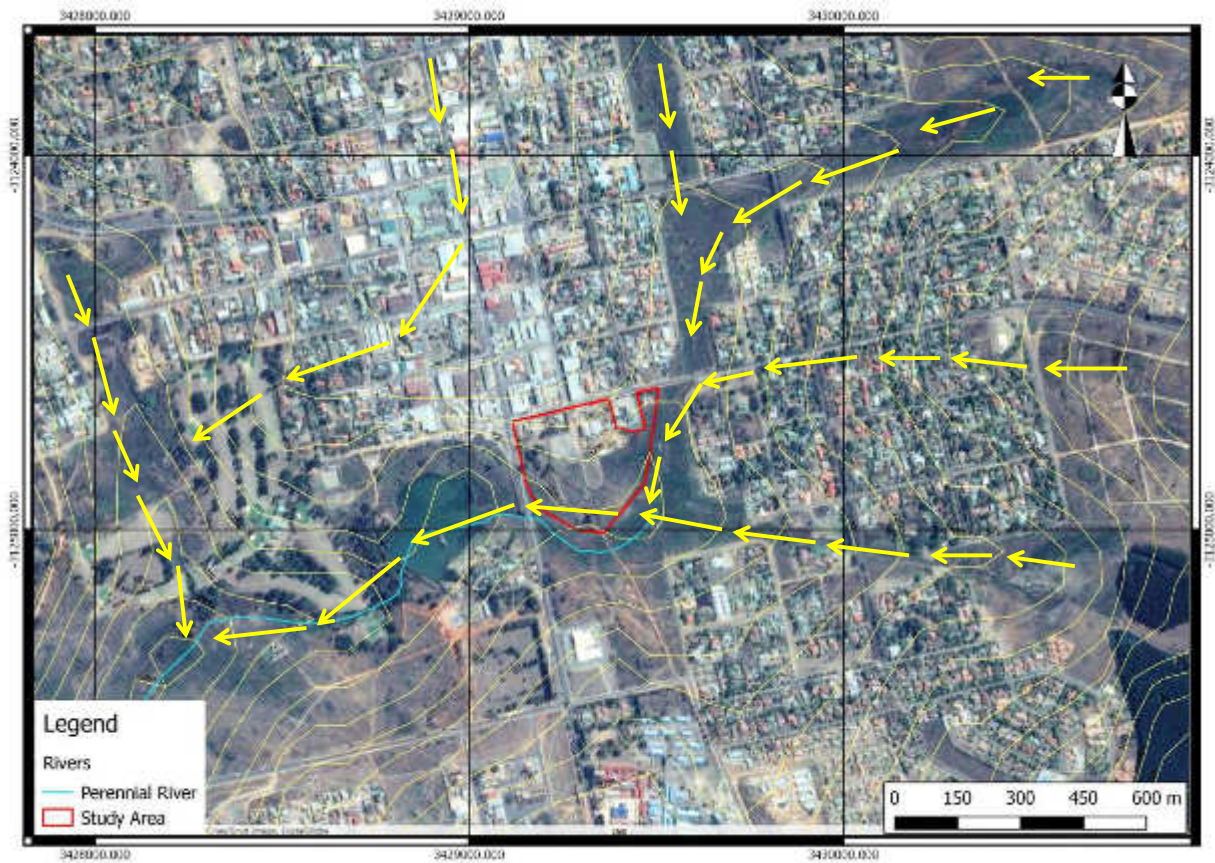


Figure 6: Hydrology Map Larger Area

➤ **Surface Hydrology:**

General:

The study area is located on the southern edge of the Town of Piet Retief alongside the N2 National Road and adjacent to a perennial stream that tributes to the Assegai River further to the south. This perennial stream forms the eastern and southern boundaries of the proposed development, flowing in a south-westerly direction. The site has a steep slope towards the stream. The drainage of the study area comprises of surface drainage, but at least two storm water outlets from developments to the north of the study area currently discharge storm water on the study area. Some man-made wetland/ marshy conditions established around the storm water outlet in the north-eastern section of the study area.

The study area is affected by a 1:100 year floodline and a wetland/ watercourse, but the proposed development layout has been designed to avoid the area below the 1:100 year flood line and the areas within the proposed natural watercourse buffer of

32m. No buffer is proposed around the man-made seepage wetland in the north-eastern section of the study area, which is associated with a storm water discharge point. Furthermore, the poor drainage area associated with a pipe in the south-western section of the study area is not regarded as a man-made wetland or watercourse and therefore no watercourse delineations or buffers were identified for this poor drainage area. **Refer to Figure 7 for Wetland Delineation Map**

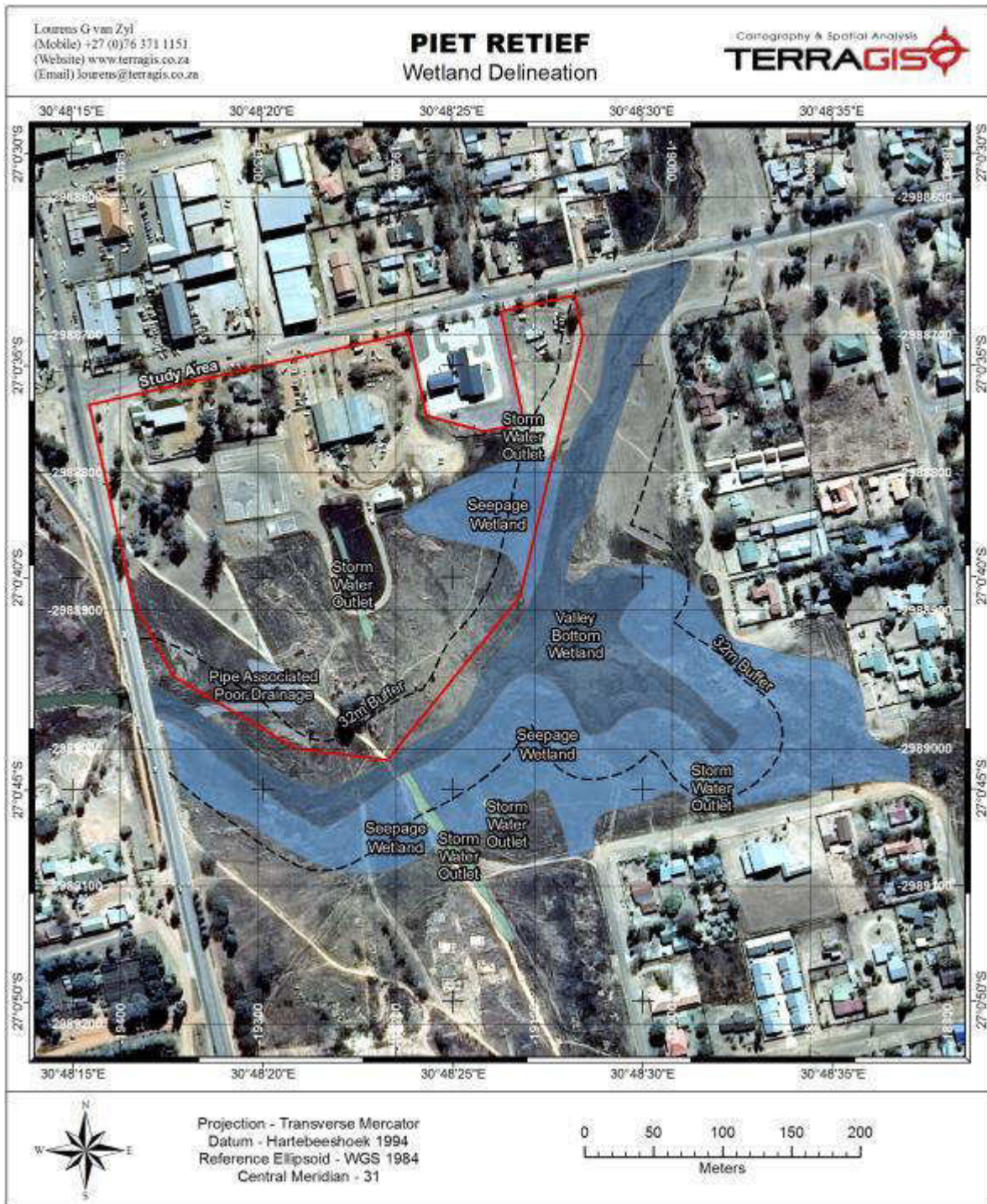


Figure 7: Wetland Delineation Map

Wetlands:

Wetland consultant, Terrasoil Science, was appointed to conduct a wetland delineation and management report for the study area. Seepage wetland areas have been identified on the site and have been modified by human activities. Since 2003 changes occurred on the site in the form of additional paving and storm water runoff. The valley bottom wetland is greatly impacted upon through erosion and excavation, there is also significant amounts of litter and invasive plants throughout the channel. Figure 5 illustrates the delineated wetland with the proposed/ recommended buffer zone. The specialist recommends that the construction activities should be limited to a distance of 30m from the water course except if adequate storm water management and containments structures are constructed to minimise high energy flows into the stream channel. The seepage wetland has no recommended buffer zone due to it being situated immediately downslope of paved up areas.

➤ **Sub-Surface Hydrology**

According to the geotechnical engineer, during the trial holes no perched water or seepage was encountered. An abundance of moisture in the soil profile is anticipated on a seasonal basis due to the site being situated within the bend of the watercourse. Close to the stream, marshy conditions and surface seepage is likely to occur at the end of the rainy season. This is due to the shallow groundwater which has accumulated in the soil profile. At depths of less than ten meters, in pores and fractures, ground water is expected to occur.

Implications for the development:

- The study area is affected by a natural and man-made wetland area;
- Should the natural wetland area be impacted upon, a proper wetland rehabilitation plan should be followed during the construction and operational phases;
- Untreated waste water must not be discharged into the wetland or watercourse;
- Mitigate the velocity and point of discharge of storm water to prevent erosion and siltation;
- The application for a Water Use License is probable due to the wetland within 500m of the proposed development and due to the proposed development across the seepage wetland (man-made wetland);

- Due to probable marshy conditions on site it is recommended by the geotechnical engineer that a network of sub-surface drains be installed to remove the moisture. Instead, bulk earthworks can be manipulated to reclaim the saturated area;
- The above mentioned moisture removal measures could however have a detrimental impact on the integrity of the existing wetland on the study area and the other watercourses and riparian zones associated with the drainage feature and therefore such moisture removal measures must be compiled in collaboration with the wetland and storm water management specialists.

1.2.5 Agricultural Potential

(Refer to Figure 8 below and Appendix G for Enlarged Figures)

According to a GIS Desktop study, the application site has a medium agricultural potential and is not recognized as arable land.

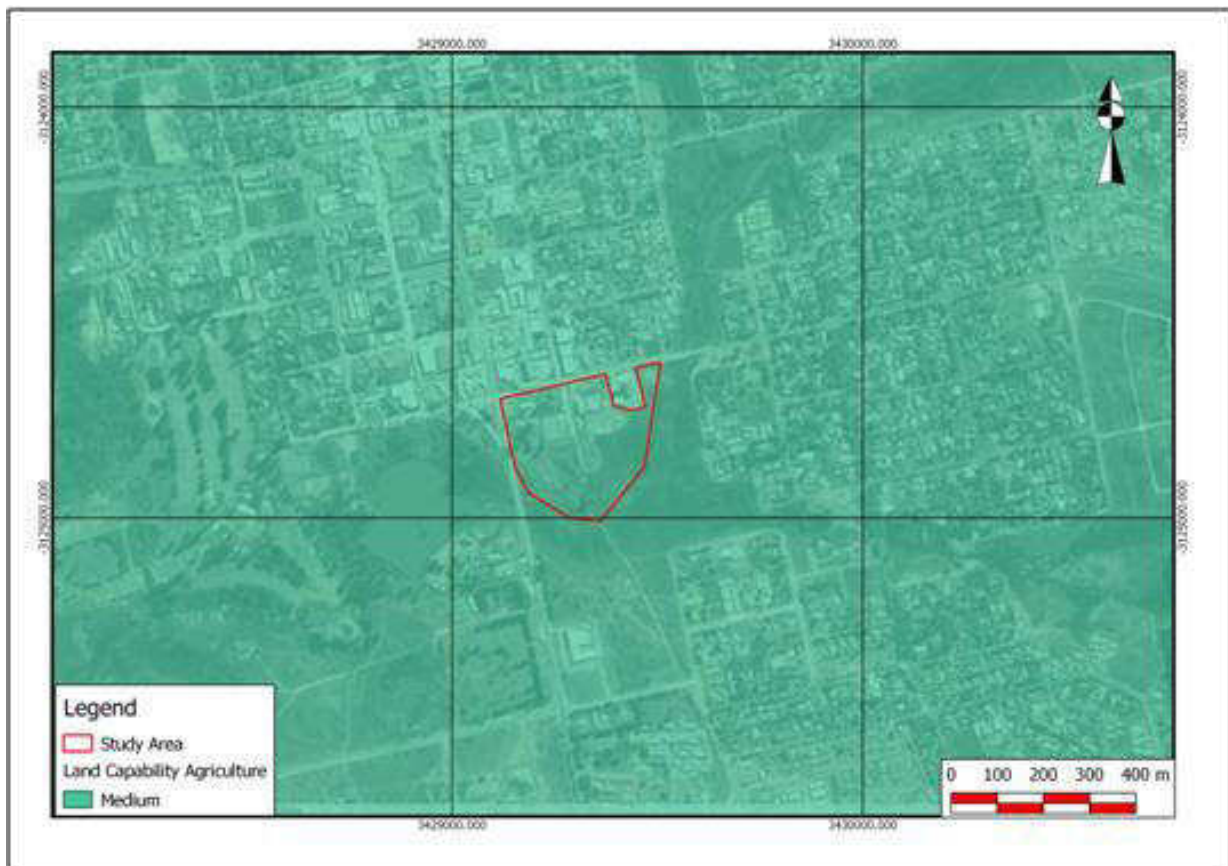


Figure 8: Agricultural Potential Map

Bokamoso is however of the opinion that due to the current size of the subject property, it will not be possible for the study area to function as a viable economical agricultural unit.

Furthermore, the study area is located on the corner of Brand and Church Street, on the periphery of the Piet Retief Business node/ CBD and residential areas and the site's accessibility and ideal location contributes to the site's very high development potential. If one compares the medium agricultural potential of the site with the high development potential, the development potential outweighs the agricultural potential, especially from an economical point of view.

Implications for the development:

Not significant.

1.2.6 Flora and Fauna

(Refer to Appendix G for Enlarged Figure and Refer to Appendix D3 for Ecological Assessment)

A Flora and Fauna Assessment report was compiled by Enviro-Insight CC for the proposed Portion of Portion 100 (Portion of Portion 1) of the farm Piet Retief Town and Townlands 149 HT, Mpumalanga. The study determined that the site is located in the KaNgwane Montane Grassland (a regional type of grassland) that is considered Vulnerable.

Sections of the site was found to have been disturbed or transformed. A stream and stream buffer area is located adjacent to the site.

The study determined that the following Fauna were of concern: Water Rat *Dasymys incomtus* (Near Threatened); Spotted-neck otter *Lutra maculicollis* (IUCN Near Threatened) and the Striped Weasel *Poecilogale albinucha* (Data Deficient). These three Fauna were considered as "trigger" species that were deemed in need of protection. It was recommended that the movement of any red listed species should not be restricted and that their habitats should be buffered.

The Flora found on the site were noted to predominantly species found in disturbed areas, species such as *Melinis repens* and *Pennisetum clandestinum* (determined to be the dominant species on the site).

The site is classified as being non-sensitive and it's not expected that any Red-Listed species will occur. It was recommended that the stream/ stream buffer habitat areas should be buffered in order to maintain corridor movement of birds and aquatic faunal species. Any alien or invasive plants should also be removed from the site.



Figure 9: Sensitivity Map

Implications for the development:

- It is recommended that only indigenous flora be used for landscaping;
- An alien invasive eradication and monitoring programme should be implemented;
- Sediment barriers should be placed above and below the construction site in pairs of three to reduce sediment entering the system lower down in the catchment area; and
- The stormwater leaving the site downstream must be clean and of the same quality as in situ before it enters the construction site (upstream). Pre-construction measures must be in place to ensure that sedimentation is trapped.

1.1 Social Aspects

1.3.1 Archaeology

(Refer to Appendix D3 for Specialist's Report)

In terms of Section 38 of the National Heritage Resources Act, 1999, SAHRA must be notified of developments on areas that are larger than 5000m². SAHRA has been informed of the proposed development during the notification process, which formed part of the public participation process.

The northern section of the study area accommodates municipal buildings which consist of storage facilities, offices, a licensing department, vehicle testing grounds and structures previously by the fire department. The Disaster Management Centre of Gert Sibande District Municipality is found on a portion of portion 100 (to the north-east of the study area – along Brand Street) but is excluded from the proposed development site and is fenced off. Apart from the Disaster Management Centre, all other municipal structures on the study area will be demolished. The applicant must apply for demolition permits at the local authority prior to the construction phase.

The southern and eastern sections of the study area are covered with natural vegetation, but former human impacts already caused some disturbance of the natural vegetation coverage. Some exotic invaders and weeds were spotted on the study area during the fauna and flora investigations. No significant cultural and historical features were identified on the open space portions of the study area during the site investigations and therefore the anticipated impact on any cultural/heritage resources will be low to neutral.

Implications for Proposed Development:

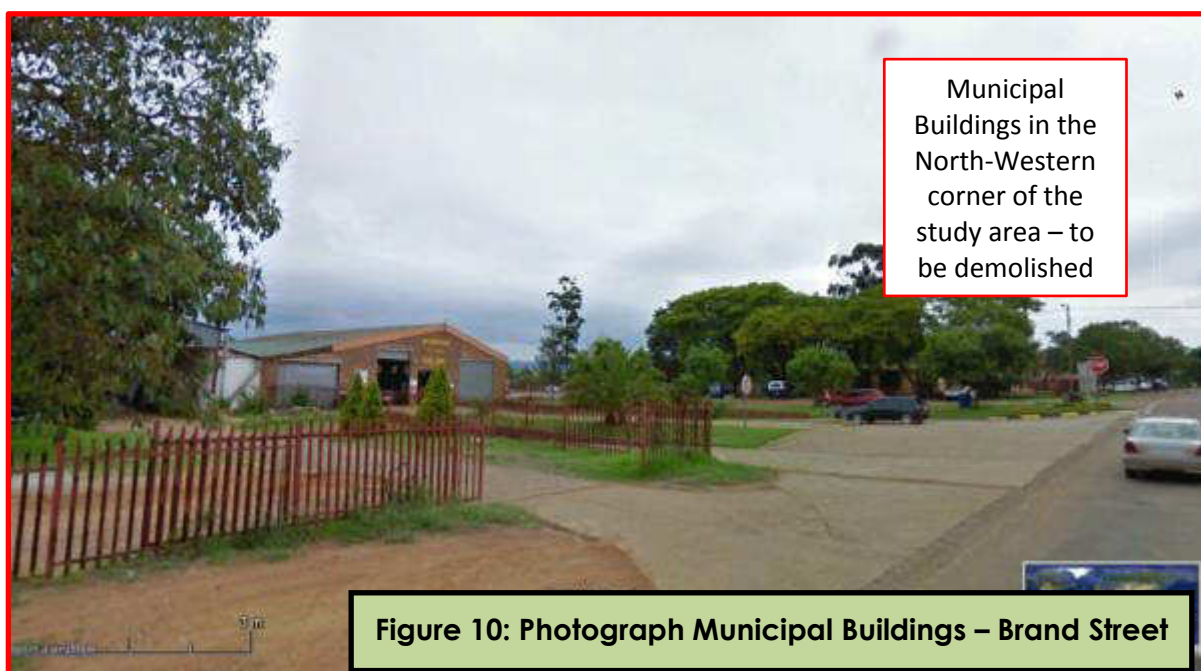
- A cultural and historical specialist must confirm the cultural and historical significance of the structures and features on the site. The input of the specialist must be submitted to SAHRA for comment. The SAHRA comments/ Record of Decision must be attached to the demolition applications to be submitted to the local authority;
- Should any human remains be disturbed, exposed or uncovered during excavations for the proposed project, these should immediately be reported to the South African Heritage Resource Agency (SAHRA) and/or a museum. Sub-

- surface remains should not be disturbed or removed until inspected by an archaeologist;
- Site preparation activities must be monitored for the occurrence of any other archaeological material (historic waste disposal sites etc.) and similar sub-surface findings;
 - Should any finds be made or artefacts uncovered during future developments on the study area, an archaeologist and/or the South African Heritage Resource Agency (SAHRA) and/or a museum have to be informed immediately, to conduct an investigation and evaluation of the finds;
 - The above recommendations must will also be included in the Environment Management Program (EMP) for the proposed project; and
 - It should be noted that if any structures older than 60 years will be earmarked for demolition for purposes of the proposed development a demolition permit should be obtained from the Mpumalanga Heritage Authority.

1.3.2 Existing and Proposed Zoning and Land-use

➤ Existing and Surrounding Zoning and Land Use:

Currently the site is used for municipal purposes, which consist of storage facilities, offices, licensing department, vehicle testing grounds and structures used previously for the fire department.





Municipal Buildings in the North-Western corner of the study area – to be demolished – on the corner of Brand Street and Kerk Street

Figure 11: Municipal Buildings on Corner of Brand Street and Kerk Street



Municipal Buildings in the North-Western corner of the study area (in Brand Street)– to be demolished

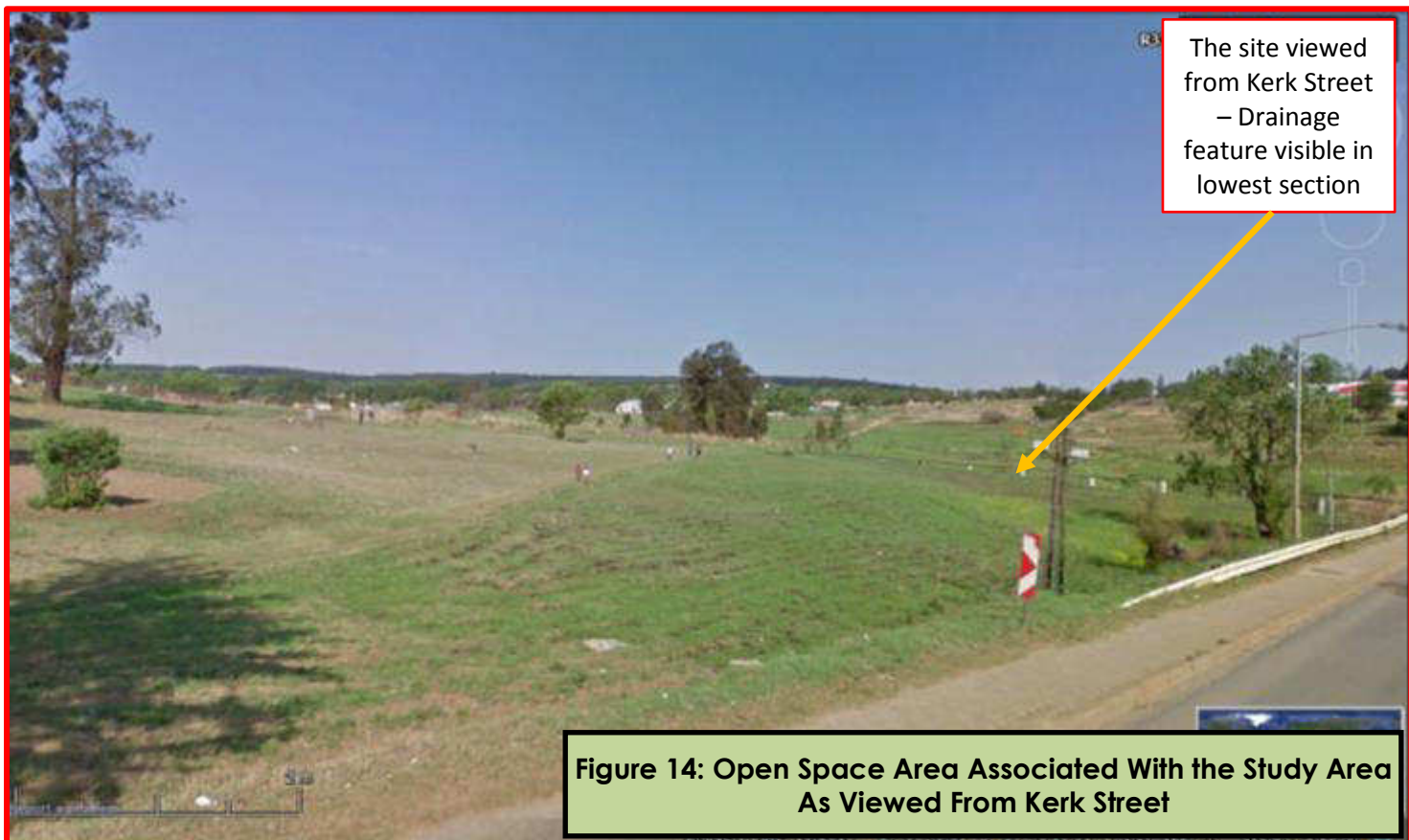
Figure 12: Municipal Buildings Brand Street

The Disaster Management Centre of Gert Sibande District Municipality is found on a portion of portion 100 but is excluded from the proposed development site and fenced

off. The Disaster Management Centre will not be demolished and the proposed mall will be designed around this centre.

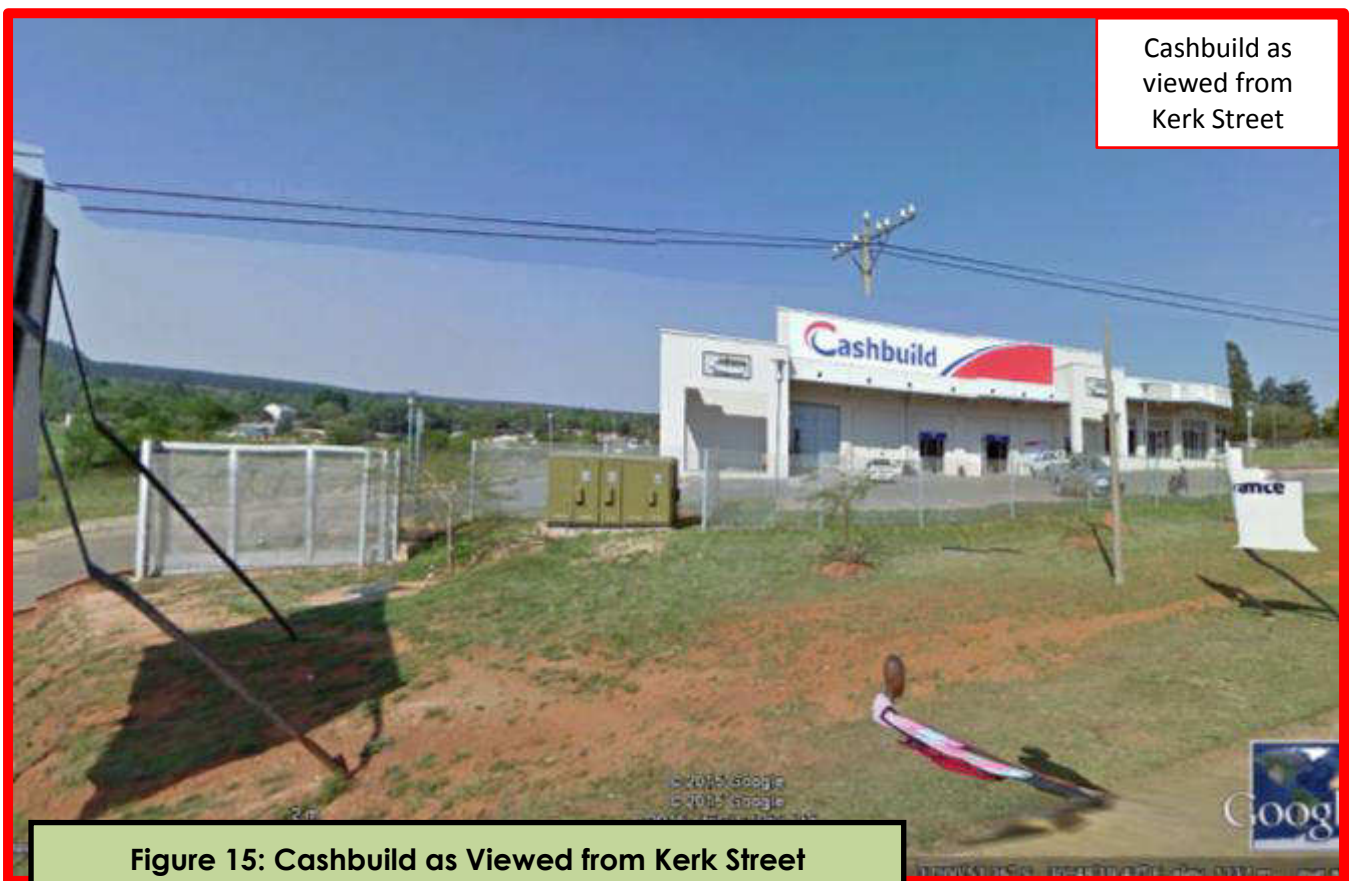


The areas to the east, south and west of the study area are mainly open spaces associated with the watercourses, wetlands and riparian areas that stretch through the town. The natural vegetation of the study area has already been disturbed through former human intervention.



The Piet Retief CBD is situated to the north and north-west of the study area and this area is already built up. Residential areas are mainly located to the east and south-east of the study area and the drainage feature along the southern and eastern boundary of the study area forms the buffer area between the proposed new shopping mall and the residential areas. A tourism/accommodation facility associated with the dam area, is situated to the south west of the study area.

A hardware facility, namely Cashbuild is situated to the south of the drainage feature and the study area, and to the west of a residential area. Apparently the owner of the property only utilized some of the commercial rights on the property when he developed Cashbuild. He is still planning to develop the balance of the commercial rights.



The town's golf course is located further to the west and a public cemetery is situated further to the south west.

The current zoning for the site is Municipal.

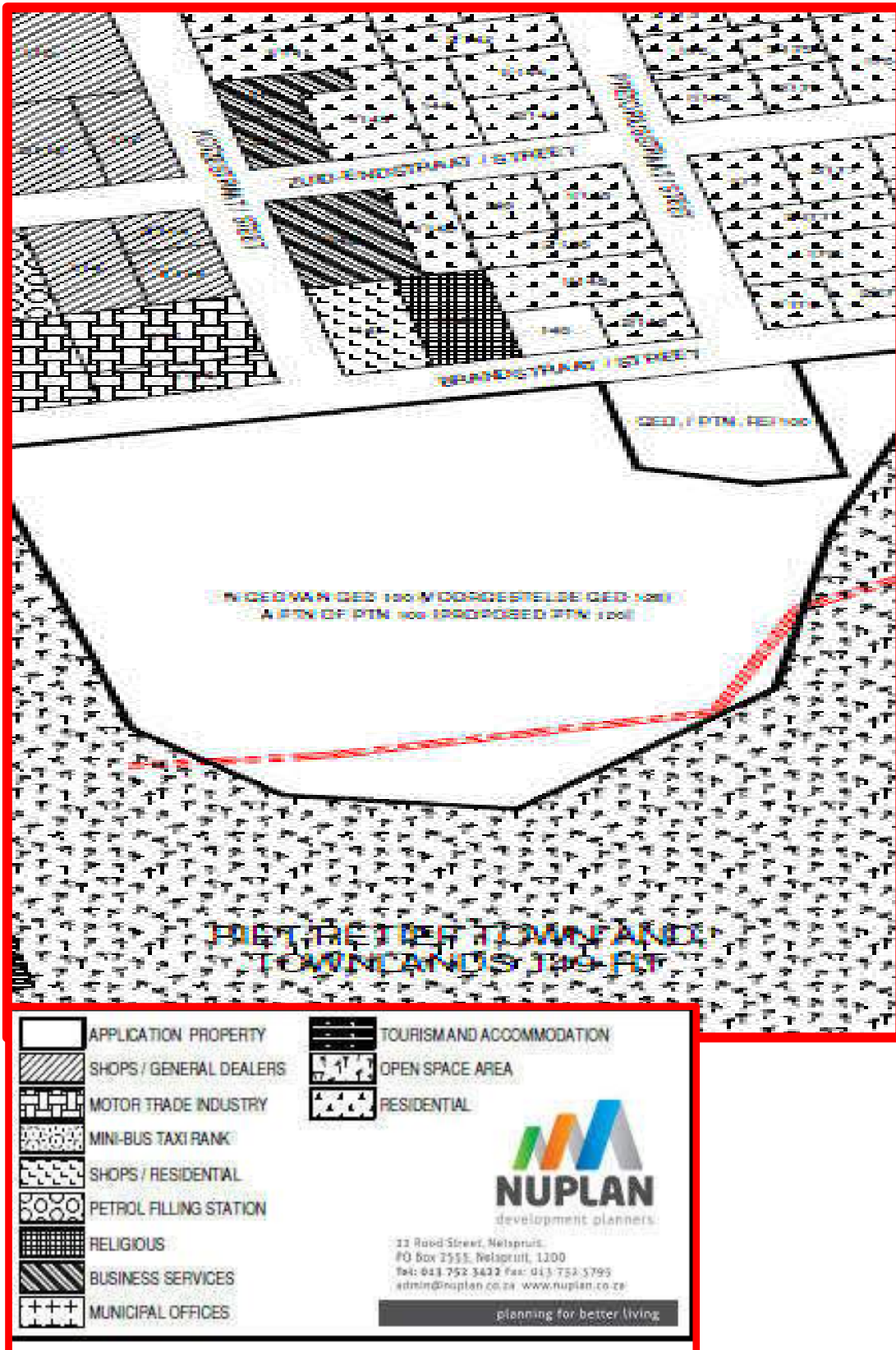


Figure 16: Surrounding Land-Use Map compiled by NUPLAN Development Planners

➤ **Social Facilities in the Surrounding Area**

Residential areas are mainly situated to the north-east, east and south-east of the study area and such residential townships accommodate a variety of social facilities. The police station, Mapulaneng hospital and schools are all within a 2 km radius from the proposed development. The provision of social facilities and services forms an important component of development and such facilities must be expanded or increased in accordance with the demand created through development.

Social facilities (i.e. schools, clinics, police stations etc.) are often a problem when developers apply for land-use rights in areas that are not regarded as priority development areas by local authorities and other government departments. In most cases such developments are outside or on the periphery of the urban areas (in many cases even outside the urban edge) and the implementation of services, infrastructure and social facilities are often not included in the short term budgets of the local authorities. This problem is often addressed through desperate developers that are forced to subsidize such social facilities or services until the budget becomes available, until the upgrading or the implementation of services and facilities in the area becomes a priority.

In the case of this development, the applicant agreed to replace the sub-standard municipal social facilities on the north-western corner of the study area with new facilities, on a site to the south-west of the study area, which has been identified by the local authority.

Implications for the Proposed Development

- The municipal infrastructure and services of the town of Piet Retief urgently needs some upgrading. Some of the existing roads in the town need resurfacing, general upgrading and maintenance and the proposed development creates an ideal opportunity for the upgrading of the roads and services around the study area;
- The town needs development, because the development will contribute to the rates and taxes payable to the local authority and this additional income will also increase the funds available for the upgrading and maintenance of the roads and infrastructure of the other services and roads of the town;

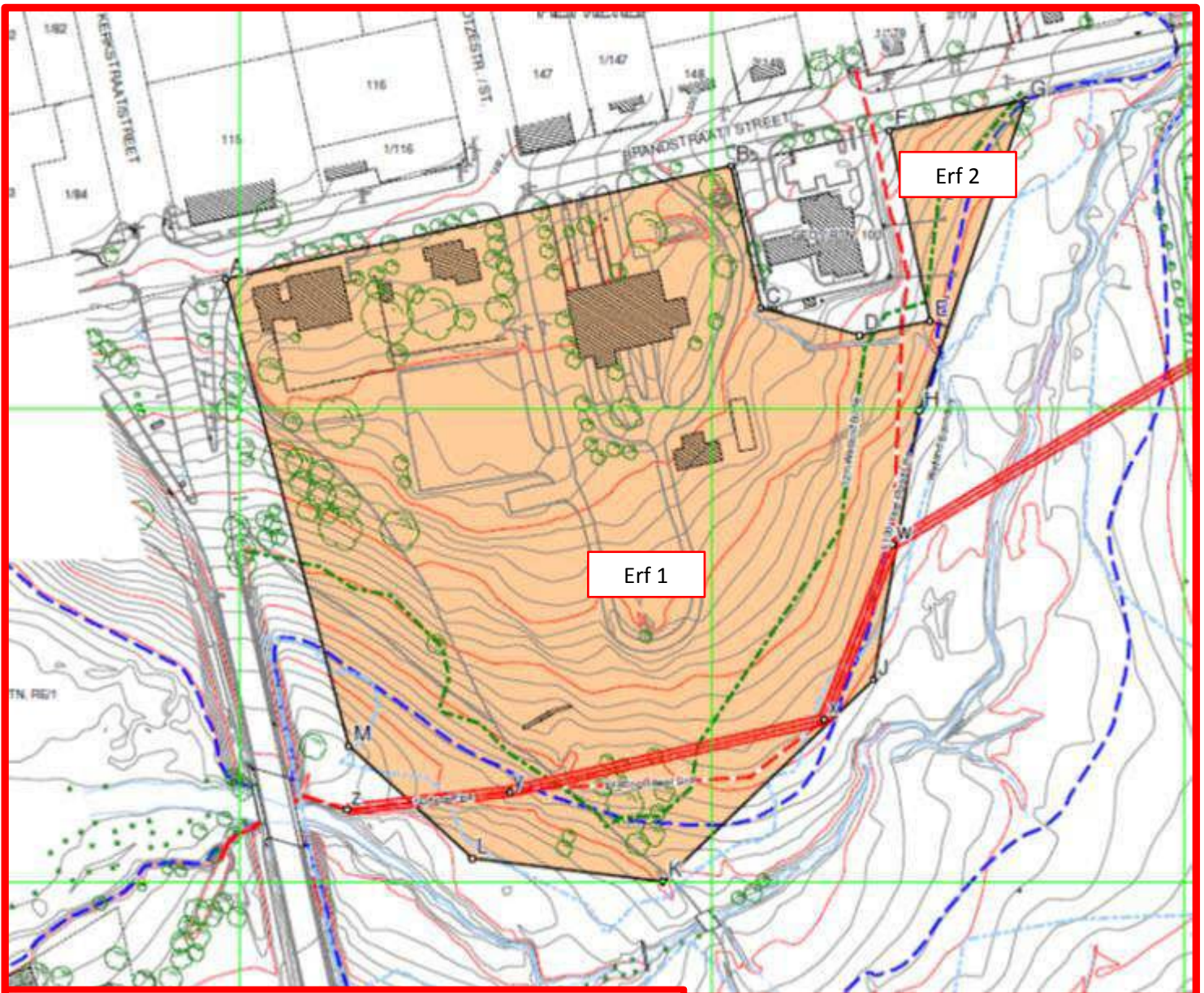
- The open space to the south of the study area is currently unutilised and the vegetation on this area is disturbed and invaded by exotics and weeds. A drainage feature, which is connected to the larger provincial open space system associated with watercourses, flows in an east-west direction along the eastern and southern boundaries of the study area. The exotic invaders and weeds already encroached onto the riparian zone and some urgent intervention is required to prevent such weeds and invaders from destroying the open spaces associated with the watercourses of the province. The local authority does not have the capacity to maintain all the open spaces in the municipal area and the proposed development creates an ideal opportunity for the rehabilitation and long term management and maintenance of the riparian and wetland areas of the study area. It is suggested that a PPP be established for the rehabilitation, management and maintenance of the areas associated with the watercourse.
- The existing buildings on the study area are dilapidated and the applicant agreed to replace the social facilities, which were accommodated in such dilapidated structures, in new social facility to be developed by the applicant on another property already identified;
- The proposed new shopping mall will contribute to the social facilities in the area and all the residents of the town will benefit from the proposed services upgradings; and
- The proposed development will promote sustainable development if the above-mentioned inputs required from the applicant are implemented.

1.3.3 Proposed Zoning and Land-use

(Refer to Appendix C for Facility Illustrations)

The proposed zoning for the property is as follows:

The proposed zoning for the mall development is "Special" for shops, businesses, offices, places of refreshment, dry cleaners, motor dealerships, vehicle sales mart, vehicle sales showroom, workshops, as well as related uses subservient thereto.



LAND USE TABLE:


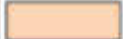
USE ZONE	NOTATION	ERF NUMBER	AREA (m ²)	% OF TOWNSHIP	NUMBER OF ERVEN
Special		1	62,185	95.64%	1
Special		2	2,834	4.36%	1
TOTAL		1-2	65,019	100.00%	2

Figure 17: Proposed Land-Use

The proposed "special" zoning excludes residential units, residential buildings, places of worship and a public garage (including a filling station) that are normally associated with a Business 1 zoning.

The proposed development will entail the following:

The proposed height : Not exceed 2 storeys

- Rehabilitation of riparian area.

1.3.4 Qualitative Environment

(Refer to Figure 19 and Appendix G for Enlarged Figure)

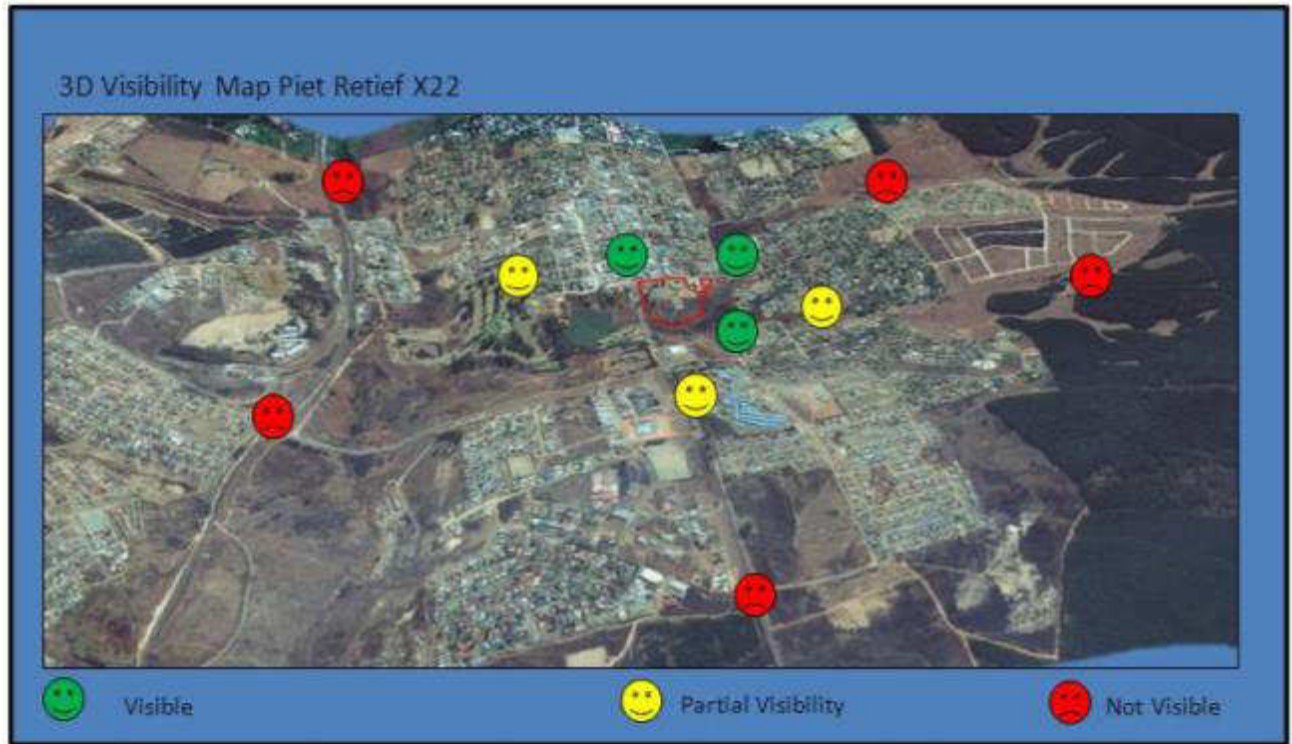


Figure 19: Visibility Map

➤ Visual Aspects

The following Visual Impact Assessment Criteria (**Please refer to Table 2**) have been used to determine the impact of the proposed development on the state of the environment – the significance is indicated by the respective colour coding for each of the impacts, being high, medium and low:

Table 2: Visual Impact Assessment Criteria

CRITERIA	IMPACT		
	HIGH	MEDIUM	LOW
Visibility	A prominent place	A place with a loosely	A place having little

	with an almost tangible theme or ambience.	defined theme or ambience.	or no ambience with which it can be associated.
Visual quality	A very attractive setting with great variation and interest – no clutter.	A setting with some visual and aesthetic merit.	A setting with no or little aesthetic value.
Compatibility with the surrounding landscape	Cannot accommodate proposed development without the development appearing totally out of place – not compatible with the existing theme.	Can accommodate the proposed development without it looking completely out of place.	The surrounding environment will ideally suit or match the proposed development.
Character	The site or surrounding area has a definite character/ sense of place.	The site or surrounding environment has some character.	The site or surrounding environment exhibits little or no character/ sense of place.
Visual Absorption Capacity	The ability of the landscape not to accept a proposed development because of a uniform texture, flat slope and limited vegetation cover.	The ability of the landscape to less easily accepts visually a particular type of development because of less diverse landform, vegetation and texture.	The ability of the landscape to easily accept visually a particular type of development because of its diverse landform, vegetation and texture.
View distance	If uninterrupted view distances to the site	If uninterrupted view distances to the site	If uninterrupted view distances to the site are > 500 m and <

	are > 5 km.	are < 5 km but > 1 km.	1000 m.
Critical Views	Views of the site seen by people from sensitive view sheds i.e. farms, nature areas, hiking trails etc.	Some views of the site from sensitive view sheds.	A limited or partial view of the site from sensitive view sheds.
Scale	A landscape with horizontal and vertical elements in high contrast to human scale.	A landscape with some horizontal and vertical elements in some contrast to human scale.	Where vertical variation is limited and most elements are related to the human & horizontal scale.

