

GEOTECHNICAL REPORT

MAKWARELA STUDENT ACCOMODATION

13 JULY 2018

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EXECUTIVE SUMMARY

Instratin Property Developers, Investors and Asset Managers appointed Dwala Group to carry out a preliminary geotechnical investigation for the proposed Makwarela Student Accommodation. The geotechnical investigation was carried out on the 08th of June 2018.

The investigation comprised profiling nine (9 No) test pits and the sampling of selected soil horizons for laboratory testing. This report presents the findings of the geotechnical test pit investigation and laboratory results. The geological profile at the site may be summarised as follows;

- A Topsoil comprising dry, brown, dense, micro-shattered, silty sand.
- An Upper Transported layer occurring as slightly moist, reddish-brown, stiff, shattered, silty clay.
- A Lower Transported layer comprising slightly moist, reddish-brown speckled rusty grey, dense to very dense, intact, sub-angular medium gravel in a matrix of clayey sand.
- A Residual granite layer comprising slightly moist, orangey-brown mottled reddish brown, dense, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel.

No groundwater seepage was encountered in any of the test pits excavated on site, but ferruginization, which indicates that a changing water regime can be expected, was noted in some test pits. Problems due to ground water seepage are therefore expected in places, especially during and after a very wet rainy season.

No adverse conditions prohibiting the construction of residential building structures for the development were encountered.

Due to the presence of potentially expansive and compressible horizons over the entire site, the site has been delineated into one geotechnical zone. The descriptions of the zone is as follows:

> **Zone H3/S2:** This zone covers the entire site and is characterised by relatively thick expansive and compressible soil profile with H3 (total expected heave of >30mm) and S2 (total normal settlement >20mm).

It is recommended that the proposed four storey buildings (assumed to induce more than 150 kPa loading) be founded (**as per option 3**) on lightly reinforced strip and pad footings on the dense residual granite, overlain by a competent soil mattress to minimise differential settlements of the structures. The soil mattress should be prepared as follows

1. Introduction

Instratin Property Developers, Investors and Asset Managers appointed Dwala Group to carry out a preliminary geotechnical investigation for the proposed development of Makwarela Student Accommodation. A geotechnical investigation was carried out at the site on the 08th of June 2018.

The objectives of the geotechnical investigation were to

- Determine stratigraphy of the site and its geotechnical properties.
- To determine whether any problematic soils are present at the site that would have an effect on either founding or construction methods for structures.
- To delineate the site into appropriate geotechnical zones according to any essential differences in founding conditions encountered.
- To evaluate the founding conditions at the site and to recommend building precautions if necessary for the different geotechnical zones.
- To obtain basic data concerning the use of the in-situ materials for guideline purposes.

The investigation entailed a field investigation comprising visual survey, test pits and soil profiling. Representative soil samples were collected from test pits excavated on the site and submitted for laboratory testing.

2. Available information

At the time of the investigation the following information was available:

- The 1:250 000 scale geological map of the Messina sheet 2230 (Council for Geoscience, 1981).
- The 1:250 000 scale geological map of the Messina sheet 2230 (Soil and Research Institute, 1998).
- Seismic hazard maps from Kijko et al. (2003) - Probabilistic Peak Ground Acceleration and Spectral Seismic Hazard Maps for South Africa. Report number 2003-0053, Council for Geoscience, Pretoria.
- Site Development plan of the Student Accommodation.
- Aerial photographs, sourced from Google Earth®.

3. Site locality and description

The proposed study area is located in Makwarela and can be accessed via Road (R524). The site is around a and is generally characterized by a flat surface. The vegetation comprises of grass and tree shrubs, as shown in Figure 1 below.



Figure 1: Showing the investigated area in Makwarela

4. Climate

Thohoyandou normally receives about 752mm of rain per year, with most rainfall occurring during mid-summer. It receives the lowest rainfall (4mm) in June and the highest (154mm) in January. The average midday temperatures for Thohoyandou range from 22.9°C in June to 30.3°C in January. The region is the coldest during July when the mercury drops to 7.5°C on average during the night (SA Explorer; 2018).

The Weinert Climatic N-number for the area (Weinert, 1980) which is <5 indicating that the climate is semi-humid and chemical weathering processes are dominant.

5. Investigation Methodology

The geotechnical investigation was conducted on the 08th of June 2018 and comprised test pitting and laboratory testing.

5.1 Test pitting

The site investigation comprised an excavation of nine (9 No.) test pits with a truck loader backhoe (TLB). A two-person team carried out the test pitting in order to comply with accepted safety requirements as reflected in the Site Investigation Code of Practice (SAICE, 2010). The test pits were set out and profiled by a team of engineering geologists/geotechnical engineers in accordance with South African standards (Standards South Africa. South African. National Standard. Profiling, Percussion Borehole and Core Logging in Southern Africa SANS 633:2012). Test pit details are summarised below in Table 1.

Table 1: Test Pit Summary

Test Pit No	Coordinates (WGS84)		Depth (m)	Remarks
	Northing	Easting		
TP 01	22°58'6.05"S	30°29'58.25"E	3.50	No refusal
TP 02	22°58'5.33"S	30°29'59.64"E	3.30	No refusal
TP 03	22°58'4.86"S	30°30'0.77"E	3.50	No refusal
TP 04	22°58'4.03"S	30°29'59.86"E	3.50	No refusal
TP 05	22°58'4.52"S	30°29'58.68"E	3.00	No refusal
TP 06	22°58'5.38"S	30°29'56.66"E	3.20	No refusal
TP 07	22°58'2.77"S	30°29'58.56"E	3.00	No refusal
TP 08	22°58'3.35"S	30°29'56.91"E	3.40	No refusal
TP 09	22°58'4.10"S	30°29'55.15"E	3.00	No refusal

5.2 Laboratory testing

Representative samples were recovered and sent to a SANAS-accredited Engineering Laboratory in Pretoria for testing. Soil testing included determination of the Foundation Indicators (comprising sieve and hydrometer grading analyses and Atterberg Limits), chemical tests (pH and conductivity) as well as determination of the compaction characteristics including Mods, i.e. maximum dry densities (MDD) and optimum moisture contents (OMC), as well as CBR's, and the results are given in section 9 of the report.

According to the published seismic hazard map of South Africa (Kijko, et. al. 2003), the value for the peak ground acceleration at the site is 0.08.m/s^2 shown in Figure 2 below.

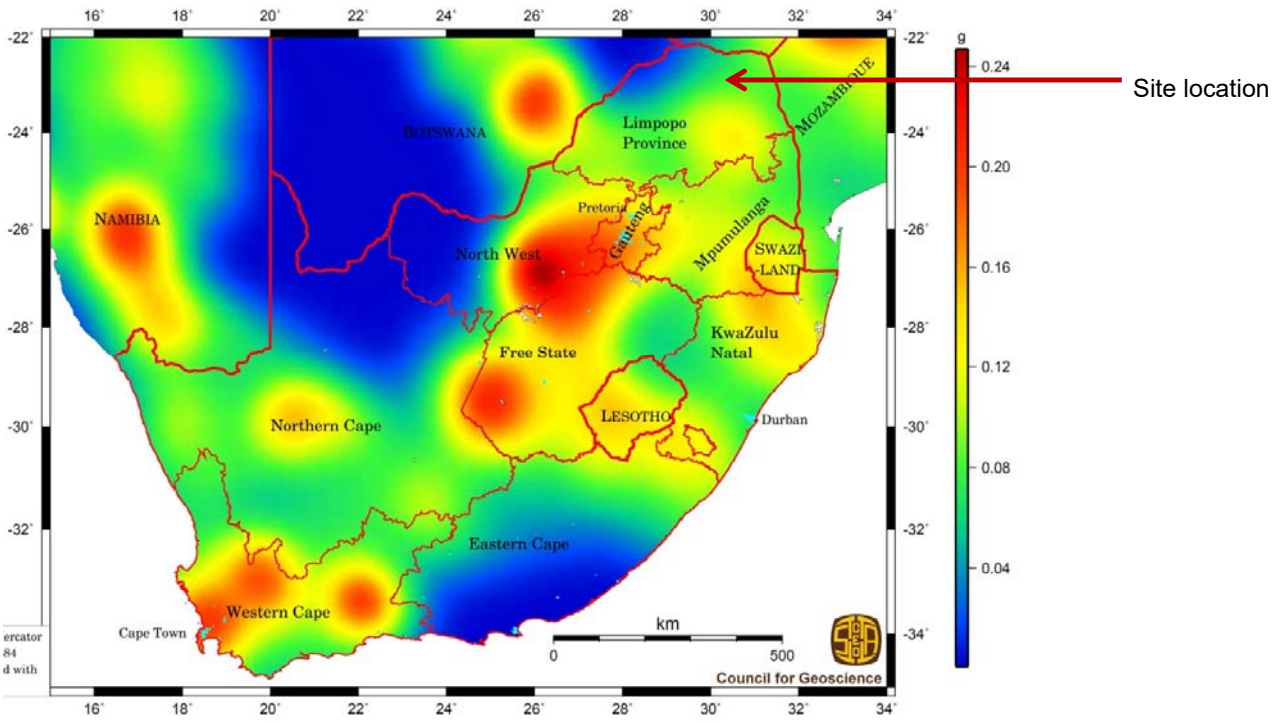


Figure 2: Peak ground acceleration (g) with 10% probability for being exceeded in a 50 year old period.

The peak ground acceleration expresses the seismic hazard and the value of 0.08 m/s^2 may be considered a low level of seismic hazard. A 10% probability exists that this value will be exceeded in a 50 year period.

6. Geology

According to the 1:250 000 geological map of the Messina Sheet 2230 (CGS, 1981), the site area is underlain by leucocratic biotite gneiss, leucocratic granite and pegmatite, grey biotite gneiss and migmatite of the Beit Bridge Complex as shown in Figure 3 below.