- ❖ The application site will be visible from the surrounding view sheds predominantly due to the study area's current topographical character, and the proposed size of the development. From the visual analysis it is clear that the existing property can be regarded as a place with a loosely defined theme or ambiance but a setting with minimal aesthetic value due to its current land-use (municipal purposes including storage facilities, offices, licensing department, vehicle testing grounds and structures used previously for the fire department);
- ❖ The CBD area has some "Sense of Place" and it also acts as a landmark/ gathering area in Piet Retief and the surrounding areas;
- ❖ The proposed development will not drastically impact on the views towards the study area from surrounding properties and from vehicles moving along the adjacent streets and the proposed structures are regarded as in line with a CBD development and the local authority planning; and the proposed new structure will without any doubt enhance the "Sense of Place" of the CBD area and it will assist in attracting more visitors to the CBD area. Furthermore, the study area is located in the road that forms part of the N2 national Road;
- ❖ The idea is to create structures and features in the CBD area that stand out and that are less easily accepted by the less diverse landform and structure, because

this characteristic will accentuate the CBD area even more. The landscaping to be implemented should be planned in such a way that it reduces the scale of the proposed new structure to a more human scale.

Implications for the development:

- The location of the study area is desirable in terms of accessibility and visibility from major roads; the proposed development will be highly visible from surrounding view sheds and this aspect can be contributed to the study area's topographical character and the proposed developable height of the development.
- Due to the surrounding developed landscape, it is anticipated that the proposed development will be accommodated from a visual perspective. From the tabulated assessment above it can be concluded that the proposed development will make a significant contribution towards the character and enhanced sense of place of the Piet Retief Central Business District. The surrounding developed urban landscape has a less diverse landform and texture but can still accommodate the proposed development from a visual perspective.
- The following measures are proposed to ensure that the proposed development is accommodated by the surrounding view sheds from a visual perspective:
 - o The architectural styles, colours, textures and construction materials will determine the visual impact of the proposed development on the surrounding areas;
 - o The proposed development will be seen from a distance and therefore the roofs should not reflect the sun or be covered with roofing materials that have bright colours;
 - o Bokamoso is of the opinion that it would be possible to mitigate the anticipated visual impact through planning that takes the existing surrounding urban environment and aesthetical features of the site into consideration. The colour scheme for the proposed development must preferably blend in with the mosaic of colours from the surrounding urban environment;
 - o Existing trees should be retained as far as possible, preferably only indigenous trees. The trees will soften the visual impact of the

- proposed permanent structures and they will bring the scale of the vertical structures in some contrast to human scale;
- The landscaping to be installed as part of the proposed development must be chosen to assist with the creation and sustaining of a pleasant micro-climate, to act as visual screening and enhancement mechanism, to accentuate important focal points and movement and visual axis and to create a tranquil feeling;
 - Landscaping should be done in concurrence with the building construction in order to create an instant visual enhancement of the development;
 - Trees, shrubs and groundcovers that are prominent to the area and/or indigenous should preferably be used – landscaping that is in line with the natural vegetation of the area will not only help to reduce the visual impact of the development, but it will also create habitats for fauna and flora species;
 - Where legally required, separate signage applications will also have to be submitted to the relevant authorities for approval;
 - The lighting for the proposed development as well as all the billboards should be effectively designed so as not to spill unnecessary outward into the oncoming traffic, or into the yards of the neighbouring properties or open spaces;
 - The exterior and interior lighting design should be sensitively designed to:
 - Prevent the lighting-up of the evening sky and the skyline;
 - Prevent any unnecessary spillage of lighting into the eyes of oncoming traffic;
 - Prevent the usage of flickering signage and advertising boards, especially where such boards will be visible from busy roads and surrounding residential areas; and
 - It is recommended that movement activated lights are installed and that only some of the lights are on during the night in order to save energy. It is also recommended that the use of solar energy for external lighting and signage lighting be investigated.

➤ **Sense of Place**

The Sense of Place is a subjective feeling a person gets about a place by experiencing the place visually, physically, socially and emotionally. The "Sense of Place" of an area is one of the major contributors to the "Image of an area".

The image of an area consists of two main components, namely **place structure** and **sense of place**. These could be defined as the following:

- Place structure refers to the arrangement of the physical place making elements within a unique structure that can be easily legible and remembered; and
- The Sense of Place is the subjective meaning attached to a certain area by individuals or groups and is linked to its history, culture, activities, ambience and the emotions the place creates.

The study area can be regarded as a place with a loosely defined ambience but a setting with minimal aesthetic value due to its current land-use (municipal purposes). The surrounding developed landscape- an urban area with views typically associated with central business districts has however some character and/or sense of place. The drainage feature and the open spaces associated with the drainage feature also contributes to the "Sense of Place" of the study area.

It is however anticipated that the proposed shopping centre development along the southern periphery of the CCBD of Piet Retief will significantly enhance the character and Sense of Place of the study area and if well planned and managed, it will also act as an attractive "Place Making Element" and "Southern Gateway" into the town of Piet Retief.

➤ **Pollution**

Noise Pollution

Some noise will be generated during the construction phase and such uneven construction associated noise may become a nuisance to the surrounding land owners, residents and businesses.

Noise generated during the operational phase will mainly be the noise generated by the increased traffic and noise generated by the proposed facilities and activities (i.e. air conditioners, placed of refreshment, compressors etc.) which is not anticipated to be a nuisance.

Implications for the development:

- It is anticipated that a certain amount of noise will be generated during the construction phase. The contractors should take care, and manage construction works to such an extent to comply with minimum ambient noise levels as defined in local, provincial, and National policies and frameworks. Construction activities must also be restricted to hours as specified in the National Building Regulations and if specific construction activities require that work continue after hours (i.e. the pouring of concrete slabs which cannot be interrupted), the surrounding residents must be notified of such potential disturbing activities;
- The contractor should notify the local/surrounding land-owners well in advance of any works that will generate noise (i.e. blasting operations);
- Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities should be located well away from noise sensitive areas. All construction vehicles, plant and equipment are to be kept in good repair;
- Truck traffic should be routed away from noise sensitive areas, where possible;
- Blasting operations, if required are to be strictly controlled with regard to the size of explosive charge in order to minimize noise and air blast and timings of explosions. The number of blasts per day should be limited;
- Construction activities are to be contained to reasonable hours during the day. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning;
- Working hours during weekdays must be limited from 06h00 until 18h00;
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents and be kept informed of the nature and duration of intended activities; and
- As construction workers operate in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993). Where necessary ear protection gear should be worn.

Air/Dust Pollution

It is not foreseen that the proposed development would contribute significantly in terms of pollution by smoke, as it is a commercial development and not industrial land-use. It can however be expected that a certain amount of dust, will be generated due to earthmoving activities and construction works. One should note that the impact of dust pollution is short term, lasting for the duration of construction only.

Implications for the development:

- If dry and windy conditions occur during the construction phase, dust pollution could become a problem. The regular and effective damping of working areas must therefore be carried out on a continuous basis, to ensure that the generation of dust due to involved construction works are kept under control.

1.3.5 Services

Lekwa Consulting Engineers (Pty) Ltd was appointed by Zarafusion (Pty) Ltd as the Civil Engineers for the proposed Shopping Centre. **(Please refer to Figure 20 and Appendix D4 for a copy of the report)**

1.3.5.1 Water Supply

The Mkhondo Municipality is the authority (Water Services Authority) and provider (Water Services Provider) for Piet Retief and is responsible for the provisioning of water services within its area of jurisdiction.

The proposed development site is currently zoned as municipal and the existing rights for the property allows for 75% coverage of Municipal purposes. As the property forms part of an existing township, the existing network would have been designed/sized for these existing rights. There is an existing water connection which is currently being used by the land occupiers. The services engineer informed that according to the "Red Book" (Guidelines for the provision of Engineering Services and Amenities in Residents Township Developments) the annual average water demand is the same for Government and Municipal areas and Offices and Shops. It is therefore anticipated

that the current water network and connection should have sufficient capacity for the proposed shopping mall in Piet Retief.

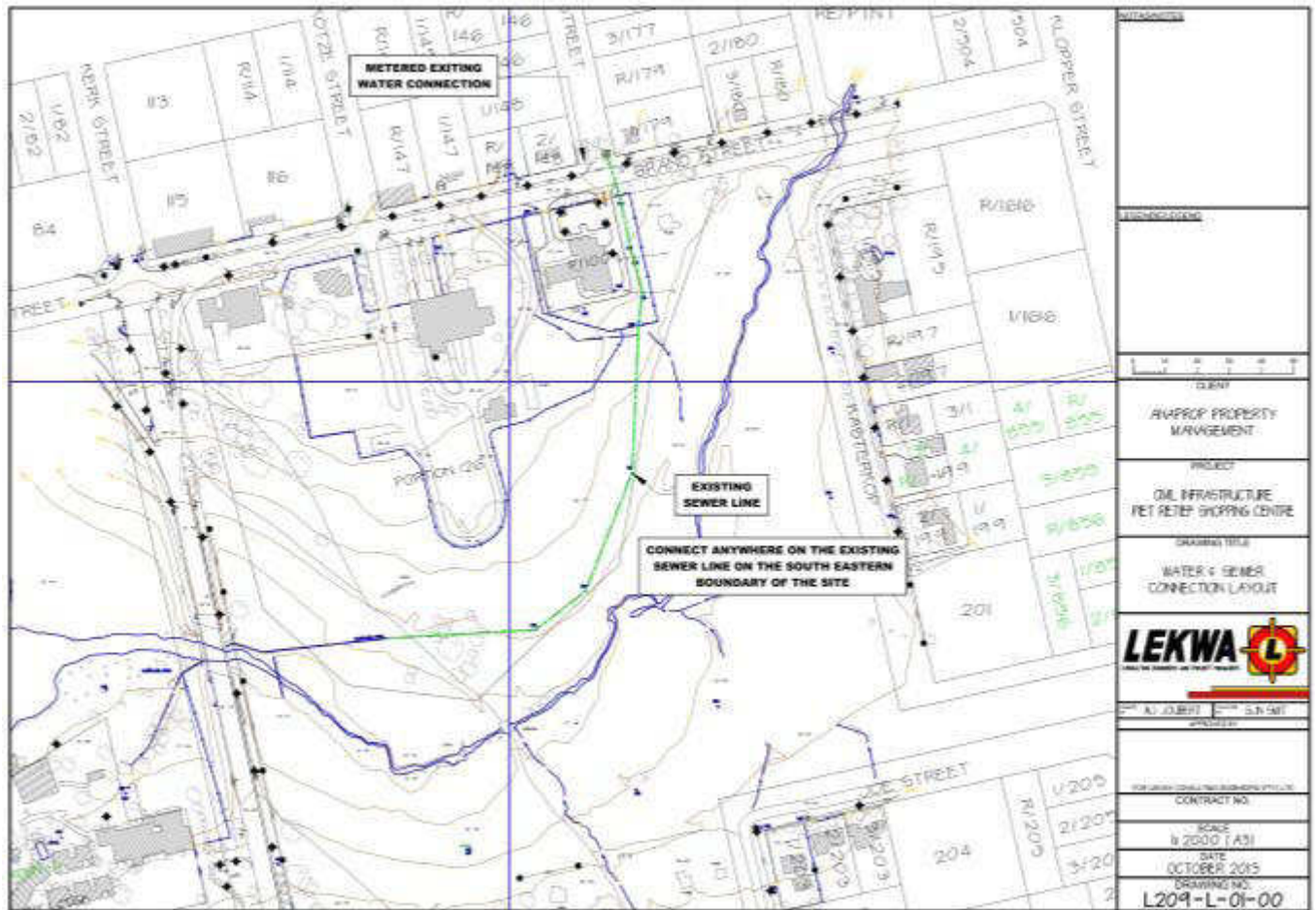


Figure 20: Services Map (Water and Sewer)

Internal Water Supply

In accordance with the “Red Book”, the estimated water demand per shop/office is 400 litres per day / 100 m² of gross floor area. The instantaneous peak factor in the mains can be calculated by converting the proposed development to equivalent erven according to the design annual average demand. One equivalent erven has an annual average daily demand of 1000 litres. The peak factor is estimated to be about 4 but this can only be finalised once the final layout is set. Based on this peak factor, the estimated water demand for the proposed development of a shopping mall is 156 kℓ per day.

Implications for the development:

Not significant. Water supply is available for the proposed development.

1.3.5.2 Sewage

As mentioned earlier, Mkhondo Municipality is responsible for provision of water services within Piet Retief and its area of jurisdiction as they are the Water Service Authority (WSA) and the Water Services Provider (WSP) for Piet Retief.

There is an existing sewer connection which is currently being used by the land occupiers. As the property forms part of an existing township, the existing network would have been designed/sized for these existing rights. It is therefore anticipated that the current sewer network and connection should have sufficient capacity for the proposed shopping mall in Piet Retief.

Internal sewer

Again, the "Red Book" is used for standards, and the estimated sewage outflow per unit (of any sort) is 80% of the water demand of the relevant unit. This also allows for 15% storm water infiltration rate.

A four meter wide Servitude line is planned to be constructed to the southern side of the development site, this proposed sewer line runs across the site from the eastern side to the western side of the development site (topography of the area will have to be considered during the design process and the viability of this option considered).

The estimated sewer flow for the proposed shopping mall is 6.6 l/s. A 110mm sewer pipe installed at minimum 1:95 at 80% full flow will provide for sufficient capacity.

Implications for the development:

Not significant. Sewage services is available on the existing rights and therefore is it is anticipated to be sufficient capacity for the proposed development. Should any upgrade or extensions be done for the existing sewer line the topography of the area will have to be considered during the design process.

1.3.5.3 Storm Water

According to Lekwa Engineers, the storm water network of the development site must convey all surface storm water runoff (road and roof discharge) to the existing storm water network which serves the town of Piet Retief.

Due to the predisposition of the existing soils to erosion, it is crucial that effective storm water erosion control measures be implemented both during and following construction of the civil infrastructure.

Storm water from parking areas will be transferred to open channels which should be covered with steel grids. These channels will then convey the storm water to the municipal storm water networks with controlled discharge. The storm water from rooftops will be collected at a central point at each shop/unit or drained into the municipal network with a controlled discharge rate. No storm water attenuation is expected to form part of the storm water plan.

Implications for the development:

- Efficient scour protection and filtration systems will be required at all discharge points to maintain the integrity of the water quality flow and control the erosion protection at these points.

1.3.5.4 Solid Waste Removal

The local authority will be responsible for the solid waste removal. The waste will be disposed of at a registered landfill site and the landfill site has the capacity to accommodate the additional waste generated by the proposed development.

Implications for the development:

The local authority must confirm that they will remove the solid waste and they must also confirm that the existing registered landfill site has the capacity to accommodate the waste to be generated by the development.

1.3.5.5 Electricity

There is an existing electrical connection and the final size of this connection will be established as soon as the type of facilities in the mall is known. Such information is not yet available.

Expected Maximum Demand

Information not yet available.

Existing Infrastructure

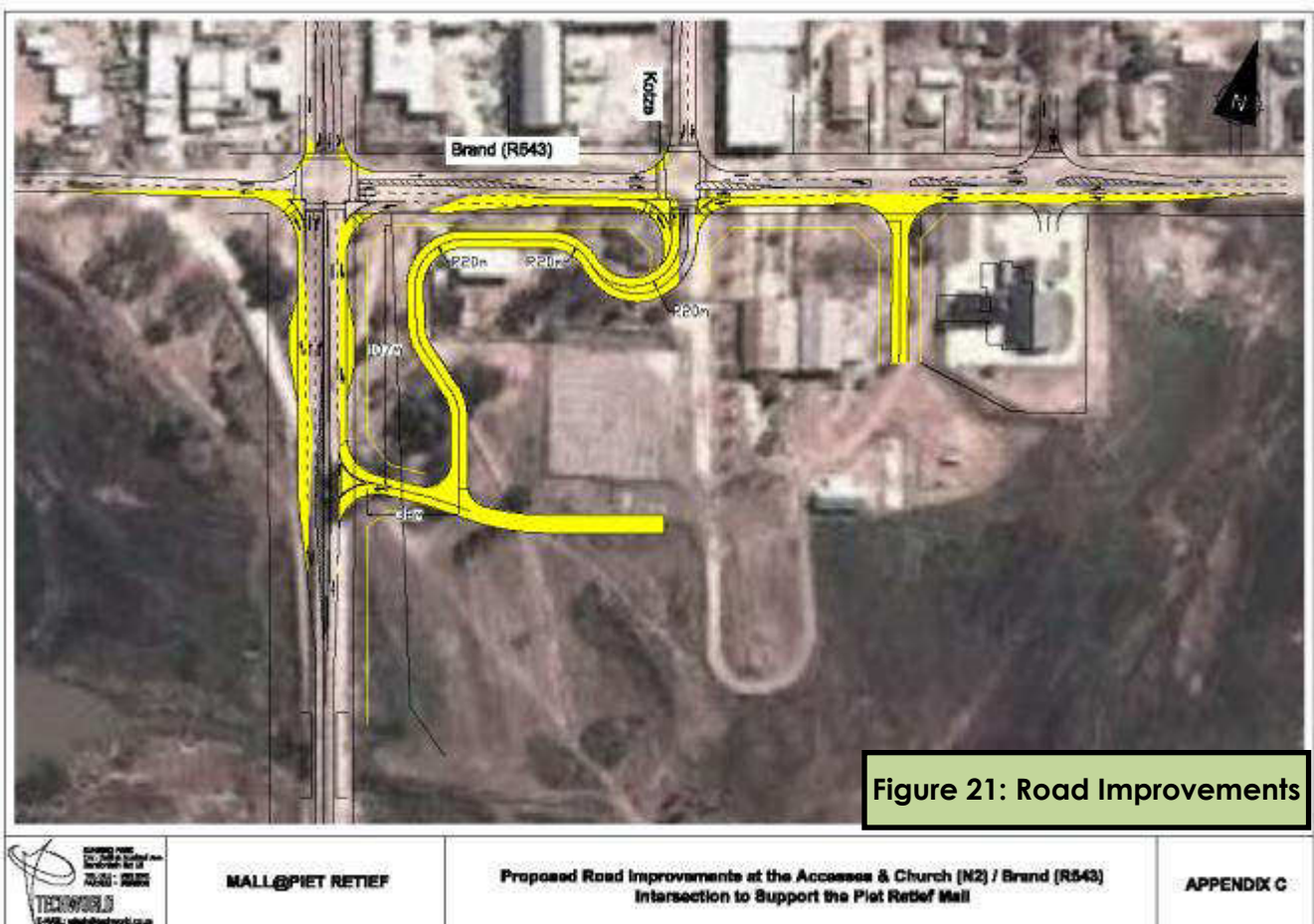
Information not yet available.

Implications for the development:

Not significant.

1.3.5.6 Road Access

(Please refer to Appendix D5)



MALL@PIET RETIEF

Proposed Road Improvements at the Accesses & Church (N2) / Brand (R543)
Intersection to Support the Piet Retief Mall

APPENDIX C

Primary access to the proposed shopping mall is planned from Brand Street and a secondary access is planned in Church Street (this will be a marginal access, left-in and left-out).

2. APPLICABLE LEGISLATION AND GUIDELINES

2.1 Activities applied for in terms of NEMA

Apart from the fact that Zarafusion (Pty) Ltd has to apply for Town Planning Approval in terms of the Town planning and Townships Ordinance, 1986, it will also be necessary for the applicant to apply for Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA).

In June 2010 the Minister of Environmental Affairs passed the Amended Environmental Impact Assessment Regulations¹ (The Regulations) in terms of Chapter 5 of the National Environmental Management Act, 1998² (NEMA). The Amended Regulations replaced the 2006 Environmental Impact Assessment (EIA) regulations, which were also promulgated in terms of the National Environment Management Act, 1998 (Act No. 107 of 1998). The new regulations came into effect on 18 June 2010 and, therefore, all new applications must be made in terms of the New NEMA regulations and not in terms of the 2006 EIA Regulations of the NEMA. The purpose of this process is to determine the possible negative and positive impacts of the proposed development on the surrounding environment and to provide measures for the mitigation of negative impacts and to enhance positive impacts.

Notice R. 544, R 545, & R 546 of the Amended Regulations list activities that indicate the process to be followed. The Activities listed in Notice No. Notice R. 544 & R 546 require that a Basic Assessment process be followed and the activities listed in Notice No. R 545 requires that the Scoping and EIA process be followed.

An application for Environmental Authorization for the proposed shopping mall was submitted to the approving authority, **Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) and an acknowledgement letter was received on 05/03/2014.** Bokamoso commenced with the public participation process

¹ Environmental Impact Regulations, 2010

² Act No. 107 of 1998

immediately after the application has been submitted and has been included as part of this report. The application has been assigned the reference number **17/2/3/GS-239**.

Note: The Public Participation Section of this report (Section 3, Appendix F) supplies more detail regarding the entire public participation process that was followed.

In the environmental application process (to be compiled in terms of NEMA) the applicant is applying for the following listed activities.

Table 3: Listed activities in terms of Notice R. 544 & R. 546

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice) ⁴ :
R. 544, 18 June 2010	Activity 9	<p>The construction of facilities or infrastructure exceeding 1000 meters in length for the bulk transportation of water, sewage or storm water –</p> <ul style="list-style-type: none"> (i) With an internal diameter of 0,36 meters or more; or (ii) With a peak throughput of 120 liters per second or more; <p>excluding where:</p> <ul style="list-style-type: none"> a. Such facilities or infrastructure are for bulk transportation of water, sewage or storm water drainage inside a road reserve; or <p>Where such construction will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.</p>
R. 544, 18 June 2010	Activity 11	<p>The Construction of:</p> <ul style="list-style-type: none"> (i) Canals; (ii) Channels; (iii) Bridges; (v) Weirs; (vi) Bulk storm water outlet structures; (x) Infrastructure or structures covering 50 square metres or more.

		Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
R. 544, 18 June 2010	Activity 18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from: <ul style="list-style-type: none"> (i) a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving: <ul style="list-style-type: none"> (ii) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (iii) Occurs behind the development setback line
R. 544, 18 June 2010	Activity 23	The transformation of undeveloped, vacant land to- <ul style="list-style-type: none"> (iv) residential, retail, commercial, recreational, industrial or Institutional use inside an urban area, and where the total area to be transformed is 5 hectares or more, but less than 20 hectares, or (v) residential, retail, commercial, industrial or Institutional use outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares;- <p>Except where such transformation takes place for linear activities.</p>
R. 544, 18 June 2010	Activity 24	The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this schedule, such land was zoned as open space, conservation or had an equivalent zoning.

Please take note that the 2010 NEMA EIA Regulations were replaced by the Amended 2014 NEMA EIA Regulations on 4 December 2014, but due to the fact that the application was submitted in terms of the 2010 NEMA EIA Regulations, this application

will be dealt with in terms of such Regulations. Once the Decision has been issued in terms of the 2010 NEMA EIA Regulations, such Decision will be regarded as a Decision issued in terms of the New 2014 EIA Regulations and all following procedures (i.e. Amendment Applications, Appeals etc. must be made/submitted in terms of the 2014 NEMA EIA Regulations. Refer to Chapter 8 – Transitional Arrangements and Commencement of the 2014 NEMA EIA Regulations).

Regulation 53 (3) of the 2014 NEMA EIA Regulations furthermore states “Where an application submitted in terms of the previous NEMA EIA Regulations, is pending in relation to the activity of which a component of the same activity was not identified under the previous NEMA Notices, but is now identified in terms of Section 24 (2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of Section 24 (2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed.”

Section 24(2) Activities to be considered by MDEDET:

We perused the Amended 2014 NEMA EIA Regulations and decided to list the activities that will most probably be triggered in terms of such Regulations (**Refer to the table below**). The activities identified are very similar to that activities applied for in terms of the 2010 NEMA EIA Regulations and we therefore feel confident that all the activities as listed have been assessed.

Due to the fact that the 2014 Regulations are still new, we recommend that MDEDET rather dispense this application in terms of the 2010 NEMA EIA Regulations.

Table 4. 2014 Amended NEMA EIA Regulations: Listed Activities that will most probably be triggered:

Listing Notice 1:		
R.983	Activity 9	The development of infrastructure exceeding 1000

		<p>metres in length for the bulk transportation of water or storm water-</p> <ul style="list-style-type: none"> (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or (b) where such development will occur within an urban area.
	<p>Activity 10</p>	<p>The development and related operation of infrastructure exceeding 1000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes</p> <ul style="list-style-type: none"> (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve; or (b) where such development will occur within an urban area.
	<p>Activity 12</p>	<p>The development of-</p> <ul style="list-style-type: none"> (i) canals exceeding 100 square metres in size; (ii) channels exceeding 100 square metres in size; (iii) bridges exceeding 100 square metres in size; (iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area, exceeds 100 square metres in size; (vi) bulk storm water outlet structures exceeding 100 square metres in size; (vii) marinas exceeding 100 square metres in size; (viii) jetties exceeding 100 square metres in size; (ix) slipways exceeding 100 square metres in size; (x) buildings exceeding 100 square metres in size; (xi) boardwalks exceeding 100 square metres in size; or (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge

		<p>of a watercourse; - excluding-</p> <p>(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;</p> <p>(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;</p> <p>(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;</p> <p>(dd) where such development occurs within an urban area; or</p> <p>(ee) where such development occurs within existing roads or road reserves.</p>
	Activity 19	<p>The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-</p> <p>(i) a watercourse;</p> <p>(ii) the seashore; or</p> <p>(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater- but excluding where such infilling, depositing , dredging, excavation, removal or moving-</p> <p>(a) will occur behind a development setback;</p> <p>(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or</p> <p>(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.</p>
	Activity 27	<p>The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-</p> <p>(i) the undertaking of a linear activity; or</p> <p>(ii) maintenance purposes undertaken in accordance with a maintenance management plan</p>

2.2 Relevant Legislations and Regulations

2.2.1 International Legislations and Regulations

Relevant International Conventions to which South Africa is party:

- Convention relative to the Preservation of Fauna and Flora in their natural state, 8 November 1993 (London);
- Convention on Biological Diversity, 1995
(Provided, and added stimulus for a re-examining and harmonization of its activities relating to biodiversity conservation. This convention also allows for the in-situ and ex-situ propagation of gene material);
- Agenda 21 adopted at the United Nations Conference on Environment and Development (UNCED) in 1992.
(An action plan and blueprint for sustainable development)

2.2.2 National Legislations and Regulations

- **National Environmental Management Act, 1998 (Act No. 107 of 1998) and the Environmental Impact Assessment Regulations**

The Environmental Impact Assessment (EIA) process followed is in compliance with the National Environmental Management Act: NEMA, 1998 (Act No. 107) of 1998), as amended and the Environmental Impact Assessment Regulations of 2010 (Government Notice No's R544, 545 & 546 of 2010). The proposed development involves 'listed activities', as defined by the NEMA, 1998. Listed activities are activities, which may potentially have detrimental impacts on the environment and therefore require environmental authorisation from the relevant authority, before such activities are implemented.

NEMA provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state and to provide for matters connected therewith.

This Act formulates a set of general principles to serve as guidelines for land development and it is desirable that:

- The law develops a framework for integrating good environmental management into all development activities;
- The law should promote certainty with regard to decision-making by organs of state on matters affecting the environment;
- The law should establish principles guiding the exercise of functions affecting the environment;
- The law should ensure that organs of state maintain the principles guiding the exercise of functions affecting the environment;
- The law should establish procedures and institutions to facilitate and promote co-operative government and inter-governmental relations;
- The law should establish procedures and institutions to facilitate and promote public participation in environmental governance; and
- The law should be enforced by the State and that the law should facilitate the enforcement of environmental laws by civil society.

Integrated Environmental Management

Integrated Environmental Management (IEM) is a philosophy, which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process. This philosophy aims to achieve a desirable balance between conservation and development (Department of Environmental Affairs, 1992). The IEM guidelines intend endearing a pro-active approach to sourcing, collating and presenting information at a level that can be interpreted at all levels.

The Environmental Impact Assessment Regulations (EIA)

The Minister of Environmental Affairs, promulgated and passed in (April 2006) Environmental Impact Assessment Regulations (the new regulations) in terms of Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). When these regulations came into effect on 3 July 2006 they replaced the Environmental Impact Assessment Regulations that were promulgated in terms of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) (ECA) in 1997, and introduced new provisions for EIAs.

The National Environmental Management Amendment Act, 2008 (Act 62 of 2008) (NEMAA), that was promulgated on 9 January 2009 (came into effect on 1 May 2009), made a number of significant amendments to the general provisions applicable to EIA's. On 2 August 2010 the Amended EIA Regulations came into effect and replaced the previous EIA Regulations that were promulgated on 21 April 2006.

Notice R. 544 R 545, & R 546 of the Amended Regulations list activities that indicate the process to be followed. The Activities listed in Notice No. Notice R. 544 & R 546 require that a Basic Assessment process be followed and the activities listed in Notice No. R 545 requires that the Scoping and EIA process be followed.

Please note that the NEMA EIA Regulations were amended on 4 December 2014 and came into effect on 8 December 2014. Table 4 lists the activities applicable for the 2014 Regulations.

Implications for the development:

Significant - The application for the proposed development consists only of activities listed under Notice **No. R544**, as applied for under the 2010 EIA Regulations, therefore a Basic Assessment Report will be submitted to the Mpumalanga Department of Economic Development, Environment and Tourism for consideration.

➤ **The National Water Act, 1998 (Act No. 36 of 1998)**

The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways that take into account, amongst other factors, the following:

- Meeting the basic human needs of present and future generations;
- Promoting equitable access to water;
- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Reducing and preventing pollution and degradation of water resources;
- Facilitating social and economic development; and
- Providing for the growing demand for water use.

In terms of Section 21 of the National Water Act, the developer must obtain water use licenses if the following activities are taking place:

- a) Taking water from a resource;
- b) Storing water;
- c) Impeding or diverting the flow of water in a water course;
- d) Engaging in a stream flow reduction activity contemplated in Section 36;
- e) Engaging in a controlled activity identified as such in Section 37(1) or declared under Section 38(1)
- f) Discharging waste or water containing waste into a water resource through a pipeline, canal, sewer, sea outfall or other conduit;
- g) Disposing of waste in manner which may detrimentally impact on a water resource;
- h) Disposing in any manner which contains waste from or which has been heated in any industrial or power generation process;
- i) Altering the beds, banks, course or disposing of water found underground if it is necessary for the safety of people;
- j) Removing, discharging, or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- k) Using water for recreational purposes.

The National Water Act (Section 144) also requires that (where applicable) the 1:50 and 1:100 year flood line be indicated on all the development drawings that are submitted for approval.

Implications for the development:

Significant - The proposed development is situated outside the 1:100 year floodline, according to the 1:100 year floodline delineation, and will therefore not be affected by any normal flood events. Furthermore, there is a drainage line outside the southern and eastern boundary of the proposed development site and the 32m buffer zone from the delineated wetland is within the study area. The proposed development will be within 500m of the delineated wetland.

➤ **National Environmental Management: Air Quality Act (Act No. 39 of 2004)**

The NEMA: Air Quality Act, 2004 serves to repeal the Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965). The Air Quality Act regulates air quality in order to protect the environment. It provides reasonable measures for the prevention of pollution and ecological degradation and for securing ecological sustainable development while promoting justification economic and social development.

The purpose of the Act is to set norms and standards that relate to:

- Institutional frameworks, roles and responsibilities;
- Air Quality management planning;
- Air Quality monitoring and information management;
- Air Quality management measures
- General Compliance and enforcement

Amongst other things, it is intended that the setting of norms and standards will achieve the following:

- The protection, restoration and enhancement of air quality in South Africa;
- Increased public participation in the protection of air quality and improved public access to relevant and meaningful information about air quality;
- The reduction of risks to human health and the prevention of the degradation of air quality.

The Act describes various regulatory tools that should be developed to ensure the implementation and enforcement of air quality management plans. These include:

- Priority Areas, which are air pollution “hot spots”
- Listed activities, which are ‘problem’ processes that require an Atmospheric Emission License;
- Controlled emitters, which includes the setting of emission standards for ‘classes’ of emitters, such as motor vehicles, incinerators, etc.
- Control of noise;
- Control of odours

Implications for the development:

Not Significant - It is not foreseen that the proposed development would contribute significantly in terms of smoke and noise as it is a commercial shopping mall development and not industrial. It can however be expected that a certain amount of dust will be generated with construction activities, due to earthmoving activities and demolition works. One should note that the impact of dust pollution is short term and lasting for the duration of construction only.

➤ **The National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA)**

The NHRA requires Heritage Resources Impact Assessments for various categories of development stipulated in Section 38 of the Act. It also provides for the grading of heritage resources and the implementation of a three-tier level of responsibilities and functions for heritage resources to be undertaken by the State, Provincial Authorities, depending on the grade of the heritage resource. The Act defines cultural significance, archaeological and paleontological sites and materials (section 35), historical sites and structures (section 34), and graves and burial sites (section 36) that fall under its jurisdiction. Archaeological sites and material are generally those resources older than a hundred years, including gravestones and grave dressing. Procedures for managing graves and burial grounds are set out in Section 36 of the NHRA. Graves older than 100 years are legislated as archaeological sites and must be dealt with accordingly.

Section 38 of the NHRA makes provision for application by developers for permits before any heritage resource may be damaged or destroyed.

Implications for the development:

Not Significant - Due to the highly disturbed and totally transformed state of the study area, it was not deemed necessary to conduct a Heritage Impact Assessment in terms of the requirements as provided for in Section 38 of the NHRA, 1999. If any remains/cultural resources are exposed or uncovered during the construction phase, it should immediately be reported to the South African Heritage Resources Agency

(SAHRA). Burial remains should not be disturbed or removed until inspected by an archaeologist.

➤ **The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)**

The Act provides for the control over the utilisation of Natural Agricultural resources of South Africa, in order to promote the conservation of soil, water sources and vegetation, as well as combating of weeds and invader plants and for matters connecting therewith.

Implications for the development:

Not Significant - According to a GIS desktop study, the study area has a medium agricultural potential and soils. Bokamoso are however of the opinion that as the development site is considered to be very small, developed and located within an urban environment, it would not be possible to utilise the site alternatively for the purpose of Agriculture.

➤ **National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003)**

The purpose of this Act is to provide for the protection, conservation and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes, for the management of those areas in accordance to national norms and standards, as well as for the intergovernmental co-operation and public consultation in matters concerning protected areas. Protected areas are to be conserved for their biodiversity and ecological integrity.

Implications for the development:

Not Significant - From GIS desktop study it is evident that the application site is not located within any conservancy or protected area.

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

The Waste Management Act which was finally Gazetted on 10 March 2009, is to give effect to the White Paper on Integrated Pollution and Waste Management and the

National Waste Management Strategy (NWMS).

Purpose:

To reform the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

Objectives:

- To ensure sound environmental management of waste;
- To provide for utilisation of environmentally-sound methods that maximise the utilisation of valuable resources and encourage resource conservation and recovery;
- To reduce risk to human health and prevent the degradation of the environment through usage of mechanisms that promote the following:
 - Pollution prevention and cleaner production
 - Volume reduction at source
 - Recycling, recovery and re-use
- Set guidelines and targets for waste avoidance and volume reduction through source reduction and waste minimisation measures, including composting, recycling, re-use, recovery, green charcoal process, and others, before collection, treatment and disposal in appropriate and environmentally sound waste management facilities in accordance with this act;
- To ensure the proper segregation, collection, transportation, storage, treatment and disposal of waste through the formulation and adoption of the best environmental practice in ecological waste management;
- To promote national research and development programs for improved waste management and resource conservation techniques, more effective institutional arrangement and indigenous and improved methods of cleaner production, waste reduction, re-use, collection, treatment, separation and recovery;
- To encourage greater private sector participation in waste management;

- To encourage cooperation and self-regulation among waste generators through the application of market-based instruments;
- To institutionalize public participation in the development and implementation of national, provincial and local integrated, comprehensive, and ecological waste management programs;
- To strengthen the integration of ecological waste management and resource conservation and recovery topics into the academic curricula of formal and non-formal education in order to promote environmental awareness and action among the citizenry; and
- To control the export, import, transit, re-use, recovery, treatment and disposal of waste to ensure that all operations relating to export, import, transit, re-use, recovery, treatment and disposal will be undertaken in an environmentally sound manner.

Please note that the listed activities that will trigger a waste license application were amended on 29 November 2013.

Implications for the development:

Not significant - The construction and operation of the proposed development are not subjected to any activity as listed in Category A and B of NEMA: WA, 2008.

3 DETAILS OF THE PUBLIC PARTICIPATION PROCESS

(Refer to Appendix F for all public participation details)

The principles of the National Environmental Management Act, 1998 (Act No 107 of 1998) and the Environmental Impact Assessment Regulations, April 2006 govern many aspects of Environmental Impact Assessments, including Public Participation. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment and ensuring the participation of previously disadvantaged people, women and youth.

Effective public involvement is an essential component of many decision-making structures, and effective community involvement is the only way in which the power given to communities can be used efficiently. The Public Participation Process is

designed to provide sufficient and accessible information to interested and affected parties (I&AP's) in an objective manner to assist them to:

- Raise issues of concern and suggestions for enhanced benefits;
- Verify that their issues have been captured;
- Verify that their issues have been considered by the technical investigations; and
- Comment on the findings of the Basic Assessment Report.

In terms of the Guideline Document for Environmental Impact Assessment (EIA) Regulations promulgated in terms NEMA, stakeholders (I&AP's) were notified of the Environmental Evaluation Process through:

- 1) A site notice that was erected (at prominent points on and around the study area) on **19 March 2014 (refer to Appendix F1)**;
- 2) A public notice was distributed in a 100m radius around the proposed site to all parties concerned (**Refer to Appendix F2**);
- 3) Notices regarding the project were **e-mailed to a list of interested and affected parties and the councillors** in the area that registered for other projects in the area (**Refer to Appendix F3**);
- 4) An advertisement was placed in the **Excelsior Newspaper on 21 March 2014 (Refer to Appendix F4)**;
- 5) A list of all persons, organisations and organs of state that were registered as interested and affected parties in relation to the application are attached in **Appendix F5**;
- 6) A summary of the issues raised by the interested and affected parties, are attached in **Appendix F6**;

4 LONGTERM SUSTAINABILITY, NEED AND DESIRABILITY

4.1 NEED

Residential growth rates within the primary and secondary catchment is projected at 2.0% and 1.2%, respectively. These rates were used to get a projected figure of ±33164 households in 2015. Based on these demographics, possible market shares, gross leasable floor area, radius of primary trade area and travel time to centre, the

proposed shopping mall classifies as a community centre or small regional centre.

The fact that the proposed shopping mall will satisfy the need for a variety of shopping facilities and is walking distance from a large portion of the development in Mkhondo and eThandakukhanya. The existing shopping centre to the north of Mkhondo is not classified as a community centre but rather a neighbourhood centre. This is due to the size of the centre, as the proposed development will have a gross leasable floor area of $\pm 25000\text{m}^2$ and this neighbourhood centre is only 3200m^2 .

There is a need to upgrade and improve the CBD area of Piet Retief. The proposed shopping mall on the boundary of the CBD area will assist this need. In addition to that, the Mkhondo Local Municipality acknowledged the need for a regional or community shopping centre for the Mkhondo region by requesting proposals for the development of the study area.

4.2 DESIRABILITY

4.2.1 The Site

- The site available for development is ± 7 ha in extent and ample space is available for a shopping centre of 25000m^2 .
- The local and regional accessibility of the application site is exceptional. Direct access to the main road of Piet Retief will guarantee the popularity of the centre as a retail and business node.
- The proposed development is located south of the Piet Retief CBD and accordingly the application site is surrounded by mixed land uses such as:
 - Residential
 - Retail
 - Offices
 - Filling stations
 - Municipal land

The application is compatible with existing and future surrounding land uses.

- The site has a prominent location in Piet Retief and the proposed centre will enjoy high visibility from the main road.
- The site could be regarded as a high ranking site for a shopping centre as it meets all the basic requirements such as visibility, accessibility, trade area, traffic volumes and complementary facilities.

4.2.2 General

The application complies with modern principles and parameters for land development. The following of these principles are inter alia applicable to this case:

- ❖ The promotion and integration of the social, economic, institutional and physical aspects of land development;
- ❖ The promotion of integrated land development in rural and urban areas in support of each other;
- ❖ To promote the availability of residential and employment opportunities in close proximity to or integrated with each other;
- ❖ The optimisation of existing resources including such resources relating to agriculture, land, minerals, bulk infrastructure, roads, transportation and social facilities;
- ❖ To discourage the phenomenon of urban sprawl and to contribute to the development of more compact towns and cities;
- ❖ To contribute to the correction of the historically distorted spatial patterns of settlement in the Republic and to the optimum use of existing infrastructure in excess of current needs; and
- ❖ Encourage environmentally sustainable land development practices and processes.

The CBD area of Piet Retief is characterised by a large number of pedestrians and informal trading on the sidewalks that contribute to the unstructured and neglected perspective of the DBC area. This leads to traffic congestions and also has an effect on the general amenity of the CBD. A shopping mall can accommodate mini-bus taxis with a new rank and thereby easing pressure of the current taxi rank in the CBD which currently contributes to the neglected representation of the CBD area.

The neighbourhood centre (Pick n Pay centre) is 2km from the southern CBD entrance and this is not convenient for pedestrians and commuters. The proposed shopping mall will be in close proximity, not only to Mkhondo, but also to the eThandakukhanya and Kempville townships. The unemployment aspect of these townships will also be addressed as the construction and operational phases will create a large number of employment opportunities. The existing municipal buildings and infrastructure are old and not suitable in terms of safety and functionality. These buildings will be demolished and a new testing ground and traffic centre will be constructed on another property.

Based on all these motivations and factors the proposed mall, and its functions and services, is definitely desirable in the town of Piet Retief. This application is in line with the town's needs and desirability and will have additional economic advantages such as optimising the use of land, optimal use of infrastructure and job creation. Economic development is one of the priorities of the central Government and all efforts in this regard should be welcomed and supported by the authorities.

4.3 Feasibility Study

Refer to Appendix D7 for the Feasibility Study compiled by Fernridge Consulting

Conclusions and recommendations made by Fernridge Consulting:

Conclusions

- The proposed shopping mall will cater for the upper and lower income households in Piet Retief and surrounding area.
- The site is rated as "Good" (74%) with good visibility, however good signage is required for motorists.
- Majority of local residents make use of public transport and should the proposed mall be constructed, which is much closer, they will save on transport costs.
- There are very little formal retail amenities within the secondary catchment.
- The closest formal retail centre with a great variety of shops and services is Ermelo, which is situated 113km from Piet Retief.

Recommendations

- Signage and visibility of the tenants at the proposed development will be of

utmost importance in order to attract people, intercept passing trade, and generate support. Sufficient parking and functional layout are also very important.