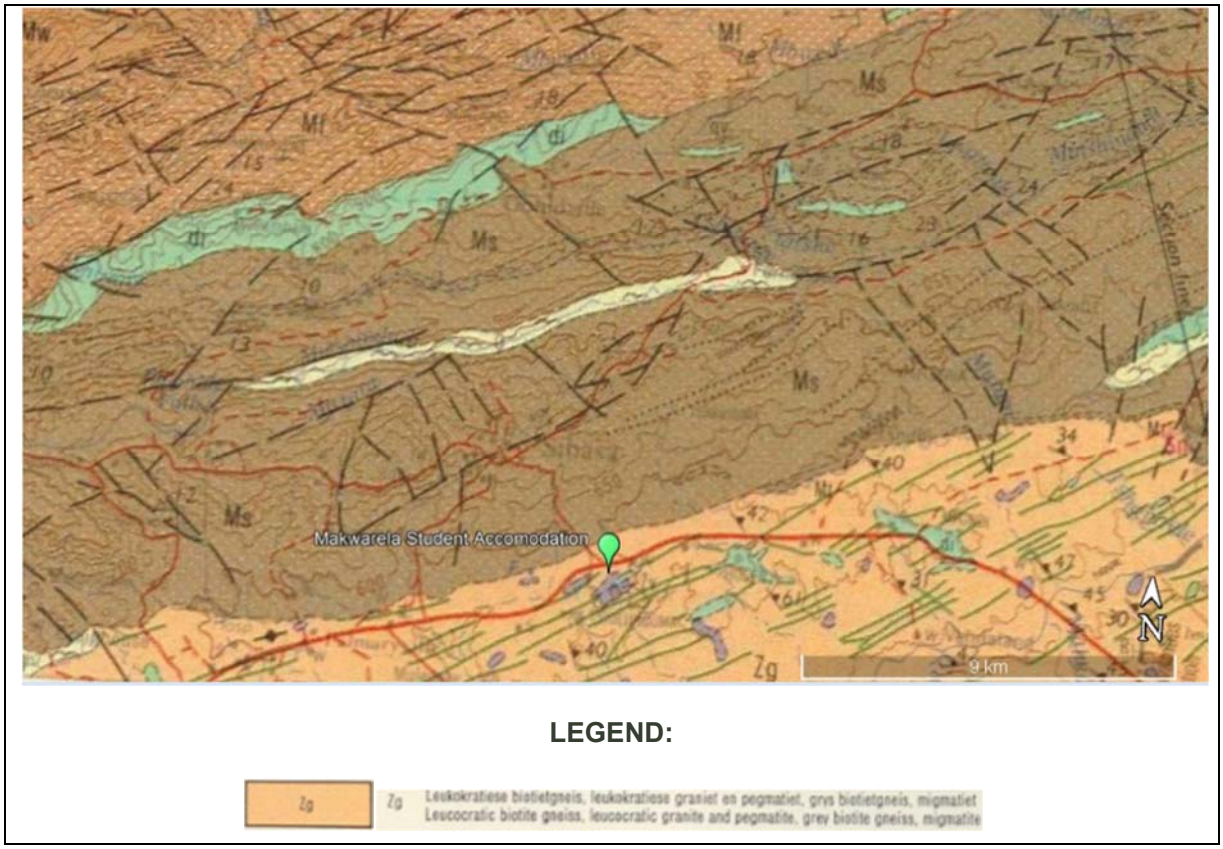


Figure 3: Showing the general geology map of the site. (Geological Survey, printed by the Government Printer, Pretoria, 1981).

7. Results of Investigation

The detailed descriptions of the soil profiles encountered in the test pits are presented in Appendix B; while the soil profiles for the whole site are summarised below in Table 2 below. All values represented are in metres (m).

Table 2 Test pit profile summary

Test Pit No	Topsoil	Upper Transported horizon	Lower Transported horizon	Residual granite
TP 01	0 - 0.25	0.25 - 1.40	1.40 - 2.20	2.20 - 3.50
TP 02	0 - 0.30	0.30 - 1.55	1.55 - 2.50	2.50 - 3.30
TP 03	0 - 0.35	0.35 - 1.80	1.80 - 2.60	2.60 - 3.50
TP 04	0 - 0.40	0.40 - 1.70	1.70 - 2.30	2.30 - 3.50
TP 05	0 - 0.40	0.40 - 1.45	1.45 - 1.90	1.90 - 3.00
TP 06	0 - 0.40	0.40 - 1.60	1.60 - 2.30	2.30 - 3.20
TP 07	0 - 0.35	0.35 - 1.40	1.40 - 1.90	1.90 - 3.00
TP 08	0 - 0.30	0.30 - 1.95	1.95 - 2.45	2.45 - 3.40
TP 09	0 – 0.25	0.25 - 2.20	2.20 - 2.60	2.60 - 3.00

The soil horizons and bedrocks encountered are as follows:

- Topsoil horizon;
- Upper Transported horizon;
- Lower Transported horizon and
- Residual granite.

7.1 Topsoil

The Topsoil horizon comprises brown silty sand. This horizon was encountered in all the test pits excavated at the site with a micro-shattered soil structure and was found at surface of the site up to a maximum depth of 0.35m. The overall consistency of this horizon is dense.

7.2 Upper Transported Horizon

The Upper transported horizon comprises reddish brown sandy clay. This horizon was encountered in all the test pits excavated at the site with a shattered soil structure and underlies the topsoil. This layer extends to a minimum depth of 1.40m and a maximum depth of 1.80m. The overall consistency of this horizon is stiff.

7.3 Lower Transported Horizon

The Lower transported horizon occurs as reddish brown speckled rusty grey clayey sand. This horizon was encountered in all test pits with an intact soil structure and underlies the Upper Transported Horizon. This layer extends from a minimum depth of 1.90m to a maximum depth of 2.60m. The average consistency of the horizon is medium dense to very dense.

7.4 Residual granite

The residual granite consists of orange brown mottled reddish brown sand. This horizon was encountered in all test pits and underlies the lower transported horizon. The layer extends to a minimum depth of 3.00m and attains a maximum depth of 3.50m. The consistency of the horizon is dense.

8. Groundwater conditions

No groundwater was encountered the test pits excavated on site but ferruginization, which indicates that a changing water regime can be expected, was noted in some test pits. Problems due to ground water seepage are therefore expected in places, especially during and after a very wet rainy season.

9. Laboratory tests

Representative samples of the materials encountered on site were taken and submitted to a soils laboratory where they were subjected to the following tests:

- Grading and Atterberg Limits including moisture content;
- Compaction tests
- Chemical tests (pH and conductivity)

The laboratory results are attached as Appendix C to this report

Foundation Indicators

Representative samples were collected for laboratory testing and submitted for foundation indicator tests. The test results are attached in Appendix C and summarised in Table 3 below.

Table 3: Summary of Foundation Indicator Tests results

Hole no.	Depth (m)	Soil composition				GM	Atterberg limits			Activity	Moisture Content	Unified soil classification
		Clay (%)	Silt (%)	Sand (%)	Gravel (%)		LL (%)	WPI (%)	LS (%)			
Lower Transported												
TP1	1.40--2.20	25.1	10.2	27.4	37.3	1.40	57-	13	10.5	MEDIUM	12.1	SM
Residual Granite												
TP2	2.50--3.30	29.7	33.2	34.9	2.3	0.45	55	20	9.5	MEDIUM	0.0	MH
TP4	2.30--3.50	20.5	42.7	32.7	4.1	0.46	58	15	7.5	MEDIUM	23.2	MH

Where: GM = Grading modulus
LL = Liquid Limit
PI = Plasticity Index
WPI = Weighted Plasticity Index (PI x % passing the 0.425 mm sieve)
LS = Linear Shrinkage
Activity = Expansiveness of the soil according to Van der Merwe's method
SM = Sitly sand
MH = Inorganic silt

Table 3 above indicates that:

The **Lower transported soil** on the site generally consists of silty sand (SM). The moisture content of this material is 12.1%. The horizon has a very high grading modulus of 1.40. The fine fractions of this material also exhibit high (57%) liquid limits as well as a high (10.5%) linear shrinkage. The weighted plasticity index (WPI) of the soil is moderate (13%), indicating that the material has moderate plasticity characteristics. The material has a medium potential expansiveness, according to the method proposed by Van der Merwe (1973).

The **Residual granite soil** comprises of inorganic silt (MH). The moisture content of this material is 23.2%. The horizon has a low grading moduli ranging between 0.45.to 0.46. The fine fractions of this material also exhibit high liquid limits ranging from 55% to 58% as well as a moderate linear shrinkage ranging from 7.5% to 9.5%. The weighted plasticity index (WPI) of the soil is moderate ranging from 15% to 20%, indicating that the material has moderate plasticity characteristics. The material has medium potential expansiveness, according to the method proposed by Van der Merwe (1973).

Compaction Tests

Samples of materials identified as potential sources of construction materials were sampled for laboratory testing. The samples were subjected to compaction tests in which the moisture-density relationship was established, with Californian Bearing Ratio (CBR) tests carried out to determine the suitability of the soils for use in constructing layer works below paved areas. The test results are summarised in Table 4 below:

Table 4: Summary of Compaction Tests results

Hole no.	Depth (m)	OMC (%)	MDD (kg/m^3)	Swell (%)	CBR at various densities				TRH 14 Class
					90 %	93 %	95 %	98 %	
Residual Granite									
TP4	2.30-3.50	16.4	1665	1.00	1.8	2.1	2.2	2.4	>G10

Where: OMC = Optimum moisture content
MDD = Maximum dry density (Mod AASHTO)
Swell = Soaked at 100% Mod AASHTO compaction

The **Residual granite** has a low (1 665 kg/m^3) maximum dry density and a very high (16.4%) optimum moisture content value. The CBR swell value is moderate and the tests yielded very low CBR values at densities typically specified in the field (93 % to 95 %). The material does not conform to G10 according to the TRH 14 guidelines (CSIR: 1987).

The material should therefore NOT be considered for use as selected layers in road pavement layer works and engineered fill. Consequently, this material is considered unsuitable as construction material. If deemed appropriate, these materials may be utilised for barrier system design, general landscaping purposes, or alternatively spoiled.

Chemical Tests

The chemical test results comprising pH and conductivity are listed in Table 6 as well as Appendix C. Several environmental factors have an effect on buried metals. These factors are:

- Electrical conductivity of the soil
- Chemical properties of the soil
- Ability of the soil to support sulphide reducing bacteria
- Heterogeneity of the soil (long-line currents)
- Differential aeration
- Stray currents in the soil, and
- Bacteria attack

The conductivity of the soil has a profound influence on the rate of corrosion of buried metallic objects. Based on the significance of soil resistivity on corrosively, Duligal (1996) provides the following table for evaluation of the conductivity of soil:

Table 5: Guideline values for interpretation of soil conductivity (Duligal, 1996)

Soil conductivity		
Soil conductivity (mS/m)	**Soil resistivity (Ohm.cm)**	**Corrosively classification**
More than 50	0 – 2000	Extremely corrosive
25 – 50	2000 – 4000	Very corrosive
20 – 25	4000 – 5000	Corrosive
10 – 20	5000 – 10000	Mildly corrosive
Less than 10	>10000	Not generally corrosive

Disturbed samples of the residual material were taken and subjected to chemical (pH and conductivity) tests. The test results are summarised as follows.

Based on Evans guideline (1977), a soil pH less than 6 indicates serious corrosion potential.

Table 6: Summary of Chemical Tests Results

Hole no.	Depth (m)	pH	Conductivity (mS/m)
Upper Transported			
TP7	0.35-1.40	7.7	2.9
Lower Transported			
TP6	1.60-2.30	7.5	16.1
Residual Granite			

TP2	2.50-3.30	7.6	9.5

According to the soil conductivity guideline values in Table 5 (Duligal, 1996) and the results in

Table 6, the **transported horizon and the residual granite** on this particular site are not corrosive. Corrosion of buried metallic elements is therefore unlikely.

10. Geotechnical Considerations

The purpose of the investigation is to provide founding recommendations for the proposed four storey student accommodation. The following constraints, as proposed by Partridge, Wood and Brink (1993), have to be considered for the classification of the sites for urban development.

a. Shallow seepage or groundwater level

No groundwater was encountered in any of the test pits excavated on site. Ferruginization, which indicates that a changing water regime is expected, was noted in some test pits. Problems due to ground water seepage are therefore expected in places, especially during and after a very wet rainy season.

b. Collapsible / Compressible soil profile

The lower transported layer is generally described as predominantly sandy material (clayey sand). This horizon is generally slightly moist and although it has a dense to very dense consistency it is expected that the material will soften when inundated. From our experience and investigations carried out in the vicinity of this site this lower transported sandy soils are likely to be collapsible.

c. Expansive soil profile

According to the laboratory results of the foundation indicator tests in section 9 of this report the lower transported horizon and residual granite horizon have medium potential of expansiveness.

d. Erodibility of the soil profile

The surface at the site is covered by the sandy material thus possibly prone to erodibility due to the sandy nature of the covering material on site; however it must be noted that no significant erosion channels were encountered during the investigation. The proposed site is however relatively flat, covered with grass and sparse trees, and there is therefore a reduced risk of erodibility problems. Limited erosion problems are expected on this site.

e. Excavatability

The excavation characteristics have been estimated from the performance of the TLB used for the investigation. On this site no refusal was encountered at any of the test pits, therefore “soft excavation” in terms of SABS 1200D can be expected to a depth of 3.50m on this site.

f. Steep slopes/ unstable natural slopes

The site is characterised by a generally flat surface. No indication of the presence of unstable natural slopes was found during the desk study or field investigation.

g. Areas subject to flooding

No risk for flooding is apparent on the site. It is therefore unlikely that the proposed development will be subject to flooding. A flood line study falls outside of our current scope of work. It is recommended that a formal flood line study be conducted if deemed necessary. The site is reasonably flat and the draining of surface water would need proper consideration.

h. Suitability of in-situ materials for use in layer works.

The residual material does not conform to G10 according to the TRH 14 guidelines (CSIR: 1987). The material should therefore not be considered for use as selected layers in road pavement, layer works and engineered fill. Consequently, this material is considered unsuitable as construction material. If deemed appropriate, these materials may be utilised for barrier system design, general landscaping purposes, or alternatively spoiled.

11. Engineering Geological Zoning

For urban planning purposes the site is zoned according to the NHBRC classification systems. Due to the presence of potentially expansive and compressible horizons over the entire site, the site has been delineated into one geotechnical zone. The descriptions of the zone is as follows:

Zone H3/S2: This zone covers the entire site and is characterised by relatively thick expansive and compressible soil profile with H3 (total expected heave of >30mm) and S2 (total normal settlement >20mm).