- It is not necessary for the proposed shopping mall development to create major inflow, it just need to retain the primary and secondary catchment as the expenditure is currently flowing out to other towns, for instance Ermelo.
- The centre should host an attractive, well balanced mix of tenants incorporating a high percentage of national retailers and should not duplicate existing tenants. Relocations could be considered. New national tenants currently not present in the catchment must be introduced to the area. The tenant mix should be for all the market profiles.
- It should be a one-stop offer where the customer's needs (all purchases and services) are all met.
- An additional service at the proposed mall for pension/grant payout point.

5 IDENTIFIED ALTERNATIVES

5.1 No-Go Alternative

The "No-Go" option entails that the study area stays in its current state. If no development takes place, the open space erf will remain neglected and unmaintained and it will become an informal social gathering point, which often creates safety and security threats. Especially, with the old municipal buildings and testing grounds that will be moved as well. At present the site gives free access to pedestrians and it is used as a shortcut route from the north westerner of the site to the south of the site (see below). The unrestricted access to the site will also have an impact on the wetland system south of the proposed development site.



Based on the above, the “No-Go” option is not regarded as the preferred alternative for the study area.

5.2 Locality Alternatives

The study area is surrounded by existing and future land-uses that are in line with the proposed land-use and this proposed development together with other new developments in the area will contribute to the renewal and upliftment of the CBD area of Piet Retief and immediate surroundings. This upliftment project will also promote the optimum utilisation of services, it will prevent urban sprawl and it will create jobs in close proximity of existing residential areas and public transport facilities.

5.3 Land-use Alternative

5.3.1 Agricultural

The study area has medium agriculture potential. We are however of the opinion that the proposed development site is in the first instance too small to act as a viable and economical agricultural unit, the land is not zoned for agricultural purposes, the soils are very compacted and unfertile due to the loss of topsoil, buildings and infrastructure present on the site and it is situated within an urban area (directly south of the CBD) and agricultural activities are not regarded as compatible with CBD areas.

5.3.2 Residential

The option of a pure residential development with mixed densities was also considered. It was however decided that the commercial value of the study area (in terms of its strategic locality) is regarded as too high to sacrifice the land for a development that only comprise of residential uses. In addition the noise levels associated with the high traffic volumes of the N2 National Road and the activities within a CBD area are regarded as too high for a pure residential development. A person will rather purchase a residential property that is not associated with a business development in a more tranquil area, in line with the residential areas that surround the study area.

5.3.3 The Development of a Shopping Centre (The Preferred Option)

The proposed shopping mall development as described in this report is regarded as the preferred land-use for the study area and to follow are some of the most important benefits associated with this mixed use development:

- More rates and taxes payable to the involved local authority;
- Promote the optimisation of existing services;
- Upliftment of the CBD ;
- Urban renewal;
- Increased jobs;
- Job opportunities in close proximity of residential areas;
- Job opportunities in close proximity of public transport;
- Easy access;
- Maximum exposure;
- Development on already disturbed areas;
- Prevention of urban sprawl;
- Economical injection to the CBD;
- Upgrading of existing services and infrastructure;

5.3.4 Conservation Area

The application site is largely devoid of natural vegetation. According to the terrestrial biodiversity assessment as derived from the Mpumalanga Biodiversity Conservation Plan

(MBCP 2007) the subject property is classified to have **no natural habitat remaining**, and is therefore according to the classification not deemed as sensitive.

The site is too small to act as habitat for fauna and flora species that are not adapted to the urban environment and it is subject to severe edge effects. It can furthermore not act as movement corridor or linkage for smaller faunal species as the surrounding area is residential townships and other developments.

5.4 Layout Alternatives

5.4.1 The Original Layout (Layout Alternative 1)

The original layout was done prior to the detailed site inspections, which included 1:100 year floodline delineation as well as a wetland assessment. The original layout was planned in such a way that parking and other section of the shopping mall is within the 1:100 year floodline and the 32m buffer zone of the wetland.

5.4.2 The Final Layout (Layout Alternative 2 – The Preferred Layout)

The final layout was done after the specialist studies, which took the traffic, geotechnical conditions, hydrology, the topography etc. into consideration, were conducted. The wetland buffer zone and 1:100 year floodline were however the major reason for change in the layout in the southern section of the study area. **(Refer to Appendix C2 for Final Layout - The Preferred Layout)**

6 DESCRIPTION AND ASSESSMENT OF ENVIRONMENTAL IMPACTS

6.1 Environmental Impact Description, Environmental Management & Mitigation measures

The most significant anticipated environmental impacts associated with the development of the proposed application site are discussed in this section with

reference to possible mitigation measures that will minimize negative impacts and enhance positive impacts.

6.1.1 Construction Related Impacts

BENEFICIAL IMPACTS

Socio-economic:

- **Creation of Job opportunities**

The proposed development would create job opportunities during the construction phase. The value that the jobs created by the construction industry should not be underestimated as it benefits lots of people that have no other work and further transfer skills.

- **Improved site security**

24 Hour security measures will already be implemented during the construction phase and no trucks will be allowed to overnight or stop on the site and the site will be closed so no more pedestrians will use this as a resting place or short cut route.

Bio-Physical Environment

- **Eradication of alien and invader plant species**

All alien and invasive species will be removed from the site prior to construction. This will limit the spreading of alien and invasive plant species and in turn, promote the growth indigenous plant species on the proposed site and ultimately, the surrounding area.

ADVERSE IMPACTS

Bio-Physical Environment

- **Geology and Soils**

- The site clearance and levelling will cause some additional exposed areas and could trigger some additional erosion and siltation, especially during rainy periods;
- Dust pollution;
- Degradation of soils;
- Unstable conditions;
- Dangerous excavations.

Proposed Mitigation measures

- Implementation of temporary storm water management measures as well as erosion control measures, during construction;
- Appointing of a geotechnical engineer to assist with foundation designs and other stability and geotechnical issues;
- Implementation of dust suppression measures during the construction phase;
- Clear marking of dangerous excavations.

➤ **Hydrology**

- More exposed areas and increased erosion and siltation and water pollution;
- Pollution/damaging of the wetland to the south and east of the study area;
- Construction during the rainy periods;
- Excavated materials (with levelling) that are stockpiled in wrong areas can interfere with the adjacent wetland/stream as it can cause sedimentation and water pollution.

Proposed Mitigation measures

- Implementation of temporary storm water management measures as well as erosion control measures, during construction;
- Fencing the site to ensure that the wetland to the south of the site is not influenced by construction activities;
- Schedule (where possible) construction associated with earthworks for the dryer winter months.

➤ **Climate**

- Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes it difficult to build in and rehabilitate disturbed areas on site;
- These wet conditions often cause delays to building projects. The drainage of water away from the construction site into the surrounding open space areas could (if not planned and managed correctly) have an impact on the water quality of these water bodies.

Proposed mitigation measures

- It is recommended that the construction phase be scheduled for the winter months, especially activities such as the installation of services, foundations, excavations and road construction;
- It is also recommended that precautionary measures be taken in order to prevent the extensive loss of soil during rainstorms. Large exposed areas should be protected against erosion by matting or cladding;
- Measures should be implemented during the rainy season to channel storm water away from open excavations and foundations; and
- Construction workers and construction vehicles and machinery must stay out of the soggy areas during the wet periods. Barrier tape should be used to demarcate the areas that are drenched with water it should only be removed when the appointed Environmental Control Officer (ECO)/ Site supervisor/ project manager /main contractor regard the conditions as favorable.

➤ **Flora & Fauna**

The study area is not regarded as of any fauna and flora importance as the site is on a busy intersection just south of the Piet Retief CBD.

The proposed development could have the following impacts on the biological and ecological environments:

- The clearance of the site and the construction activities will result in the eradication of the existing vegetation on site;
- Destruction of the wetland habitat can lead to habitat loss;

- Increase in flow velocity around the development area in an already fragmented environment;
- Increase in surface drainage to accommodate infrastructure;
- Accidental introduction of exotics and invaders;
- The proposed development can result in an increase of hardened surfaces and subsequent storm water runoff. Any hardening in the surfaces will reduce the infiltration and ultimately reduce the yield of ground water that may be feeding into the wetland systems adjacent to the study area.

Proposed Mitigation measures

- All affected and exposed areas should be rehabilitated upon the completion of construction. In this regard, special reference is made to the use of indigenous vegetation as the first choice during landscaping;
- All areas affected by construction, which are to remain as open space areas, should be rehabilitated upon the completion of the construction phase of the development;
- The landscape architect should only specify the use of native and indigenous plant species in their plant design;
- Indigenous species and preferably endemic plant species should be encouraged within the development as this will promote habitat for birds and insects; and
- All exotic invader plant species on site should be eradicated.

➤ **Veld fires may cause damage to infrastructure, vegetation and fauna**

Construction workers could start uncontrolled fires, which could damage infrastructure on site and the adjacent open space areas.

Proposed mitigation measures

- One central cooking and fire area should be established on site. This should be located in a fire safe area where vegetation (especially Veld grass) has been removed;
- Cooking fires and smoking should strictly be limited to only this area. No smoking at the construction site should be permitted outside this area; and
- No fires or smoking should be allowed on windy days.

➤ **Areas where vegetation was not removed for construction are not rehabilitated**

Soils will be disturbed and exposed during the construction phase which may in turn cause environmental risks. The terrestrial biodiversity assessment that has been derived from the Mpumalanga Conservation Plan indicates that no natural habitats are present on site. The northern half of the site is in a developed state. Exposed areas should however be rehabilitated upon the completion of construction.

Proposed Mitigation measures

- All large and exposed areas should be rehabilitated immediately after construction has completed;
- Topsoil should be filled back directly during the installation of services; and
- All exposed and affected areas which are to remain as open space should be appropriately re-vegetated and/or landscaped to prevent erosion and/or the loss of valuable soil on site.

Air Pollution, Localised Vibration and Noise pollution

➤ **Nuisance to neighbours in terms of dust generation**

It can be expected that a certain amount of dust will be generated due to earthmoving activities and demolition works. One should take note that the impact of dust pollution is short-term and lasting for the duration of construction only.

Proposed Mitigation measures

- The application site must be damped on a regular basis with water during dry and windy conditions

➤ **Nuisance to neighbours in terms of noise generation, especially due to demolition works**

A certain amount of noise will be generated during the construction phase, which may definitely become a nuisance to the surrounding land owners, residents and businesses. One should note that although noise is generated during any normal construction operation, the development/construction of the new shopping mall is associated with demolition works. It is therefore anticipated that a considerable amount of noise will be generated, especially due to this.

Proposed Mitigation Measures

- It is anticipated that a certain amount of noise will be generated during the construction phase. The contractors should take care, and manage construction/demolition works to such an extent to comply to minimum ambient noise levels as defined in local, provincial, and National policies and frameworks;
- The contractor should liaise with local residents on how best to minimise impact.
- The local population should be kept informed of the nature and duration of intended activities;
- Construction yards, workshops, concrete batching plants and other noisy fixed facilities should be located well away from noise sensitive areas;
- All construction vehicles, plant and equipment are to be kept in good repair;
- Blasting operations (if required) are to be strictly controlled with regard to the size of explosive charges in order to minimise noise and air blast and timings of explosions;
- Construction activities should remain and take place during reasonable hours during the day and early evening. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning; and
- It must be ensured that the working conditions of construction workers comply with the requirements of the occupational Health and safety Act, 1993 (Act No 85 of 1993)

➤ **Heavy vehicle traffic and noise increase on the local roads**

Construction vehicles will have a negative impact on traffic volumes, road safety and noise levels during the construction period. Heavy construction vehicles will have an added negative impact on traffic flow during the peak hour traffic times.

Proposed Mitigation measures

- The Traffic Impact Study indicated that the developer should construct some upgrades to the local intersections/entrance to the proposed development area. It is recommended that these upgrades be implemented before major construction takes place on site. If the road upgrades cannot be scheduled early on in the construction program the developer should investigate the need to employ traffic officials to facilitate traffic flow at the intersections around the construction site;

- The heavy construction vehicles should avoid the local roads during peak traffic times and large deliveries should also be scheduled outside the peak traffic times;
- Signs should be erected in the vicinity of the site and on all major junctions that the construction vehicles will use; and
- The construction vehicles should obey all traffic rules and stay within the speed limits.

Visual Impact & Waste Management

➤ If the site office and camp is not managed according to the EMP

A construction site of this scale requires the establishment of construction infrastructure, such as a site office, material stockyards, and workshops. The area where the above facilities are to be erected should be located in an already disturbed part of the site.

Absence of proper sanitation facilities and good housekeeping could negatively impact the local community, surface/sub-surface hydrology and soils.

Proposed Mitigation measures

- Identify a central waste storage area and establish suitable containers skips for the different waste streams;
- The wind direction and the proximity to neighbouring properties should be taken into account, when a central waste storage area is established;
- Rubble and waste should be removed from the construction site on a weekly basis by a service provider;
- The contractor should communicate with other trades and businesses in the area to establish waste exchange and recycling possibilities;
- Rubble and waste should be removed to registered dumping sites as is acceptable to the local authorities; and
- Chemical toilets, one for every ten workers, should be erected close to the area where construction works are taking place.

➤ Dumping of builder's rubble on site

The dumping of builder's rubble on site may cause visual pollution. Dumping of waste in the open space areas south and east of the site could have a detrimental effect on the

fauna, flora of the open space area. Builder's rubble can also pollute the hydrological system and soil of the open space area. It is therefore critical that no builder's rubble be dumped within the open space area or vacant land within the surrounding area.

Proposed Mitigation measures

- Identify a specific point for waste and rubble on site;
- The area should be located in an area that is already disturbed and which can be hidden from the surrounding residents to prevent visual pollution;
- All the rubble and waste materials should be transported and disposed at this central waste disposal site that should be established;
- Rubble should be removed from this area on a regular basis as to not cause a negative visual impact;
- Appropriate containers for different waste streams should be provided on site; and
- Barriers and screens should be erected around the waste storage area to mitigate and reduce its visual impact;

➤ **Vehicle maintenance on site could cause visual pollution**

Temporary maintenance and refuelling workshops may be required for construction vehicles. Soil and water pollution by oil, lubricants and fuel may occur at these facilities. The volume of lubricants and fuel expected to be on site should only cause localised pollution. However, any pollution of the soil and water is undesirable and should be prevented.

Proposed Mitigation measures

- One area in the site camp should be used for fuel or hazardous materials and lubricant storage;
- This area should be bunded to contain 1.5 times the storage volume of fuel and should have a concrete base;
- A working area should be established at the site camp with a concrete base on which all machinery repairs, vehicle services and such activities should take place; and
- After the construction works are completed this area should be rehabilitated and the soil quality should be restored.

➤ **Light Pollution**

Security and temporary lighting on site during the construction phase could have an adverse impact on the surrounding neighbours and driving conditions on the surrounding roads.

Proposed Mitigation measures

- Security lighting should be directed to the ground;
- Only the needed lighting should be installed;
- Lighting should not shine into the neighbouring properties or onto the surrounding roads and oncoming traffic; and
- The design, placement and arrangement of exterior lighting should take the sensitive night views into consideration.

➤ **Construction works could cause an adverse visual impact to the surrounding land owners/residents**

The infrastructure associated with the construction phase (Site camp and waste storage area) could cause an adverse visual impact.

Proposed Mitigation measures

- Waste and building material stockyards should at all times be cleaned and kept tidy;
- No litter, plastic package or cement bags should at any time be left on site. It is expected that the site be kept in a neat and tidy at all times. Waste items should be disposed off once a week by a contracted service provider;
- Screens should be erected to hide unsightly waste storage areas or any other temporary infrastructure that may cause an adverse visual impact; and
- Where possible, screens should be erected around the site, to mitigate the adverse visual impact that construction activities have on the surrounding urban environment.

Cultural & Historical

➤ **The potential occurrence of cultural and historical assets on site**

Archaeological sites/sites of cultural and historical importance can be disturbed and/or destroyed during construction works, if exposed.

Proposed Mitigation measures

- Archaeological sites that are exposed during construction work, should immediately be reported to a museum, preferably one at which an archaeologist are present, so that an investigation and evaluation of the findings can be made;
- It should be noted that in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999), Section 35(4) no person may, without a permit issued by the responsible heritage resources authority, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or material;
- Section 34 (1) also in addition states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority;
- If the remains of the old irrigation channel are older than 60 years, it will be necessary to obtain a demolition permit from SAHRA; and
- If it was found that the irrigation channel has some cultural and historical value, sections of the remains of the irrigation channel (if possible) should be incorporated as part of the shopping centre development. This will enhance the "Sense of Place".

Safety and Security

➤ **The following safety and security problems can arise during the construction phase**

- Reckless operators of construction vehicles can cause dangerous conditions on the nearby roads as well as on the construction site;
- Deep excavations without warning signs can pose a health and safety risk to the construction personnel on site, as well as the public/ surrounding residents/ pedestrians; and
- Possible crime initiated due to an influx of people that are associated with construction.

Proposed Mitigation measures

- Although regarded as a normal practice, it is important to erect proper signs indicating the operation of heavy vehicles in the vicinity of dangerous crossings and access roads;
- Dangerous excavations where construction is not actively taking place, should be properly marked and demarcated with orange safety barrier tape;
- Construction must be completed in the shortest possible time. No construction worker or relative may reside on the application site during the construction phase. All construction workers must leave the site at the end of the day's work. A security company must be appointed to secure the site, and to ensure a safe and controlled environment;
- No construction worker, friend or relative may reside on site. Only security personnel may be present on site after construction hours; and
- No construction worker should be allowed to enter any adjacent private property for any reason without written consent.

6.1.2 Operational Related Impacts

BENEFICIAL IMPACTS

Socio-Economic

➤ **Economical and Institutional:**

- This new centre will increase and expand the product and service range within the market and improve the overall quality thereof;
- The proposed shopping mall will attract larger volumes of customers from the Piet Retief and surrounding area and reduce leakage of purchase power from this market;
- More rates and taxes payable to the involved local authority;
- Promote the optimisation of existing services;
- Increased jobs;
- Job opportunities in close proximity of residential areas;
- Job opportunities in close proximity of public transport;
- Maximum exposure;

- Economical injection to the CBD;
- Prevention of urban sprawl; and
- The proposed expansion is in line with the planning frameworks for the area.

➤ **Social:**

- Upliftment of the CBD;
- Urban renewal;
- Increased jobs;
- Job opportunities in close proximity of residential areas;
- Job opportunities in close proximity of public transport;
- Easy access;
- Contribute to the upliftment of the Piet Retief CBD area and beautification of the prominent corner stand that is currently regarded as an eyesore and a security risk;
- The proposed mall will ensure a safe, secure and controlled environment;
- Upgrades to the surrounding road network will benefit the surrounding community;
- The proposed shopping mall will create a more attractive retail shopping development. It is anticipated that the proposed mall will enhance the "Sense of Place" of the study area and the surrounding urban environment.

➤ **Services (roads, water, sanitation, waste management, storm water management)** (Refer to Appendix D4 for a copy of the services report)

- Possible contributions for the upgrading of external services such as the external sewer network and the surrounding road network;
- The proposed new shopping mall will promote the optimal utilisation of services and infrastructure;
- If well planned and managed, the proposed new shopping facility will provide additional social facilities for usage by tourists and local residents.
- The proposed new development will contribute significantly to the increase of rates and taxes payable to the Mkhondo Local Authority.

Bio-Physical Environment:

- *Geology and Soils:*
 - Prevention of any further erosion and siltation on and around the site.

- *Hydrology:*
 - Protection of the adjacent wetland watercourse and the associated riparian zone.

- **Fauna and Flora:**
 - Implementation of a weed control programme;
 - Replacement of exotic species with indigenous species;
 - Removal of exotic invaders;
 - Development on already disturbed areas; and
 - Create opportunity to introduce indigenous vegetation species on the site and to attract birds and insects.

The proposed development will create the opportunity to re-vegetate the site with indigenous vegetation. The exposed areas will be covered with paved surfaces or vegetation and will prevent any further erosion and siltation. The areas covered with vegetation will also improve the micro-climatic conditions of the site and its surroundings. It will also contribute to the aesthetical qualities of the study area.

It is also recommended that plant species that attract birds and insect species be introduced as part of the planting selection to be used for the development's gardens.

ADVERSE IMPACTS

Roads and Traffic

- The impact of additional vehicle traffic on the already busy roads due to traffic associated with development.

Proposed Mitigation measures:

- The appointed traffic engineers indicated that certain intersections and roads in the vicinity of the study area be upgraded, in order to accommodate the volume of traffic that are generated due to the proposed expansion. **(Please Refer to Appendix D5 for a copy of the Traffic Impact Assessment)**

Qualitative Environment**➤ Lighting Pollution**

- The proposed development could cause a significant level of light pollution due to security and advertisement lighting. These lighting could easily glare into the surrounding environment, especially surrounding residences if not designed appropriately.

Proposed Mitigation measures:

- It is recommended that all the lighting on site be designed to point downwards and the lighting system should be designed not to cause glare, dispersal or unnecessary flickering.

➤ Air pollution

The development will generate additional traffic on the local roads that will contribute to the air pollution levels in the immediate area.

Proposed Mitigation measures:

- Air pollution levels will not exceed acceptable levels. No mitigation measures proposed.

➤ Noise pollution

Some additional noise will be generated during the operational phase of the proposed Shopping Centre due to:

- Increased Traffic on the surrounding roads; and
- Activities associated with the operation of the new facility (Air conditioning, compressors, places of refreshment etc.)

Proposed Mitigation measures:

- The design, placement and orientation of extractor fans for the ventilation of the buildings must take the noise impact aspect into consideration. Equipment with the best noise rating should be used. Roof mounted fans may further require attenuators and need to be screened from noise sensitive areas;
- High quality air conditioning equipment should be installed. Equipment with the best noise rating should be used;
- Where required, high quality refrigeration compressors should be installed. Equipment with the best noise rating should be used. Exterior installations should be acoustically encapsulated; and
- All mechanical equipment should be well maintained.

➤ **Visual Impact**

The site has a prominent location in Piet Retief and the proposed shopping mall will enjoy high visibility.

Proposed Mitigation measures:

- The architectural styles, colours and textures and construction materials will determine the visual impact of the proposed development on the surrounding areas;
- The proposed development will be seen from a distance. Roofs of the proposed shopping mall should therefore not be covered with bright colours.

Hydrology

➤ **Stormwater Management and the Protection of the adjacent Wetland**

Surface water run-off from the site has the potential to affect the surrounding open-space areas if not well managed.

Proposed Mitigation measures:

- Adequate storm water management must be incorporated in the design of the proposed development to ensure the effective management of surface water run-off from the site, and to prevent erosion and the associated sedimentation of the surrounding areas;

- The release points of storm water to the surrounding open space areas must be done carefully and the use of energy dissipation structures, reno mattresses and geo-textiles should be made to prevent erosion down the gradient of the discharge points;
- Sheet run-off from paved surfaces and access roads need to be curtailed;
- All areas which have been affected by construction, which are to remain as open space should be rehabilitated upon the completion of the construction phase;
- Discharge of storm water runoff from site should be limited to pre-design development peak flows and volumes;
- Where practical, retention and detention storage systems should be used to manage peak storm water flows within the on-site storm water management system;
- Uncontaminated storm water run-off from roofs, parking bays and the landscape should not be allowed to mix with process effluent, stored chemicals or storm water runoff from areas susceptible to chemical/petroleum based spills;
- Paved areas exposed to rainfall where dust, litter or spilled substances accumulate should be regularly cleaned using methods that prevent drainage or leaching of fluid into the surrounding environment. Gross pollutant (litter), oil and sand traps (appropriate to the site) are recommended at drain entry or discharge points. These traps require regular inspection and residue removal;
- First-flush water diversion for dusty outdoor areas should be considered to capture initial storm water run-off after any extended dry period.

6.2 Significance Description Methodology

The significance of Environmental Impacts was assessed in accordance with the following method:

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, in the case of adverse impacts regardless of any prevention measures.

Rating = 5

The severity factor 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 - natural and man-made functions not affected – Factor 1
- Medium intensity - environment affected but natural and man-made functions and processes continue - Factor 2
- High intensity - environment affected to the extent that natural or man-made functions are altered to the extent that it will temporarily or permanently cease or become dysfunctional - 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 4.

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

$$\begin{aligned}
 \text{The Severity factor} &= \text{Intensity factor X Duration factor} \\
 &= 2 \times 3 \\
 &= 6
 \end{aligned}$$

A Severity factor of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table 16 below:

Table 5: Severity Ratings

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 >6 to 15)

- Positive impact:
Should weigh towards a decision to continue
- Negative impact:
Should be mitigated to a level where the impact would be of low significance before project can be approved.

High significance (calculated Significance Rating 16 and more)

- 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.

6.3 Significance Assessment

Refer to **Table 6** for the Calculation and Result of the Significance Assessment of Impacts identified to be associated with the Proposed Development.

Table 6: Calculation and Result of the Significance Assessment of Impacts Identified to be Associated with the Proposed Development

Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating- prior to mitigation and after mitigation (Note proposed mitigation measures are supplied in EMP and in Item 5)
		Intensity	Duration			

						above – no mitigation required for beneficial impacts)
THE CONSTRUCTION PHASE						
BENEFICIAL IMPACTS (Note: Not necessary to mitigate because the impact are positive)						
Socio-Economic						
Creation of Employment opportunities	4	4	2	8	3	12 Medium
Improved site security	5	2	3	6	3	15 Medium
Flora						
The eradication of exotic invaders and weeds on the subject property	5	4	2	8	3	15 Medium
ADVERSE IMPACTS						
Geology and Soils						
The site clearance and levelling will cause some additional exposed areas and could trigger some additional erosion and siltation, especially during rainy periods	4	2	2	4	2	8 Medium
	2	2	2	4	2	4 Low
Dust pollution	4	2	2	4	2	8 Medium
	2	2	2	4	2	4 Low
Degradation of soils	4	2	2	4	2	8 Medium
	2	2	2	4	2	4 Low
Unstable conditions	4	2	2	4	2	8 Medium
	2	2	2	4	2	4 Low
Dangerous excavations	4	2	2	4	2	8 Medium
	2	2	2	4	2	4 Low
Surface & Sub-surface Hydrology						
More exposed areas and increased erosion, siltation and water pollution	3	2	2	4	2	6 Low
	2	2	2	4	2	4 Low
Removal/damaging of the adjacent wetland, south of the study area	3	2	4	4	4	12 Medium
	2	1	2	2	2	4 Low
Construction during the rainy periods	4	2	2	4	2	8 Medium
	2	2	2	4	2	4 Low

Excavated materials that are stockpiled in wrong areas can interfere with the natural drainage, cause sedimentation and water pollution	4 2	2 2	2 2	4 4	2 2	8 Medium 4 Low
Climate						
Should the construction be phased for the summer months, frequent rain could cause very wet conditions, which makes it difficult to build in and rehabilitate disturbed areas on the site	4 2	2 2	2 2	4 4	2 2	8 Medium 4 Low
The wet conditions often cause delays to building projects. The drainage of water away from the construction site into the surrounding open space areas could (if not planned and managed correctly) have an impact on the water quality of these water bodies	4 2	2 2	2 2	4 4	2 2	8 Medium 4 Low
Flora and Fauna						
The clearance of the site and the construction activities will result in the eradication of the existing vegetation on site	4 2	2 2	4 4	8 8	2 3	8 Medium 6 Medium
Accidental introduction of exotics and invaders	2 2	1 1	4 2	4 2	2 2	4 Low 4 Low
Veld fires may cause damage to infrastructure, vegetation and fauna	2 2	1 1	2 2	2 2	2 2	4 Low 4 Low
Areas where vegetation cleared for construction are not properly rehabilitated	4 2	2 1	4 2	8 2	3 2	12 Medium 4 Low
Destruction of the wetland habitat can lead to habitat loss	4 2	2 1	4 2	8 2	3 2	12 Medium 4 Low
Increase in flow velocity around the development area in already fragmented environment	4 2	2 1	4 4	8 4	3 2	12 Medium 4 Low
Increase in surface drainage to	4	2	4	8	3	13 Medium

accommodate infrastructure and structures	2	1	4	4	2	4 Low
Air pollution, Localized vibration & noise pollution						
Nuisance to neighbours in terms of dust generation.	4 2	2 1	2 2	4 2	2 2	8 Medium 4 Low
Nuisance to neighbours in terms of noise generation during construction	4 2	2 1	2 2	4 2	2 2	8 Medium 4 Low
Heavy vehicle traffic and noise increase on the local roads	4 2	2 1	2 2	4 2	2 2	8 Medium 4 Low
Visual Impact & Waste Management						
If the site office and camp, and associated waste are not managed according to the EMP	4 2	2 1	2 2	4 2	2 2	8 Medium 4 Low
Builder's rubble is dumped during the construction phase on site.	4 2	2 1	2 2	4 2	2 2	8 Medium 4 Low
Vehicle maintenance on site could cause visual pollution	2 2	2 1	2 2	4 2	2 2	4 Low 4 Low
Lighting pollution	3 2	2 1	2 2	4 2	2 2	6 Low 4 Low
Construction works could have an adverse visual impact on the surrounding residents and landowners	4 2	2 1	2 2	4 2	2 2	8 Medium 4 Low
Cultural & Historical						
The occurrence of cultural and historical assets on the proposed development site	2 2	2 1	4 2	8 2	3 2	6 Low 4 Low
Safety and Security						
The following safety and security problems are likely to occur during the construction phase: <ul style="list-style-type: none"> Reckless operators of construction vehicles can cause dangerous conditions on the subject property and surrounding roads; 	3 2	2 1	2 2	4 2	2 2	6 Low 4 Low

<ul style="list-style-type: none"> • If ground works, especially deep excavations are not properly marked or demarcated for safety reasons; and • Possible crime initiated by construction workers/friends/relatives during the construction phase 						
--	--	--	--	--	--	--

OPERATIONAL PHASE						
BENEFICIAL IMPACTS (Note: Not necessary to mitigate because the impact are positive)						
Socio-Economic						
Economical and Institutional						
The proposed new centre will increase and expand the product and service range within the market and will improve the overall quality thereof.	5	2	4	8	3	15 Medium
The new mall will attract larger volumes of customers from the area and reduce leakage of purchase power from the market.	5	2	4	8	3	15 Medium
More rates and taxes payable to the local authority	5	4	4	16	5	25 High
Promote the optimum utilisation of services	5	4	4	16	5	25 High
Increased jobs	4	2	4	8	3	12 Medium
Job opportunities in close proximity of residential areas	5	2	4	8	3	15 Medium
Job opportunities in close proximity of public transport	5	2	4	8	3	15 medium
Maximum exposure	5	4	4	16	5	25 High
Economical injection to the town	4	2	4	8	3	12 Medium
Prevention of urban sprawl	4	2	4	8	3	12 Medium
The proposed expansion is in line with the planning frameworks for the area	5	2	4	8	3	15 Medium

Social						
Upliftment of the CBD	4	2	4	8	3	12 Medium
Urban renewal	4	2	4	8	3	12 Medium
Increased jobs	4	2	4	8	3	12 Medium
Job opportunities in close proximity of residential areas	4	2	4	8	3	12 Medium
Job opportunities in close proximity of public transport	4	2	4	8	3	12 Medium
Contribute to the upliftment of the Piet Retief CBD area and the beautification of the prominent corner stand that is currently regarded as an eye sore and safety risk	4	2	4	8	3	12 Medium
The proposed mall will ensure a safe, secure and controlled environment	4	2	4	8	3	12 Medium
Upgrades to the surrounding road network will benefit the surrounding community	5	4	4	16	5	25 High
The proposed new shopping mall will create a more attractive retail shopping development. It is anticipated that the proposed centre will enhance the "Sense of Place" of the study area and the surrounding environment	4	2	4	8	3	12 Medium
Services, Roads and Traffic						
Possible contributions for the upgrading of external services such as the external sewer network, the surrounding road network and the water purification works (which is currently being upgraded, but some funds are required to successfully complete the upgrading of the municipal water supply system)	4	4	4	16	5	20 High
The proposed new centre will promote the optimum utilisation of services	4	4	4	16	5	20 High
Bio-Physical Environment						
Geology and Soils						

Prevention of any further erosion and siltation	2	2	4	8	3	6 Low
Hydrology						
Protection of the adjacent wetland	4	2	4	8	3	12 Medium
Fauna and Flora						
Implementation of a weed control programme	2	2	4	8	3	6 Low
Replacement of exotic species with indigenous species	4	2	4	8	3	12 Medium
Removal of exotic invaders	2	2	4	8	3	6 Low
Development of the already disturbed areas	4	4	4	16	5	20 High
Create the opportunity to introduce indigenous vegetation species to the site and to attract birds and insects	2	2	4	8	3	6 Low
ADVERSE IMPACTS						
Roads & Traffic						
The impact of additional vehicular traffic on already busy roads due to traffic associated with the development	4	4	4	16	5	20 High
	2	2	4	8	3	6 Low
Qualitative Environment, Pollution & Visual Impact						
Light pollution	4	4	4	16	5	20 High
	2	2	4	8	3	6 Low
Air Pollution	2	2	4	8	3	6 Low
	2	1	4	4	2	4 Low
Noise Pollution	2	2	4	8	3	6 Low
	2	1	4	4	2	4 Low
Visual Impact	4	4	4	16	5	20 High
	2	2	4	8	3	6 Low
Hydrology						
Storm water management and the protection of the adjacent wetland	4	2	4	8	3	12 Medium
	2	1	4	4	2	4 Low

6.4 Discussion of Significance Assessment

Thirty-two (32) beneficial and thirty-four (34) adverse impacts are associated with the proposed development.

Twenty-four (24) of the anticipated beneficial impacts are socio-economic and institutional related and eight (8) bio-physical related. Of the thirty-four (34) adverse impacts, nineteen (19) are bio-physical related and fifteen (15) are socio-economical and institutional related.

Of the thirty-four (34) anticipated adverse impacts that are associated with the construction and operation of the proposed development, three (3) of the impacts have a high significance rating, but such ratings were successfully reduced to low impacts with low significance ratings through the application of suitable mitigation measures.

The above results can mainly be ascribed to the current developed and transformed state of the study area, and its immediate surrounding environment (Piet Retief CBD). In addition to this, no geotechnical condition exists, to such an extent, of not allowing the proposed development of a shopping mall to proceed.

Twenty-eight (28) of the thirty-four (34) adverse impacts relate to the construction phase alone. Thus, almost 83% of all the adverse impacts, associated with the development of the shopping centre, are of a short term in nature, lasting for construction only and can be successfully mitigated.

The significance assessment furthermore indicates that twenty-nine (29) of the beneficial impacts are related to the operational phase of the shopping mall and twenty-two (22) of these impacts are related to the socio-economical and institutional environments. This means that the socio-economical and institutional environmental will benefit significantly from the proposed development of a shopping mall.

In light of the above, it can be provisionally concluded that, no "fatal flaw" adverse impacts or impacts that cannot be adequately mitigated, are anticipated to be associated with the proposed new shopping centre. This is subjected to the condition

that all recommended mitigation measures as stipulated in the Environmental Management Plan (**EMP**) and as supplied in this report, be adhered to, in order to mitigate the adverse impacts and to achieve the maximum gain from the identified beneficial impacts. **(Refer to Appendix E1 for the attached report).**

7 INPUTS AND RECOMMENDATIONS BY SPECIALISTS

All the inputs and recommendations made by the various specialists were taken into consideration and such inputs have been summarized in this report. Furthermore, the recommendations made by the specialists were included as part of the EMP.

The various specialist reports are included as Appendix D of this BAR.

8 ENVIRONMENTAL MANAGEMENT PLAN (containing the aspects contemplated in regulation 33)

Please refer to Appendix E1 for the attached Environmental Management Plan (EMP)

9 ASSUMPTIONS, UNCERTAINCIES AND GAPS IN KNOWLEDGE

The following assumptions and gaps in knowledge are implicit in this Basic Assessment Report (BAR)

9.1 Assumptions:

- The primary assumption underpinning this BAR and the individual specialist studies upon which this BAR is based is that all information received from the applicant, professional consultants, and other stakeholders including registered I & AP's are correct and valid at the time of the study;
- The significance of impacts was not underestimated. The specialist assessed impacts under the worse-case scenario situation.

10 ENVIRONMENTAL IMPACT STATEMENT

Environmental Impact Statement that summarizes the impacts that the proposed development may have on the environment after the management and mitigation of impacts that have been taken into account.

The major impacts that are likely to occur during the construction and operational phases are the following:

10.1 The Physical and Biological Environment:

Construction Phase

- The natural environment will be affected by construction related activities- site clearance, bulk earthworks etc. The study area is on the other hand in a developed and transformed state with no important or significant faunal or floral species present;
- The study area is affected by a 1:100 year floodline but this is incorporated in determining the final layout. A stream/wetland habitat is present to the south and east of the site. The 32m buffer zone traverses the boundary of the site. It is also recommended that the layout of the proposed shopping mall be re-evaluated to ensure that the wetland and associated buffer zone is not impacted. It must however be noted that runoff from the proposed development site has the potential to affect the surrounding open space areas if adequate stormwater management measures are not implemented;
- The site occurs at a medium slope towards the adjacent wetland. Levelling and its associated materials, as well as surface runoff, should be managed to avoid pollution of the wetland;
- Valuable topsoil may be lost during the construction process. The loss of topsoil can be minimised through the storage of topsoil in stockpiles on site and the re-use thereof within the landscape component of the development;

- Some vegetative coverage will be lost and areas will be exposed. Such areas will be subject to erosion and siltation. The terrestrial biodiversity assessment as derived from the Mpumalanga Conservation Plan however indicates that no natural habitats or sensitive faunal or floral species are present on site.

Operational Phase

- Some vegetative coverage will be permanently lost to accommodate the hard surfaces and structures associated with the proposed development;
- Increased storm water volumes due to an increase in impermeable surfaces.

10.2 The Socio-economic Environment

Construction Phase

- Nuisance to neighbours due to dust pollution that are associated with construction activities;
- Nuisance to neighbours due to noise that is generated by construction activities;
- Nuisance to neighbours due to the undesirable visual impact that is associated with construction activities;
- Damage to local roads by heavy vehicles; and
- Health, safety and security problems that is likely to occur during construction of the proposed mall.

Operational Phase

- Increased traffic volumes;
- Possible noise pollution and visual pollution caused by the signage, interior lighting, security lighting, exterior lighting, transformers, air conditioners, places of refreshments etc.

Finding

None of the adverse impacts that were identified are regarded as impacts that cannot be mitigated to acceptable levels and therefore it is our opinion that there are no

“fatal flaws” associated with the proposed development of the shopping mall in Piet Retief.

11 CONCLUSION AND RECOMMENDATIONS:

As mentioned throughout the report, the subject property is in a developed and transformed state with buildings and infrastructure already present and no significant or sensitive faunal or floral habitats. In addition the proposed layout is not affected by the 1:100 year floodline even though the site is subject to the 1:100 year floodline.

The geotechnical engineers furthermore indicated that no geotechnical condition exist to the extent of not allowing the proposed development to proceed. The involved geotechnical engineers subsequently indicated that certain measures are recommended to ensure a safe and sound development.

The significance assessment of the impacts that is associated with the development of the shopping mall indicates that almost 83% of the anticipated adverse impacts are of a short term nature lasting for the construction phase only. In addition, it is important that one should take cognizance of the fact that the significance of these impacts is predominantly low to medium, with high mitigation levels.

The significance assessment further indicated that a great number of beneficial impacts are associated with the development of the proposed mall. These impacts are generally of a socio-economic nature with medium to high significance ratings.

The need, desirability and sustainability of the proposed shopping mall have been well motivated in this report, and based on the findings of the involved town and regional planners and market research specialists, the development of the new shopping mall will be economically and socially viable. Some of the key findings that have been made include:

- The local residents need to visit neighbouring towns for the purpose of shopping (food, furniture, appliances etc.) and services. The proposed mall will reduce this outflow and rather manage the flow within the local market;

- The proposed development will increase the rates and taxes payable to the local authority;
- The proposed development will contribute significantly to the upgrading of the existing external services and roads;
- The proposed development will be in line with the existing and future land-uses of the area.

Opinion and Recommendations by EAP:

It is believed that both beneficial and adverse impacts were thoroughly assessed, and the needs and benefits have been assessed so as to give the proposed shopping mall development the go-ahead. As a result Bokamoso is of the opinion that the proposed Shopping Mall will have a significant long-term beneficial socio-economic impact on the subject property and its immediate surroundings.

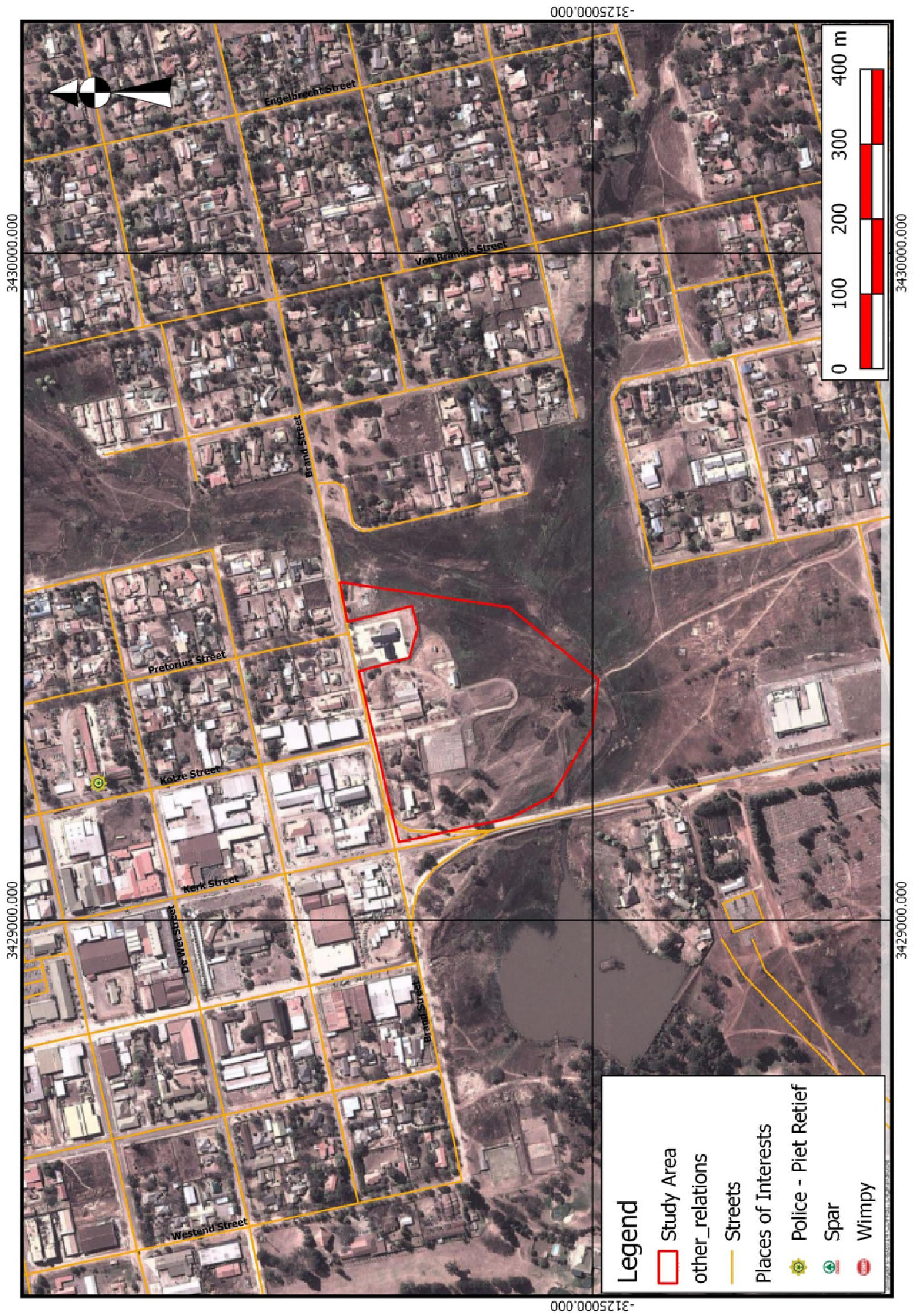
It is therefore recommended by Bokamoso that the proposed development be approved, subjected to the implementation of appropriate mitigation measures as stipulated in this report and the Environmental Management Plan (EMP), to achieve maximum advantage from the beneficial impacts and the sufficient mitigation of adverse impacts.

It is recommended that, based on the findings of the BAR and supplemental specialist information that:

- Should the proposed Piet Retief x 22 Shopping Mall obtain the necessary environmental authorisation, an Environmental Management Plan (EMP) must be implemented for the construction and operational phases of the development. The EMP, as attached to this document, should be made part of the contractual documents of the contractors;
- The construction of all structures, roads and services must be in accordance with the specifications of the Geotechnical Investigation;
- The design and implementation of the infrastructure and services are to be done in accordance with engineering specifications so as to comply with the requirements, regulations and standards of the local controlling authority;

- It is recommended that DWS be approached regarding the applicability of Section 21 of the National Water Act. Even though the seepage wetland in the north-eastern section of the study area is regarded as a man-made watercourse/ wetland, DWS will most probably require that a License application be submitted for the removal of the wetland and for the proposed development within 500m from a wetland;
- Runoff from the proposed development site has the potential to affect the surrounding open space areas. It is therefore recommended that adequate storm water management be incorporated in the design of the proposed development in order to prevent erosion and the associated sedimentation of the surrounding areas. All areas affected by construction which are to remain as open space areas should be rehabilitated upon the completion of the construction phase of the development; and
- Signage/advertising board signage should comply with the relevant by-laws, regulations and standards of the local authority.





Legend

- Study Area
- other_relations
- Streets
- Places of Interests
- ⚙ Police - Piet Retief
- Ⓢ Spar
- Ⓜ Wimpy

Appendix B:

Photographs







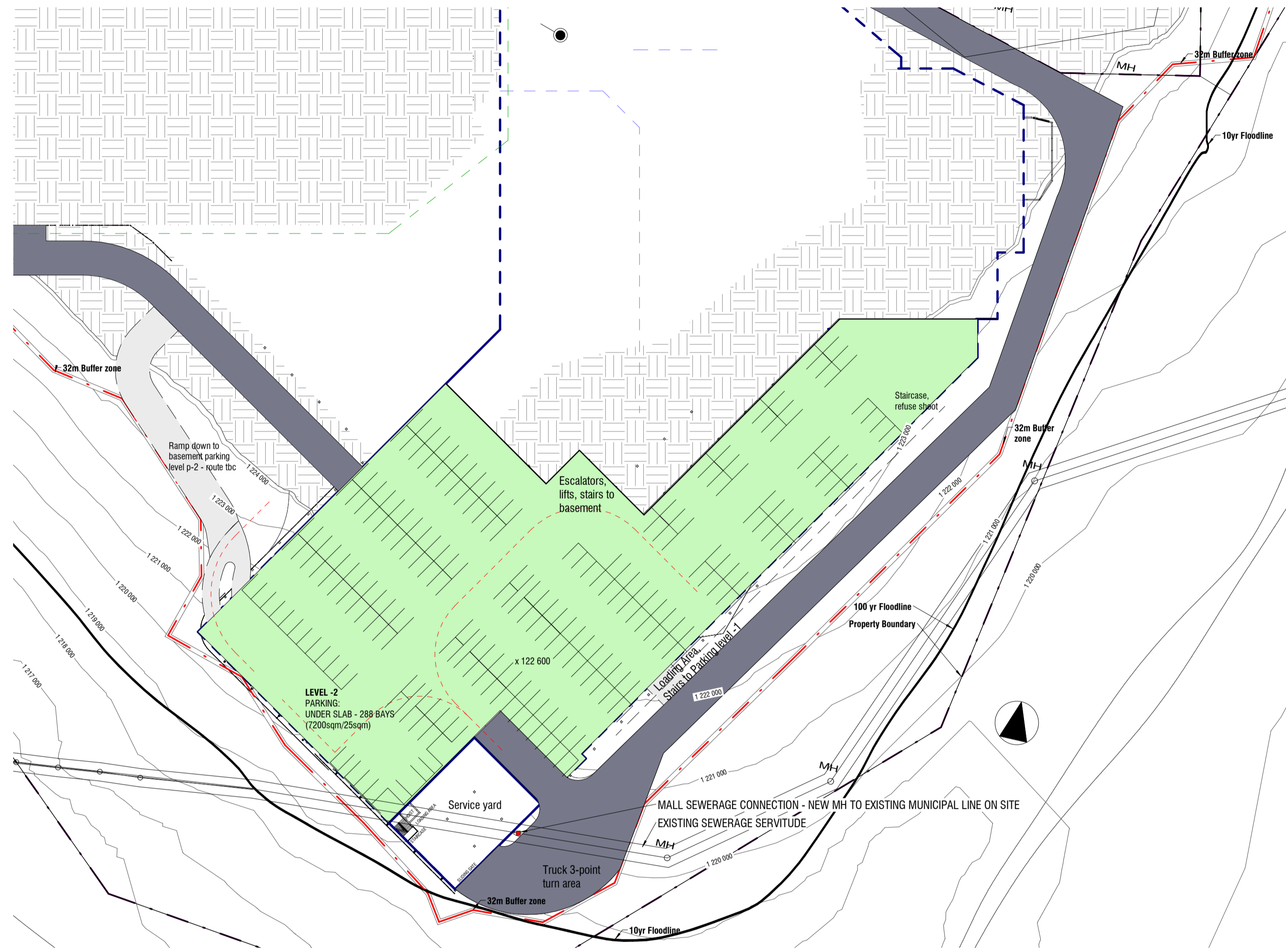


Appendix C:

Facility Illustration

Appendix C1: The Original Layout





-02 Parking Level 1 750
SCALE: 1 : 750

PARAGON GROUP
PARAGON ARCHITECTS
PARAGON INTERFACE
HUB ARCHITECTS
PARAGON ARQUITETURA

PARAGON ARCHITECTS

1st Floor, 33 Fricker Road, Illovo Boulevard, Tel 011 482 3781, Fax 011 482 3784, info@paragon.co.za
Copyright © 2014/03/24 02:14:52 PM. Copyright subsists in this drawing. The person or entity, whose name appears in the title block of this drawing, is hereby granted a non-exclusive license to use, display, print, and/or reproduce this drawing to the extent necessary to carry out and complete the project described in the title block of this drawing.

- NOTES**
- This drawing is the property of Paragon Architects PTY. LTD. and is intended for the use only on site and for the project to which it relates.
 - Copyright in this drawing is owned by Paragon Architects PTY. LTD.
 - All work is to be carried out in accordance with SANS 10400 and other relevant SANS Standards.
 - This drawing is not to be scaled. Figured dimensions to be used. All dimensions are in millimeters unless otherwise stated.
 - All levels and dimensions to be checked on site by the contractor before work is carried out and any discrepancies to be reported to the Architect.
 - The contractor shall in all aspects of the works comply with the provisions of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) and any regulations promulgated in terms of that Act or the Factories Machinery and Building Works Act of 1941.
 - This drawing must be read in conjunction with all the relevant drawings, schedules and specifications from the Architect and all other consultants related to the project.

REV	DATE	DRAWN	DESCRIPTION
A	140318	JM	Issue for information
B	140324	MB	Issue for information

Mall@Piet Retief
 FOR
Anaprop Property Management

Portion 126, Piet Retief Town & Townlands 149HT, Mpumalanga

-02 Parking Level Leasing Plan
 SCALE: 1 : 750
 PROJECT: **PAX_138** STAGE / SERIES / SIZE: **D004-07-A1** REVISION: **B**

INFO	COUNCIL	TENDER	CONSTRUCTION

 DATE: 2013.08.12 DRAWN BY: Author

This license in respect of the copyright is expressly limited as aforesaid and the person and/or entity referred to above shall not be entitled to grant sub-licenses in respect of the copyright in this drawing to any other entity. This license confers no ownership rights in the drawing and this drawing and the copyright subsisting therein will, at all times, remain the property of Paragon Architects (Pty) Ltd. Any unauthorized reproduction, publication, transmission, adaptation and/or inclusion of this drawing in a cinematograph film or television broadcast is an act of copyright infringement which will render the doer of the act liable for civil law copyright infringement and may in certain circumstances render the doer liable to criminal prosecution. Requests and enquiries concerning this drawing and the rights subsisting therein should be addressed to the copyright owner.

ACTS OF PARLIAMENT
All Contractors shall ensure that, before any work is put in hand, they comply with all the necessary Acts of Parliament of the Republic of South Africa.

C:\Revit\files\140324_PAX_0108-R11\Piet Retief Mall_mel_2014.rvt
 2014/03/24 02:14:52 PM



C -01 Level Leasing complete 1750
SCALE: 1 : 750

PARAGON GROUP
PARAGON ARCHITECTS
PARAGON INTERFACE
HUB ARCHITECTS
PARAGON ARQUITETURA

PARAGON ARCHITECTS

1st Floor, 33 Fricker Road, Illovo Boulevard, Tel 011 482 3781, Fax 011 482 3784, info@paragon.co.za
Copyright © 2014/03/24 02:14:55 PM
Copyright subsists in this drawing. The person or entity, whose name appears in the title block of this drawing, is hereby granted a non-exclusive license to use, display, print, and/or reproduce this drawing to the extent necessary to carry out and complete the project described in the title block of this drawing.

NOTES

- This drawing is the property of Paragon Architects PTY. LTD. and is intended for the use only on site and for the project to which it relates.
- Copyright in this drawing is owned by Paragon Architects PTY. LTD.
- All work is to be carried out in accordance with SANS 10400 and other relevant SANS Standards.
- This drawing is not to be scaled. Figured dimensions to be used. All dimensions are in millimeters unless otherwise stated.
- All levels and dimensions to be checked on site by the contractor before work is carried out and any discrepancies to be reported to the Architect.
- The contractor shall in all aspects of the works comply with the provisions of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) and any regulations promulgated in terms of that Act or the Factories Machinery and Building Works Act of 1941.
- This drawing must be read in conjunction with all the relevant drawings, schedules and specifications from the Architect and all other consultants related to the project.

This license in respect of the copyright is expressly limited as aforesaid and the person and/or entity referred to above shall not be entitled to grant sub-licenses in respect of the copyright in this drawing to any other entity. This license confers no ownership rights in the copyright vesting in the drawing and this drawing and the copyright subsisting therein will, at all times, remain the property of Paragon Architects (Pty) Ltd. Any unauthorized reproduction, publication, transmission, adaptation and/or inclusion of this drawing in a cinematograph film or television broadcast is an act of copyright infringement which will render the doer of the act liable for civil copyright infringement and may in certain circumstances render the doer liable to criminal prosecution. Requests and enquiries concerning this drawing and the rights subsisting therein should be addressed to the copyright owner.

REV	DATE	DRAWN	DESCRIPTION
1	14/03/24	MB	Issue for Information

Mall@Piet Retief
FOR
Anaprop Property Management
Portion 126, Piet Retief Town & Townlands 149HT, Mpumalanga

Lvl -1 Leasing Layout Complete

SCALE: 1 : 750

PROJECT	STAGE / SERIES / SIZE	REVISION
PAX_138	D004-08-A1	A

INFO	COUNCIL	TENDER	CONSTRUCTION

DATE: 2013.08.12
DRAWN BY: MB

ACTS OF PARLIAMENT
All Contractors shall ensure that, before any work is put in hand, they comply with all the necessary Acts of Parliament of the Republic of South Africa.

C:\Revit\files\140324_PA-0108-R11\Piet Retief Mall_mel_2014.rvt



C 00 Ground Floor Leasing complete 1 750
SCALE: 1 : 750

Area Schedule Complete		
Number	Area	Level
136	2119 m ²	-01 Level
138	2849 m ²	-01 Level
139	287 m ²	-01 Level
140	3966 m ²	-01 Level
141	910 m ²	-01 Level
142	2662 m ²	-01 Level
143	542 m ²	-01 Level
88	400 m ²	-01 Level
90	412 m ²	-01 Level
92	233 m ²	-01 Level
94	400 m ²	-01 Level
102	400 m ²	-01 Level
98	574 m ²	-01 Level
96	368 m ²	-01 Level
-01 Level:	16122 m ²	
14		
22	2644 m ²	00 GF
26	402 m ²	00 GF
40	2822 m ²	00 GF
14	3195 m ²	00 GF
97	250 m ²	00 GF
28	1408 m ²	00 GF
30	699 m ²	00 GF
54	161 m ²	00 GF
70	225 m ²	00 GF
48	88 m ²	00 GF
56	176 m ²	00 GF
58	175 m ²	00 GF
60	179 m ²	00 GF
18	280 m ²	00 GF
24	1001 m ²	00 GF
42	268 m ²	00 GF
52	155 m ²	00 GF
16	180 m ²	00 GF
78	264 m ²	00 GF
32	212 m ²	00 GF
12	71 m ²	00 GF
6	484 m ²	00 GF
2	36 m ²	00 GF
68	300 m ²	00 GF
44	514 m ²	00 GF
36	681 m ²	00 GF
82	64 m ²	00 GF
84	112 m ²	00 GF
86	83 m ²	00 GF
80	219 m ²	00 GF
4	400 m ²	00 GF
74	36 m ²	00 GF
66	280 m ²	00 GF
64	190 m ²	00 GF
62	212 m ²	00 GF
135	257 m ²	00 GF
8	50 m ²	00 GF
20	255 m ²	00 GF
38	250 m ²	00 GF
76	111 m ²	00 GF
34	212 m ²	00 GF
46	103 m ²	00 GF
50	104 m ²	00 GF
75	31 m ²	00 GF
00 GF: 44	19841 m ²	
Grand total:	35963 m ²	
58		

PARKING CALCULATION - RETAIL			
Gross Rentable Area =	36000 m ²		
Assignable Area (80% of Gross Rentable Area) =	28800 m ²		
Total Parking Bays Required		Less Taxi Credits	Bays in Hand
Parking @ 6 Bays per 100m ² =	1728 Bays	1728 Bays	-228 Bays
Parking @ 5 Bays per 100m ² =	1440 Bays	1440 Bays	60 Bays
Parking @ 4 Bays per 100m ² =	1152 Bays	1152 Bays	348 Bays
Total Taxi Bays Provided =	0 Bays		
Parking Bay Credits at 8 Bays per Taxi =	0 Bays		
Total Parking Bays Provided =	1500 Bays		

Parking requirements for Future Rentable area: 36000sqm GLA @4/100 - 1120 bays required (1500 provided)

PARAGON GROUP
PARAGON ARCHITECTS
PARAGON INTERFACE
HUB ARCHITECTS
PARAGON ARQUITETURA

PARAGON ARCHITECTS

1st Floor, 33 Fricker Road, Illovo Boulevard, Tel 011 482 3781, Fax 011 482 3784, info@paragon.co.za

Copyright notice and disclaimer text.

NOTES

- This drawing is the property of Paragon Architects PTY. LTD. and is intended for the use only on site and for the project to which it relates.
- Copyright in this drawing is owned by Paragon Architects PTY. LTD.
- All work is to be carried out in accordance with SANS 10400 and other relevant SANS Standards.
- This drawing is not to be scaled. Figured dimensions to be used. All dimensions are in millimeters unless otherwise stated.
- All levels and dimensions to be checked on site by the contractor before work is carried out and any discrepancies to be reported to the Architect.
- The contractor shall in all aspects of the works comply with the provisions of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) and any regulations promulgated in terms of that Act or the Factories Machinery and Building Works Act of 1941.
- This drawing must be read in conjunction with all the relevant drawings, schedules and specifications from the Architect and all other consultants related to the project.

REV	DATE	DRAWN	DESCRIPTION
(A)	14/03/24	MB	Issue for Information

ACTS OF PARLIAMENT
All Contractors shall ensure that, before any work is put in hand, they comply with all the necessary Acts of Parliament of the Republic of South Africa.

Mall@Piet Retief
FOR
Anaprop Property Management

00GF Leasing Layout Complete

SCALE: As indicated

PROJECT: PAX_138 STAGE / SERIES / SIZE: D004-09-A1 REVISION: A

INFO	COUNCIL	TENDER	CONSTRUCTION

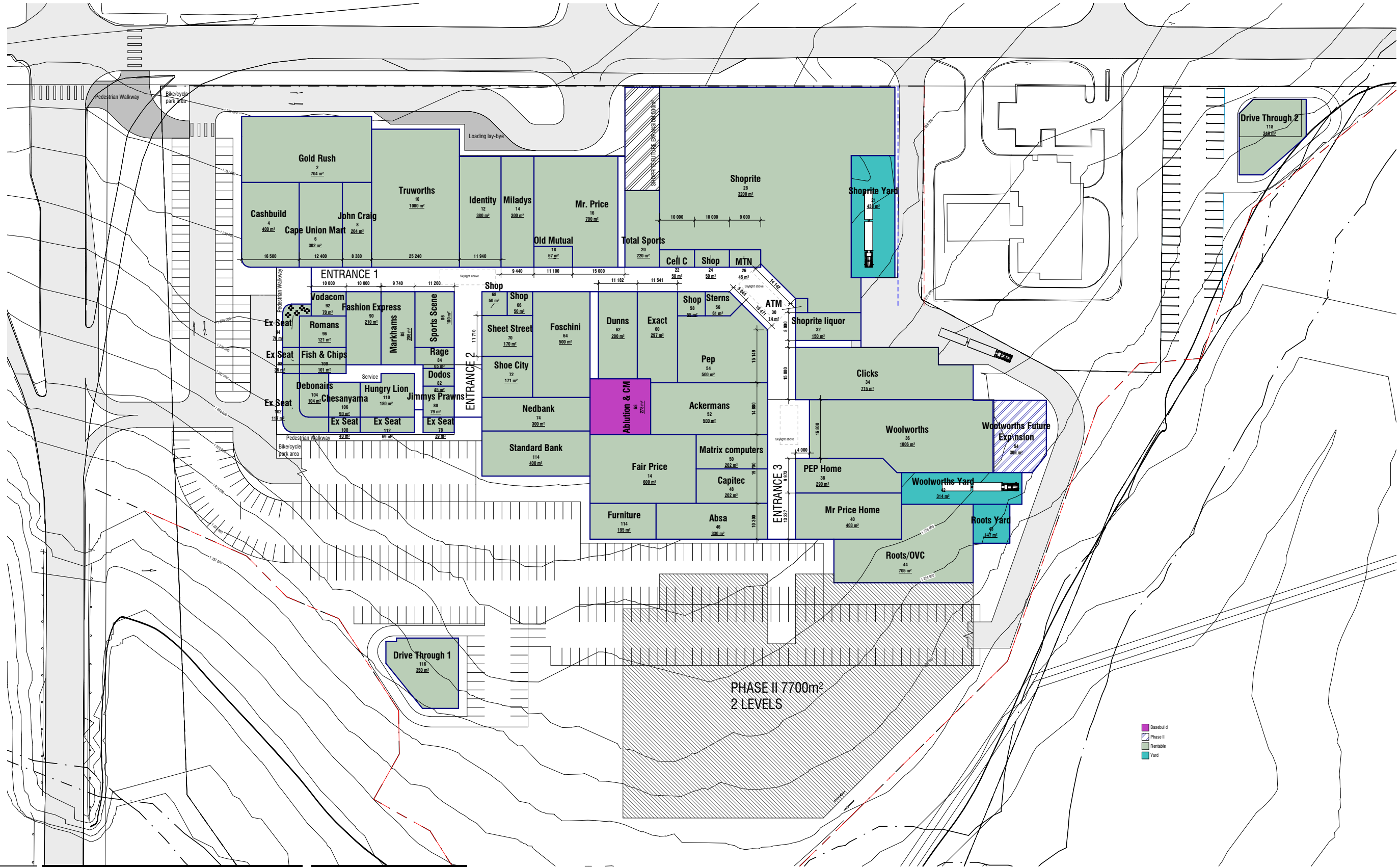
DATE: 2013.08.12 DRAWN BY: MB

2014/03/24 02:14:58 PM



Appendix C2:

Final Layout - The Preferred Layout



PARAGON GROUP
 PARAGON ARCHITECTS
 PARAGON INTERFACE
 HUB ARCHITECTS
 PARAGON ARQUITETURA
PARAGON ARCHITECTS

Option E
 SCALE: 1 : 500
Mall@Piet Retief
 FOR
Anaprop Property Management

00 Ground Floor (Option E)
 SCALE: 1 : 500

Area Schedule (Rentable Option...)	
Area Retail Type	Area
Rentable	18276 m ²
Grand total: 59	18276 m ²



Appendix D:
Specialist Reports



Appendix D1:
Geotechnical Report

**GEO TECHNICAL CONDITIONS ON A PORTION OF
PORTION 123 OF PIET RETIEF TOWN &
TOWNLANDS 149 HT, MPUMALANGA:
A REPORT FOR THE PROPOSED ESTABLISHMENT
OF NEW MUNICIPAL OFFICES**

2013/J057/ZAR

ON BEHALF OF : ZARAFUSION (PTY) LTD

the MALL @ PIET-RETIEF

21A NOORDEND STREET

PIET-RETIEF

2330

TEL : 012-656 8957

PREPARED BY : SOILKRAFT CC

PO BOX 73478

LYNNWOOD RIDGE

0040

TEL : 012-991 0426

**GEOTECHNICAL CONDITIONS ON A PORTION OF
PORTION 123 OF PIET RETIEF TOWN &
TOWNLANDS 149 HT, MPUMALANGA:
A REPORT FOR THE PROPOSED ESTABLISHMENT
OF NEW MUNICIPAL OFFICES**

2013/JJ057/ZAF

INDEX

	INDEX	PAGE
1	INTRODUCTION	1
2	AVAILABLE INFORMATION	1
3	SITE DESCRIPTION	2
4	EXISTING FACILITIES	3
5	SITE INVESTIGATION	4
6	DISCUSSION	8
7	CONCLUSIONS	11
8	RECOMMENDATIONS	12
9	SOURCES OF REFERENCES	14
10	ADDENDUM A: TEST PIT PROFILES	16
11	ADDENDUM B: RESULTS OF SOIL TESTING	24

Soilkraft cc

Reg no CK 990201143

PO Box 73478

Lynnwood Ridge

0040

Tel: 012-9910426

Fax: 012-9912666

Email: izak@soilkraft.co.za

GEOTECHNICAL CONDITIONS ON A PORTION OF PORTION 123 OF PIET RETIEF TOWN & TOWNLANDS 149 HT, MPUMALANGA: A REPORT FOR THE PROPOSED ESTABLISHMENT OF NEW MUNICIPAL OFFICES

1 INTRODUCTION

- *Appointment:* It is proposed to establish new municipal offices on a portion of Portion 123 of Piet Retief Town and Townlands 149 HT in Piet Retief, Mpumalanga. To this end Soilkraft cc was appointed by Mr K. Anastasiadis on behalf of Zarafusion (Pty) Ltd to undertake a geotechnical investigation on the property. The purpose of the investigation was to:
 - identify possible relevant geotechnical constraints
 - make certain recommendations regarding the founding of structures
 - identify other factors that could possibly influence the future development of the area
- *Reporting:* Two printed and bound copies and the original of the report are supplied to the client. An electronic copy of the entire report is also supplied to enable the client to adjust the site plans to a scale convenient to him and to provide additional copies of the report, should it be required. All printed drawings in the hard copies are in A3 or A4 format, and serve for illustrative purposes only.
- *Project Restrictions:* No proposed layout of the new facility was available at the time of the investigation. As such, the entire site was investigated and general recommendations provided as far as construction etc. is concerned

2 AVAILABLE INFORMATION

The following sources of information were consulted:

- 1 : 50 000 scale topographical map, Kemp 2730BB Piet Retief, published in 1989
- 1 : 250 000 geological map, Vryheid 2730, published in 1988
- 1 : 250 000 geological map, Mbatane 2630, published in 1988

- The document *Geotechnical Conditions on Portions 16 and 17 of the Farm Welgekozen 514-IT: A Report for the Development of the Proposed Thandekile Township* compiled by Soilkraft cc on behalf of Welgekozen 514-IT Filling Station cc and issued on 23 July 2002.
- The document *Geotechnical conditions on the remainder of portion 17, portion 18 and the proposed portion of portion 53 (including the reserve of Theo Mooko Street) of the farm Welgekozen 514-IT: A report for the establishment of the N2 Woodhill Shopping Centre*, compiled by Soilkraft cc on behalf of Dr H Joubert and issued on 17 April 2006
- The document *Geotechnical conditions on portion 14 of the farm Welgekozen 514-IT: a report for the proposed township establishment of Thandekile Extension four* compiled by Soilkraft cc on behalf of Tech IQ Consulting Engineers on 25 March 2013
- The document *Geotechnical conditions on portion 15 of the farm Welgekozen 514-IT: a report for the proposed township establishment of Thandekile Extension three*, compiled by Soilkraft cc on behalf of Tech IQ Consulting Engineers on 27 March 2013

3 SITE DESCRIPTION

3.1 Site Location

The area investigated forms a portion of Portion 123 of Piet Retief Town and Townlands 149 HT in Piet Retief, Mpumalanga. The area identified for investigation is approximately 4,5ha in size and is situated near the geographical centre of the town.

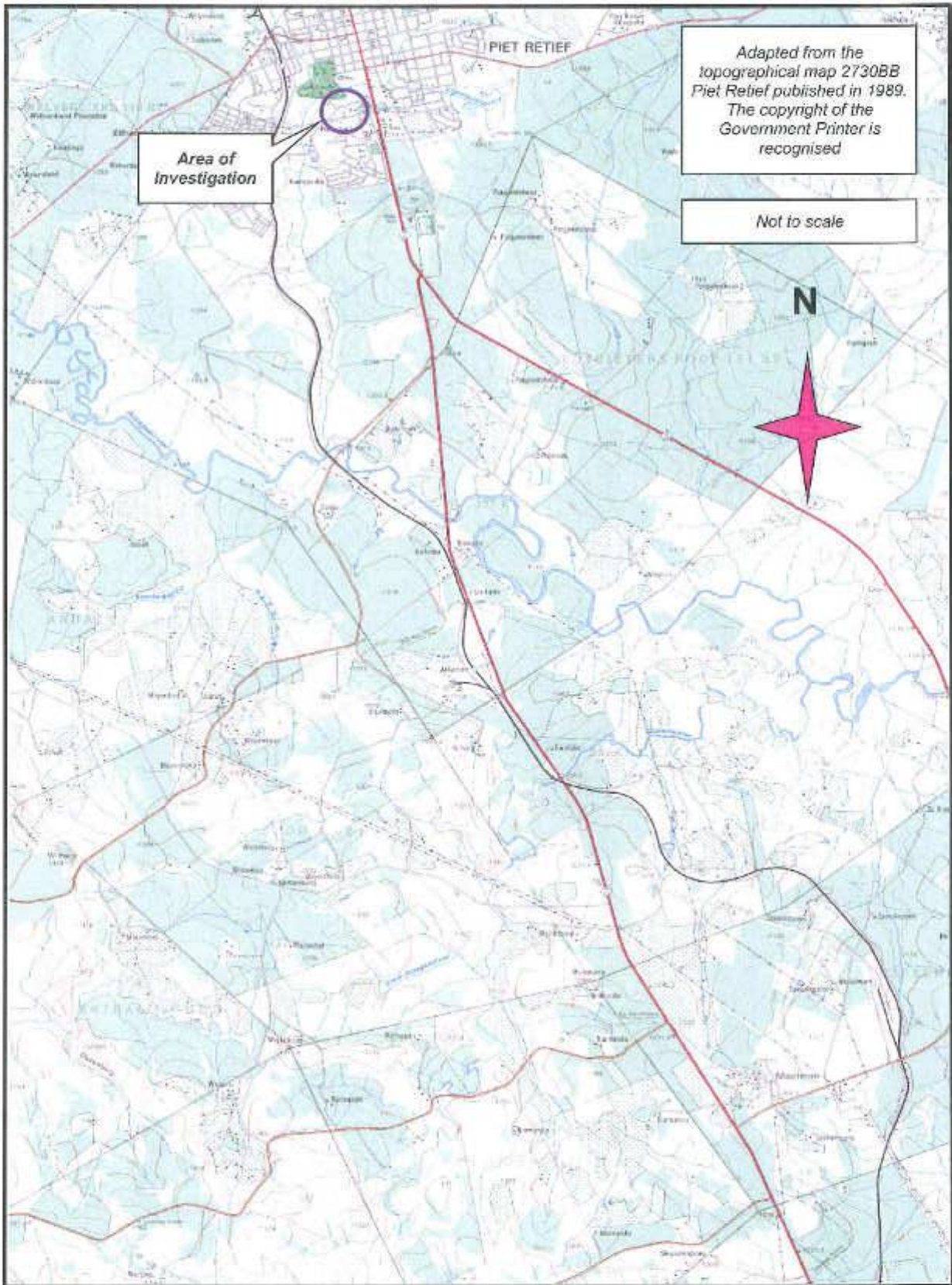
The site is located south of the town's golf course and immediately west of the Piet Retief public cemetery. The site is bordered to the north by an unpaved road and electrical servitude, while the eastern boundary is formed by an unpaved road which divides the study area and the public cemetery. The southern boundary is formed by a paved road leading to Thokozani. The western boundary of the site tapers and also lies against the above-mentioned road. The site can be accessed by vehicle or on foot from any side.

Refer to the attached Figure 1: Locality Plan.

3.2 Topography and Drainage

According to surveyor's drawings, the site investigated is situated at altitudes between 1217m and 1233m above mean sea level. The site dips in a north north westerly direction at an average gradient of approximately 7%.

Drainage of the study area presumably takes place by means of sheetwash and infiltration; however, due to the significant gradient it is likely that surface runoff will be notable when intense or prolonged



**SOIL
KRAFT**

LOCALITY PLAN

FIGURE 1

precipitation events occur. A number of shallow, eroded channels were noted on site where surface runoff has incised the surface resulting in small trenches no deeper than 300mm. Notable these trenches ran adjacent to footpaths or tracks, were not vegetated and largely ran near-perpendicular to the prevailing landscape gradient. All surface runoff is destined to drain in accordance with the prevailing gradient and would join the water course north of the study area.

3.3 Vegetation

Vegetation on the site consisted only of short wild grass across the western half of the site. The vegetation on the eastern half of the site consisted of taller wild grass and clusters of wattle and eucalyptus trees. Soils on the eastern side of the site were disturbed.

3.4 Climate and Weather Conditions

The property is located in an area with an approximate Weibull N-value of 1,5 and a Thornthwaite Moisture Index close to zero. Climatically the area may thus be described as sub-humid. This signifies that chemical weathering of rock material will dominate over mechanical weathering, resulting in the formation of active clays where suitable bedrock materials are encountered. Minerals such as amphiboles, pyroxenes and olivine are particularly susceptible to chemical weathering; however mechanical weathering may not be entirely disregarded, especially where brittle bedrock materials are encountered.

The area receives summer rainfall at a mean annual precipitation of 892mm, generally in the form of thunderstorms, but prolonged periods of soft rain are common. The average maximum summer temperature of approximately 26,1°C occurs in December. Winters are cold to very cold and the presence of morning frost is common.

4 EXISTING FACILITIES

At the time of the investigation the site was found to be vacant land. While an electrical servitude is present along the northern boundary of the site and other utilities are likely available in the region, it is unlikely that any services have been installed directly to this site.

From initial reconnaissance of the site it appeared as though the south eastern corner of the land had been exploited for gravel procurement (i.e. borrow pit) at some point in past decades. Considering the growth of trees in the borrow area, it is estimated that the borrow pit is at least twenty years old.

Site conditions are illustrated on the attached Photo 1 - Site Conditions.



**SOIL
KRAFT**

SITE CONDITIONS

PHOTO 1

5 SITE INVESTIGATION

5.1 Trial Holes

For the purposes of the survey eight trial holes were excavated on site. It was initially proposed that fewer trial holes may be excavated if conditions were very uniform; however, site conditions necessitated that additional trial holes be excavated to delineate areas that are considered problematic. This will be discussed in more detail in subsequent sections of the report.

Trial holes were excavated with the aid of a Case 580 Super R backhoe, supplied by Mkhondo Plant Hire. On 4 September 2013 the trial holes were inspected and profiled by a professional engineering geologist according to the guidelines of SAICE and SAIEG^(Reference 3). For the benefit of the non-geotechnical reader, these guidelines are summarised in the attached Table 1 : Soil Profiling Parameters. The profiles of the trial holes may be found in Addendum A to this report. The profile descriptions as per the test pits reflect the impressions created by the pedological conditions and may sometimes be in slight variance with the results of the soil tests. The location of the trial holes were recorded with a handheld GPS using the WGS84 reference system, and are recorded on trial hole log sheets.

The positions of trial holes are depicted in Figure 2.

5.2 Materials Tests

Soil samples were retrieved from trial holes and delivered to the commercial geotechnical laboratory facilities of Geostrada in Pretoria. Geostrada is a SANAS accredited laboratory. Soil tests included the following:

- *Foundation Indicator Tests.* Foundation indicator samples were tested to determine the general geotechnical properties of the in situ materials.
- *Soil Chemistry:* Soil chemistry tests consisted of soil paste pH and conductivity determinations. The soil chemistry/corrosivity is assessed to determine whether in situ soils are corrosive towards buried steel objects (e.g. utilities, services, anchoring poles, etc.).
- *Consolidation Tests:* Undisturbed soil samples were retrieved for consolidation tests. The consolidation tests were performed to assess the materials' susceptibility to settle under loading.
- *California Bearing Ratio.* California Bearing Ratio (CBR) tests were extracted and tested to determine the quality of in situ soil materials encountered. The aim of this is to determine whether in situ materials can be considered for the construction of layer works or whether it can be used in cut and fill earthworks operations.

TABLE 1 : SOIL PROFILING PARAMETERS

CONSISTENCY : GRANULAR SOILS

CONSISTENCY : COHESIVE SOILS

SP. N.	SHELLS & SANDS		DRY DENSITY (kN/m ³)	SP. N.	SILTS & CLAYS and combinations with SANDS		UCS (kPa)
	Generally fine to medium soils				Generally slow draining soils		
1-1	Very loose	Overlies very easily when compacted with peck of pick. Requires power tools for excavation	<1450	2-3	Very soft	Pick point easily pushed in 100mm. Soil yields by light pressure	<50
2-3	Loose	Some resistance to penetration by sharp pick point. Many blows by pick point	1450-1600	2-4	Soft	Pick point easily pushed in. 20mm in 100mm. Moulded by fingers with light pressure. Pick point penetrates to 100mm	50-125
4-5	Medium dense	Considerable resistance to penetration by sharp pick point.	1600-1750	4-8	Stiff	Very difficult to mold with fingers. Slight indentation by pick point	125-250
6-10	Dense	Very high resistance to penetration by sharp pick point. Requires many blows by pick point for excavation	1750-1900	8-12	Stiff	Cannot be moulded by fingers. Penetrated by thumb nail	250-500
11-15	Very dense	High resistance to penetration by geological pick. Requires power tools for excavation	>1900	15-30	Very stiff	Slight indentation by blow of pick point. Requires power tools for excavation	500-1000

SOIL TYPE

SOIL TYPE	PARTICLE SIZE (mm)
Clay	<0.002
Silt	0.002-0.05
Sand	0.05-2.0
Gravel	2.0-60.0
Cobbles	60.0-200.0
Boulders	>200.0

MOISTURE CONDITION

Dry	No water detectable
Slightly moist	Water just discernible
Moist	Water easily discernible
Very moist	Water can be squeezed out
Wet	Generally below water table

SOIL STRUCTURE

COLOUR		Intact	No structure present
Speckles	Ways sized particles of colour. Small regular patches of colour > 5mm	Flaking	Presence of discontinuity, possibly cemented.
Marked		Slightly eroded	Very strong, highly oriented shelled discontinuity planes
Stratified	Large irregular patches < 50mm	Shattered	Presence of open fissures. Soil breaks into grave size blocks
Stained	Approximately equal bands of varying colours	Micro-shattered	Small size shattering. Very closely spaced open fissures. Soil breaks into sand size crumbs.
Speckled	Randomly orientated streaks of colour	Residual structure	Residual bedding, laminations, nodules etc.
Stratified	Local colour variations. Associated with discontinuity surfaces		

ORIGIN

Transported	Removal by wash tails etc.
Residual	Weathered from parent rock, eg residual granite
Metamorphic	Marble, schists, gneiss etc.

DEGREE OF CEMENTATION OF PEDOCRETES

TERM	DESCRIPTION	UCS (MPa)
Very weakly cemented	Some material can be crushed between fingers and thumb. Distinctly visible cracks (like 4 hrs. freeze/thaw)	0-1.0
Weakly cemented	Cannot be crushed between fingers. Some material can be crushed by strong pressure between thumb and index finger. Cracks difficult to see.	1-5-2.0
Hardened	Material is a thick coherent mass. Does not crush easily and thumb can be distinguished with some difficulty by a knife blade.	2-3-5.0
Strongly cemented	Even blow of sharp pick point on face will disintegrate some. Some indentations. Grains cannot be distinguished by knife blade.	5.0-10.0
Very strongly cemented	Hardened specimen can be broken by a single firm blow of hammer head. Entire appearance is concrete.	10-25

The results of the soil test results are summarised in the attached Table 2 : Results of Soil Tests. The original results are included in Addendum B.

6 DISCUSSION

6.1 Geology

Regional geological information indicates that the site is situated on the Mozaan or Nsuze Groups, associated with the Pongola Sequence. These Groups contain igneous materials which are largely derivatives of granite. Parent materials include medium to coarse grained biotite granite, porphyritic biotite granite or coarse grained hornblende granite.

Trial holes revealed that the soil profile is deeply weathered. As a result, no bedrock was encountered in any of the trial holes; however, based on tactile and visual considerations of the residual soils it was clear that the site was indeed underlain by a granite derived material.

The regional geology is indicated on the attached Figure 3 : Regional Geology.

6.2 Groundwater

- *Patched Water*: Slow seepage was encountered in trial hole two from a depth of 500mm. Considering the trial hole conditions and site observations, this trial hole contained material that had been exposed to groundwater for extended periods and had likely been extensively leached. The area in which trial hole two was excavated also appeared to see seasonal surface water seepage and was very moist or wet even at the end of the dry season. Water-favouring, broad-leaved grass was noted at this position and its immediate surroundings. The conditions are expected to become more pronounced during the wet season and are likely to be most pronounced at the end of the rainy season.
- *Permanent Water*: Vegter^{Reference 97} indicates the probability for drilling successfully for water in the area to be less than 40% and the probability that such a borehole will yield more than 2l/s is between 30% and 40%. Groundwater is expected to occur at depths less than ten metres in pores, fractures and disintegrated rock restricted to a zone directly below ground water level.

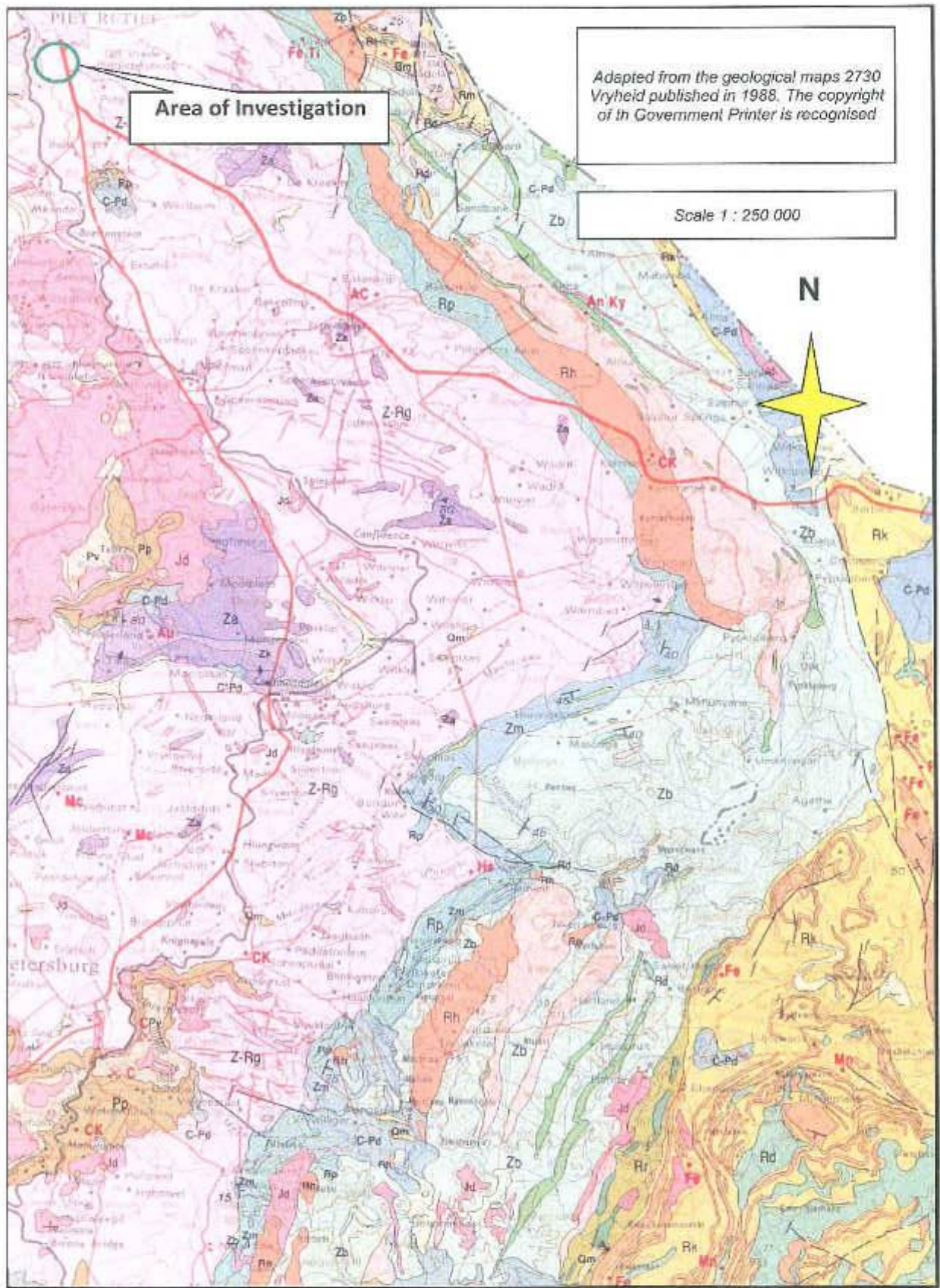
6.3 Soil Profile

Before discussing the geotechnical properties of the site, it is important to differentiate between materials encountered in the soil profiles. The following materials were noted:

- *Fill*: Fill materials were exposed in trial holes four and five. The material spanned from surface to

TABLE 2 : SUMMARY OF SOIL TESTING

TEST PIT NO.	SAMPLE NO	DEPTH (mm)	SOIL ORIGIN	SOIL TYPE	GM	PI	LL	US CLASS	pH	C E C	NDD (KGM ²)	OMC (%)	CBR @ % COMPACTION			SOIL-CLASS	
													93	95	98	PRA	COLTO
1	3/8815	000 - 100	Residual granite (10)	Clayey sand	0.86	15	41	Medium			1632	12.8	7.2	10	14	A-7.5	GD
2	3/8820	100 - 200	Residual granite 2	Sandy gravel	1.46	28	52	Medium	8.21	0.0127						A-7.6	
3	3/8821	0 - 100	Residual granite 1	Clayey sand	1.04	15	52	Low to medium								A-7.6	
5	3/8822	400 - 1200	Residual granite (10)	Clayey sand	1.01	20	47	Medium	9.03	0.0042	1778	15.7	7.3	10	15	A / 6	GD
7	3/8823	1600 - 2800	Residual granite 1	Sandy silt	0.47	22	47	Medium								A-7.6	



Area of Investigation

Adapted from the geological maps 2730 Vryheid published in 1988. The copyright of the Government Printer is recognised

Scale 1 : 250 000



SOIL KRAFT

REGIONAL GEOLOGY

FIGURE 3

depths between 1500mm and 2400mm and consisted of mixed soil and ash materials. The fill had a very loose consistency and contained abundant glass bottles and containers estimated to date back at least five or six decades. It is likely that the area surrounding these two trial holes constitute an old landfill as the surroundings were clearly also very disturbed. No sample was taken of this fill material

- *Colluvium*: Colluvial soils were found in trial holes one, two and six through to eight, spanning between 400mm and 1000mm in vertical thickness. The material was generally described as dark brown, clayey sand with a shattered structure and medium dense consistency. The horizon also contained very abundant quartz gravel. In trial hole two the material had been tesched and graded from a silty sand to a coarse sand with depth, and had a loose or very loose consistency. The colluvial soil was not sampled
- *Ferruginised Residual Granite*: A horizon of orange brown ferruginised residual granite was exposed in trial holes one, six, seven and eight. This horizon had a very loose or medium dense consistency and a voided structure. In addition, lenses of gravel also occurred in places and the horizon was between 600mm and 1200mm in vertical thickness. Test results revealed that the clayey sand is moderately expansive and contains active clay content between 33% and 40%. Plasticity indices between 19% and 20% were recorded while grading moduli ranged from 0,86 to 1,01. The material was classified as A-7-6 in both instances tested
- *Residual Granite 1*: The first of the residual granite materials identified was characterised by its pinkish colour. The material had an intact or voided structure and material consistencies ranged from very loose to medium dense for granular materials and soft to stiff for cohesive materials. The horizon was described either as clayey sand or sandy silt. The base of the horizon was seldom reached and thicknesses of at least 500mm to 1900mm were recorded. Material test results suggest that this material is also moderately expansive, despite one sample being a borderline case. The test results revealed active clay content between 34% and 55%, with associated plasticity indices between 19% and 22%. Grading moduli of the material ranged from 0,41 to 1,04 and PRA classifications included either A-7-5 or A-7-8. Consolidation tests of this material revealed that it is moderately to highly susceptible to settlement. The settlement is likely a combination of collapse settlement and consolidation settlement. Pre-consolidation pressures also suggest that the materials have been loaded by overburden, but to different extents. With this in mind, a conservative approach is adopted and a high susceptibility to consolidation is anticipated.
- *Residual Granite 2*: The second discernible residual granite horizon occurred in trial holes two, four and five. This horizon was characterised by grey white or orange brown colour and was often found to be ferruginised at its base. The residual soil had a medium dense to dense consistency and contained abundant gravel fragments of quartz. One sample was taken of this material and results revealed that despite being described as sandy gravel. The material is still moderately expansive. Active clay content and a plasticity index of 18% and 26% were recorded. The material's grading modulus was calculated to be 1,45 and as before. A PRA classification of A-7-8 was awarded. The base of this horizon was not always reached and vertical thicknesses were recorded between 600mm and 1600mm

- *Residual Granite 3:* The third residual granite horizon was encountered only in trial holes two and three, spanning at least 200mm to 700mm. The base of the horizon was not reached. This material had a distinctive green grey colour and was described as silty sand with an intact structure and medium dense consistency. Due to its limited occurrence and depth of occurrence, the material was not sampled.