12. Conclusions/Recommendations

Recommendations are provided regarding the following:

- General development
- Founding of Proposed Structures;
- Surface Beds;
- Reinforcement of brick work;
- Lateral Stability of Excavations;
- Drainage Measures; and
- General development.

12.1 General Development

No adverse conditions prohibiting the construction of structures were encountered at the site.

12.2 Founding of Proposed Structures

Founding alternatives for lightly loaded single and double-storey structures constructed in this zone include the foundation options explained below. **We recommend Option 3 foundation for this development.**

Option 1 Stiffened or cellular raft

Stiffened or cellular raft with lightly reinforced or articulated masonry. Bearing pressure not to exceed to 50 kPa. Fabric reinforcement in floor slabs. The site should be properly drained and adequate plumbing and service precautions should be taken to prevent water leaks.

Option 2 Piled or pier foundations

Reinforced concrete ground beams or solid slabs on piled or pier foundations. Ground slabs with fabric reinforcement. The site should be properly drained and adequate plumbing and service precautions should be taken to prevent water leaks.

Option 3 Soil raft

Due to the presence of the potentially expansive and compressible soil profiles encountered on the site it is recommended that the proposed four storey buildings (assumed to induce more than 150 kPa loading) be founded on lightly reinforced strip and pad footings on the dense residual granite, overlain by a competent soil mattress to minimise differential settlements of the structures. The soil mattress should be prepared as follows:

Soil Mattress Foundation

The foundation of the planned development should be placed on the dense residual horizon found at depths of between 2,0 and 3,0 m and utilising a bearing pressure not exceeding 150 kPa. If the footing pressures exceed 150 kPa, a deep foundation design, which may entail a piled raft foundation, should be provided by a professional geotechnical engineer.

The preparation of a soil raft entails the following:

- Remove the in-situ material to the depth of the residual granite or a maximum depth of 3.0 m and 1 m wider than the footprint of the structure.
- Compact the base of the excavation to 90 % of the Mod AASHTO density.
- Backfill with 500 mm G5 quality material (as specified in TRH14) in 250 mm thick layers, compacted to 95 % of the Mod AASHTO density.
- Place the strip/pad footings on the compacted G5 soil mattress
- Backfill with suitable material

The backfill material must conform to the following:

- Maximum plasticity index : 12 %
- Minimum grading modulus : 1
- Minimum CBR at 93% Mod AASHTO density: 25

The laboratory test revealed that transported material and residual materials on this site do not meet these requirements, therefore suitable backfill material will need to be borrowed from outside of the site.

12.3 Surface beds

For the lightly loaded structures where ground improvement below individual footings is envisaged and only light floor loading (not exceeding 25kPa) is envisaged, the surface beds (floor slabs) can be founded on ripped and recompacted in-situ material overlain by compacted sand fill. The thickness of the surface bed should be agreed upon in consultation with a geotechnical engineer. Fill material below the floor slabs shall meet the specification of a G7 material or better (according to TRH14) and shall be compacted in 150 mm thick layers to 93 % of Modified AASHTO density at ±2 % of OMC.

To avoid rising damp problems it is recommended that the surface beds be constructed at least 200 mm above final ground level.

12.4 Reinforcement of brick work

Brickforce should be incorporated in the masonry structure as follows (or as otherwise instructed by the structural engineer):

- In every fourth layer of brickwork with lap lengths of at least 400 mm,
- In every layer of brickwork from the foundation to the underside of the floor slab, and
- In the first five courses of all brickwork above windows and doors, as well as in the first five courses underneath windows.
- Articulated joints in the masonry walls shall be considered in order to mitigate any differential settlements.

12.5 Lateral Stability of Excavations

The sidewalls will require battering to 45º in service trenches and foundation excavations. As the depths of such trenches, and the presence or absence of groundwater usually dictate the overall stability of the trench, it is recommended that the excavations must be evaluated by a competent person to determine appropriate measures.

12.6 Drainage Measures

Water must be kept away from the foundations. The following drainage precaution must be adhered to:

- No accumulation of surface water is permitted and the entire development must be properly drained;
- A 1m apron must be constructed around each building to keep surface runoff away from foundations;
- Waterborne sewerage reticulation must be installed. All water services should be sleeved;
- Water bearing services should have flexible couplings where they enter or exit buildings;
- All trenches and excavation works must be properly backfilled and compacted in order to prevent them from functioning as French drains. Backfilling should be done at optimum moisture content, in 150mm thick layers to at least 90% of modified AASHTO density.

12.7 General

No adverse conditions prohibiting the construction of structures for the student accommodation development were encountered. It is recommended that development proceed subject to the following preconditions:

Recommendations regarding proposed development include the following:

- Founding recommendations for the site;
- Drainage precautions that represent good practice must be implemented.

An engineered soil raft would be suitable for the proposed four storey structures (assumed to induce no more than 150 kPa loading).

The preliminary recommendations included in this report relate only to the specific footprint on the site that has been investigated. Where ground conditions are at variance with those discussed in this report do occur, such conditions should be inspected by competent personnel to ensure that they do not pose a problem for the development.

13. References

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Appendix A

Summary of standard soil and rock profile description terminology

STANDARD DESCRIPTIONS USED IN SOIL PROFILING

1. MOISTURE CONDITION

Term	Description
Dry	
Slightly moist	Requires addition of water to reach optimum moisture content for compaction
Moist	Near optimum content
Very Moist	Requires drying to attain optimum content
Wet	Fully saturated and generally below water table

2. COLOUR

The Predominant colours or colour combinations are described including secondary coloration described as banded, streaked, blotched, mottled, speckled or stained.

3. CONSISTENCY

3.1 Non-Cohesive Soils

Term	Description
Very Loose	Crumbles very easily when scraped with geological pick
Loose	Small resistance to penetration by sharp end of geological pick
Medium Dense	Considerable resistance to penetration by sharp end of geological pick
Dense	Very high resistance to penetration to sharp end of geological pick. Requires many blows of hand pick for excavation.
Very Dense	High resistance to repeated blows of geological pick. Requires power tools for excavation

3.2 Cohesive Soils

Term	Description
Very soft	Easily penetrated by thumb. Sharp end of pick can be pushed in 30 - 40mm. Easily moulded by fingers.
Soft	Pick head can easily be pushed into the shaft of handle. Moulded by fingers with some pressure.
Firm	Indented by thumb with effort. Sharp end of pick can be pushed in up to 10mm. Can just be penetrated with an ordinary spade.
Stiff	Penetrated by thumbnail. Slight indentation produced by pushing pick point into soil. Cannot be moulded by fingers. Requires hand pick for excavation.
Very Stiff	Indented by thumbnail. Slight indentation produced by blow of pick point. Requires power tools for excavation.