6.4 Geotechnical Zoning

When discussing the geotechnical zoning of the area, the following must be considered:

- *Properties of Heave:* Test results suggest that all materials tested are moderately expansive with one exception which proved to be a borderline case between a low and moderate expansiveness. Soil heave was calculated for each relevant trial hole using the method proposed by van der Merwe^{Reference 9.3}, as adopted in RAFT software compiled by the CSIR. The heave calculated during the investigations ranged from 4,4mm to 28mm, with the former being an exception. For the most part unrestrained heave exceeded 15mm.
- *Properties of Settlement:* As discussed in the preceding section, consolidation results suggest that residual granite is moderately to highly susceptible to settlement. The settlement is likely a combination of collapse settlement and consolidation settlement and due to differing pre-consolidation stresses, a conservative approach was adopted. Assuming a foundation pressure of 50kPa and a depth of influence of 900mm, settlement in the excess of 20mm was estimated for all parts of the site which are devoid of fill materials.
- *Problematic Fill:* Problematic fill prevails in the north eastern part of the site. The fill is of substantial thickness and is not suitable for construction or founding.
- *Borrow Pit:* The south eastern portion of the site has been massively disturbed and exploited for gravel procurement. The area was not rehabilitated and has seen scattered dumping of refuse and rubble.

Considering the discussion above the entire site can be divided into geotechnical zones according to guidelines of the NHBRC^{Reference 9.2}. While these guidelines are not strictly applicable to the municipal building, it gives a clear indication of the expected geotechnical conditions. With the considerations above in mind, the site can be divided into the following geotechnical zones:

- *Geotechnical Zone 1: H2/S2:* This zone includes the western part of the site and contains trial holes one, two, six, seven and eight. The profiles are made up of thick horizons of residual granite (with or without ferruginisation) which is overlain by limited alluvial soils. A combination of up to 50mm unrestrained heave and combined settlement in the excess of 20mm is anticipated in this zone. The settlement calculation is based on a 600mm wide strip foundation imposing a 50kPa foundation stress. A localised area in the vicinity of trial hole two is expected to make for marshy conditions on a seasonal basis.

- **Geotechnical Zone II: P_{Fill}/H-H1.** This zone includes the north eastern part of the site and contains trial holes four and five. The zone is dominated by thick, problematic fill materials overlying residual materials at depth. The volume of unrestrained heave is largely affected by the thickness of overlying fill and a maximum of 15mm unrestrained heave is expected in this zone.
- **Geotechnical Zone III: P_{Borrow Pit}/H2/S2.** This zone includes trial hole three and its surroundings which have been disturbed by material procurement. While gravel has been removed from this zone, the in situ profile which remains is still roughly compliant with that encountered in Zone I; hence similar soil movements are expected. The zone is, however, in a disturbed and unrehabilitated state and contains heaps of rubble and refuse.

The geotechnical zoning is illustrated in Figure 4.

6.5 Conditions of Excavation

Conditions of excavation can be best summarised at the hand of the SANS 1200 guidelines. Based on the said guidelines, conditions of excavation can be summarised as follows:

- **Fill:** The fill materials encountered were very easily excavatable by backhoe; however, the material was found to be extremely unstable in excavation and sidewalls often collapsed dramatically. An overall very loose consistency based estimated in the fill material, as trial holes through the material could not be entered on account of safety.
- **Colluvium:** Colluvial soils were excavatable by T.P. with relative ease. No major impediments were noted in the material.
- **Ferruginised Residual Granite:** The ferruginised residual granite offered little significant resistance to excavation. It is likely that the material will be more difficult to excavate when in a dry state; however in the conditions encountered, the material was excavatable with relative ease.
- **Residual Granite:** All remaining residual granite horizons were penetrated with little or moderate effort. Excavation with the aid of a backhoe proceeded through the residual soils without encountering refusal in any trial hole.
- **Bedrock:** No bedrock was encountered during this site investigation.
- **Excavation Stability:** With the exception of excavations made through fill materials, all remaining trial holes remained stable during the investigation. It is expected, though, that very granular materials may be subject to instability in the presence of ground vibration and/or excess moisture. With this in mind, it is expected that excavations in the vicinity of trial hole two will be very unstable due to water ingress.
- **Seepage Water:** Cognisance must be taken of expected water ingress in the vicinity of trial hole two. It is also likely that very moist soil conditions will occur in the entire soil profile on a seasonal basis.

- *General:* A minimum proven depth of excavation with the aid of a backhoe was established at 2400mm without encountering refusal.

6.6 Soil Corrosivity

When discussing soil corrosivity, it is important to consider the guidelines as proposed by Evans^{Reference 9.6}. The corrosivity of a soil towards buried, exposed, metallic surfaces depends on the following properties of a material:

- Electrical conductivity
- Chemical properties
- Ability of the soil to support sulphate reducing bacteria
- Heterogeneity

The tests carried out for the completion of this report must be considered indicative of the soil conditions only. The pH of a soil gives an indication of potential acid related problems. Should the soil pH be less than 5,0 corrosion may take place and should the pH be less than 4,50, the problem of corrosion may be serious. If the conductivity of the soil is less than 0,1mS/cm, corrosivity is generally not a problem. However, the corrosion potential of the soil increases with an increase in conductivity. Should the conductivity of the soil exceed 0,5mS/cm, the soil can be regarded as very corrosive.

Samples of the residual granite were extracted and tested, as these materials are most likely to host services and utilities. The results revealed the following:

- *Soil Acidity:* Soil paste mixtures revealed pH levels between 8,21 and 9,03. This range of values is indicative of alkaline materials. As such corrosion related to acidic materials is not expected.
- *Soil Conductivity:* The conductivity tests showed a significant range in results. The paste sample had soil conductivity values between 0,0040S/m and 0,0127S/m. While the former is indicative of a non-corrosive material, the latter indicates a slightly to mildly corrosive material.
- *Waterlogged Conditions:* Waterlogged conditions are expected to occur in the vicinity of trial hole two. In addition, it is likely that soil profiles across the site will be moist to very moist on a seasonal basis, resulting in enhanced oxidation of metallic objects in the sub-surface.

6.7 Seismicity

Kijko^{Reference 9.9} indicates the annual probability for an earthquake with intensity of 4,3 on the Modified Mercalli Scale to occur in the area to be less than 10^0 and with an intensity of 7,5 the probability is 10^{-1} . A 10% probability exists that an earthquake with Peak Ground Acceleration of 0,15g to 0,17g may take place once in 50 years.

To put the above information into perspective, Table 2 - Earthquake and Magnitude and Intensity, is attached to this report

6.8 Material Utilisation

Two samples of ferruginised residual granite were extracted for CBR testing. This horizon was sampled as it is most likely to be considered for use in layer works due to its vertical distribution. The material was also considered to be the best target for material utilisation of all the materials encountered in the profile.

Test results revealed that the two samples were of G8 and G9 COLTO quality. The materials achieved a maximum CBR value of 20% at 100% Modified AASHTO density and had maximum dry density values between 1778kg/m³ and 1862kg/m³.

6.9 Other Considerations

- *Historic Monuments:* There are no historic monuments on the site.
- *Dolomite Stability:* The site is not subject to instabilities due to the presence of dolomite
- *Undermining:* The area is not subject to undermining, though large portions in the south east of the site had been exploited for gravel procurement.
- *Cemetery Sites:* No cemeteries or graves were encountered during the investigation. Taking the guidelines of Fischer^{REFERENCE 97} into account, the property is not suitable to be developed as a cemetery site

7 CONCLUSIONS

The following main conclusions can be drawn from the geotechnical investigation of this property:

- *Geology:* Based on the deeply weathered profile of residual granite soils, it is deduced that the site is located on granitic bedrock associated with the Pongola Sequence. No bedrock was encountered in trial holes.
- *Soil Profile:* Soil profiles on this site are dominated by residual granite materials. Limited colluvial cover was encountered and thick, problematic fill prevails in the north eastern parts of the site.
- *Groundwater:* Seepage water and very moist to wet soil profiles are expected to occur in the vicinity of trial hole two. It is also likely that the entire site will see very moist soil profiles on a seasonal basis.

TABLE 3 : EARTHQUAKE MAGNITUDE AND INTENSITY

MODIFIED MERCALLI INTENSITY SCALE	INTENSITY	DESCRIPTION	RICHTER SCALE MAGNITUDE	RADIUS OF PERCEPTIBILITY (km)
I	Instrumental	Detected only by seismography		
II	Feeble	Noted only by sensitive people	3.5 to 4.2	3 to 24
III	Slight	Like the vibrations due to a passing lorry. Felt by people at rest especially on upper floors		
IV	Moderate	Felt by people while walking. Rocking of loose objects, including vehicles	4.3 to 4.8	24 to 48
V	Rather strong	Felt generally; most sleepers are awakened and talking		
VI	Strong	Frees sway and suspended objects swing; damage by overturning and falling of loose objects	4.9 to 5.4	48 to 117
VII	Very strong	General public alarm; walls crack; plaster falls	5.5 to 6.1	117 to 200
VIII	Destructive	Car drivers seriously disturbed, masonry fissured; buildings damaged	6.2 to 6.9	200 to 400
IX	Ruinous	Houses collapse; pipes break		
X	Disastrous	Ground cracks badly; buildings destroyed; railway lines bent; landslides on steep slopes	7.0 to 7.3	400 to 700
XI	Very disastrous	Few buildings remain standing; bridges destroyed; all services out of action; great landslides and floods	7.4 to 8.1	400 to 700
XII	Catastrophic	Total destruction; objects thrown into the air; ground rises and falls in waves	>8.1	400 to 700

- **Founding Conditions:** The study area was divided into three geotechnical zones namely H2/S2, P_{Full}/H-H1 and P_{Borrow Pit}/H2/S2. Construction restrictions and construction precautions are therefore required
- **Excavation Potential:** All in situ materials are excavatable by backhoe. No refusal of excavation was encountered in any of the trial holes and a minimum proven depth of excavation by backhoe was established at 2400mm
- **Soil Corrossivity:** Conditions of mildly corrosive soils prevail on the site. This relates to both the conductivity of the soil materials and oxidation by seepage water in the profile
- **Material Utilisation:** In situ ferruginised residual granite proved to be of G8 to G9 COLTO quality.
- **Historic Monuments:** There are no historic monuments on the site.
- **Cemetery Sites:** No cemeteries or graves were encountered during the investigation. The property is not suitable to be developed as a cemetery site.
- **Dolomite Stability:** The site is not subject to instabilities due to the presence of dolomite.
- **Undermining:** The area is not subject to undermining, though a dated borrow pit was found on the south eastern side of the site.
- **Seismicity:** The annual probability for an earthquake with intensity of 4,3 on the Modified Mercalli Scale to occur in the area to be less than 10^0 and with an intensity of 7,5 the probability is 10^{-1} . A 10% probability exists that an earthquake with Peak Ground Acceleration of 0,15g to 0,17g may take place once in 50 years.

8 RECOMMENDATIONS

8.1 Preliminary Proposals for Founding and Construction

8.1.1 Conventional Structures

At the time of report compilation no information was available regarding the proposed structures, other than that the structures are to be single storey. With this in mind, the recommendations given below are of a general nature:

- **Geotechnical Zone 1: H2/S2:** Construction in this zone can be done by means of a soil replacement raft with reinforced strip footings placed in the raft. The footings shall be designed to accommodate the residual movements. In situ soil materials are to be excavated to 1,0m beyond the building perimeter to a depth 1.5 times the widest foundation and replaced with inert materials of at least G7 COLTO quality. The material must be compacted to 93% Mod AASHTO density at moisture contents between -1% and +2% of optimum moisture content. Foundation pressures shall be limited to 50kPa and floor slabs shall be fabric reinforced, while articulation joints shall be installed at all doors and openings. Reinforced masonry is also recommended.

- *Geotechnical Zone II: $P_{\text{fill}}/H-HI$* : This zone is not suitable for construction in its current state and would require the removal of all fill materials and full rehabilitation of the area before it is would be eligible for development. At present this zone should therefore be avoided if possible. Rehabilitation of this zone would require the removal of all fill and rubble materials from the site. The excavation can then be backfilled in 150mm layers using materials of at least G7 COLTO quality, compacted at between -1% and +2% of optimum moisture content. Once the desired level has been reached, compaction of the fill must be assessed by means of plate load tests or DPSH probe tests. Founding may then proceed by means of lightly reinforced strip footings with a foundation pressure limited to 50kPa. Reinforced masonry and articulation joints are to be installed at all external doors and opening.
- *Geotechnical Zone III: $P_{\text{Borrow}} P_{\text{fill}}/H2/S2$* : As with zone II, this zone is not suitable for development in its current state. This zone can be rehabilitated in a similar fashion to zone II, after all rubble materials had been removed.

Site drainage must be planned carefully to ensure that surface water is disposed of effectively in the absence of a notable site gradient. Finally, cut-off drains may be required around structures to prevent shallow seepage water in the profile from affecting structures and foundations adversely. This applies in particular to the area surrounding trial hole 2. It could be considered to install a sub-surface drain against the road reserve along the southern border of the site to intercept penetrating moisture.

The anticipated soil movements, soil zoning and proposed foundation precautions are summarised in the attached Table 4 : Foundation Design, Building Procedures and Precautionary Measures and illustrated in Figure 4.

8.1.2 Portal Frame Structures

If it is decided in future that the structures are to be constructed by means of a portal frame type structure with point loads or columns, safe bearing capacities of the in situ soils have to be established to confirm that the in situ materials can accommodate the loads. Supplementary DPSH probing can be considered in such an instance.

8.2 Conditions of Excavation

Considering the conditions of excavation encountered, the following is recommended

- *Fill Materials*: The fill materials encountered were easily excavatable by backhoe, but prone for extremely unstable excavations. Hand excavation in this material is not recommended and sidewalls in the fill must be battered to at least 1 (V) : 1.5 (H). Alternatively sidewalls must be supported by full-face bracing.

TABLE 4 : FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES

AREA	GEOTECHNICAL CLASS	% OF TOTAL AREA	ESTIMATED SOIL MOVEMENT	SOIL PROFILE	DEVELOPMENT POTENTIAL	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS
I	H2/S2	50%	Up to 30mm unrestrained heave and settlement exceeding 20mm	Colluvium underlain by successions of residual granite	Intermediate	Modified	Soil replacement raft	Slightly corrosive soils Moisture areas
II	P ₁₀ /H-H1	2%	Up to 15mm unrestrained heave	Problematic fill underlain by residual granite	Not Favourable	N/A	N/A	Problematic fill
III	P ₂₀ /H2/S2	28%	Up to 50mm unrestrained heave and settlement exceeding 20mm	Surface rubble underlain by successions of residual granite	Not Favourable	N/A	N/A	Defunct borrow area Waste and refuse heaps

- *Colluvium*: Colluvial materials can be considered excavatable by mechanical means. Hand excavation would also be possible.
- *Residual Granite*: All residual granite horizons are excavatable by machine. While the material would probably be excavatable by hand, it is likely that seasonal soil moisture may plague hand excavation.
- *General*: A minimum proven depth of excavation by backhoe was established at 2400mm. No refusal of excavation was encountered in any of the trial holes when using a backhoe.
- *Groundwater*: Provision must be made for wet excavation in the vicinity of trial hole two. Such conditions may also occur erratically across other parts of the site on a seasonal basis.
- *Excavation Stability*: The safety of all persons working in or near open excavations must be ensured. Particular caution must be paid in areas where wet conditions or fill materials occur.

8.3 Soil Corrosivity

Mildly to slightly corrosive soils prevail on site; hence it is recommended that precautionary steps be taken to protect buried and exposed steel objects (e.g. services, utilities, anchoring poles, etc.). The use of protective coating may be considered. Where piping is involved, the use of PVC piping may be considered though care must be taken to ensure that such pipes are not damaged by the heave action of soils.

8.4 Material Utilisation

No project details are known as far as proposed layer works or parking areas are concerned. As such, recommendations in this regard are limited. In situ ferruginised residual granite should best be considered as being of G9 COLTO quality. Materials of better specification should be imported from commercial (or other) sources.

9 SOURCES OF REFERENCE

9.1 SAIEG-AEG-SAICE. *Guidelines for Soil and Rock Logging* – Proceedings of the 1990 Geoterminology Workshop.

9.2 Vegter JR: *An Explanation of a Set of National Ground Water Maps*, published by the Water Research Commission, in August 1995.

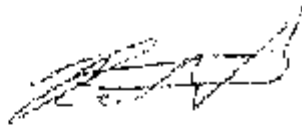
9.3 Van der Merwe DH: *Prediction of Heave from the Plasticity Index and Per cent Fraction of Soil*, published in *The Civil Engineer in South Africa*, Vol 6, No 6, pages 103 to 107, published in June 1964.

9.4 NHBRC: *Home Building Manual Part 1 & 2* Revision: 1, page 19, published in February 1999.

9.5 Evans UR: *The Corrosion and Oxidation of Metals* published by Edward Arnold in 1971.

9.6 Kijko A *et al.* : *Probabilistic Peak Ground Acceleration and Spectral Seismic Hazard Maps for South Africa*, Report: 2003-0053 by the Council for Geoscience.


9.7 Fischer G.J *The Selection of Cemetery Sites in South Africa*, published by the Council of Geoscience



F.J. Breytenbach (Pr. Sci. Nat.)

8 October 2013

For Scilkraft cc



F.J. Breytenbach (Pr. Eng.)

**GEOTECHNICAL CONDITIONS ON A PORTION OF
PORTION 123 OF PIET RETIEF TOWN &
TOWNLANDS 149 HT, MPUMALANGA:
A REPORT FOR THE PROPOSED ESTABLISHMENT
OF NEW MUNICIPAL OFFICES**

2013/J067/ZAR

10 ADDENDUM A : TEST PIT PROFILES

TRIAL HOLE: TP 1

PROJECT: Proposed New Municipal Offices

LOGGED BY: JJB

SITE NAME: A Pin of Ptn 123 of First Relief Town & Townlands 149 HT, Mowmolonga

DATE LOGGED: 04/09/2013

CLIENT: Zorafusion (Pty) Ltd

LOCATION: 27°00'59,8" S 30°48'01,4" E

Soilkraft cc

P O Box 73478

Lynnwood Ridge

01140

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				NOTES: 1 No seepage water encountered. 2 No refusal of excavation encountered. 3 Disturbed sample taken at 600 – 1100 mm for a foundation indicator and CBR. 4 Undisturbed sample taken at 1100 - 3000 mm for a consolidation test. 5 Termite nests are present in the vicinity of trial hole.
0.20		Slightly moist, dark brown, medium dense, shattered, clayey SAND with very abundant quartz gravel Calcium				
0.40						
0.60	Slightly moist, orange brown, very loose, voided, clayey SAND Ferruginous residual granite.					
0.80			3/8915	0.5 - 1.0		
1.00						
1.20	Moist, pale pink, very loose, voided, clayey SAND. Residual granite.					
1.40						
1.60						
1.80						
2.00						
2.20			3/8919	1.1 - 3.0		
2.40						
2.60						
2.80						
3.00						
3.20						
3.40						

Contractor: Mkhondo Plant Hire

Date Drilled: 04/09/2013

Machine: Case 580 Super R

Hole Diameter: 700 mm

Water Depth:

Sheet: 1 of 1

SOIL PROFILE: TEST PIT 1

FIGURE: A1

TRIAL HOLE: TP 2

PROJECT: Proposed New Municipal Offices

LOGGED BY: LID

SITE NAME: A Ptn of Ptn 123 of First Relief Town & Townlands 149 HT, Mmamelanga

DATE LOGGED: 04/09/2013

CLIENT: Zarafusion (Pty) Ltd

LOCATION: 27°00'50,9" S 30°49'06,5" E

Soilkraft cc

P O Box 73478

Lynwood Ridge

0140

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				<p>NOTES:</p> <p>1 Slow seepage water encountered at 500 mm.</p> <p>2 No refusal of excavation encountered.</p> <p>3 3 disturbed sample taken at 1000 – 2600 mm for a foundation indicator, pH and conductivity test.</p> <p>☒ Water encountered</p> <p>☒ Water level</p> <p>--- Bottom of hole</p> <p>--- Approximate material change</p> <p>* Disturbed sample</p> <p>■ Undisturbed sample</p>
0.20		Moist, dark brown, loose, intact <i>silty SAND</i> . Colluvium. Roots are present in the horizon				
0.40						
0.60		Wet, light grey, very loose, intact <i>coarse SAND</i> . Residual granite.				
0.80						
1.00		Very moist, gray white becoming orange brown, medium dense to dense, intact, quartz rich <i>sandy GRAVEL</i> . Residual granite, ferruginised at base.				
1.20						
1.40						
1.60			3/8020	1,0 - 2,0	☒	
1.80						
2.00						
2.20						
2.40						
2.60		Moist, green grey, medium dense, intact, <i>silty SAND</i> . Residual micaceous granite				
2.80						
3.00						
3.20						
3.40						

Contractor: Mkhondo Plant Hire

Date Drilled: 04/09/2013

Machine: Case 580 Super R

Hole Diameter: 700 mm

Water Depth: 500 mm

Sheet: 1 of 1

SOIL PROFILE: TEST PIT 2

FIGURE: A2

TRIAL HOLE: TP 3

PROJECT: Proposed New Municipal Offices

LOGGED BY: UB

SITE NAME: A Ptn of Ptn 123 of Plot Relief Town & Townlands 149 HT, Morningside

DATE LOGGED: 04/09/2013

CLIENT: Zarafusion (Pty) Ltd

LOCATION: 27°00'58.9" S 30°48'10.2" E

Soilkraft cc

P O Box 73478

Lynnwood Ridge

9040

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				NOTES: 1 No seepage water encountered 2 No refusal in excavation encountered 3 Disturbed sample taken at 0 - 1400 mm for a foundation indicator ▽ Water encountered ▼ Water level --- Bottom of hole --- Approximate material change ● Disturbed sample ■ Undisturbed sample
0.20		Very moist, pale orange speckled white, medium dense to loose, intact, clayey SAND Residual granite.				
0.40						
0.60						
0.80			3-5921	0.0 - 1.4	●	
1.00						
1.20						
1.40		Very moist, dark pink, soft, intact, clayey SILT Residual granite				
1.60						
1.80						
2.00		Moist, green gray medium dense, intact, silty SAND Residual micaceous granite				
2.20						
2.40						
2.60						
2.80						
3.00						
3.20						
3.40						

Contractor: Mkhondo Plant Hire

Date Drilled: 04/09/2013

Machines: Case 580 Super R

Hole Diameter: 700 mm

Water Depth:

Sheet: 1 of 1

SOIL PROFILE: TEST PIT 3

FIGURE: A3

TRIAL HOLE: TP 4

PROJECT: Proposed New Municipal Offices

LOGGED BY: J.M

SITE NAME: A Port of Port 123 of Port Relief Town & Townlands 149 HT, Mpumalanga

DATE LOGGED: 04/09/2013

CLIENT: Zerafusion (Pty) Ltd

LOCATION: 27°00'54,1" S 30°18'09,1" E

Soilkraft cc

P O Box 73478

Lynnwood Ridge

8040

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				<p>NOTES:</p> <p>1 No seepage water encountered</p> <p>2 No refusal of excavation encountered.</p> <p>3 Unstable sidewalls.</p> <p>4 Water encountered</p> <p>5 Water level</p> <p>6 Bottom of hole</p> <p>7 Approximate material change</p> <p>8 Disturbed sample</p> <p>9 Undisturbed sample</p>
0.20		FILL : Mixed soil and ash containing refuse (glass, plastic, etcetera). Overall very loose consistency				
0.40						
0.60						
0.80						
1.00						
1.20						
1.40						
1.60		Very moist, grey white becoming orange brown medium dense to dense. Incl. quartz rich pebbles (GRAVEL). Residue: granite				
1.80						
2.00						
2.20						
2.40						
2.60						
2.80						
3.00						
3.20						
3.40						

Contractor: Mkhondo Plant Hire

Date Drilled: 04/09/2013

Machine: Case 580 Super R

Hole Diameter: 700 mm

Water Depth:

Sheet: 1 of 1

SOIL PROFILE: TEST PIT 4

FIGURE: A4

TRIAL HOLE: TP 5

PROJECT: Proposed New Municipal Offices

LOGGED BY: JB

SITE NAME: A Port of Port 123 of Piet Rebet Town & Townlands 149 HT, Mpumalanga

DATE LOGGED: 04/09/2013

CLIENT: Zarafusion (Pty) Ltd

LOCATION: 27°00'55,0" S 30°18'07,4" E

Soilkraft cc

P O Box 73478

Lynnwood Ridge

0040

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or irans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				NOTES: 1 No seepage water encountered 2 No refusal of excavation encountered. 3 Walls of trial hole are unstable. ☒ Water encountered ☒ Water level --- Bottom of hole --- Approximate material change ● Disturbed sample ■ Undisturbed sample
0.20		HLL : Mixed soil and trash containing refuse (glass, plastic, etcetera) Overall very loose consistency.				
0.40						
0.60						
0.80						
1.00						
1.20						
1.40						
1.60						
1.80						
2.00						
2.20						
2.40		Very moist, grey white becoming orange brown, medium dense to dense, intact, quartz rich clayey GRAVEL. Residual granula.				
2.60						
2.80						
3.00						
3.20						
3.40						

Contractor: Mkhondo Plant Hire

Date Drilled: 04/09/2013

Machine: Case 500 Super R

Hole Diameter: 700 mm

Water Depth:

Sheet: 1 of 1

SOIL PROFILE: TEST PIT 5

FIGURE: A5

TRIAL HOLE: TP 6

PROJECT: Proposed New Municipal Offices

LOGGED BY: NB

SITE NAME: A Ptn of Ptn 123 of Plot Relief Town & Townlands 149 Hl. Mpumalanga

DATE LOGGED: 04/09/2013

CLIENT: Zarafusion (Pty) Ltd

LOCATION: 27°00'56,1" S 30°48'06,3" E

Soilkraft cc

P O Box 73478

Lynnwood Ridge

0040

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				NOTES: 1 No seepage water encountered. 2 No refusal of excavation encountered. 3 Disturbed sample taken at 400 – 1200 mm for a foundation modulus, pH, conductivity test and CBR. [Symbol] Water encountered [Symbol] Water level [Symbol] Bottom of hole [Symbol] Approximate material change [Symbol] Disturbed sample [Symbol] Undisturbed sample
0.20	[Symbol]	Slightly moist, dark brown, medium dense, shattered, clayey SAND with very abundant quartz gravel. Colluvium.				
0.40		Slightly moist, orange brown medium dense, voided, clayey SAND. Fertuginous residual granite.				
0.60						
0.80			3/8922	CA - 1.2	[Symbol]	
1.00						
1.20		Moist, brown pink bleached grey brown firm to stiff, fat clay CLAY. Micaceous residual granite.				
1.40	[Symbol]					
1.60						
1.80						
2.00						
2.20						
2.40						
2.60						
2.80						
3.00						
3.20						
3.40						

Contractor: Mkhondo Plant Hire

Date Drilled: 04/09/2013

Machine: Case 580 Super R

Hole Diameter: 700 mm

Water Depth:

Sheet: 1 of 1

SOIL PROFILE: TEST PIT 6

FIGURE: A6

TRIAL HOLE: TP 7

PROJECT: *Proposed New Municipal Offices*

LOGGED BY: *JB*

SITE NAME: *A Ptn of Ptn 123 of Plot Relief Town & Townships 149 HT, Mamelange*

DATE LOGGED: *04/09/2013*

CLIENT: *Zorafusion (Pty) Ltd*

LOCATION: *27°00'59,1" S 30°48'04,0" E*

Soilkraft cc

P O Box 73478

Lynnwood Ridge

0040

Tel: 012 991 0426

Fax: 012 991 2555

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				NOTES: 1 No seepage water encountered. 2 No refusal of excavation encountered. 3 Disturbed sample taken at 1600 - 1800 mm for a foundation indicator. 4 Undisturbed sample taken at 1800 - 2000 mm for a consolidation test.
0.20		Slightly moist, dark brown, medium dense, shaly, clayey SAND with very abundant quartz gravel. Colluvial.				
0.40		Slightly moist, orange brown, very loose, voided, silty SAND. Ferruginised residual granite				
0.60						
0.80						
1.00						
1.20						
1.40						
1.60		Moist, pinkish white, soft, intact, sandy SILT Residual granite.				
1.80			3/8923	1,6 - 2,8	●	
2.00						
2.20			3/8924	1,6 - 2,8	■	
2.40						
2.60						
2.80						
3.00						
3.20						
3.40						

- ☼ Water encountered
- ▼ Water level
- Bottom of hole
- - - Approximate material change
- Disturbed sample
- Undisturbed sample

Contractor: *Mkhondo Plant Hire*

Date Drilled: *04/09/2013*

Machine: *Case 580 Super R*

Hole Diameter: *700 mm*

Water Depth:

Sheet: *1 of 1*

SOIL PROFILE: *TEST PIT 7*

FIGURE: *A7*

TRIAL HOLE: TP 8

PROJECT: *Proposed New Municipal Offices*

LOGGED BY: *JB*

SITE NAME: *A Ptn of Ptn 123 of Plet Relief Town & Townlands 149 HF, Murrumbidgee*

DATE LOGGED: *04/09/2013*

CLIENT: *Zarafusion (Pty) Ltd*

LOCATION: *27°00'57,4" S 30°48'03,9" E*

Soilkraft cc

P O Box 73478
Lynnwood Ridge
0040

Tel: 012 991 0426

Fax: 012 991 2355

Cell: 082 577 6215

Email: admin@soilkraft.co.za

or izak@soilkraft.co.za

or frans@soilkraft.co.za

Depth (m)	Legend	PROFILE	SAMPLE			Remarks
			Number	Sample Depth (m)	Symbol	
0.00		Ground Surface				NOTES: 1 No seepage water encountered 2 No refusal of excavation encountered [wavy] Water encountered [dashed] Water level [solid] Bottom of hole [dotted] Approximate material change [circle with cross] Disturbed sample [square with cross] Undisturbed sample
0.20		Slightly moist, dark brown, medium dense, shattered, clayey SAND with very abundant quartz gravel. Colluvium				
0.40		Slightly moist, orange brown, very loose, voided, silty SAND with gravel lenses. Ferruginised residual granite.				
0.60						
0.80						
1.00						
1.20						
1.40						
1.60						
1.80						
2.00						
2.20						
2.40						
2.60						
2.80						
3.00						
3.20						
3.40						
Contractor: Mkhondo Plant Hire Date Drilled: 04/09/2013 Machine: Case 580 Super R			Hole Diameter: 700 mm Water Depth: Sheet: 1 of 1			
SOIL PROFILE: TEST PIT 8			FIGURE: A8			

**GEOTECHNICAL CONDITIONS ON A PORTION OF
PORTION 123 OF PIET RETIEF TOWN &
TOWNLANDS 149 HT, MPUMALANGA:
A REPORT FOR THE PROPOSED ESTABLISHMENT
OF NEW MUNICIPAL OFFICES.**

2013/J057/ZAR

11 ADDENDUM B : RESULTS OF SOIL TESTS

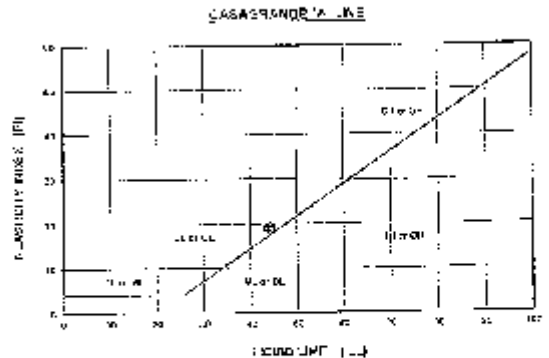
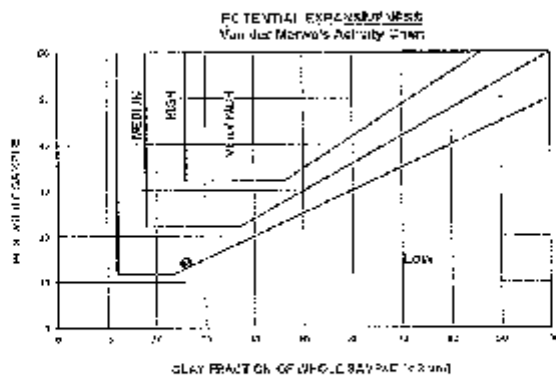
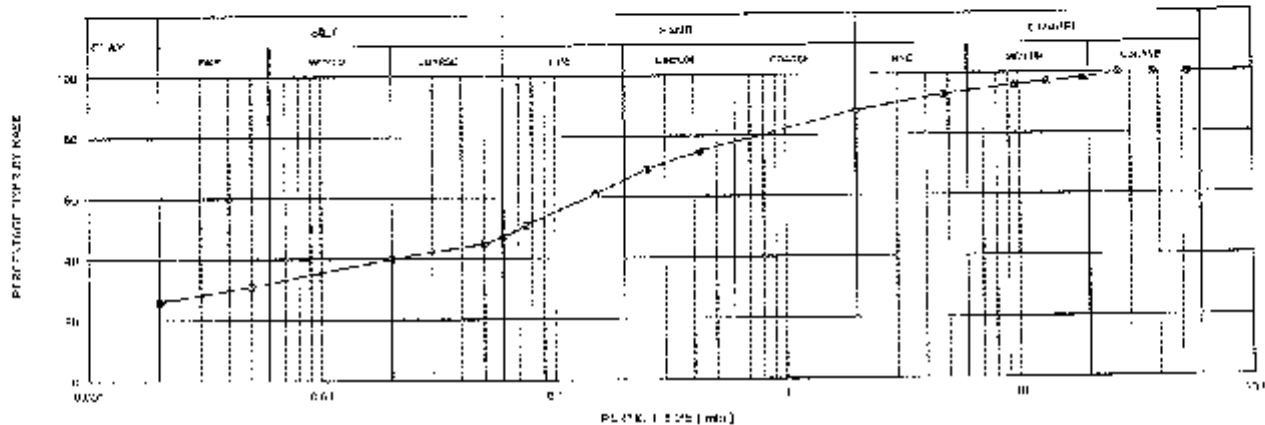


FOUNDATION INDICATOR TEST RESULTS - REP COM 7

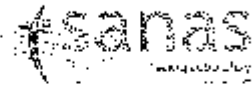
Client: Scillec	Source/Location: 	Lab No: 20-2-C-155
Project Name: Plet Retail Municipality	Layer: 	Sample No: 210518
Project No: 	Level: 	Date: 25/03/2018
Rule (TP No): TP1	Stabilizing Agent: 	Test Method: TMH (A1, A5 & M1)
Depth (mm): 500 - 1100	Soil No: 	Client Ref No:
Description: 	Changes: 	SPS X:
Additional Info: 	CHS: 	SPS Y:

SIEVE ANALYSIS				ATTEBERG LIMITS			SOIL CLASSIFICATION							
Sieve (mm)	% Passing	Sieve Size	% Passing	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Weighted PI (%)	Linear Shrinkage (%)	Grouping Modulus	Uniformity Coefficient	Clay Content (%)	Activity	Unified Classification	TRE Classification
75.0	100	0.425	75	44	25	19	14	9.5	0.86	74	12	3.7	SC	A-7-6
60.0	100	0.250	69								41			
42.5	100	0.150	61								21			
25.0	100	0.075	51								26			
15.0	98	0.060	45											
7.5	87	0.020	40											
4.75	96	0.0075	34											
2.0	80	0.002	28											
7.0	80													

PARTICLE SIZE DISTRIBUTION



Working parameters for the test were checked according to the standards and the results are considered valid. The test results are published in the report. The test results are published in the report. The test results are published in the report. The test results are published in the report.



10074

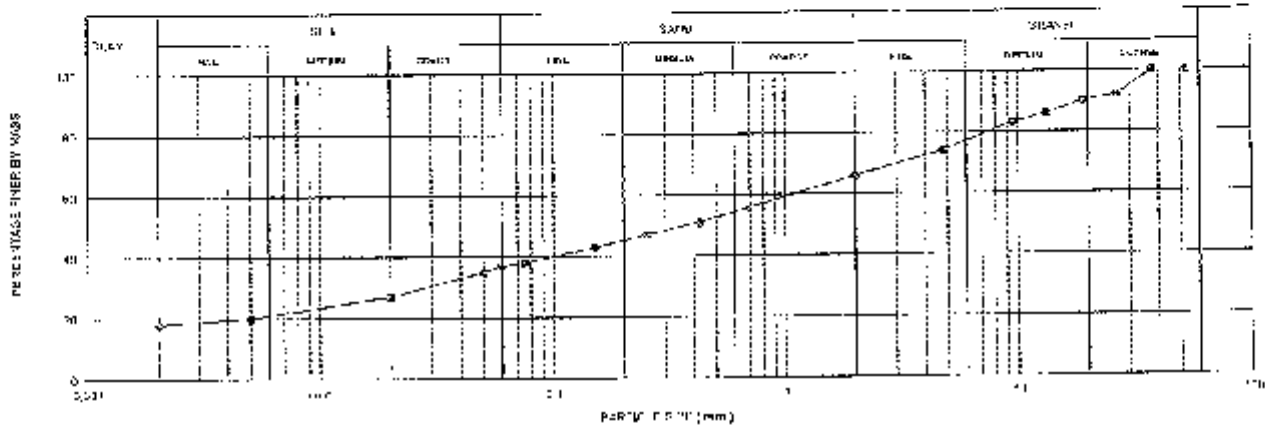


FOUNDATION INDICATOR TEST RESULTS - REP COR 7

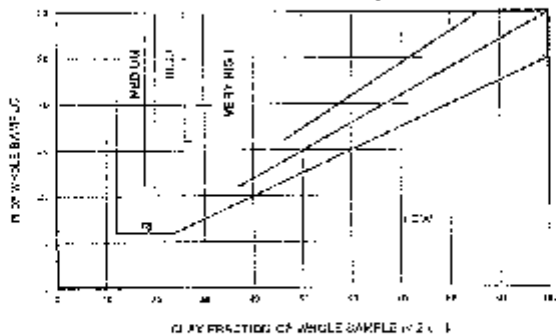
Client:	Saifkraft	Service location:	Job No.:	GE19-0-1-165
Project Name:	Plot Rector Municipality	Layer:	Sample No.:	38320
Project No.:		Lot:	Date:	25/05/2013
Note/TP ID:	TP2	Stabilizing Agent:	Test Method:	TESTS A1, A5 & D11
Depth (mm):	1000 - 2500	Section:	Client Ref No.:	
Description:		Change:	GPS X:	
Additional info:		Offset:	GPS Y:	

SIEVE ANALYSIS				ATTERBERG LIMITS			SOIL CLASSIFICATION				
Sieve (mm)	% Passing	Sieve (mm)	% Passing	Liquid Limit (%)	Plasticity Index (%)	Weighted PI (%)	Linear Shrinkage (%)	Shrinkage Modulus	Uniformity coefficient	Coefficient of curvature	Remarks:
75.0	100	0.425	51	52	26	13	13.3	1.45	66E	3.4	
63.0	100	0.250	47								
53.0	100	0.150	43								
37.5	100	0.075	38								
20.0	92	0.060	37								
15.0	90	0.050	35								
11.8	86	0.020	27								
7.5	83	0.0075	20								
4.75	74	0.002	18								
2.00	66										

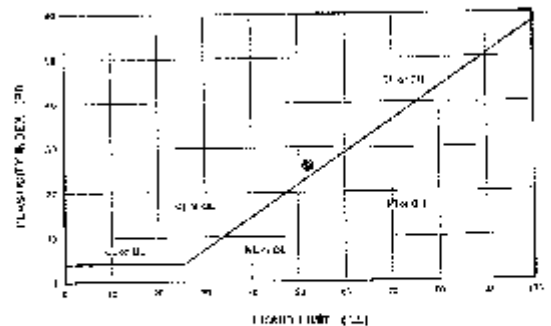
PARTICLE SIZE DISTRIBUTION



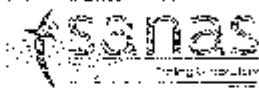
POTENTIAL EXPANSIVENESS
Similar to Merz's A-finity Chart



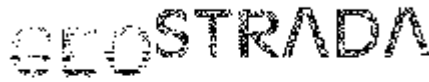
SHRINKAGE W/ ULR



Copyright reserved to the author. This report is for the use of the client only. The author is not responsible for any errors or omissions in this report. The client is responsible for the use of this report. The author is not responsible for any errors or omissions in this report. The client is responsible for the use of this report.



10023



Original Engineering Materials Laboratory

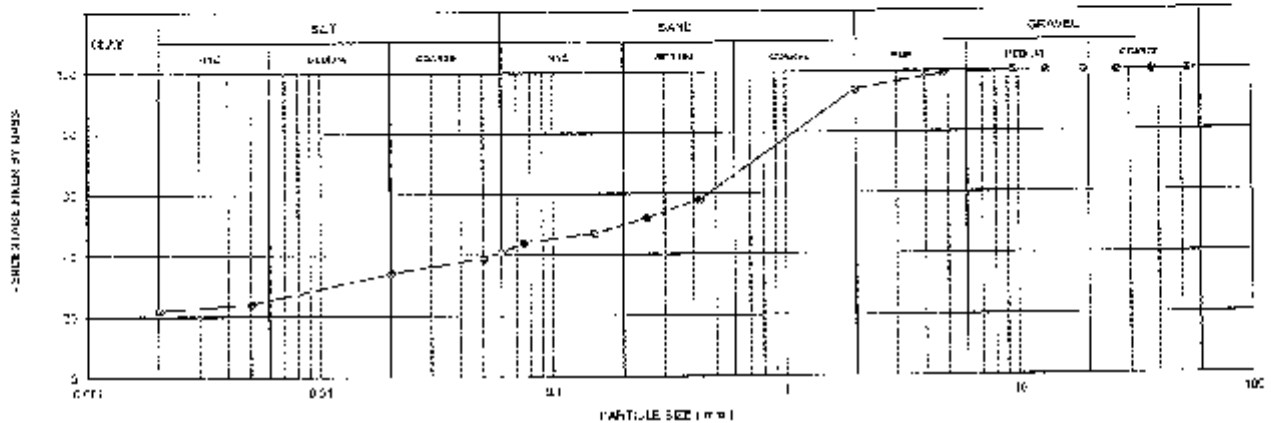


FOUNDATION INDICATOR TEST RESULTS - REP COM 7

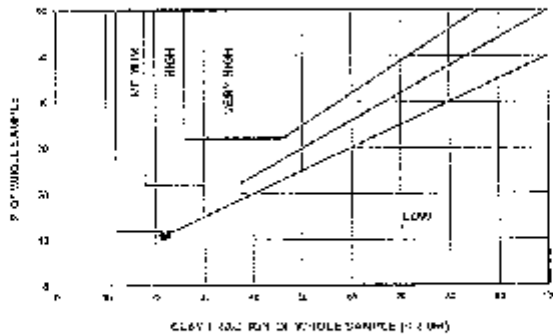
Client:	Markant	Source/Location:	Job No.:	2015-01-06
Project Name:	Swat Relief Municipality	Layer:	Sample No.:	3/0321
Project No.:		Lane:	Date:	25/06/2015
Field/TP No.:	TP3	Stabilizing Agent:	Test Method:	TMH1A1, A5 & M11
Depth (mm):	4 - 1400	Section:	Other Ref No.:	
Description:		Change:	GPS X:	
Additional Info:		OTset:	GPS Y:	

SIEVE ANALYSIS				ATTERBURG LIMITS			SOIL CLASSIFICATION					
Sieve (mm)	% Passing	Sieve (mm)	% Passing	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Weighted P (%)	Linear Shrinkage (%)	Shrinkage Modulus	Uniformity coefficient	Coefficient of curvature	Remarks
75.0	100	75.0	56	52	33	19	11	5.5	1.04	2.96	9.2	
150.0	100	150.0	52									
300.0	100	300.0	47									
600.0	100	600.0	44									
1250.0	100	1250.0	41									
2000.0	100	2000.0	39									
4250.0	100	4250.0	34									
8500.0	100	8500.0	24									
17000.0	99	17000.0	22									
34000.0	94											

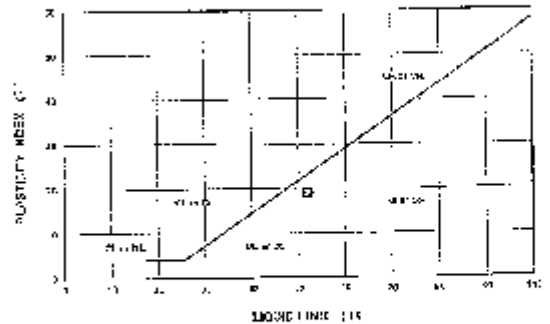
PARTICLE SIZE DISTRIBUTION



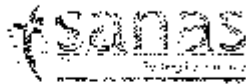
POTENTIAL EXPANSIVENESS
van der Merwe's Activity Chart



CASAGRANDE LIQUID



Only the people in charge of the tests are responsible for the results and the laboratory is not responsible for the results. The laboratory is not responsible for the results of the tests if the client does not follow the instructions of the laboratory. The laboratory is not responsible for the results of the tests if the client does not follow the instructions of the laboratory.



00000

GEOSTRADA

ENGINEERING MATERIALS LABORATORY

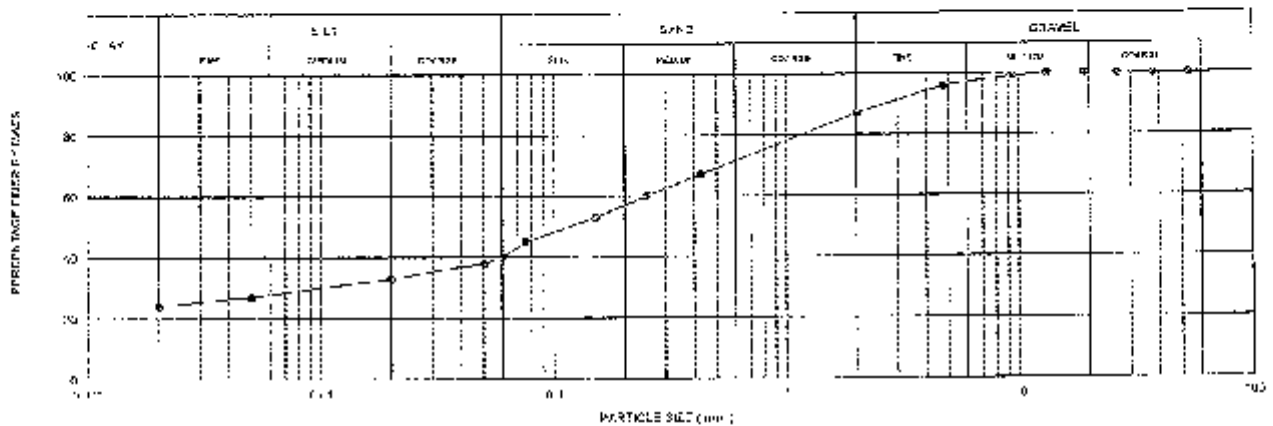


FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	Sackroff	Sample Location:	Job No:	2012-G-1138
Project Name:	Plot Reiter Municipality	Layer:	Sample No:	SI022
Project No:		Lane:	Date:	25/03/2013
Hotel P No:	IPS	Striking Agent:	Test Method:	TMH 51, A1 & M1
Depth (mm):	400 - 1200	Section:	Client Ref No:	
Description:		Change:	GPS X:	
Analysed In:		Office:	GPS Y:	

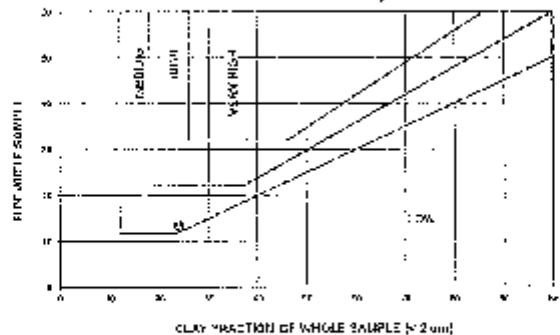
SIEVE ANALYSIS				ATTERBERG LIMITS			SOIL CLASSIFICATION	
Sieve No.	% Passing	Sieve No.	% Passing	Limit	(%)	Value	Classification	Value
75.0	100	0.425	37	Liquid Limit		47	% Gravel	13
60.0	100	0.250	30	Plastic Limit		27	% Sand	47
53.0	100	0.150	55	Plasticity Index		20	% Silt	16
37.5	100	0.075	45	Weighted P		1.0	% Clay	24
26.5	100	0.050	40	Linear Shrinkage		8.5	Activity	0.8
12.0	100	0.050	38	Shrinkage Index		1.01	Unified Classification	SC
10.0	100	0.020	33	Uniformity coefficient		1.25	TRB Classification	A-7-A
9.5	89	0.005	27	Coefficient of curvature		0.4		
4.75	86	0.002	24	Remarks:				
2.00	87							

PARTICLE SIZE DISTRIBUTION

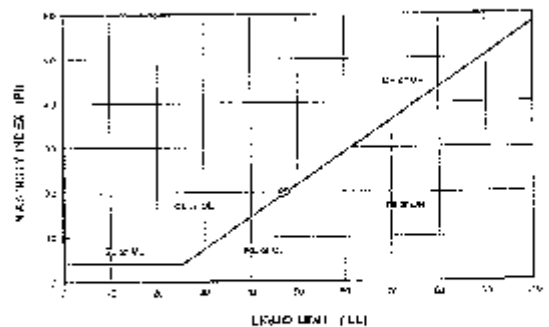


POTENTIAL EXPANSIVENESS

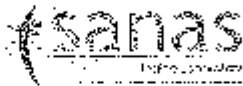
From the Maxwell's Activity (Pa)



CASAGRANDE LLIN



These test results are the property of Geostrada Engineering Materials Laboratory and are intended for the use of the client only. No part of these results may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of Geostrada Engineering Materials Laboratory. The results of these tests are valid only for the specific conditions under which they were performed.



TCC23

GEOSTRADA

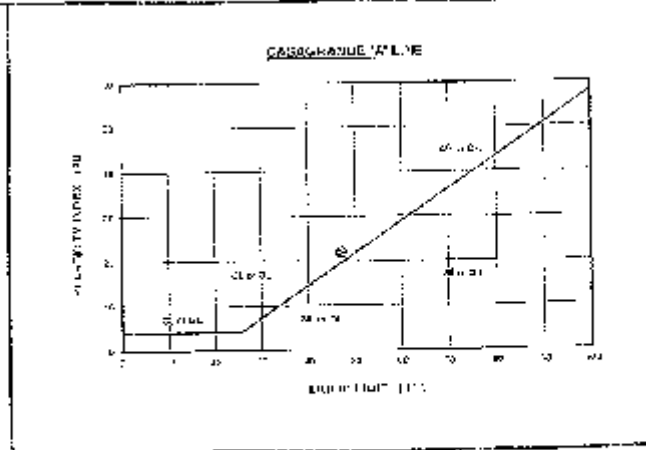
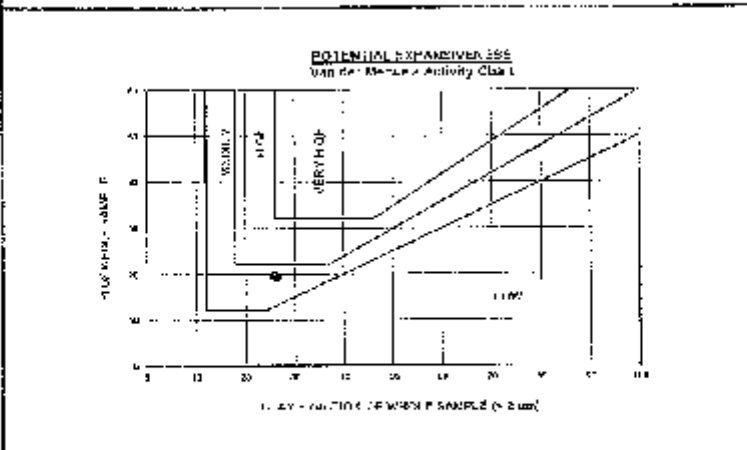
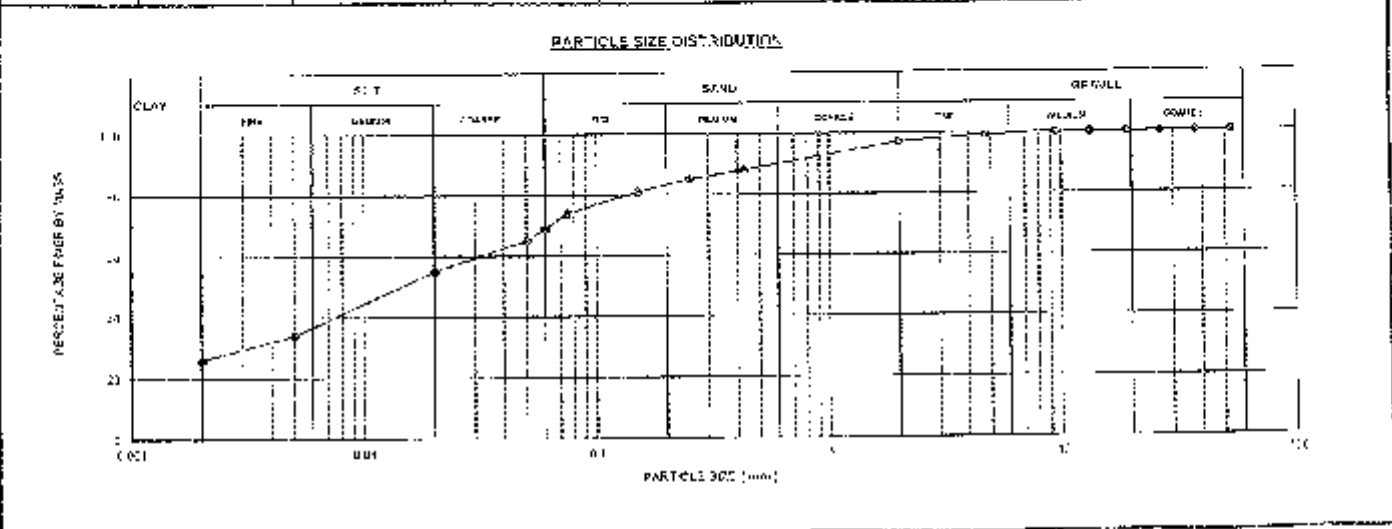
engineering materials laboratory



FOUNDATION INDICATOR TEST RESULTS - REP COM 7

Client:	Soilcraft	Source/Location:	Job No:	2013-C-166
Project Name:	Hier Retial Municipality	Layer:	Sample No:	38827
Project No:		Liner:	Date:	28/08/2013
Field/TP No:	787	Stabilizing Agent:	Test Method:	GMH AT, AB & MT1
Depth (mm):	1600 - 2500	Section:	Client Ref. No:	
Description:		Change:	GPS X:	
Additional Info:		Offset:	GPS Y:	

SIEVE ANALYSIS				ATTERBERG LIMITS			SOIL CLASSIFICATION				
Sieve (mm)	% Passing	Sieve (mm)	% Passing	Liquid Limit (%)	Plasticity Index (%)	Weighted PI (%)	Linear Shrinkage (%)	Grading Modulus	Uniformity coefficient	Coefficient of curvature	Remarks
75.0	100	0.425	82	47	25	22	10.5	0.41	18	0.2	
85.0	100	0.250	52								
50.0	100	0.150	51								
37.5	100	0.075	74								
20.0	100	0.063	59								
15.0	100	0.053	65								
10.0	100	0.043	55								
5.0	100	0.030	34								
4.75	99	0.025	26								
2.00	97										



Sanas Engineering Laboratory is a registered provider of services for the construction industry. The laboratory is a member of the South African Bureau of Standards (SABS) and is accredited for the testing of soils and aggregates. The laboratory is also a member of the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Pure and Applied Physics (IUPAP).



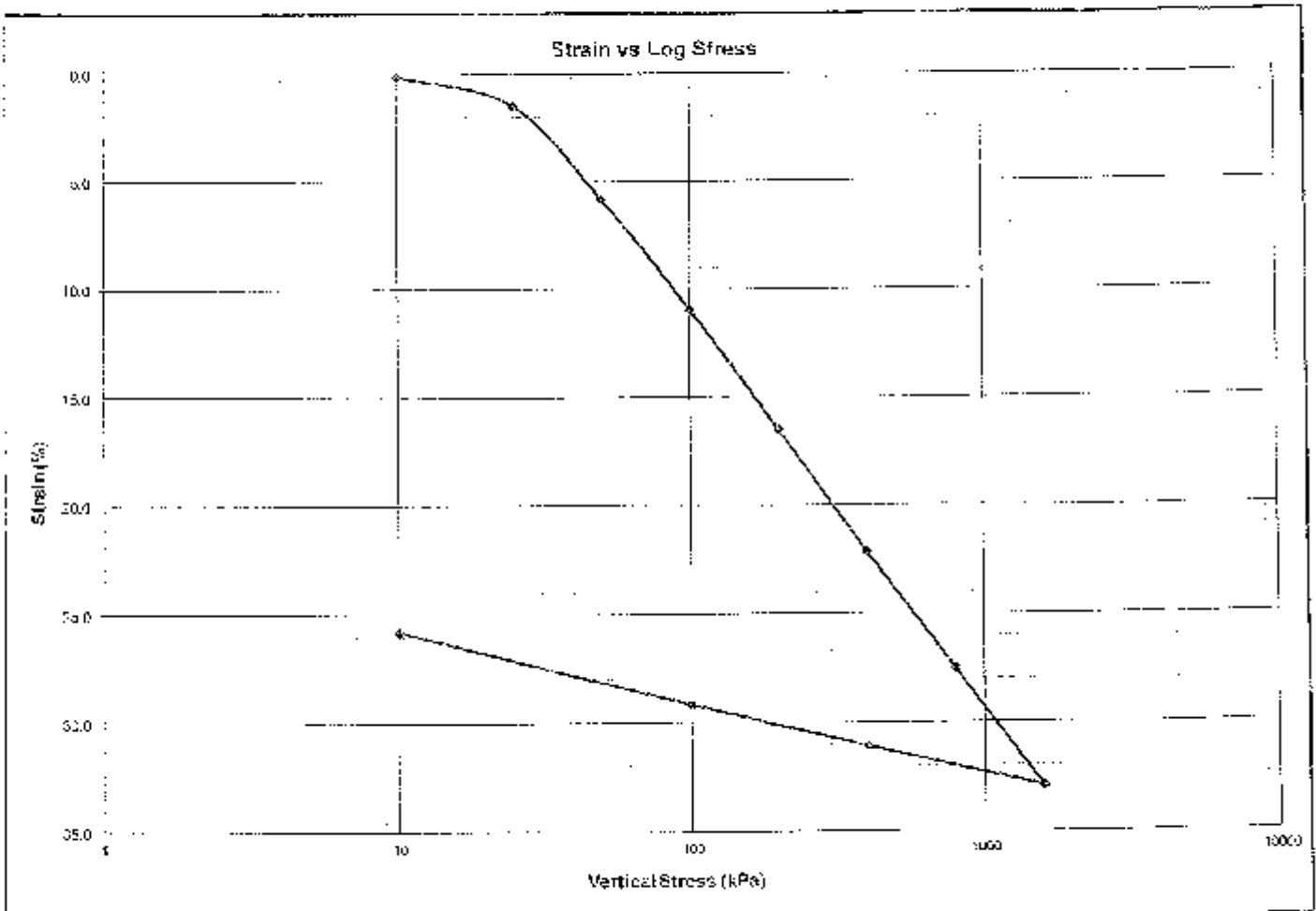
CONSOLIDATION TESTS: STANDARD OEDOMETER

BS 1377
Part 5

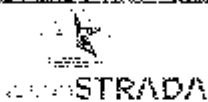
Client: Soilcraft	Project: Dief River Municipality	Job no: 2013 C-1166
Sample no: TF 1	Depth (m): 1.1 - 3.0	Date: 07/10/2015
Lab no: 348918		

Sample Parameters	Unit	Value	Remarks	Test Remarks	
Moisture Content	Before Test	%	25.1	Complete test specimen	Undisturbed sample
	After Test	%	27.0	Complete test specimen	
Dry Density	kg/m^3	1356			
Void Ratio		1.915			
Degree of Saturation	%	32.7			
Initial Specimen Height	mm	25.4			
Relative Density (SS)	-	2.711	Determined		

Test Parameters												
Vertical Stress	kPa	10	25	50	100	200	400	800	1600	400	100	10
Time Elapsed	yr	12	12	12	12	12	12	12	12	2	2	3
$H_{1/2}$	mm	25.37	25.023	23.025	22.817	21.208	19.775	18.405	17.043	17.828	17.996	18.647
Strain	%	0.115	0.483	5.808	10.955	19.512	22.147	27.535	32.007	31.073	29.150	25.799
Void Ratio	-	1.342	1.319	1.209	1.085	0.959	0.828	0.699	0.573	0.616	0.501	0.740
W_u (UMpa)	-	-	0.913	1.756	3.094	5.027	7.337	10.173	13.035	15.073	16.293	16.826



Everything possible care to ensure that tests are rechecked and are performed accurately, and that appropriate conclusions are qualified accordingly. If any data or its officials can't be verified, the client should be notified immediately. The accuracy of the test results is not guaranteed. The test results are based on the test results. The test results are published or reproduced by the client, it will be done in full, without any restriction.



CONSOLIDATION TESTS: STANDARD OEDOMETER

BS 1377
Part 5

Client: Soilkrul;
Sample no: 1711
Lab no: S-9910

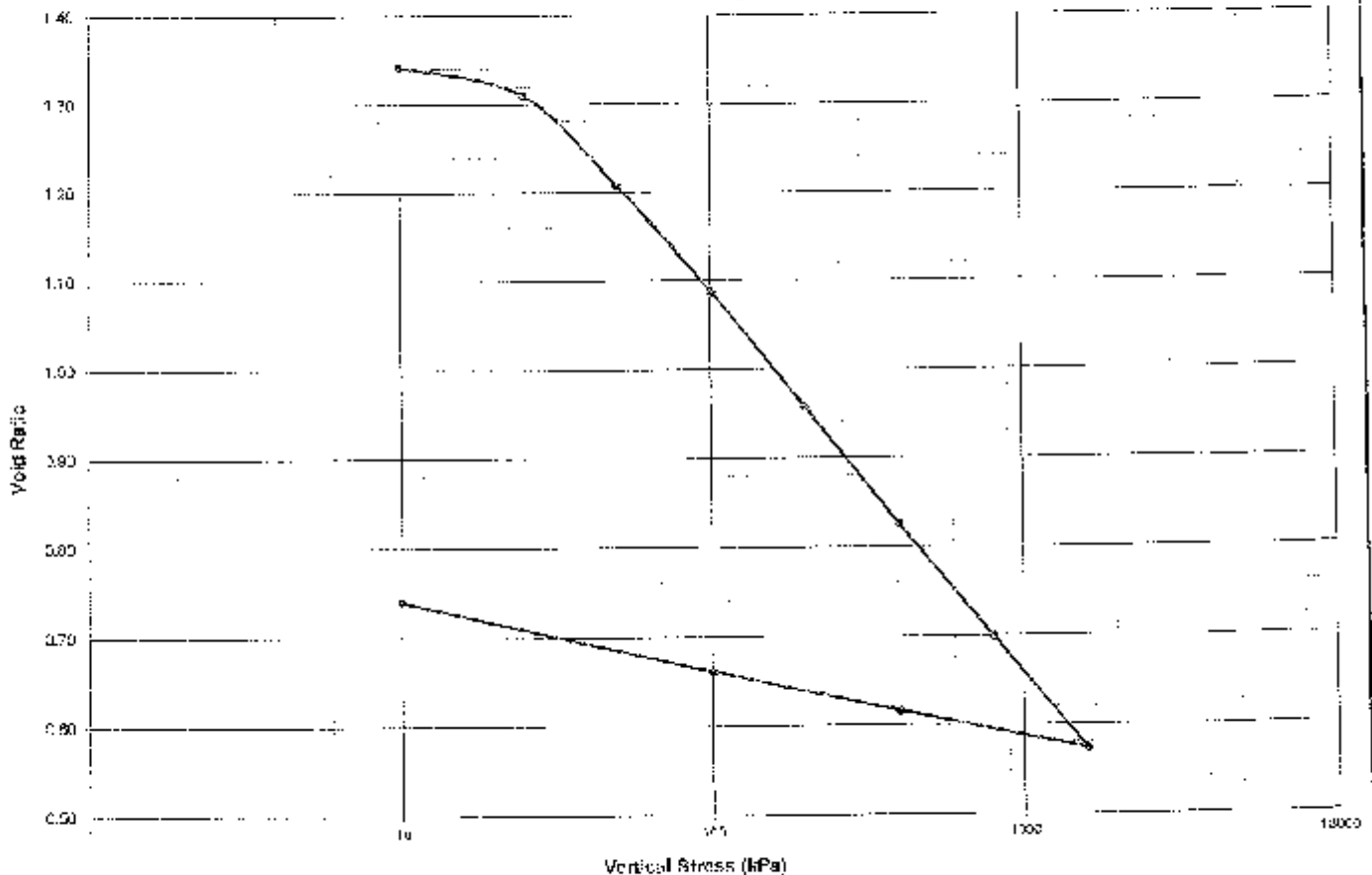
Project: Plat Relief M. Indip. ty
Depth (m): 1.1 - 3.0

Job no: 2018-C-1165
Date: 07/10/2018

Sample Parameters	Unit	Value	Remarks	Test Remarks
Moisture Content	Before Test	25.1	Complete test specimen	Undisturbed sample
	After Test	27.0	Complete test specimen	
Dry Density	Kg/m ³	1156		
Void Ratio	-	1.345		
Degree of Saturation	%	55.7		
Initial Specimen Height	mm	25.4		
Relative Density (SD)	-	2.711	Determined	

		Test Parameters										
Vertical Stress	kPa	10	25	50	100	200	400	800	1600	100	100	10
Time Elapsed	hr	12	12	52	15	12	12	12	5	2	3	
H _{inc}	mm	23.971	23.023	23.925	22.617	21.206	17.775	18.415	17.042	17.509	17.008	18.847
Strain	%	0.116	1.485	5.803	10.956	13.512	23.147	27.535	35.507	31.072	29.150	23.730
Void Ratio		1.342	1.300	1.209	1.093	0.958	0.825	0.889	0.573	0.616	0.650	0.740
M _v (1/Δ _v)		-	0.9126	1.753	1.0938	0.6737	0.3373	0.373	0.0027	0.0228	0.0829	0.5254

Void Ratio vs Log Stress



Every effort is made to ensure that tests are representative and are performed accurately and that results and conclusions are objectively presented. Results are only valid if they are not affected by any form of potential damage or bias due to any environmental changes. This test is not for any purpose other than that for which it was designed. The test results are published or reproduced by the client, shall be done in full without any alteration.



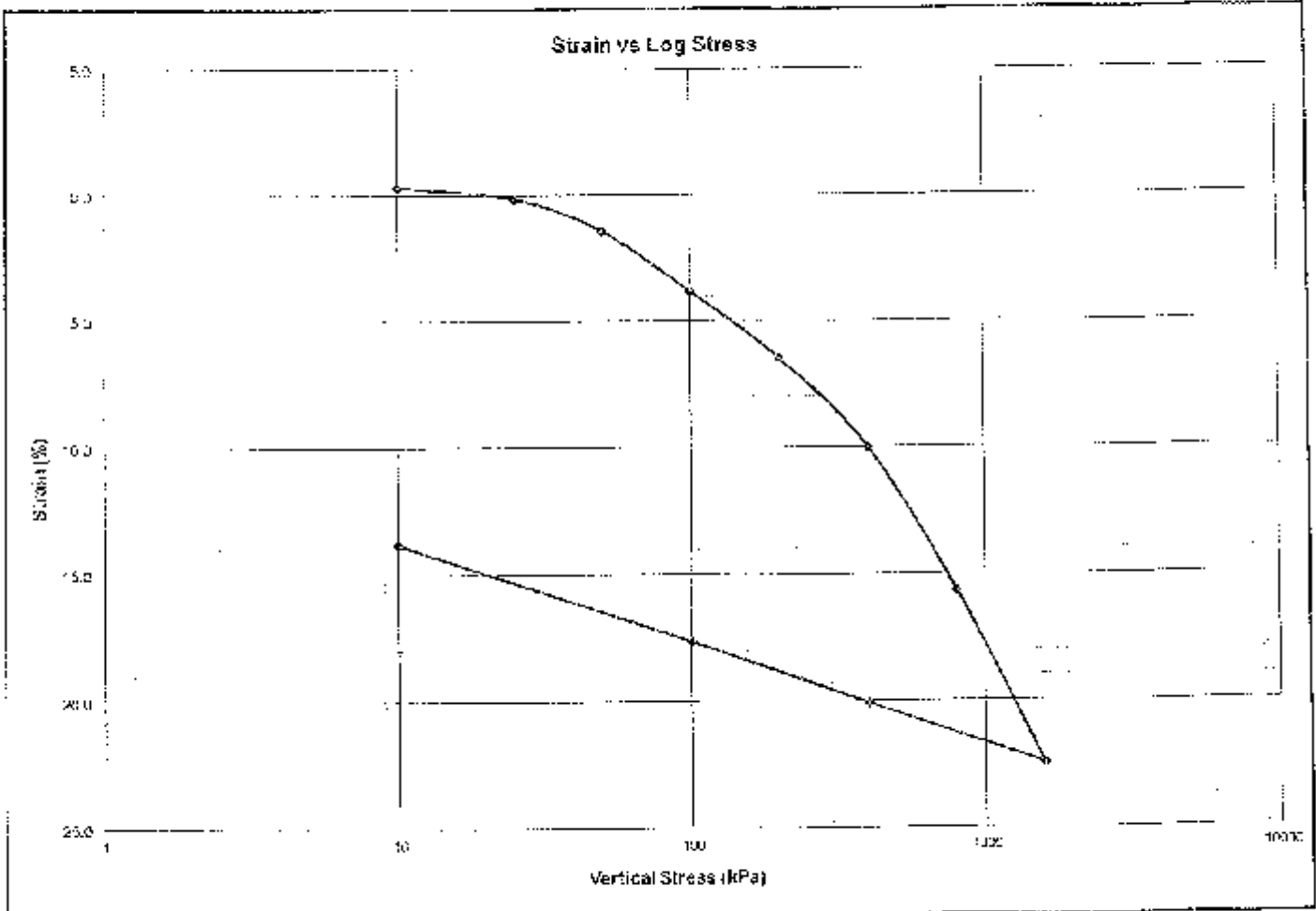
CONSOLIDATION TESTS: STANDARD OEDOMETER

**BS 1377
Part 5**

Client: Southern	Project: Plex Relief Municipality	Job no: 2013-0-1165
Sample no: TF 7	Depth (m): 1.6 - 2.0	Date: 08/10/2013
Lab no: 3/8324		

Sample Parameters	Unit	Value	Remarks	Test Remarks
Moisture Content: <u>Before Test</u>	%	41.7	Complete test specimen	Undisturbed sample
<u>After Test</u>	%	37.4	Complete test specimen	
Dry Density	Kg/m ³	1.87		
Void Ratio	-	1.305		
Degree of Saturation	%	87.2		
Initial Specimen Height	mm	20.4		
Relative Density (SG)	-	2.723	Determined	

Test Parameters												
Vertical Stress	kPa	10	25	50	100	200	400	800	1600	3000	100	10
Time Elapsed	h:	12	12	12	12	12	12	12	12	12	2	3
H ₁₀₀	mm	25.478	25.389	25.008	24.429	23.754	22.857	21.427	19.592	20.293	23.917	21.845
Strain	%	-0.795	0.161	1.425	3.824	6.479	10.012	16.641	27.472	20.108	17.648	13.858
Void Ratio		1.512	1.301	1.072	1.217	1.156	1.074	0.944	0.787	0.742	0.593	0.905
Mv (1/Mpa)		-	0.303	0.507	0.487	0.275	0.189	0.158	0.101	0.025	0.102	0.514



Everything possible is done to ensure that all test results and calculations are performed accurately, and that reports and certificates are produced correctly. Geotechnical Ltd is not liable for consequential damage or loss due to any error made in applying all the facts, nor for any erroneous statement or opinion contained in a report based on such facts. If a test report is published or reproduced by the client, it will be done in full, without any modification.



CONSOLIDATION TESTS: STANDARD OEDOMETER

**BS 1377
Part 5**

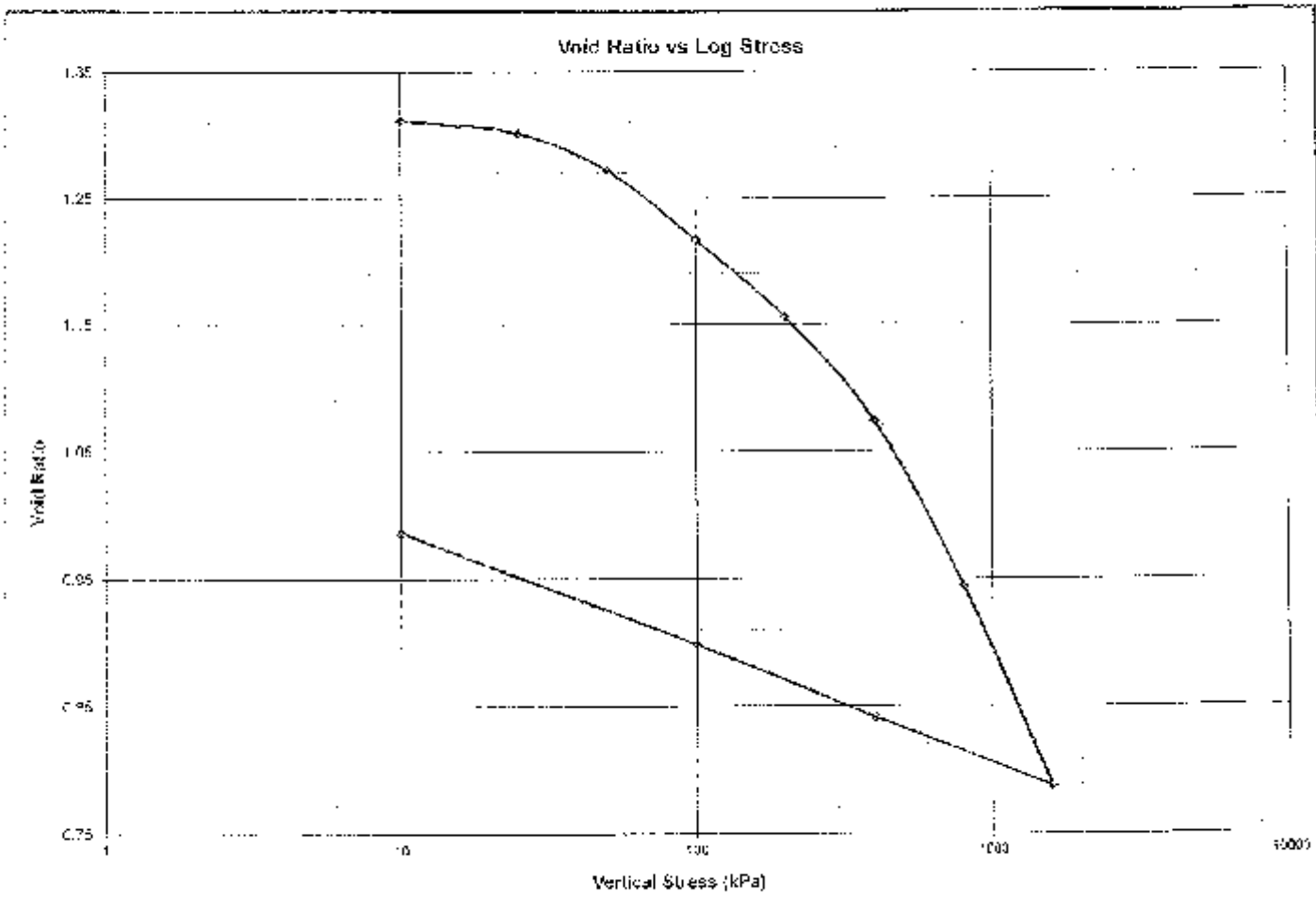
Client: Soilcraft
Sample no: TP /
Lab no: 3/8024

Project: Piet Rafel Municipality
Depth (m): 1.5 - 2.0

Job no: 2018 01166
Date: 08/10/2018

Sample Parameters	Unit	Value	Remarks	Test Remarks	
Moisture Content	Before Test	%	41.7	Complete test specimen	Undisturbed sample
	After Test	%	37.4	Complete test specimen	
Dry Density	Kg/m ³	1.82			
Void Ratio	-	1.905			
Degree of Saturation	%	87.2			
Initial Specimen Height	mm	25.4			
Relative Density (SD)	-	2.725	Determined		

Vertical Stress	kPa	Test Parameters										
		10	25	50	100	200	400	800	1000	400	100	10
Time Elapsed	hr	12	12	12	12	12	12	12	12	2	2	3
H _{ice}	mm	25.475	25.348	25.058	24.429	23.754	22.857	21.427	19.692	20.203	20.117	21.885
Strain	%	-0.295	0.161	1.425	3.024	5.479	10.012	15.241	22.472	20.108	17.349	13.830
Void Ratio	-	1.312	1.205	1.272	1.217	1.155	1.074	0.944	0.757	0.842	0.898	0.969
M _v (%/kPa)	-		0.303	0.5066	0.4067	0.2751	0.1889	0.1254	0.1112	0.0554	0.3575	0.5141



Everything possible is done to ensure that tests are representative and are performed accurately, and that reports and certifications are published truthfully. Geostrada or its client/owner in no way is responsible for any consequential damage or loss due to an error made in using published test results for any engineering statement or action contained in a report. However, it shall be the client's responsibility to test results obtained here produced by the client, it will be done in full without any influence.



FIGURE 4
LEGEND
 TEST PITS
 MARSHY CONDITIONS
 INFERRED BOUNDARY

FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES



FOR ILLUSTRATIVE PURPOSES ONLY

ZONE	GEOTECHNICAL CLASS	% OF TOTAL AREA	ESTIMATED SOIL MOVEMENT	SOIL PROFILE	DEVELOPMENT POTENTIAL	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS
I	H2/S2	50%	Up to 30mm unrestrained heave and settlement exceeding 20mm	Colluvium underlain by successions of residual granite	Intermediate	Modified	Soil replacement raft	Slightly corrosive soils Marshy areas
II	P _{Fill} /H-H1	21%	Up to 15mm unrestrained heave	Problematic fill underlain by residual granite	Not Favourable	N/A	N/A	Problematic fill
III	P _{Borrow Pit} /H2/S2	29%	Up to 30mm unrestrained heave and settlement exceeding 20mm	Surface rubble underlain by successions of residual granite	Not Favourable	N/A	N/A	Defunct borrow area Waste and refuse heaps

SOILKRAFT

FOUNDED 1948
 150 WOODSIDE
 0210
 TEL: 011 251 9111
 FAX: 011 251 9200
 CELL: 082 575 4215
 E-MAIL: admin@soilkraft.co.za

PO BOX 2028
 150 WOODSIDE
 0210
 TEL: 011 251 9111
 FAX: 011 251 9200
 CELL: 082 575 4215
 E-MAIL: info@soilkraft.co.za

PROJECT NAME: Proposed Piet Retief Municipality
 CLIENT: Zarafusion (Pty) Ltd
 DRAWING NO: Geotechnical Zoning
 DATE: 8 October 2013

**REPORT ON THE FOUNDATION INVESTIGATION CARRIED OUT
FOR THE PROPOSED NEW PIET RETIEF MALL
MPUMALANGA PROVINCE**

Prepared for:

Sotirales Consulting Engineers (Pty) Ltd

On behalf of:

Zarafusion (Pty) Ltd t/a Piet Retief

Report by:

Geo Simplicity Geotechnical Engineering (Pty) Ltd

Reg. No. 2013/060927/07

V.A.T. No. 4060263342

1 Killoran Place

Bedfordview

2007

+27 83 601 5189

petrus@gesosim.co.za

Ref: G082-PVS-R01

September 2014

REPORT ON THE FOUNDATION INVESTIGATION CARRIED OUT FOR THE PROPOSED NEW PIET RETIEF MALL, MPUMALANGA PROVINCE

INDEX

1	INTRODUCTION	1
2	DESK STUDY OF EXISTING INFORMATION	1
3	PURPOSE OF INVESTIGATION	1
4	METHOD OF INVESTIGATION	1
4.1	<i>Digging of test holes, soil profiling and DPSH in-situ testing</i>	1
4.2	<i>Sampling and laboratory testing</i>	2
5	GEOLOGY AND GENERALIZED SOIL PROFILE	2
5.1	<i>Geology</i>	2
5.2	<i>Generalized soil profile</i>	2
6	DISCUSSIONS AND RECOMMENDATIONS	4
6.1	<i>General</i>	4
6.2	<i>Problem soil considerations</i>	4
6.2.1	<i>Collapse potential</i>	4
6.2.2	<i>Compressibility and settlement</i>	4
6.2.3	<i>Potential expansiveness</i>	5
6.3	<i>Groundwater</i>	5
6.4	<i>Excavatability</i>	5
6.5	<i>Slope stability</i>	7
6.6	<i>Soil aggressiveness and corrosivity</i>	7
6.7	<i>Proposed founding and piling considerations</i>	8
6	REFERENCES	11

APPENDIX A: TEST HOLE AND DPSH TEST POSITIONS

APPENDIX B: TEST HOLE PROFILES

APPENDIX C: DPSH TEST RESULTS

APPENDIX D: LABORATORY TEST RESULTS

REPORT ON THE FOUNDATION INVESTIGATION CARRIED OUT FOR THE PROPOSED NEW PIET RETIEF MALL, MPUMALANGA PROVINCE

1. INTRODUCTION

This report presents the results of the foundation investigation carried out for the proposed new Piet Retief Shopping Mall, to be situated at the intersection of Kerk and Brand Streets in Piet Retief, Mpumalanga Province.

The investigation was carried out at the request of Mr Gerrit Borman, of Messrs Sotirales Consulting Engineers (Pty) Ltd on behalf of the Client, Messrs Zarafusion (Pty) Ltd, t/a Piet Retief.

Permission to proceed with the foundation investigation was granted via email and the fieldwork was carried out on 29 May 2014. The samples for laboratory testing were handed over to Messrs Roadlab (Pty) Ltd the next day for physical and chemical testing.

2. DESK STUDY OF EXISTING INFORMATION

The following existing information was studied to determine the expected in-situ geotechnical conditions and to plan our foundation investigation:

- The 1:250 000 Vryheid 2530 geological map.
- The geotechnical report compiled by Soilcraft, ref: 2013/J056/ZAR, dated 04 October 2013.

3. PURPOSE OF INVESTIGATION

The purpose of the foundation investigation is to:

- Identify any potential problematic soils which may influence the pile type and design.
- Determine the design parameters for pile design purposes, bearing the potential different pile types applicable to the in-situ soils conditions in mind.
- Provide our recommendations with regards to the most cost effective pile type and design for the site under consideration.

4. METHOD OF INVESTIGATION

4.1 Digging of test holes, soil profiling and DPSH in-situ testing

Initially, the fieldwork was planned to be carried out once the bulk earthworks had been completed, allowing complete and unhindered access to investigate representatively across the site.

Unfortunately, programme restraints resulted in the fieldwork to be carried out prior to the site being evacuated and test positions were placed as such to accommodate the existing activities and services.

Based on the piled foundations anticipated for the more heavily loaded column loads of the shopping centre, together with the fairly shallow expected bedrock occurrence below NGL, test holes by means of a Sumitomo SH 200-3 21t traxcavator combined with Dynamic Probe Super Heavy (DPSH) testing were earmarked to assist in providing information with regards to pile design parameters.

In addition, the test holes provided factual confirmation of the occurrence (level) of, and inflow rate of groundwater seepage, which is required to establish appropriate pile types.

DPSH testing provides indicative side shear parameters for pile design purposes and refusal of the standard 60° probe generally confirms competent resistance for side shear and end bearing capacities of piles, where applicable.

In total, 4No traxcavator test holes were dug where access was granted and 6No DPSH tests were carried out between test hole positions where test pitting was impossible. In addition, DPSH test results are used to provide in-situ soil consistencies with depth below test hole elevations.

Unfortunately, the abundant scattered occurrence of fill and residual obstructions (boulders, builders rubble and residual corestones, respectively) prevented DPSH cones to be advanced to representative refusal depths, with the bulk of DPSH tests refusing atop these obstructions.

The traxcavator test hole and DPSH test positions' locality plan, together with the soil profiles and DPSH test results are attached hereto in Appendix A, B and C, respectively.

4.2 Sampling and laboratory testing

A total number of eight (8No) representative disturbed samples were taken of the in-situ material for laboratory testing.

The following laboratory testing was requested:

- 8No x Foundation indicator tests.
- 8No x Chemical soil aggressiveness tests which comprised of pH and conductivity testing.

The reason for carrying out these tests specifically is described below:

- Foundation indicator testing: To provide basic classification of the in-situ soils in terms of potential expansiveness and/or heave which should be borne in mind in pile designs.
- Chemical soil aggressiveness testing: To determine the proneness of the in-situ material to corrosivity with specific reference to structural concrete for foundations (shallow and piled) as well as underground services (stormwater, water reticulation and sewer pipes and electrical cables).

The laboratory test results are attached hereto in Appendix D.

5 GEOLOGY AND GENERALIZED SOIL PROFILE

5.1 Geology

According to the 1:250 000 Vryheid 2530 geological map the site is underlain by medium to coarse grained biotite granite, porphyritic biotite granite or coarse grained hornblende granite of the Pongola Sequence.

Reworked residual, residual granite and granite bedrock was encountered in ¾ of the test holes dug.

In addition, residual diabase, generally associated with granite occurrence, was encountered in the last test hole, TH04, dug on site.

5.2 Generalized soil profile

A generalized soil profile was not encountered on site.