4. STRUCTURE

Term	Description
Intact	Absence of fissures or joints
Fissured	Presence of closed joints
Shattered	Presence of closely spaced air filled joints giving cubical fragments
Micro-shattered	Small scale shattering with shattered fragments the size of sand grains
Slickensided	Polished planar surfaces representing shear movement in soil
Bedded Foliated	Many residual soils show structures of parent rock.

5. SOIL TYPE

5.1 Particle Size

Term	Size (mm)
Boulder	>200
Pebbles	60 – 200
Gravel	60 – 2
Sand	2 – 0,06
Silt	0,06 – 0,002
Clay	<0,002

6. ORIGIN

6.1 Transported Soils

Term	Agency of Transportation
Colluvium	Gravity deposits
Talus	Scree or coarse colluvium
Hillwash	Fine colluvium
Alluvial	River deposits
Aeolian	Wind deposits
Littoral	Beach deposits
Estuarine	Tidal – river deposits
Lacustrine	Lake deposits

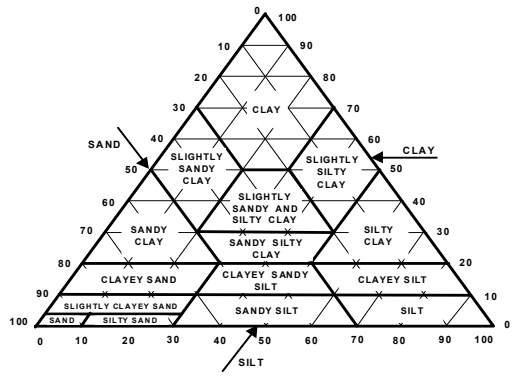
6.2 Residual soils

These are products of in situ weathering of rocks and are described as e.g. Residual Shale

6.3 Pedocretes

Formed in transported and residual soils etc. calcrete, silcrete, manganocrete and ferricrete.

5.2 Soil Classification



SUMMARY OF DESCRIPTIONS USED IN ROCK CORE LOGGING

1. WEATHERING

Term	Symbol	Diagnostic Features
Residual Soil	W5	Rock is discoloured and completely changed to a soil in which original rock fabric is completely destroyed. There is a large change in volume.
Completely Weathered	W5	Rock is discoloured and changed to a soil but original fabric is mainly preserved. There may be occasional small corestones.
Highly Weathered	W4	Rock is discoloured, discontinuities may be open and have discoloured surfaces, and the original fabric of the rock near the discontinuities may be altered; alternation penetrates deeply inwards, but corestones are still present.
Moderately Weathered	W3	Rock is discoloured, discontinuities may be open and will have discoloured surfaces with alteration starting to penetrate inwards, intact rock is noticeably weaker than the fresh rock.
Slightly Weathered	W2	Rock may be slightly discoloured, particularly adjacent to discontinuities, which may be open and will have slightly discoloured surfaces, the intact rock is not noticeably weaker than the fresh rock.
Unweathered	W1	Parent rock showing no discolouration, loss of strength or any other weathering effects.

2. HARDNESS

Classification	Field Test	Compressive Strength Range MPa
Extremely Soft Rock	Easily peeled with a knife	<1
Very Soft Rock	Can be peeled with a knife. Material crumbles under firm blows with the sharp end of a geological pick.	1 to 3
Soft Rock	Can be scraped with a knife, indentation of 2 to 4 mm with firm blows of the pick point.	3 to 10
Medium Hard Rock	Cannot be scraped or peeled with a knife. Hand held specimen breaks with firm blows of the pick.	10 to 25
Hard Rock	Point load tests must be carried out in order to distinguish between these classifications	25 - 70
Very Hard Rock	These results may be verified by uniaxial compressive strength tests on selected samples.	70 - 200
Extremely Hard Rock		>200

3. COLOUR

The predominant colours or colour combination are described including secondary colouration described as banded, streaked, blotched, mottled, speckled or stained.

4. FABRIC

4.1 Grain Size		4.2 Discontinuity Spacing		
Term	Size (mm)	Description for: Bedding, foliation, laminations	Spacing (mm)	Descriptions for joints, faults, etc.
Very Coarse	>2,0	Very Thickly Bedded	> 2000	Very Widely
Coarse	0,6 – 2,0	Thickly Bedded	600 – 2000	Widely
Medium	0,2 – 0,6	Medium Bedded	200 – 600	Medium
Fine	0,06 – 0,2	Thinly Bedded	60 – 200	Closely
Very Fine	< 0,06	Laminated	3 – 60	Very closely
		Thinly Laminated	<3	

5. ROCK NAME

Classified in terms of origin:

IGNEOUS	Granite, Diorite, Gabbro, Syenite, , Dolerite, Trachyte, Andesite, Basalt.
METAMORPHIC	Slate, Felsite, Gneiss, Schist, Quartzite
SEDIMENTARY	Shale, Mudstone, Siltstone, Sandstone, Dolomite, Conglomerate, Tillite, Limestone.

6. STRATIGRAPHIC HORIZON

Identification of rock type in terms of stratigraphic horizons.

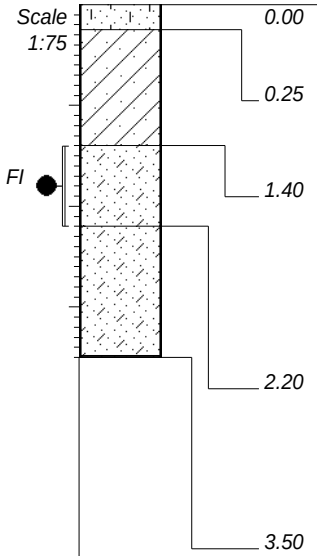
Appendix B

Soil Profile Descriptions

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP1**
Sheet 1 of 1

JOB NUMBER: 100067



Dry, brown, DENSE, micro-shattered, silty sand.
Topsoil.