From a macro point of view, two distinct soil profiles were encountered and can be summarized as follows:

Fill, alluvium and pebbles transported, granite soil/rock profile - Test holes TH01, TH02 & TH03

Depth to (m):	Layer thickness (m):	Description:
1,6 (TH01 only)	1,6	Slightly moist, olive and orange-brown, blotched olive-black, medium dense with intermittent loose to medium dense and dense zones in profile, massive, medium grained silty and clayey SAND with fine to coarse grained gravel, cobbles, boulders and builders rubble (concrete blocks and existing foundations, bricks and UPVC pipes) in profile. Fill.
TH01: 2,2 TH02: 0,5 TH03: 0,6	TH01: 0,8 TH02: 0,4 TH03: 1,4	Moist, dark olive-black, speckled black, dense, massive, fine to medium grained silty SAND with abundant scattered fine grained gravel (TH01, TH02 & TH03), cobbles and boulders up to 0,8m in diameter (TH03 only) in profile. Alluvium transported.
0,7 (TH02 only)	0,2	Moist, dark olive-black, speckled black, dense, massive, fine to medium grained silty SAND with abundant scattered fine to coarse grained gravel (pebbles) in profile. Pebbles transported.
TH01: 3,4 TH02: 4,5 TH03: NE	TH01: 1,2 TH02: 3,8 TH03: NA	Moist to very moist, dark orange-brown, mottled and streaked olive-black, firm to stiff (TH01), firm to stiff up to 1,8m becoming soft with intermittent soft to firm zones in profile with depth (TH02), slightly ferruginous and micro-shattered, clayey SILT. Reworked residual granite.
TH01: 3,6 + TH02: 5,0 + TH03: 2,0	TH01: 0,2 + TH02: 0,5 + TH03: 1,4	Moisture content varying between moist to very moist, dark olive-orange (TH01 & TH02), dark yellow-orange (TH03 only) streaked black, medium dense to dense (TH01 & TH03), very dense bordering highly to completely weathered, very soft rock (TH02), relic jointed (TH01 & TH02), massive and friable (TH03 only), fine grained silty micaceous SAND. Residual granite.
Below 2,0m (TH03 only)	Unknown	Dark yellow-orange, streaked black, highly to completely weathered, massive, presumably very closely spaced stained jointed, SOFT ROCK and possibly harder with highly weathered, soft to medium hard rock corestones in profile. Granite.

Alluvium transported, pedogenic, diabase soil profile - Test holes TH04 only

Depth to (m):	Layer thickness (m):	Description:
0,6	0,6	Moist, dark olive-black, speckled black, dense, massive, fine to medium grained silty SAND with abundant scattered fine grained gravel, cobbles and boulders (up to 1m in diameter) in profile. Alluvium transported.
1,2	0,6	Moist to very moist, dark yellow and olive-brown, speckled and mottled black (ferricrete nodules), medium dense, ferruginized, fine grained silty slightly clayey SAND with frequently scattered completely weathered ferricrete nodules in profile. Pedogenic.
1,8	0,6	Very moist to wet, dark olive-grey and orange-brown, very soft to soft, shattered and slightly micro-shattered, silty slightly sandy CLAY with abundant scattered, unweathered very hard rock cobbles and boulders (up to 1,5m in diameter) in profile. Reworked residual diabase.
2,3	0,5	Moist to very moist, dark orange-brown, mottled and blotched olive-grey, very soft to soft, slightly ferruginous and slightly micro-shattered, clayey SILT. Reworked residual diabase.
3,0	0,7	Very moist to wet, dark olive and yellow-orange, very soft, relic jointed, sandy SILT, with abundant scattered, unweathered very hard rock cobbles and boulders (up to 1,5m in diameter) in profile. Residual diabase.
3,9	0,9	Wet, dark olive and yellow-orange, medium dense to dense with intermittent loose to medium dense zones in profile, medium to coarse grained silty sand with frequent scattered highly to completely weathered and unweathered to slightly weathered, very soft to soft rock and very hard to extremely hard rock, cobble and boulder size corestones (150mm to 1m in diameter) in profile. Residual diabase.
3,9 +	Unknown	Wet, dark olive and yellow-orange, medium dense to dense with intermittent loose to medium dense zones in profile, medium to coarse grained silty sand with abundant scattered highly to completely weathered and unweathered to slightly weathered, very soft to soft rock and very hard to extremely hard rock, cobble and boulder size corestones (150mm to 1m in diameter) in profile. Residual diabase.

NE = Not encountered

Refusal of the Sumitomo SH 200-3 21t traxcavator occurred in $\frac{2}{4}$ of the test holes dug, whilst difficult advance through bouldary material was noted in an additional test hole.

Refusal of the machine occurred in test hole TH03 at 2,0m below NGL on highly to completely weathered, soft rock and possibly harder bedrock, granite and in test hole TH04 at 3,9m below NGL on an abundant occurrence of cobble and boulder size diabase corestones. Difficult advance was noted in test hole TH01 from NGL to 1,6m below NGL within cobbles, boulders and builders rubble, fill material.

Groundwater seepage was generally not encountered. However, very slight groundwater seepage was noted below 3m in test hole TH04 which resulted in the test hole sidewalls to become unstable and the bottom of the test hole to be completely saturated.

The test holes were thoroughly backfilled immediately after profiling was completed.

6. DISCUSSION AND RECOMMENDATIONS

6.1 General

According to the 1:250 000 Vryheid 2530 geological map the site is underlain by medium to coarse grained biotite granite, porphyritic biotite granite or coarse grained hornblende granite of the Pongola Sequence.

Reworked residual, residual granite and granite bedrock was encountered in $\frac{3}{4}$ of the test holes dug.

In addition, residual diabase, generally associated with granite occurrence, was encountered in the last test hole, TH04, dug on site.

6.2 Problem soil considerations

6.2.1 Collapse potential

A collapsible grain structure was not noted during the soil profiling of these soils nor was it observed in any of the other soils encountered.

Therefore, no problems insofar collapsibility are expected to occur on site.

6.2.2 Compressibility and settlement

When considering the behaviour in terms of compressibility and potential settlement of the in-situ soils with regards to conventional shallow foundation design (pad and/or strip foundations), the following criteria needs to be considered:

- The cut/fill scenario below the structural footprint.
- The anticipated load cases of the proposed structures. The following load cases were provided for analysis purposes:

Type 1 - Parking area: 850kN

Type 2 - Ground floor: 150kN

Type 3 - Level 1: 1250kN

Type 4 - Level 2: 2300kN

- The influence of the in-situ moisture content on the in-situ allowable bearing capacity of the different soil layers.

- The soil consistencies -and structure of the in-situ soils with depth in terms of allowable bearing capacity and settlement tolerances.

The final bulk earthworks level/s within the shopping centre footprint were not finalized at time of reporting. Nevertheless, with specific reference to the higher loadcases (type 1, 3 & 4), time related settlement in excess of acceptable tolerances (>20mm) are expected to occur, should conventional foundations be placed atop or within the fill, transported, reworked residual and residual soils encountered on site, pending the final footing dimensions and ad hoc geotechnical conditions at founding depth.

6.2.3 *Potential Expansiveness*

According to Van der Merwe (1964), the reworked residual granite and residual diabase soils are prone to be potentially expansive, with representative laboratory test result indicating a "Low to Medium" activity, insofar potential heave is concerned.

However, Van der Merwe's method assumes a complete "dry to wet" cycle to occur in order for heave to take place. We believe that the probability of these soils to undergo the above significant moisture fluctuation is low, especially with depth and below the shopping centre footprint. Therefore, we recommend that the maximum heave for surface beds be limited to 10mm for design purposes.

According to our calculations, all column foundations will still be in a nett compression state.

Therefore, column foundations, albeit shallow, raft (soil and/or concrete raft) or piled foundations do not require special precautionary measures to accommodate potential heave.

6.3 Groundwater

Groundwater seepage was generally not encountered. However, very slight groundwater seepage was noted below 3m in test hole TH04 which resulted in the test hole sidewalls to become unstable and the bottom of the test hole to be completely saturated.

It must be noted that the fieldwork was conducted towards the middle of the dry season (29 May 2014) and that groundwater seepage is therefore possible to occur on site, during the rainy season, possibly in the form of a perched water table, especially below soils with competent in-situ soil consistencies and/or at the soil/bedrock interface.

Therefore, we suggest that proper surface run-off and subsurface groundwater drainage form part of the permanent works.

An elevated structural building platform, in the form of an engineered fill, should be considered to provide the above.

Insofar piled foundations is concerned, we strongly suggest allowance should be made for the forming of piles under water with associated sidewall collapse, as suggested under clause 5.8 of this report.

6.4 Excavatibility

Excavatability of the in-situ material encountered in the test holes, vary significantly across the site.

Transported and fill boulders, as well as builders rubble are expected to be encountered across the site where manmade fill platforms have been constructed in the past. Cobble and boulder size corestones (between 150mm and up to 1,5m in diameter) have been encountered within the reworked residual diabase, as well in the residual diabase and granite soils (test holes TH03 & TH04).

The following table, Table 1: Excavatibility, summarizes the different classes of excavation to be expected and allowed for in the bulk earthworks, in accordance with SANS 1200D: Earthworks.

TH/DPSH position	Depth range in test holes (m)				
	Soft excavation (m)	Intermediate excavation (m)	Hard excavation (m)	Boulder A (>40% of excavation volume)	Boulder B (<40% of excavation volume) (m)
TH01	1,6 - 3,6 +	NE	NE	0 - 1,6	NE
TH02	0 - 5,0 +	NE	NE	NE	NE
TH03	0 - 0,6	NE	2,0 +	1,6 - 2,0	NE
TH04	0,6 - 1,2	NE	NE	0 - 0,6	NE
	1,2 - 1,8				
	2,3 - 3,9 +				
DPSH 4	Possible	Possible	Possible	Below NGL	Possible
DPSH 5	3,9	Possible	3,9 +	Possible	Possible
DPSH 6	0,9 - 2,4	Possible	2,1 +	0 - 0,9; 2,1 +	Possible
DPSH 7	Possible	Possible	Possible	NGL +	Possible
DPSH 8	0 - 0,9	Possible	Possible	0,9 +	Possible
DPSH 9	0 - 1,5	Possible	Possible	1,5 +	Possible

Note: NE = Not encountered in test holes

Insofar piling is concerned, we believe that significant problems associated with conventional auger drilling will be experienced, should conventional Auger Concrete Cast In-Situ (ACIS) piles be considered and the in-situ obstructions are not removed prior to the piling operations.

Piling Contractors should bear this in mind when considering the optimum pile type for this project.

Should it appear that the bulk of the bouldary and manmade builders rubble obstructions be removed prior to constructing piling platforms, we strongly suggest that the more modern European auger piling rigs should only be considered for this project. Rigs with a minimum torque of 18 tonne metre and greater/stronger should be considered. However, allowance should still be made for the handling or dealing with these obstructions, should they be encountered.

In addition, various coring and specialized drilling tools should be allowed for to form pile holes and to handle these obstructions during the piling operations.

Straddling of piles across obstructions should be considered, should it not be possible to remove all obstructions.

We believe that Driven Concrete Cast In-Situ (DCIS) and Odex Percussion Drilled Concrete Cast In-Situ (ODEX) piles will be more effective from an installation and costing point of view, should the in-situ obstructions not be removed prior to the piling operations. Oscillator Concrete Cast In-situ (OCIS) piles can also be considered. However, these piles may prove to be more costly and will result in a prolonged piling programme duration.

6.5 Slope stability

The sidewalls of all the test holes up to the first occurrence of a fairly high degree of saturation and/or ground water seepage appeared to be completely safe and stable.

However, sidewalls do become unstable where a combined high in-situ moisture content and poor soil consistency exist within profile and we believe that severe sidewall collapse will occur, once pile holes are formed below the first occurrence of a perched water table, should it be encountered.

Therefore, allowance should be made for temporary casings.

No problems are foreseen within shallow excavations insofar slope stability is concerned. However, the status quo can change drastically if water is to be encountered in these excavations, albeit in the form of a shallower perched water table, damaged water pipe or poor surface water run-off which may accidentally be draining into excavations during construction.

Therefore, excavation sides deeper than, say 1,5m, must either be battered back to 1:1,5 or shored; allowing safe working conditions for workers in excavations.

6.6 Soil aggressiveness and corrosivity

The pH and conductivity of soil is generally determined to get an indication of the potential corrosiveness of the soil. The pH of a soil gives an indication of the acidity of the soil. As a general guideline Evans [6.8] notes that corrosion may take place in soil with a pH of less than 6 and that should the pH be less than 4.5, the problem may be serious. It should however be borne in mind that a low pH value is not necessarily an indication of serious corrosiveness as the pH of the surrounding soil will generally start to rise as soon as corrosion starts.

Should one view the pH values only of the 8No samples tested (pH ranges between 7,73 and 8,92), then the soils classifies as generally not being corrosive.

However, corrosion is an electrochemical process whereby metals are changed and electrical energy is released. The conductivity of the soil therefore has a profound influence on the rate of corrosion of buried metallic objects. Duligal [6.9] provides the following table for evaluation of the conductivity of soil:

Soil conductivity (S/m)	Corrosion classification
More than 0,05	Extremely corrosive
0,025 - 0,05	Very corrosive
0,02 - 0,025	Corrosive
0,01 - 0,02	Mildly corrosive
Less than 0,01	Not generally corrosive

The soil corrosion classification can be summarized as follows:

Soil layer	Soil conductivity (S/m)	Corrosion classification
Fill	0,018	Mildly corrosive
Alluvium transported	0,009	Not generally corrosive
Pedogenic soils	0,028	Corrosive to very corrosive
Reworked and residual granite	Between 0,010 and 0,033	Not generally corrosive to very corrosive
Reworked and residual diabase	Between 0,045 and 0,068	Very to extremely corrosive

Therefore, we suggest that a "very severe" exposure condition should be followed for this site in order to prevent services to corrode with time.

Therefore, subsurface services should be treated/sleeved to prevent possible damages due to corrosion.

According to SANS 1200G: Concrete (Structural), concrete used for foundations of structures within potentially aggressive soils should have the following minimum concrete cover and maximum water:cement ratio's:

Exposure conditions	Specified strength of concrete (MPa)					Minimum cover for various exposure conditions (mm)
	20	25	30	40	50	
Mild	20	20	15	15	15	
Moderate	40	40	30	25	20	
Severe	NA	50	40	40	35	
Very severe	NA	NA	75	60	50	

Type of structures	Exposure conditions			
	Mild	Moderate	Severe	Very severe
Thin sections, reinforced piles, all sections with less than 25mm cover to reinforcement	*	0.53	0.48	0.4
Moderate sections, retaining walls, piers, beams	*	*	0.53	0.43
Exterior portions of mass concrete	*	*	0.53	0.43
Concrete slabs laid on ground	*	0.53	0.48	*
Concrete protected from the weather, inside buildings, or in ground below frost level	*	*	*	*
* In these cases the ratio will be based on strength for workability required				

The soil aggressiveness and corrosivity laboratory test results are included in Appendix E.

6.7 Proposed founding and piling considerations

The following column load cases have been provided, namely:

- Type 1 - Parking area: 850kN
- Type 2 - Ground floor: 150kN
- Type 3 - Level 1: 1250kN
- Type 4 - Level 2: 2300kN

Conventional shallow foundations should be considered for the Type 2 column load case. An engineered fill mattress or soil raft may be required in this case, pending on the exact site location in relation to the ad hoc geotechnical conditions at these positions.

Insofar the remainder of the loadcases are concerned, we believe that a piled foundation solution should preferably adopted.

When consider the method of piling, special consideration must be given to the significant occurrence of the fill obstructions, granite and diabase corestone occurrence. Reference should be made to the soil profiles, DPSH test results and in this regard.

Fill obstructions in the form of cobbles, boulders and builders rubble are expected to occur across the site when one considers the obstructions encountered in test hole TH01 and DPSH tests DPSH 7, 8, 9 specifically, and possibly 6 as well.

Cobble and boulder size granite and diabase corestones were encountered in test holes TH03 and TH04, and are expected to occur across the site as noted during the DPSH testing (see Table 1 in clause 6.2.2).

Therefore, Auger Concrete Cast In-Situ (ACIS) piles should only be considered, should these obstructions be removed during the bulk earthworks operations and we strongly suggest that the more modern European auger piling rigs should only be considered in this case. Rigs with a minimum torque of 18 tonne metre and greater/stronger should be considered. However, allowance should still be made for the handling or dealing with these obstructions. However, significant programme delays with associated costs will be the result should auger piling be attempted on site, should the ad hoc bouldary and builders rubble status remains unchanged.

In view of the high probability of corestone and obstruction occurrence, Continuous Flight Auger Concrete Cast In-Situ (CFA) piles should not be considered at all for this project.

In addition, groundwater seepage with associated sidewall collapse are likely to occur, especially at the first occurrence of dense and/or bedrock material. Allowance should therefore be made in the piling operations for the effective installation and, in the case of ACIS, Driven Concrete Cast In-Situ (DCIS) and Oscillator Concrete Cast In-Situ (OCIS) piles, extraction of temporary casings. Permanent casings are generally employed in the case of Odex Percussion Drilled Concrete Cast In-Situ (ODEX) piles and should be allowed for in this project.

In addition, allowance should be made to place concrete under water by means of tremie concreting, should DCIS piles not be considered.

Bearing the bouldary and builders rubble profile encountered on site in mind, DCIS piles should take preference, should these obstructions not be removed during the bulk earthworks operations. ODEX and OCIS piles may be considered for the same reason. However, in our experience both these (ODEX and OCIS) pile types are considerably more expensive than DCIS piles, should one consider the in-situ soil conditions.

For budget purposes and taking the aforementioned into account, we suggest that the following should be considered for the various pile types:

WL (kN)	ACIS			DCIS			OCIS			ODEX		
	Dia (mm)	CL (m)	DL (m)	Dia (mm)	CL (m)	DL (m)	Dia (mm)	CL (m)	DL (m)	Dia (mm)	CL (m)	DL (m)
850	600,0	8,0	10,5	520	5,0	5,0	1000	8,0	9,5	600	8,0	10,5
1250	600,0	8,0	11,5	610	5,0	5,0	1000	8,0	10,0	600	8,0	11,5
2300	750,0	8,0	13,0	750	5,0	5,0	1000	8,0	12,0	2 x 600	8,0	11,0

Note:

- 1 Dia = Pile diameter (mm)
- 2 CL = Anticipated casing installation depth (m)
- 3 DL = Drilled/advance length (m)
- 4 30MPA tremie concrete should be allowed for.
- 5 Allowance should be made for 0,6% pile reinforcing to be installed over the full concrete shaft length.

We strongly recommend that confirmation test holes with a traxcavator, capable of reaching a minimum depth of 5m below platform level be dug and inspected, prior to final founding decision making.

All foundations and pile designs should be inspected and verified prior to placement of any reinforcing and concrete by a competent person, and we confirm our availability in this regard, should it be requested.

We trust that you find the above in order. Should you wish to discuss the above in any further detail, please do not hesitate to contact the undersigned.

Yours faithfully,

A handwritten signature in black ink, consisting of a large, stylized 'P' and 'F' intertwined, with a horizontal line extending from the bottom of the 'F'.

P F van Straten

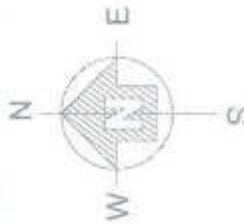
7 REFERENCES

- 7.1 JENNINGS, J.E, BRINK, A.B.A & WILLIAMS, A.A.B. Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa. Trans. S Afr. Inst. Civ. Engrs. Vol. 15, No. 1, 1973, pp3 to 12.
- 7.2 JENNINGS, J.E & KNIGHT, K. A Guide to the Construction on, or with Materials Exhibiting Additional Settlement due to Collapse. 6th Regional Conference for Africa on Soil Mechanics & Foundation Engineering. Durban, South Africa, September 1975.
- 7.3 SCHWARTZ, K. (1985): Problem Soils in South Africa - State of the Art: Collapsible Soils. The Civil Engineer in South Africa, Volume 27, No. 7. July 1985.
- 7.4 VAN DER MERWE, D.H. The prediction of Heave from the Plasticity Index and the Percentage Clay Fraction. The Civil Engineer in South Africa. Vol. 6, No. 6, 1964.
- 7.5 COLLINS, L.E. (1953). A Preliminary Theory for the Design of Underreamed Piles, in relation to the Leeuhof Clays of the Orange Free State. Proceedings of the S.A. Institution of Civil Engineers.
- 7.6 TOMLINSON M.J. Pile Design and Construction Practice. Fourth Edition.
- 7.7 SOUTH AFRICAN INSTITUTE OF CIVIL ENGINEERS. Code of Practice: Foundations and Superstructures for Single Storey Residential Buildings of Masonry Construction. Joint structural division, 1995, Johannesburg.
- 7.8 EVANS, U R. The Corrosion and Oxidation of Metals: Scientific principles and practical applications. Edward Arnold (Publishers) Ltd. 1977.
- 7.9 DULIGAL E. Significance of Soil Resistivity on Corrosivity. Unpublished report compiled for Africon. 1996.

**APPENDIX A:
TEST HOLE AND DPSH TEST POSITIONS**



LOCALITY MAP



TESTHOLE & DPISH POSITIONS

LEGEND:

	TESTHOLE NUMBER & POSITION
	TEST HOLE DEPTH (m)
	TEST HOLE REFUSAL DEPTH (m)
	GROUNDWATER SEEPAGE (m)
	DYNAMIC PROBE SUPER-HEAVY TEST NUMBER & POSITION
	DPISH TEST REFUSAL (m)

TESTHOLE DATA:

TESTHOLE	TH 1	TH 2	TH 3	TH 4
	3.60 m	5.00 m	2.15 m	3.85 m
	NOT ENCOUNTERED	NOT ENCOUNTERED	2.10 m	3.85 m
	NOT ENCOUNTERED	NOT ENCOUNTERED	NOT ENCOUNTERED	3.00 m

DPISH DATA:

DPISH No.	DPISH 4	DPISH 5	DPISH 6	DPISH 7	DPISH 8	DPISH 9
	0.90 (3.0) m	4.20 m	2.46 m	<0.30 m	2.25 m	1.80 m

Geo Simplicity Geotechnical Engineering (Pty) Ltd

Reg No. 2013/164927/07

1 Killoran Place, Bedfordview, 2007

Tel: +27 83 601 5189

Fax: +27 86 658 0641

geosimplicity@gmail.com

PROJECT

FIGURE 1:
FOUNDATION INVESTIGATION TO PIET RETIEF MALL,
MPUMALANGA PROVINCE.

REVISIONS

01 DPISH 4 DATA & PROJECT NAME

DATE

29-SEPTEMBER-2014

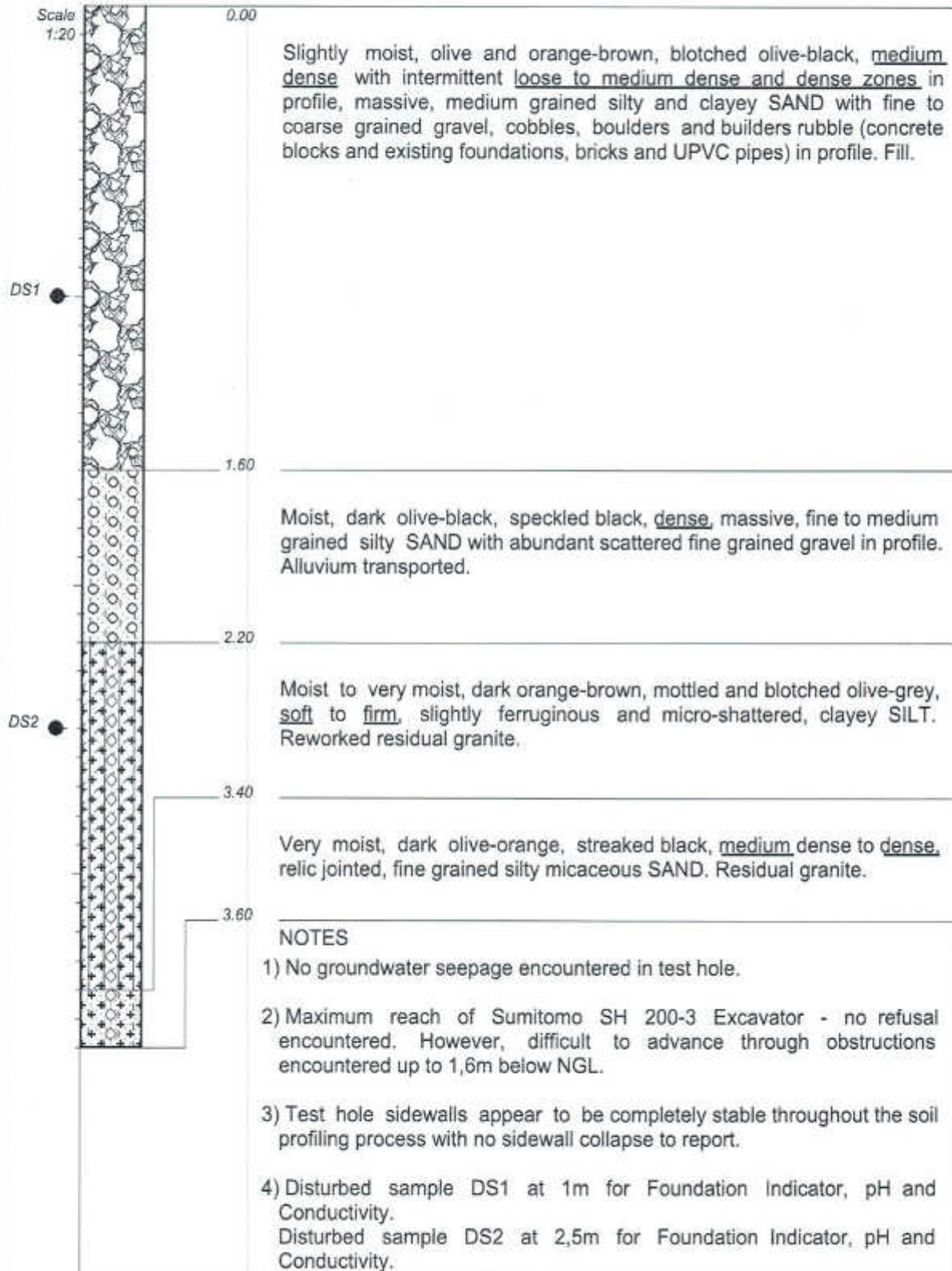
DRAWING No.

G082-DRW01-REV.01

REVISION No.

01

APPENDIX B:
SOIL PROFILES



CONTRACTOR : PW Mouton cc
MACHINE : Sumitomo SH 200-3 Excavator
DRILLED BY : N/A
PROFILED BY : PF van Straten

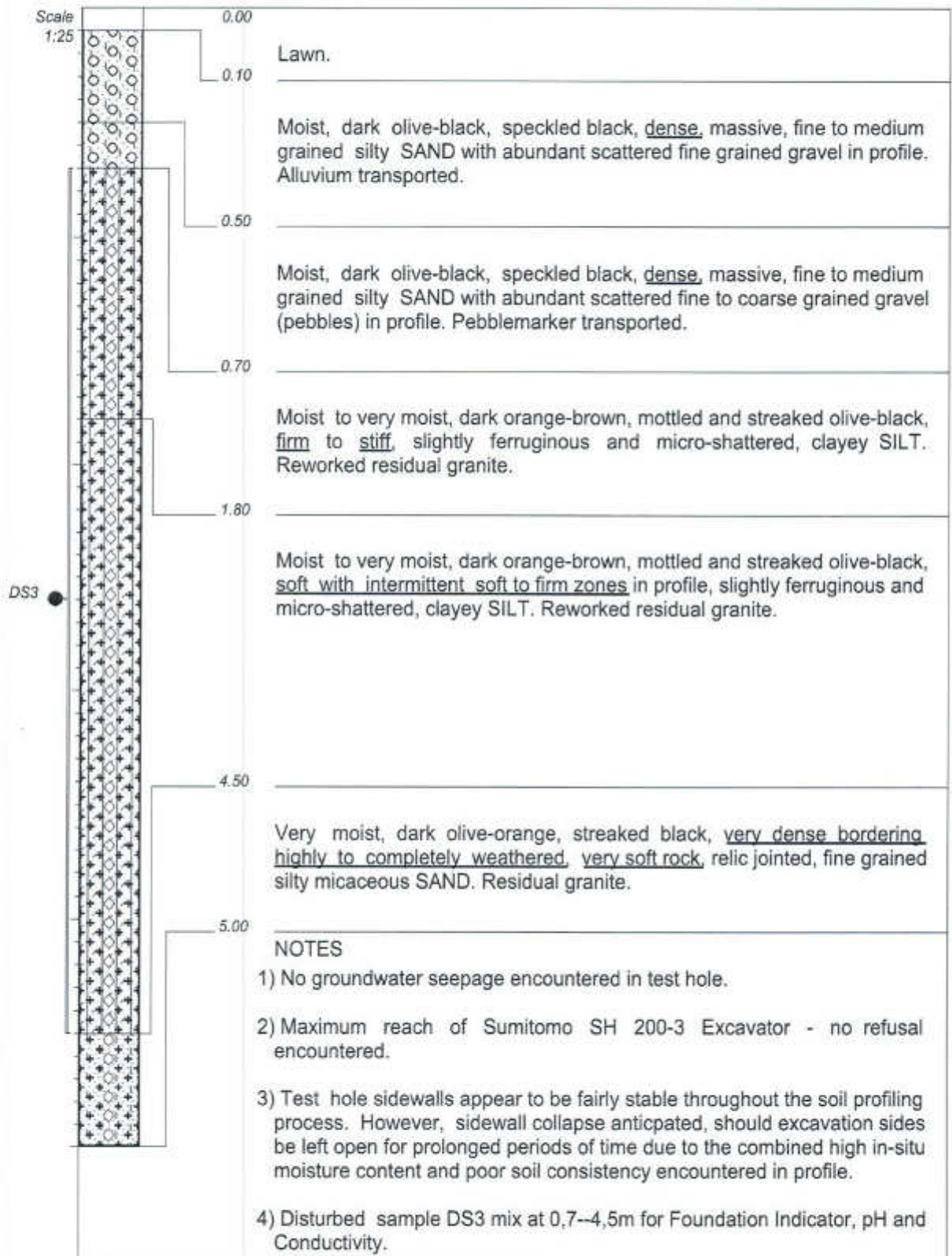
INCLINATION : Vertical
DIAM : Trench
DATE : 29/05/14
DATE : 29/05/14

ELEVATION : 1235m
X-COORD : S 27°00'37,3"
Y-COORD : E 30°48'16,8"

TYPE SET BY : T Schulz
SETUP FILE : STANDARD.SET

DATE : 30/09/2014 08:27
TEXT : ..PLOT\G082SoilProfile.TXT

HOLE No: TH 01



CONTRACTOR : PW Mouton cc
MACHINE : Sumitomo SH 200-3 Excavator
DRILLED BY : N/A
PROFILED BY : PF van Straten

INCLINATION : Vertical
DIAM : Trench
DATE : 29/05/14
DATE : 29/05/14

ELEVATION : 1233m
X-COORD : S 27°00'38,9"
Y-COORD : E 30°48'18,6"

TYPE SET BY : T Schulz
SETUP FILE : STANDARD.SET

DATE : 30/09/2014 08:27
TEXT : ..PLOT\G082SoilProfile.TXT

HOLE No: TH 02

Scale
1:10



0.00

Moist, dark olive-black, speckled black, dense, massive, fine to medium grained silty SAND with abundant scattered fine grained gravel, cobbles and boulders (up to 0,8m in diameter) in profile. Alluvium transported.

0.60

Moist to very moist, dark yellow-orange, streaked black, medium dense to dense, massive and friable, fine grained silty SAND, Residual granite. Note: Abundantly scattered, highly to completely weathered, very soft to medium hard rock corestones in a dense to very dense, medium to coarse grained silty SAND, residual granite matrix encountered from 0,6m to 2,0m below NGL in the Western face of the testhole.

2.00

Dark yellow-orange, streaked black, highly to completely weathered, massive, presumably very closely spaced stained jointed, SOFT ROCK and possibly harder with highly weathered, soft to medium hard rock corestones in profile. Granite.

NOTES

- 1) No groundwater seepage encountered in test hole.
- 2) Refusal of Sumitomo SH 200-3 Excavator at 2.0m on soft rock and possibly harder granite.
- 3) Test hole sidewalls appear to be completely stable throughout the soil profiling process with no sidewall collapse to report.

CONTRACTOR : PW Mouton cc
MACHINE : Sumitomo SH 200-3 Excavator
DRILLED BY : N/A
PROFILED BY : PF van Straten

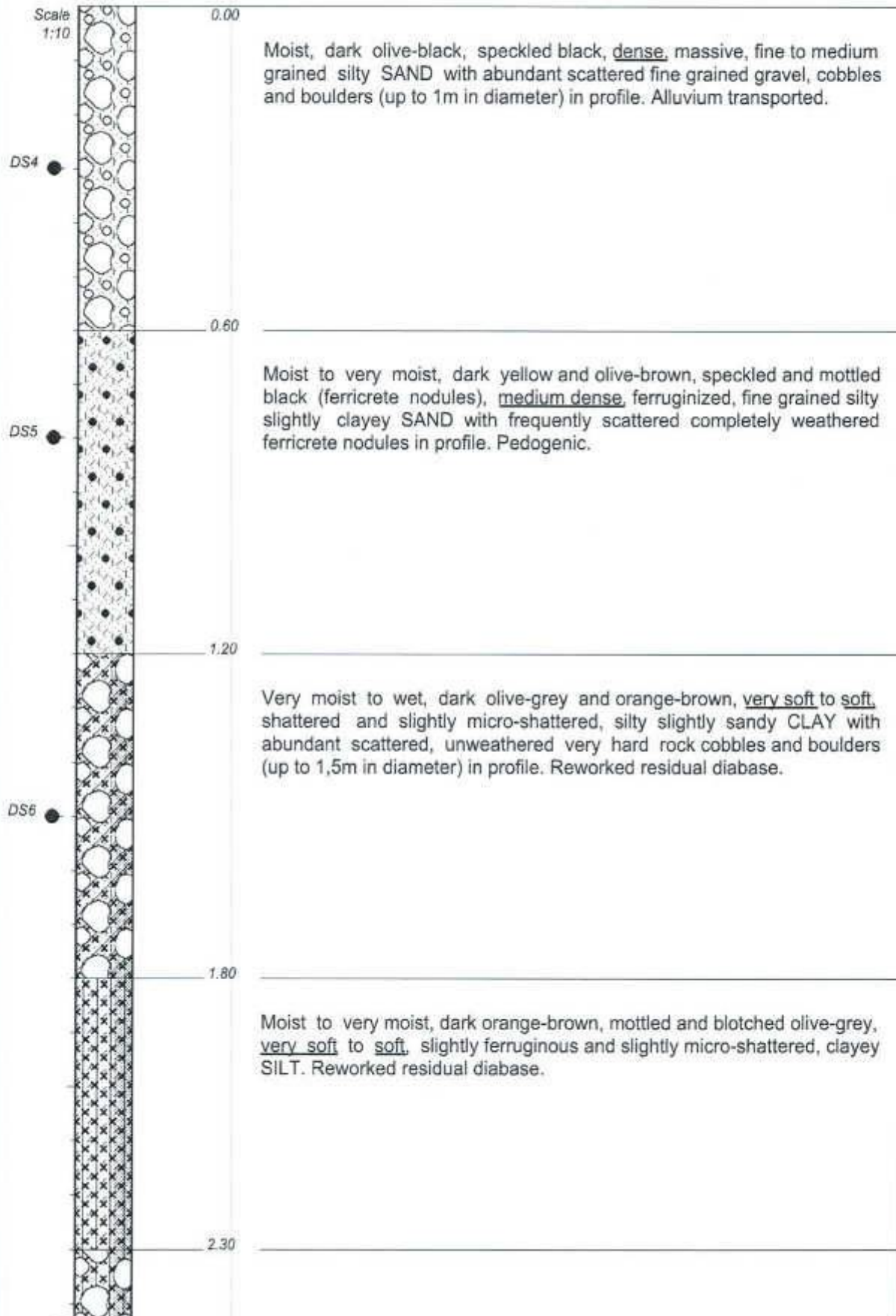
INCLINATION : Vertical
DIAM : Trench
DATE : 29/05/14
DATE : 29/05/14

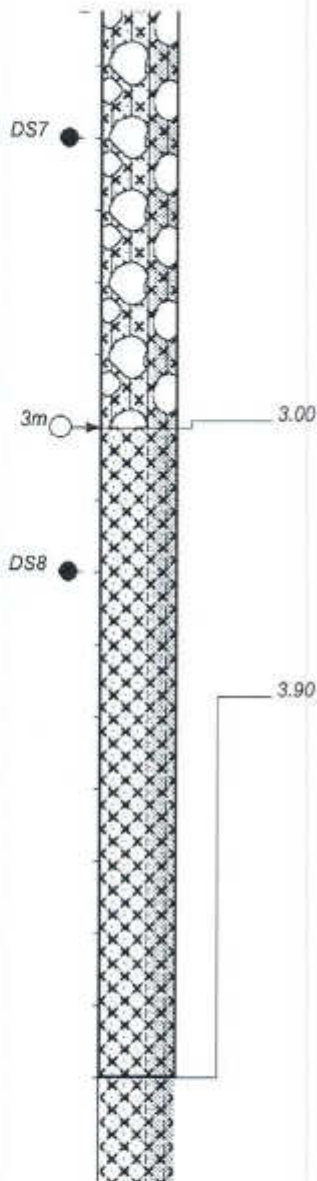
ELEVATION : 1228m
X-COORD : S27°00'41,1"
Y-COORD : E30°48'22,5"

TYPE SET BY : T Schulz
SETUP FILE : STANDARD.SET

DATE : 30/09/2014 08:27
TEXT : ..PLOT\G082SoilProfile.TXT

HOLE No: TH 03





Very moist to wet, dark olive and yellow-orange, very soft, relic jointed, sandy SILT, with abundant scattered, unweathered very hard rock cobbles and boulders (up to 1,5m in diameter) in profile. Residual diabase.

Wet, dark olive and yellow-orange, medium dense to dense with intermittent loose to medium dense zones in profile, medium to coarse grained silty sand with frequent scattered highly to completely weathered and unweathered to slightly weathered, very soft to soft rock and very hard to extremely hard rock, cobble and boulder size corestones (150mm to 1m in diameter) in profile. Residual diabase.

Wet, dark olive and yellow-orange, medium dense to dense with intermittent loose to medium dense zones in profile, medium to coarse grained silty sand with abundant scattered highly to completely weathered and unweathered to slightly weathered, very soft to soft rock and very hard to extremely hard rock, cobble and boulder size corestones (150mm to 1m in diameter) in profile. Residual diabase.

NOTES

- 1) Very slight groundwater seepage at 3m encountered in test hole.
- 2) Bottom of test hole noted to be completely saturated but no water standing, even at 40 minutes after digging.
- 3) Refusal of Sumitomo SH 200-3 Excavator on very hard to extremely hard rock corestones at 3.9m below natural ground level.
- 4) Test hole sidewalls becoming unstable below 2,5m.
- 5) Disturbed sample DS4 at 0,3m for Foundation Indicator.
Disturbed sample DS5 at 0,8m for Foundation Indicator, pH and Conductivity.
Disturbed sample DS6 at 1,5m for Foundation Indicator, pH and Conductivity.
Disturbed sample DS7 at 2,6m for Foundation Indicator, pH and Conductivity.
Disturbed sample DS8 at 3,2m for Foundation Indicator, pH and Conductivity.