Slightly moist, reddish brown, STIFF, shattered, sandy clay.
Upper Transported.

Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand.
Lower Transported.

Note: Slightly ferruginised in places.

Slightly moist, orangey brown mottled reddish brown, DENSE, shattered clayey sand with very soft granite cobbles and sub-angular medium gravel.
Residual granite.

END OF HOLE.

NOTES

1) Sidewalls stable
2) No groundwater seepage.
3) No refusal
4) FI sample taken at 1.40-2.20 m.

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

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DIAM :
DATE :
DATE : 08/06/2018

DATE : 09/07/2018 10:58
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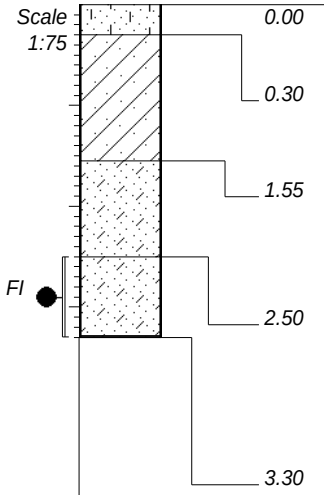
ELEVATION :
X-COORD : 30°29'58.25"E
Y-COORD : 22°58'6.05"S

HOLE No: **TP1**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP2**
Sheet 1 of 1

JOB NUMBER: 100067



Dry, brown, DENSE, micro-shattered, silty sand.
Topsoil.

Slightly moist, reddish brown, STIFF, shattered, sandy clay.
Upper Transported.

Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand,
Lower Transported.

Slightly moist, orangey brown mottled reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel,
Residual granite.

END OF HOLE

NOTES

1) Sidewalls stable.
2) No Refusal
3) No ground water seepage.
4) FI, chem sample taken at 2.50-3.30m.

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

DATE : 09/07/2018 10:58
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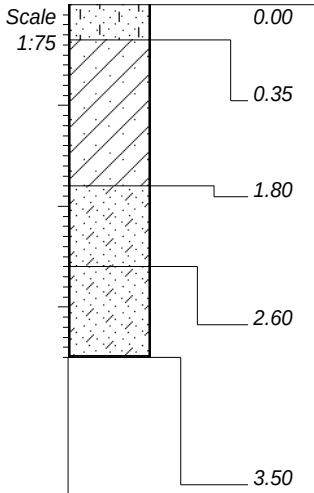
ELEVATION :
X-COORD : 30°29'59.64"E
Y-COORD : 22°58'5.33"S

HOLE No: **TP2**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP3**
Sheet 1 of 1

JOB NUMBER: 100067



0.00	Dry, brown, DENSE, micro-shattered, silty sand. Topsoil.
0.35	Slightly moist, reddish brown, STIFF, shattered, sandy clay. Upper Transported.
1.80	Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand. Lower Transported
2.60	Slightly moist, orangey brown mottled reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel. Residual granite.
3.50	END OF HOLE

NOTES

1) Sidewalls stable.
2) No groundwater seepage.
3) No sample taken.
4) No refusal.

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

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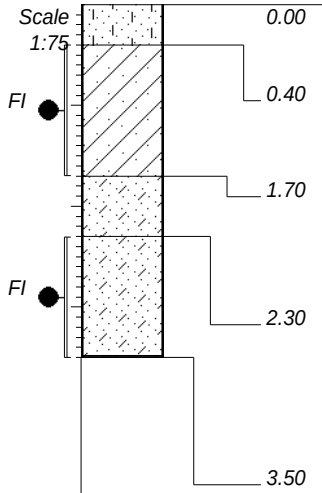
ELEVATION :
X-COORD : 30°30'0.77"E
Y-COORD : 22°58'4.86"S

HOLE No: **TP3**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP4**
Sheet 1 of 1

JOB NUMBER: 100067



0.00	Slightly moist, dark brown, DENSE, shattered, silty sand. Topsoil.
0.40	Slightly moist, reddish brown, STIFF, shattered, sandy clay. Upper Transported.
1.70	Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular gravel in a matrix of clayey sand. Lower Transported.
2.30	Slightly moist, orangey brown mottled reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel. Residual granite.
3.50	END OF HOLE

NOTES

1) Sidewalls stable.
2) No ground water seepage.
3) FI, MOD/CBR sample taken at 2.30-3.50m
4) FI sample taken at 0.40-1.70m
5) No refusal.

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

DATE : 09/07/2018 10:58
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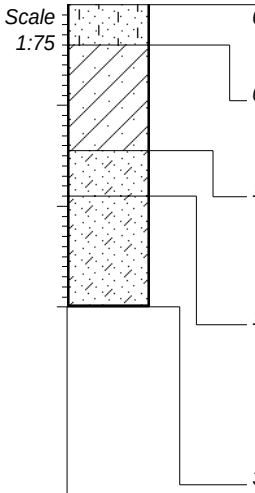
ELEVATION :
X-COORD : 30°29'59.86"E
Y-COORD : 22°58'4.03"S

HOLE No: **TP4**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP5**
Sheet 1 of 1

JOB NUMBER: 100067



Dry, brown, DENSE, micro-shattered, silty sand.
Topsoil.

Slightly moist, reddish brown, STIFF, shattered, sandy clay.
Upper Transported

Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand.
Lower Transported.

Slightly moist, orangey brown mottled reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel with roots.
Residual granite.

END OF HOLE

NOTES

1) Sidewalls stable.
2) No groundwater seepage
3) No refusal
4) No sample taken.

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

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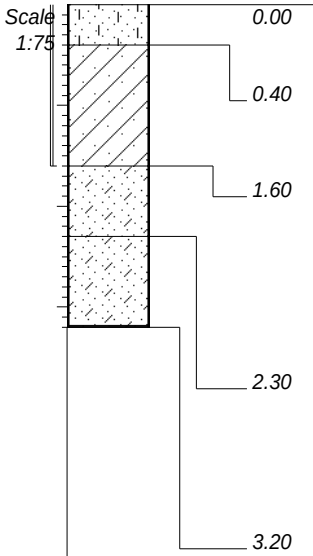
ELEVATION :
X-COORD : 30°29'58.68"E
Y-COORD : 22°58'4.52"S

HOLE No: **TP5**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP6**
Sheet 1 of 1

JOB NUMBER: 100067



0.00 — Dry, brown, DENSE, micro-shattered, silty sand with roots.
Topsoil.