CONTRACTOR : PW Mouton cc
MACHINE : Sumitomo SH 200-3 Excavator
DRILLED BY : N/A
PROFILED BY : PF van Straten

INCLINATION : Vertical
DIAM : Trench
DATE : 29/05/14
DATE : 29/05/14

ELEVATION : 1231m
X-COORD : S27°00'37,2"
Y-COORD : E30°48'24,7"

TYPE SET BY : T Schulz
SETUP FILE : STANDARD.SET

DATE : 30/09/2014 08:27
TEXT : ..PLOT\G082SoilProfile.TXT

HOLE No: TH 04

	BOULDERS	{SA01}
	GRAVEL	{SA02}
	SAND	{SA04}
	SANDY	{SA05}
	SILT	{SA06}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	GRANITE	{SA17}{SA44}
	DIABASE	{SA18}{SA41}
	FERRICRETE NODULES	{SA24}
	RUBBLE	{SA31}
	FILL	{SA32}
	CRUSHED ROCK	{SA33}
Name ●	DISTURBED SAMPLE	{SA38}
15.5 ○	WATER SEEPAGE/water strike	{CH50}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

TYPE SET BY : T Schulz
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE :

DATE : 30/09/2014 08:27
TEXT : ..PLOT\G082SoilProfile.TXT

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

**APPENDIX C:
DPSH TEST RESULTS**

PENETROMETER RESULTS			MAKARIOS GEOTECHNICAL CONTRACTORS (082 896 8481)					
Job No			REMARKS:					
Project	Piet Retief							
Site								
Date	29/05/2014							
Done by	Neer							
DEPTH	7A	7B	8	5	6	4A	4B	9
0,3	130	134	38	64	99	99	97	36
0,6			46	40	35	93	22	43
0,9			49	17	19	120	15	69
1,2			130	16	13		7	80
1,5				14	15		13	94
1,8				13	17		19	100
2,1				12	49		21	
2,4				12	100		59	
2,7				11			72	
3				18			100	
3,3				22				
3,6				40				
3,9				62				
4,2				100				
4,5								
4,8								
5,1								
5,4								
5,7								
6								
6,3								
6,6								
6,9								
7,2								
7,5								
7,8								
8,1								
8,4								
8,7								
9								
9,3								
9,6								
9,9								
10,2								
Redrive								
0,3				2				
0,6				2				

**APPENDIX D:
LABORATORY TEST RESULTS**

OUR REF : 92/GEO013-18/0001/14

DATE REPORTED : 30-May-14

CLIENT : Geo Simplicity

CHAINAGE : TH01 : DS1

SITE : Proposed Shopping Mall, Piet Retief

LAYER : 1.0m

SAMPLE No. : S2667

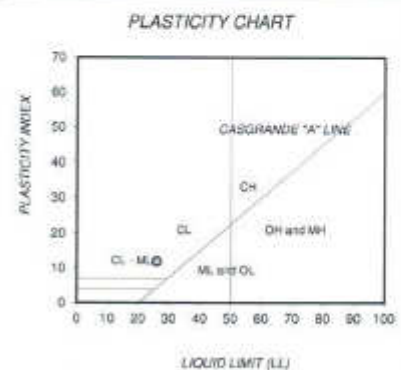
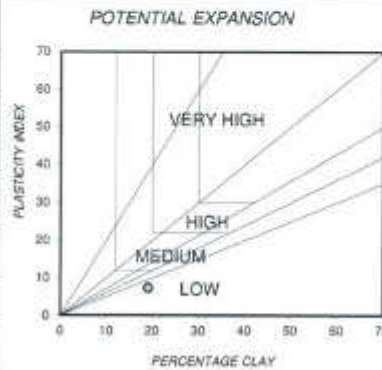
SAMPLE DESCRIPTION : Light Brown

Ferricrete Gravel & Quartz

FOUNDATION INDICATOR RESULTS

Weighted PI **7.44**

Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	96
	26.5	96
	19.0	94
	13.2	93
	4.75	87
	2.000	77
	0.425	62
	0.250	52
	0.150	40
	0.075	28
	0.050	25
0.005	23	
0.002	19	

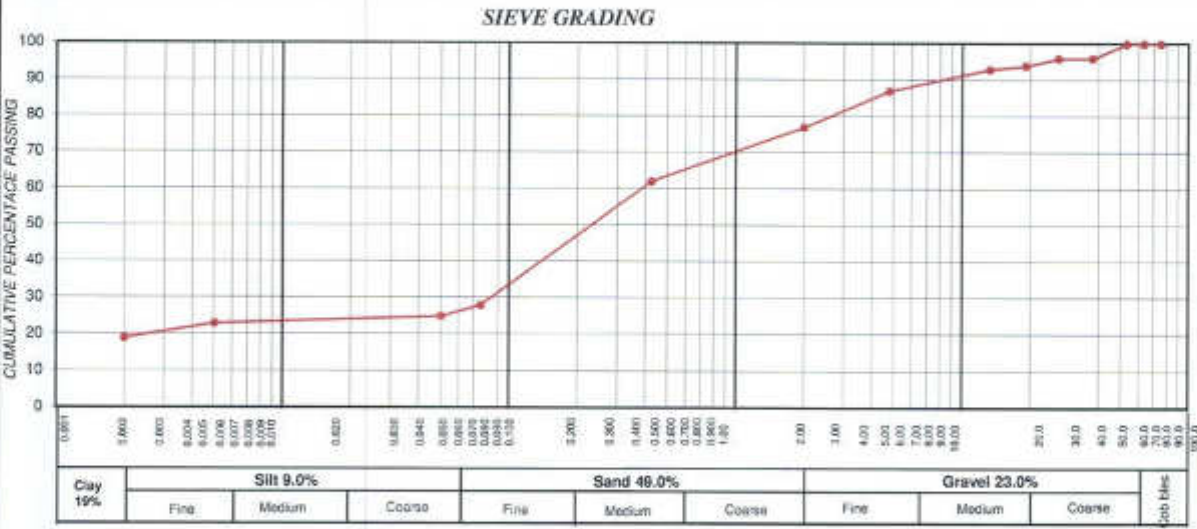
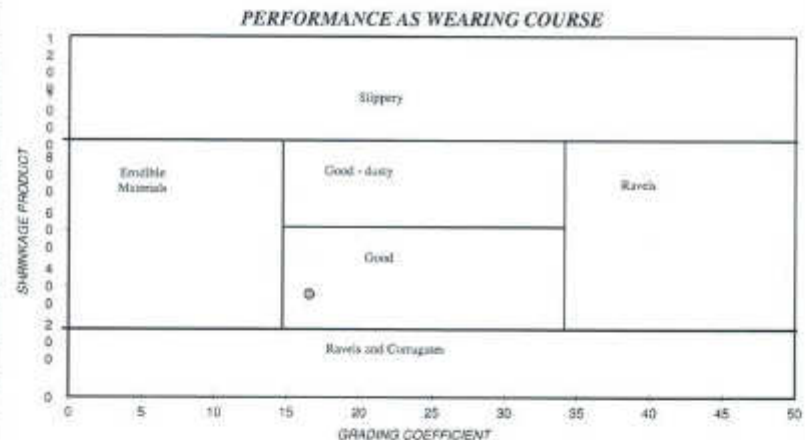


Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	15.0
	0.425 - 0.250	10.0
	0.250 - 0.150	12.0
	0.150 - 0.075	12.0
	< 0.075	36.4

Effective size	0.005
Uniformity Coefficient	22.8
Curvature Coefficient	7.4
OverSize Index	4.0
Shrinkage Product	372.0
Grading Coefficient	16.5
Grading modulus	1.33

Atterberg Limits	Liquid Limit	26
	Plasticity Index	12
	Linear Shrinkage	6

Unified Soil Classification	SC
U.S. Highway Classification	A-2-6(0)
pH - Value	N/A
Conductivity mS/cm	N/A



SIEVE SIZE (BY LOG SCALE)

OUR REF: 92/GE0013-18/0001/14

DATE REPORTED: 30-May-14

CLIENT: Geo Simplicity

CHAINAGE: TH01 : DS2

SITE: Proposed Shopping Mall, Piet Retief

LAYER: 2.5m

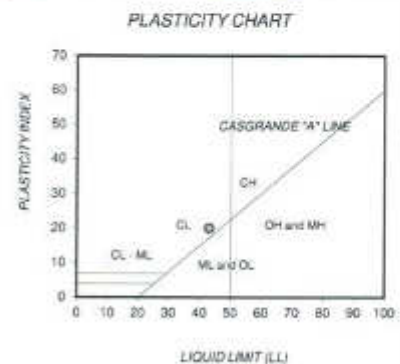
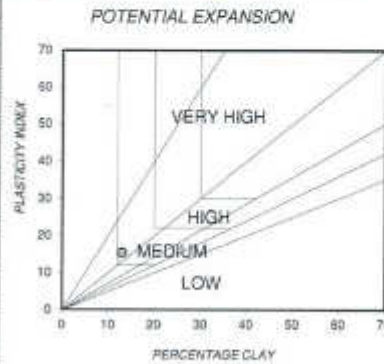
SAMPLE No.: S2668

SAMPLE DESCRIPTION: Light Yellow Orange
Ferricrete

FOUNDATION INDICATOR RESULTS

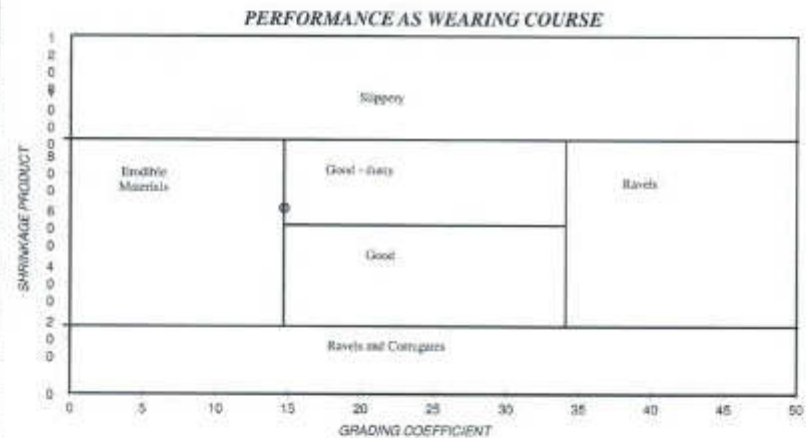
Weighted PI 15.4

Sieve analysis Cumulative percentage passing (mm)		
75.0		100
63.0		100
53.0		100
37.5		100
26.5		100
19.0		100
13.2		99
4.75		92
2.000		84
0.425		77
0.250		57
0.150		40
0.075		18
0.050		16
0.005		15
0.002		13



Soil Mortar Analysis % < 2.00mm		
2.000 - 0.425		7.0
0.425 - 0.250		20.0
0.250 - 0.150		17.0
0.150 - 0.075		22.0
< 0.075		21.4

Effective size	0.005	
Uniformity Coefficient	22.8	
Curvature Coefficient	7.4	
Oversize Index	0.0	
Shrinkage Product	672.2	
Grading Coefficient	14.7	
Grading modulus	1.21	
Atterberg Limits	Liquid Limit	43
	Plasticity Index	20
	Linear Shrinkage	8.73
Unified Soil Classification	SC	
U.S. Highway Classification	A-2-7(1)	
pH - Value	N/A	
Conductivity mS/cm	N/A	



OUR REF : 92/GEO013-18/0001/14

DATE REPORTED : 30-May-14

CLIENT : Geo Simplicity

CHAINAGE : TH02 : DS3

SITE : Proposed Shopping Mall, Piet Retief

LAYER : Mix 0.7m TO 4.5m

SAMPLE No. : S2669

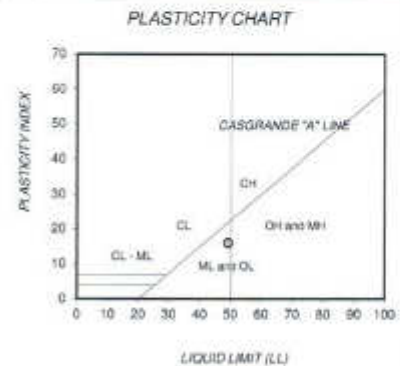
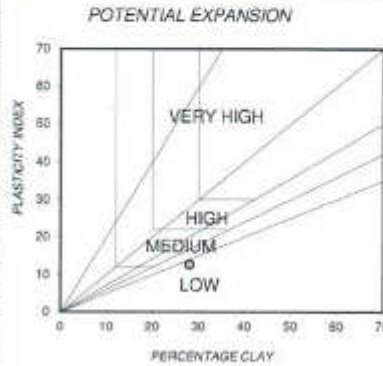
SAMPLE DESCRIPTION : Light Red Orange
 Ferricrete & Quartz

FOUNDATION INDICATOR RESULTS

Weighted PI

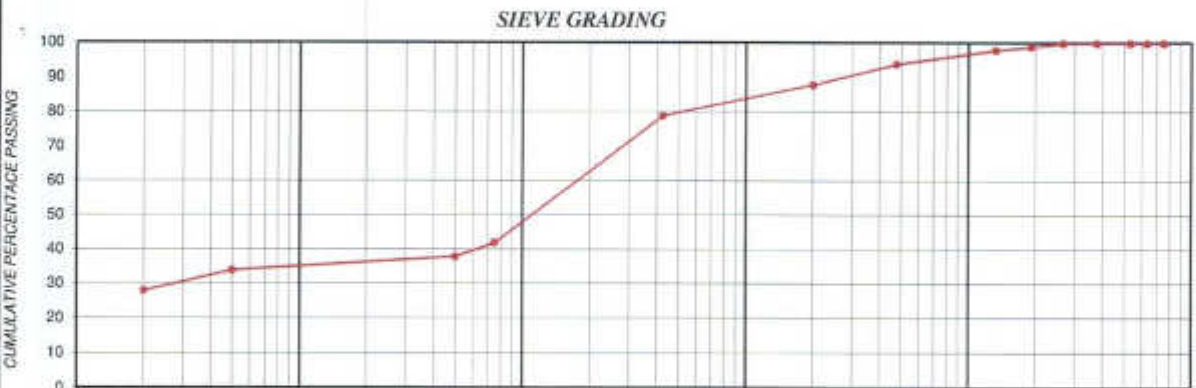
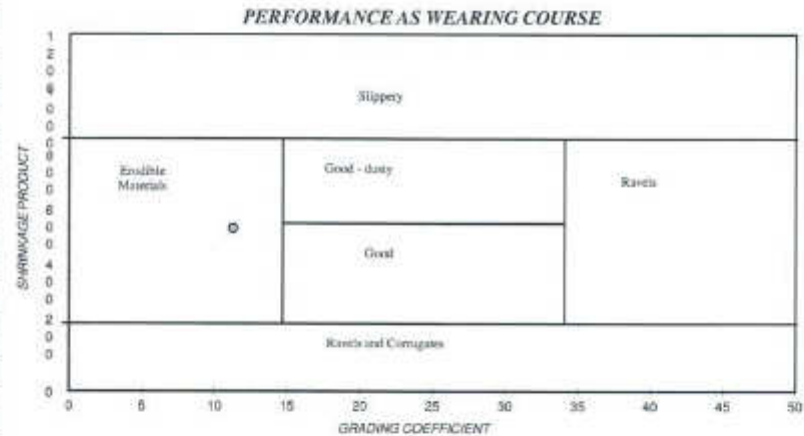
12.64

Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	99
	13.2	98
	4.75	94
	2.000	88
	0.425	79
	0.250	67
	0.150	55
	0.075	42
0.050	38	
0.005	34	
0.002	28	



Soil Mortar Analysis % < 2.000mm	2.000 - 0.425	9.0
	0.425 - 0.250	12.0
	0.250 - 0.150	12.0
	0.150 - 0.075	13.0
	< 0.075	47.7

Effective size	0.005	
Uniformity Coefficient	22.8	
Curvature Coefficient	7.4	
Oversize Index	0.0	
Shrinkage Product	594.9	
Grading Coefficient	11.3	
Grading modulus	0.91	
Atterberg Limits	Liquid Limit	49
	Plasticity Index	16
	Linear Shrinkage	7.53
Unified Soil Classification	SC	
U.S. Highway Classification	A-6(4)	
pH - Value	N/A	
Conductivity mS/cm	N/A	



Clay 20%	Silt 14.0%			Sand 46.0%			Gravel 12.0%			Cob bls
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

SIEVE SIZE (BY LOG SCALE)
 SIEVE NO. (BY METRIC)

OUR REF : 92/GEO013-18/0001/14

DATE REPORTED : 30-May-14

CLIENT : Geo Simplicity

CHAINAGE : TH04 : D54

SITE : Proposed Shopping Mall, Piet Retief

LAYER : 0.3m

SAMPLE No. : S2670

SAMPLE DESCRIPTION : Dark Brown

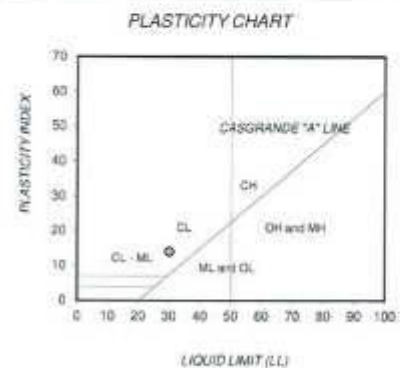
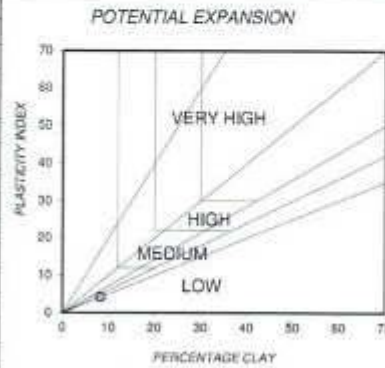
Ferricrete Gravel

FOUNDATION INDICATOR RESULTS

Weighted PI

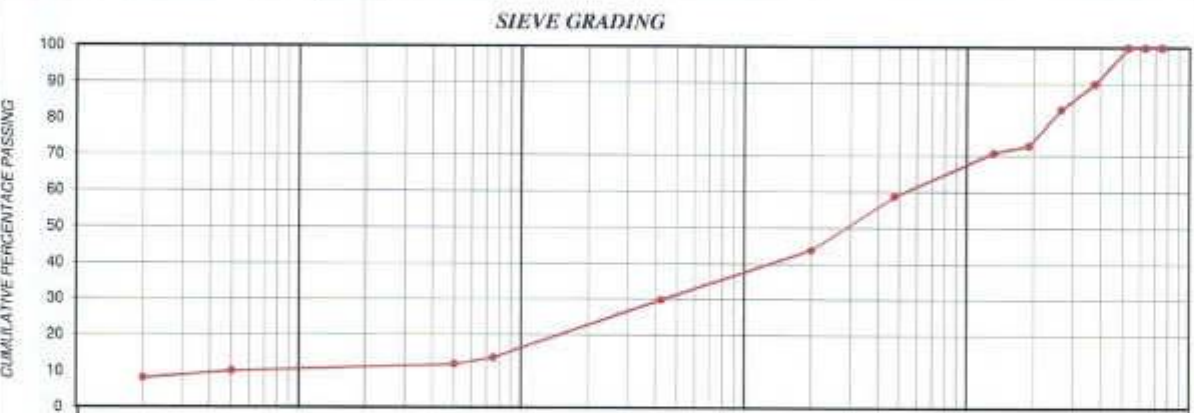
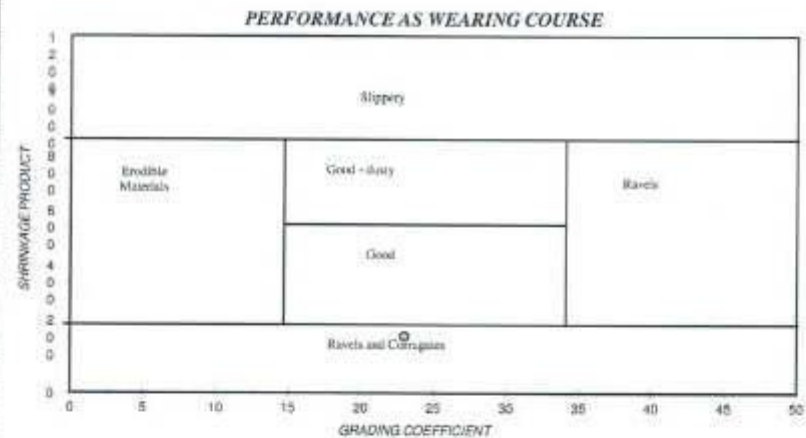
4.2

Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	90
	26.5	83
	19.0	73
	13.2	71
	4.75	59
	2.000	44
	0.425	30
	0.250	25
	0.150	20
	0.075	14
0.050	12	
0.005	10	
0.002	8	



Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	14.0
	0.425 - 0.250	5.0
	0.250 - 0.150	5.0
	0.150 - 0.075	6.0
	< 0.075	31.8

Effective size	0.005	
Uniformity Coefficient	22.8	
Curvature Coefficient	7.4	
Oversize Index	10.0	
Shrinkage Product	205.8	
Grading Coefficient	23.0	
Grading modulus	2.12	
Atterberg Limits	Liquid Limit	30
	Plasticity Index	14
	Linear Shrinkage	6.86
Unified Soil Classification	SC	
U.S. Highway Classification	A-2-6(0)	
pH - Value	N/A	
Conductivity mS/cm	N/A	



Clay 8%	Silt 5.7%			Sand 30.0%			Gravel 56.0%			Sub-bits
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

SIEVE SIZE (BY LOG SCALE)

OUR REF : 92/GEO013-18/0001/14

DATE REPORTED : 30-May-14

CLIENT : Geo Simplicity

CHAINAGE : TH04 : DS6

SITE : Proposed Shopping Mall, Piet Retief

LAYER : 1.5m

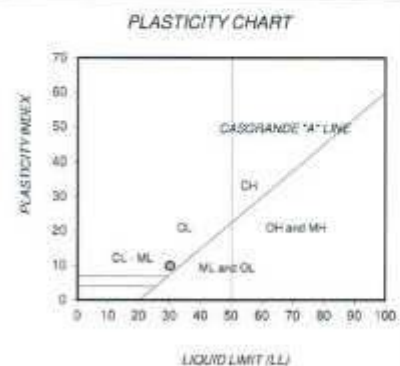
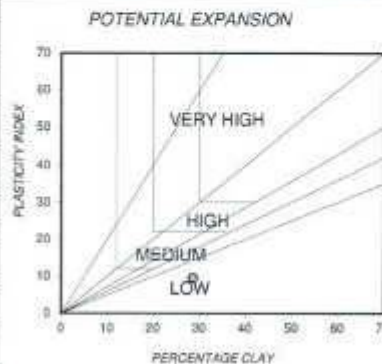
SAMPLE No. : S2672

SAMPLE DESCRIPTION : Light Yellow
Ferricrete

FOUNDATION INDICATOR RESULTS

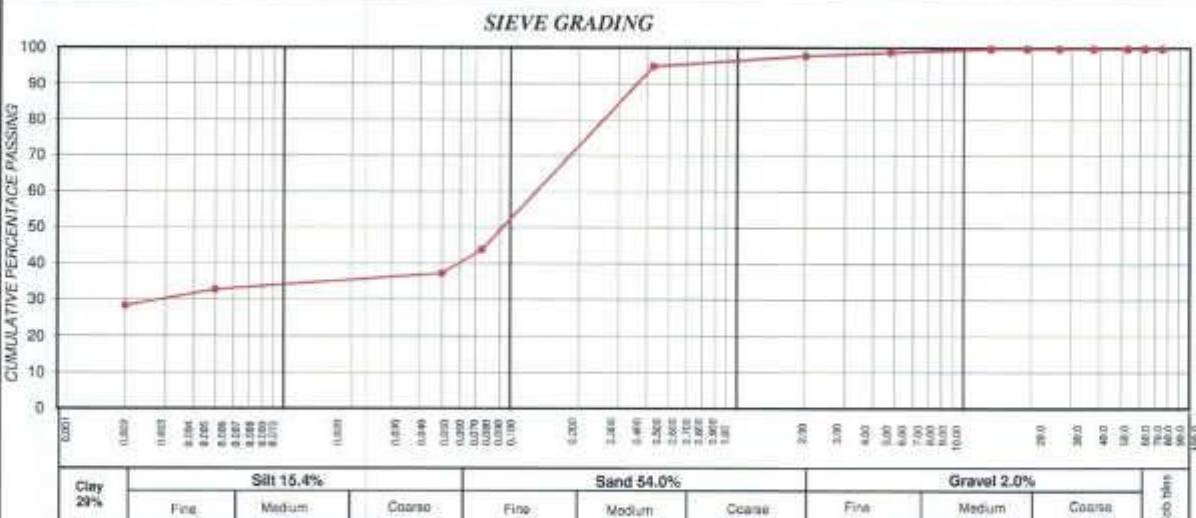
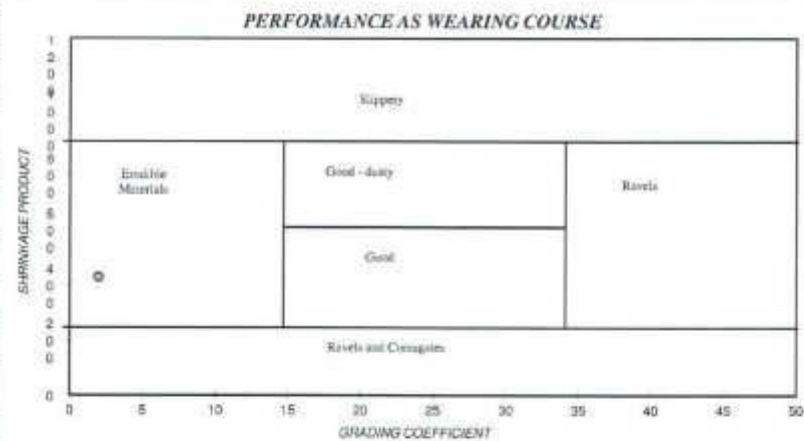
Weighted PI	9.5
--------------------	------------

Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	98
	0.425	95
	0.250	80
	0.150	63
	0.075	44
0.050	37	
0.005	33	
0.002	29	



Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	3.0
	0.425 - 0.250	15.0
	0.250 - 0.150	17.0
	0.150 - 0.075	19.0
	< 0.075	44.9

Effective size	0.005	
Uniformity Coefficient	22.8	
Curvature Coefficient	7.4	
Oversize Index	0.0	
Shrinkage Product	430.4	
Grading Coefficient	2.0	
Grading modulus	0.63	
Atter-burg Limits	Liquid Limit	30
	Plasticity Index	10
	Linear Shrinkage	4.53
Unified Soil Classification	SC	
U.S. Highway Classification	A-4(1)	
pH - Value	N/A	
Conductivity mS/cm	N/A	



SIEVE SIZE (BY LOG SCALE)



OUR REF : 92/GEO013-18/0001/14

DATE REPORTED : 30-May-14

CLIENT : Geo Simplicity

CHAINAGE : TH04 : DS7

SITE : Proposed Shopping Mall, Piet Retief

LAYER : 2.6m

SAMPLE No. : S2673

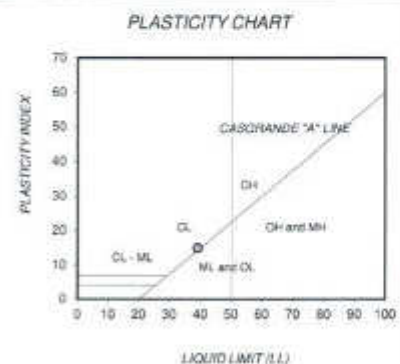
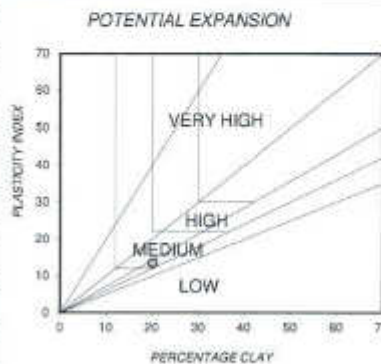
SAMPLE DESCRIPTION : Light Yellow
Ferricrete

FOUNDATION INDICATOR RESULTS

Weighted PI

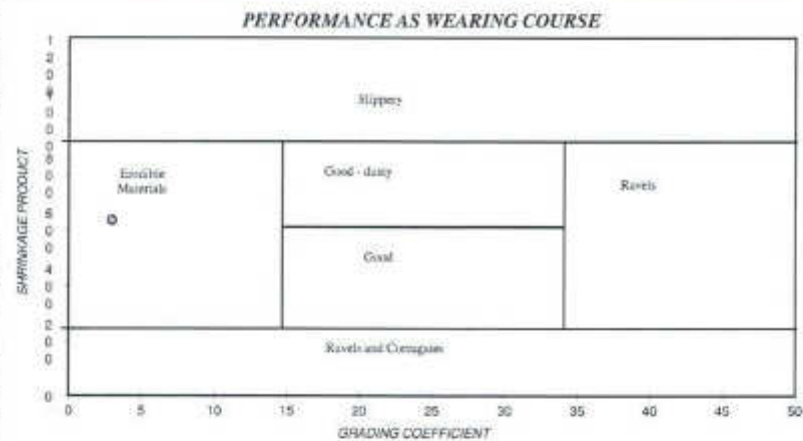
13.5

Sieve analysis Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	100
	19.0	100
	13.2	100
	4.75	99
	2.000	97
	0.425	90
	0.250	74
	0.150	57
	0.075	37
	0.050	32
0.005	27	
0.002	20	

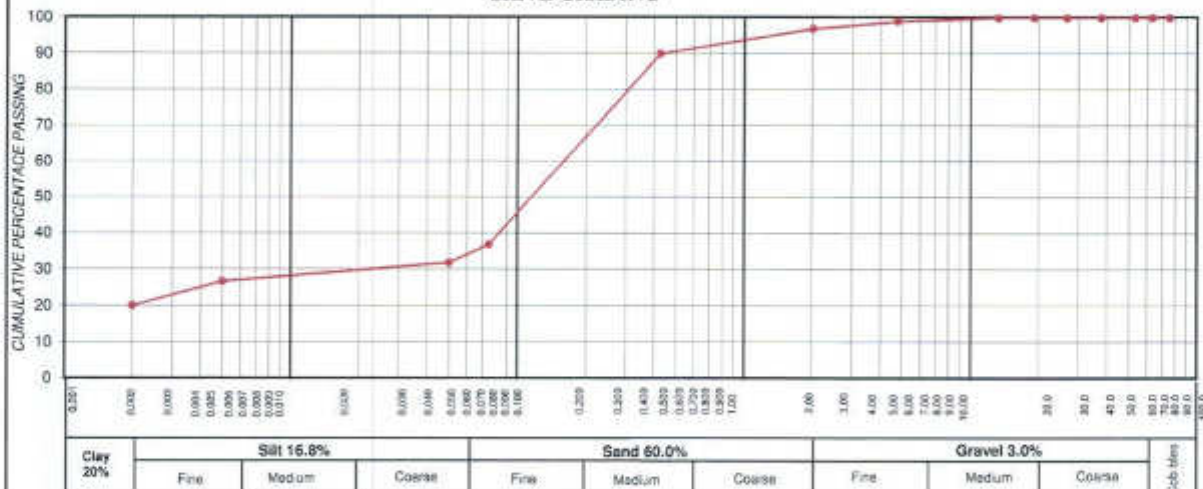


Soil Moisture Analysis % < 2.00mm	2.000 - 0.425	7.0
	0.425 - 0.250	16.0
	0.250 - 0.150	17.0
	0.150 - 0.075	20.0
< 0.075	38.1	

Effective size	0.005	
Uniformity Coefficient	22.8	
Curvature Coefficient	7.4	
Oversize Index	0.0	
Shrinkage Product	635.4	
Grading Coefficient	3.0	
Grading modulus	0.76	
Atterberg Limits	Liquid Limit	39
	Plasticity Index	15
	Linear Shrinkage	7.06
Unified Soil Classification	SC	
U.S. Highway Classification	A-6(1)	
pH - Value	N/A	
Conductivity mS/cm	N/A	



SIEVE GRADING



OUR REF: 92/GE0013-18/0001/14

DATE REPORTED: 30-May-14

CLIENT: Geo Simplicity

CHAINAGE: TH04 : DS8

SITE: Proposed Shopping Mall, Piet Retief

LAYER: 3.2m

SAMPLE No.: S2674

SAMPLE DESCRIPTION: Light Yellow

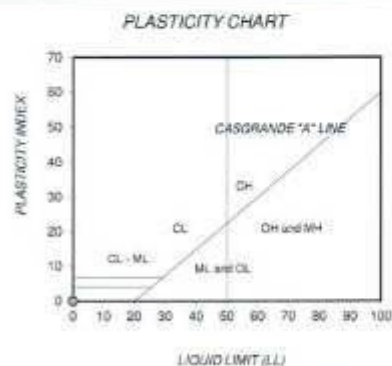
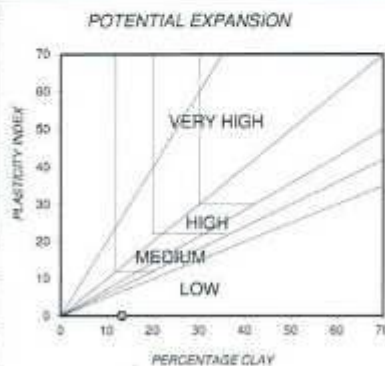
Ferricrete & Dolerite

FOUNDATION INDICATOR RESULTS

Weighted PI

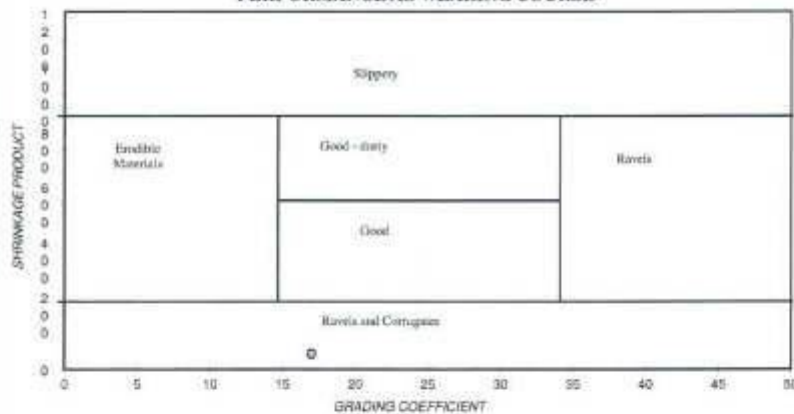
0

Sieve analysis: Cumulative percentage passing (mm)	75.0	100
	63.0	100
	53.0	100
	37.5	100
	26.5	95
	19.0	94
	13.2	89
	4.75	85
	2.000	75
	0.425	50
	0.250	40
	0.150	31
	0.075	20
0.050	18	
0.005	16	
0.002	13	

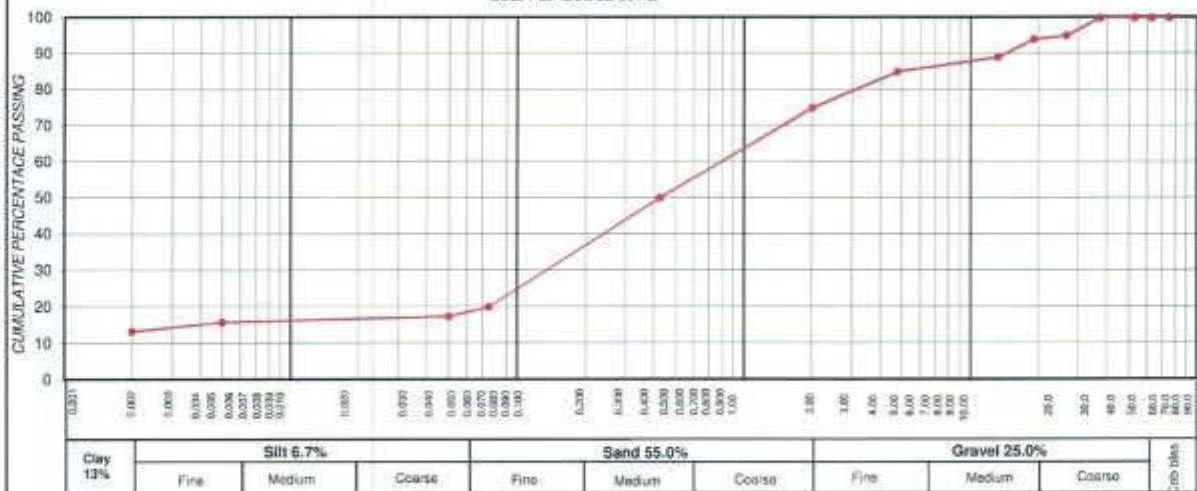


Soil Mortar Analysis % < 2.00mm	2.000 - 0.425	25.0
	0.425 - 0.250	10.0
	0.250 - 0.150	9.0
	0.150 - 0.075	11.0
	< 0.075	26.7
Effective size		0.005
Uniformity Coefficient		22.8
Curvature Coefficient		7.4
Oversize Index		0.0
Shrinkage Product		56.5
Grading Coefficient		17.0
Grading modulus		1.55
Allow-Range Limits	Liquid Limit	0
	Plasticity Index	SP
	Linear Shrinkage	1.13
Unified Soil Classification		SC
U.S. Highway Classification		A-2-4(0)
pH - Value		N/A
Conductivity mS/cm		N/A

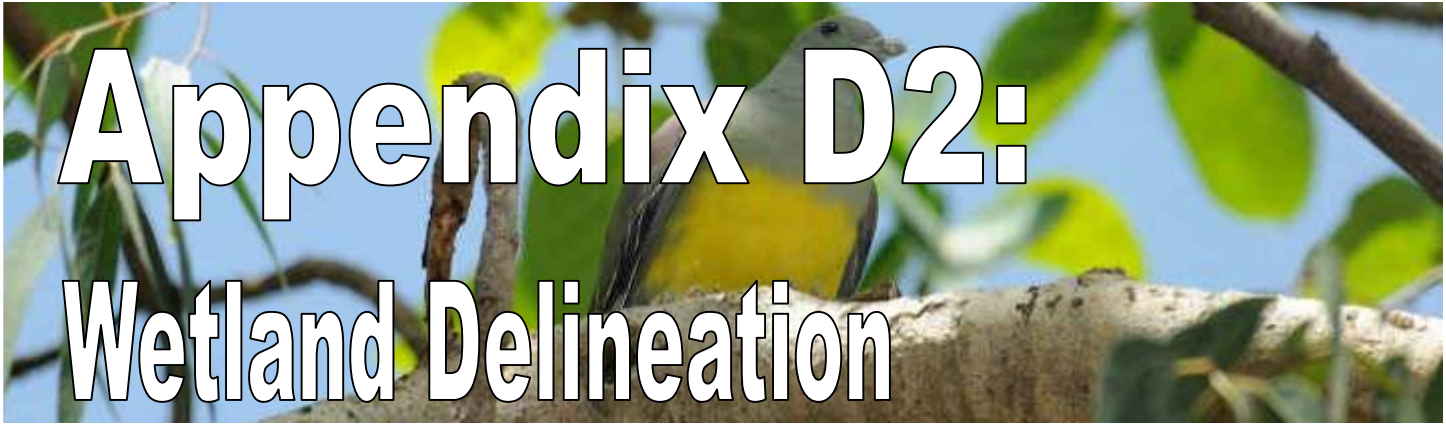
PERFORMANCE AS WEARING COURSE



SIEVE GRADING



SIEVE SIZE (BY LOG SCALE)



**Appendix D2:
Wetland Delineation**



REPORT

WETLAND DELINEATION AND MANAGEMENT REPORT:

A PORTION OF PORTION 100 OF THE FARM PIET RETIEF TOWN AND TOWNLANDS 149 HT, MPUMALANGA PROVINCE

6th January, 2015

Compiled by:

J.H. van der Waals

(PhD Soil Science, Pr.Sci.Nat.)

Registered with the South African Council for Natural Scientific Professions

(Registration number: 400106/08)

Member of:

Soil Science Society of South Africa (SSSSA)

Accredited member of:

South African Soil Surveyors Organisation (SASSO)

Declaration

I, Johan Hilgard van der Waals, declare that:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing
 - any decision to be taken with respect to the application by the competent authority; and
 - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

J.H. VAN DER WAALS

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1 Terms of Reference	1
1.2 Aim of this Report.....	1
1.3 Disclaimer	1
1.4 Methodology.....	1
2. SITE LOCALITY AND DESCRIPTION	2
2.1 Survey Area Boundary	2
2.2 Land Type Data.....	2
2.3 Topography	2
3. PROBLEM STATEMENT.....	7
4. STATUTORY CONTEXT	7
4.1 Wetland Definition	7
4.2 Watercourse Definition.....	7
4.3 The Wetland Delineation Guidelines.....	8
4.4 The Resource Directed Measures for Protection of Water Resources	9
4.4.1 The Resource Directed Measures for Protection of Water Resources: Volume 4: Wetland Ecosystems.	9
4.4.2 The Resource Directed Measures for Protection of Water Resources: Generic Section “A” for Specialist Manuals – Water Resource Protection Policy Implementation Process.....	9
4.4.3 The Resource Directed Measures for Protection of Water Resources: Appendix W1 (Ecoregional Typing for Wetland Ecosystems)	10
4.4.4 The Resource Directed Measures for Protection of Water Resources: Appendix W4 IER (Floodplain Wetlands) Present Ecological Status (PES) Method	10
4.4.5 The Resource Directed Measures for Protection of Water Resources: Appendix W5 IER (Floodplain Wetlands) Determining the Ecological Importance and Sensitivity (EIS) and the Ecological Management Class (EMC)	14
4.5 Summary and Proposed Approach	15
5 CHALLENGES REGARDING WETLAND DELINEATION IN COMPLEX GEOLOGICAL ENVIRONMENTS	16
5.1 Pedogenesis	16
5.2 Water Movement in the Soil Profile.....	17
5.3 Water Movement in the Landscape	20
5.4 The Catena Concept.....	23
5.5 The Ba54 Land Type Catena Challenge.....	24
5.6 Redox Morphology in Alkaline Soils.....	24
5.7 Implications for Wetland Delineation and Application of the Guidelines	26
5.8 Implications for Wetland Conservation in Urban Environments	26
6. METHOD OF WETLAND INVESTIGATION AND DELINEATION	29
6.1. Aerial Photograph Interpretation	29
6.2 Terrain Unit Indicator.....	29
6.3 Soil Form and Soil Wetness Indicators	29

6.4	Vegetation Indicator	30
6.5	Artificial Modifiers	30
7.	SITE SURVEY RESULTS AND DISCUSSION	30
7.1	Aerial Photograph Interpretation	30
7.1.1	Potential Wetlands	30
7.1.2	Historical Land Use Changes and Impacts	33
7.2	Terrain Unit Indicator	33
7.3	Soil Form and Soil Wetness Indicators (Site Survey)	33
7.4	Artificial Modifiers	43
8.	WETLAND ASSESSMENT	43
8.1	Proposed Delineation and Buffer	43
8.2	Wetland Classification / Types	43
8.3	Wetland Functionality	43
8.4	Present Ecological Status (PES) Determination	45
9.	CONCLUSIONS AND RECOMMENDATIONS	45
	REFERENCES	46

WETLAND DELINEATION AND MANAGEMENT REPORT: A PORTION OF PORTION 100 OF THE FARM PIET RETIEF TOWN AND TOWNLANDS 149 HT, MPUMALANGA PROVINCE

1. INTRODUCTION

1.1 TERMS OF REFERENCE

Terra Soil Science was appointed by **Bokamoso** to conduct a wetland delineation and wetland management report for the proposed Piet Retief X22 development on a portion of Portion 100 of the Farm Piet Retief Town and Townlands 149 HT in the Mpumalanga Province.

1.2 AIM OF THIS REPORT

The aim of this report is to provide a wetland delineation and management report for the Piet Retief X22 development site within the context of specific soil, topography and geology conditions.

1.3 DISCLAIMER

This report was generated under the regulations of NEMA (National Environmental Management Act) that guides the appointment of specialists. The essence of the regulations are 1) independence, 2) specialisation and 3) duty to the regulator. The independent specialist has, in accordance with the regulations, a duty to the competent authority to disclose all matters related to the specific investigation should he be requested to do such (refer to declaration above).

It is accepted that this report can be submitted for peer review (as the regulations also allow for such). However, the intention of this report is not to function as one of several attempts by applicants to obtain favourable delineation outcomes. Rather, the report is aimed at addressing specific site conditions in the context of current legislation, guidelines and best practice with the ultimate aim of ensuring the conservation and adequate management of the water resource on the specific site.

Due to the specific legal liabilities wetland specialists face when conducting wetland delineations and assessments this author reserves the right to, in the event that this report becomes part of a delineation comparison exercise between specialists, submit the report to the competent authorities, without entering into protracted correspondence with the client, as an independent report.

1.4 METHODOLOGY

The report was generated through:

1. The collection and presentation of baseline land type and topographic data for the site;

2. The thorough consideration of the statutory context of wetlands and the process of wetland delineation;
3. The identification of water related landscape parameters (conceptual and real) for the site;
4. Aerial photograph interpretation of the site;
5. Assessment of historical impacts and changes on the site through the accessing of various historical aerial photographs and topographic maps;
6. Focused soil and site survey in terms of soil properties as well as drainage feature properties; and
7. Presentation of the findings of the various components of the investigation.

2. SITE LOCALITY AND DESCRIPTION

2.1 SURVEY AREA BOUNDARY

The site lies between 27° 00' 32" and 27° 00' 44" south and 30° 48' 14" and 30° 48' 29" east in the town of Piet Retief (**Figure 1**).

2.2 LAND TYPE DATA

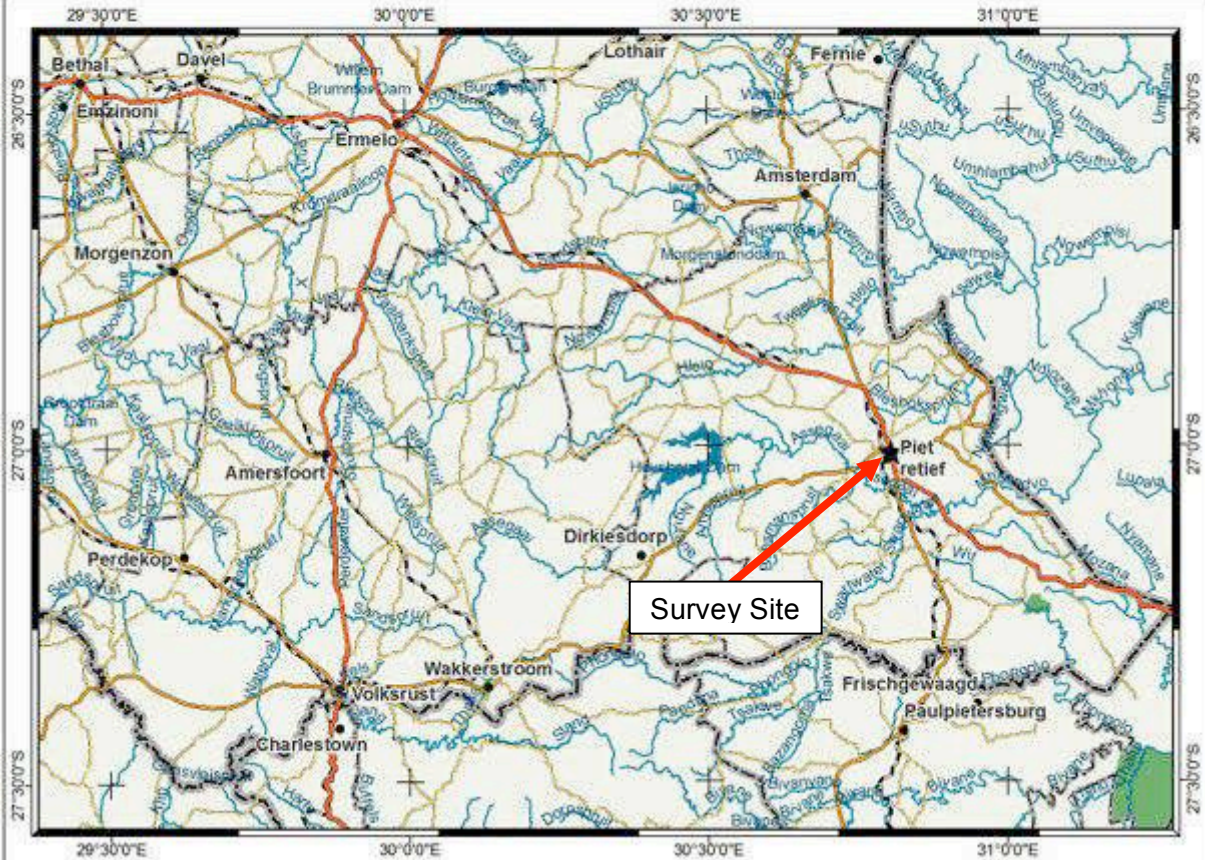
Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System (MacVicar et al., 1977). The soil data was interpreted and re-classified according to the Taxonomic System (Soil Classification Working Group, 1991).

The proposed Piet Retief X22 falls into the **Ba54** land type (Land Type Survey Staff, 1972 - 2006) with **Figure 2** providing the land type distribution for the site. **Ba** land types denote areas with dominantly plinthic catena where red soils occur frequently. Following on the field survey it is evident that the land type data (**Ba54**) caters for an area with very variable geology whereas the specific site consists of granite and occasional dolerite. Additionally, the survey site has been influenced by human activities. A dedicated discussion of the specific site conditions will be provided later in the report.

2.3 TOPOGRAPHY

The topography of the site and catchment is undulating to hilly. The bulk of the area around the site has been influenced by human activities and developments. The contour map for the site is provided in **Figure 3**. From the contour data a digital elevation model (DEM) (**Figure 4**) was generated. This data was used to generate pertinent aspects related to the wetland distribution for the site as discussed later in the report.

PIET RETIEF Locality Map



Projection - Transverse Mercator
Datum - Hartebeeshoek 1994
Reference Ellipsoid - WGS 1984
Central Meridian - 31

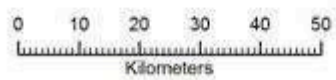


Figure 1 Locality of the survey site