0.40 — Slightly moist, reddish brown, STIFF, shattered, sandy clay with roots.
Upper Transported

1.60 — Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand.
Lower Transported.

Note: With roots

2.30 — Slightly moist, orangey brown mottled reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel.
Residual granite.

3.20 — END OF HOLE

NOTES

1) Sidewalls stable.
2) No groundwater seepage.
3) FI. pH and COND sample taken at 1.60-2.30 m.
4) No refusal

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM
TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018
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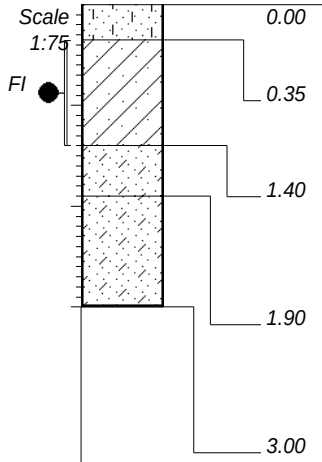
ELEVATION :
X-COORD : 30°29'56.66"E
Y-COORD : 22°58'5.38"S

HOLE No: **TP6**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP7**
Sheet 1 of 1

JOB NUMBER: 100067



0.00 – 0.35	Dry, brown, DENSE , micro-shattered, silty sand. Topsoil.
0.35 – 1.40	Slightly moist, reddish brown, STIFF, shattered, sandy clay. Upper Transported.
1.40 – 1.90	Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand. Transported.
1.90 – 3.00	Slightly moist, reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel. Residual granite.
3.00	END OF HOLE

NOTES

1) Sidewalls stable.
2) No groundwater seepage.
3) FI, pH and COND sample taken at 0.35-1.40m.
4) No refusal

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

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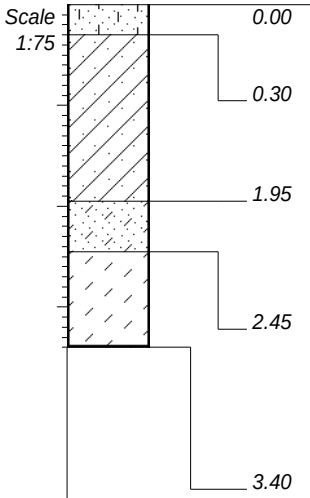
ELEVATION :
X-COORD : 30°29'58.56"E
Y-COORD : 22°58'2.77"S

HOLE No: **TP7**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP8**
Sheet 1 of 1

JOB NUMBER: 100067



Dry, brown, DENSE, micro-shattered, silty sand.
Topsoil.

Slightly moist, reddish brown, STIFF, shattered, sandy clay.
Upper Transported.

Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of. clayey sand
Lower Transported.

Slightly moist, orangey brown mottled reddish brown, DENSE, shattered clayey sand with very soft granite cobbles and sub-angular medium gravel.
Residual granite.

END OF HOLE.

NOTES

1) Sidewalls stable
2) No groundwater seepage.
3) No refusal

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

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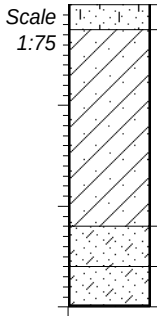
ELEVATION :
X-COORD : 30°29'56.91"E
Y-COORD : 22°58'3.35"S

HOLE No: **TP8**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

HOLE No: **TP9**
Sheet 1 of 1

JOB NUMBER: 100067



0.00	Dry, brown, DENSE, micro-shattered, silty sand. Topsoil.
0.25	Slightly moist, reddish brown, STIFF, shattered, sandy clay. Upper Transported.
2.20	Slightly moist, reddish brown speckled rusty grey, DENSE to VERY DENSE, intact, sub-angular medium gravel in a matrix of clayey sand. Lower Transported.
2.60	Slightly moist, orangey brown mottled reddish brown, DENSE, shattered, clayey sand with very soft granite cobbles and sub-angular medium gravel. Residual granite.
3.00	END OF HOLE.

NOTES

1) Sidewalls stable
2) No groundwater seepage.
3) No refusal

CONTRACTOR :
MACHINE : CAT TLB
DRILLED BY :
PROFILED BY : NM

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 08/06/2018

DATE : 09/07/2018 10:58
TEXT : ..ts\100063MAKWARELA04.txt

ELEVATION :
X-COORD : 30^0 29'55.15"E
Y-COORD : 22^0 58'4.10"S

HOLE No: **TP9**
Thohoyandou

Instratin
MAKWARELA STUDENT ACCOMMODATION

LEGEND
Sheet 1 of 1

JOB NUMBER: 100063

	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
Name	DISTURBED SAMPLE	{SA38}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : KM/MM
SETUP FILE : STANDARD.SET

DATE : 09/07/2018 10:58
TEXT : ..ts\100063MAKWARELA04.txt

LEGEND
SUMMARY OF SYMBOLS

Appendix C

Laboratory Results

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax : (012) 800 3043
Email : bennie.vanniekerk@sgs.com

TEST RESULTS

DWALA GROUP (PTY)LTD
P.O BOX 1099
UMKOMAAS
KWA-ZULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project : Makwarela Student Accomodation

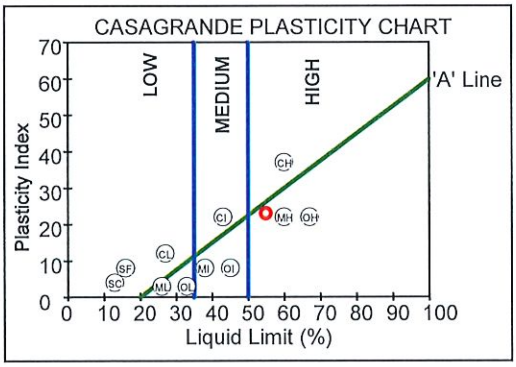
Your Ref :
Our Ref : PL/25329
Date Reported : 05.07.2018

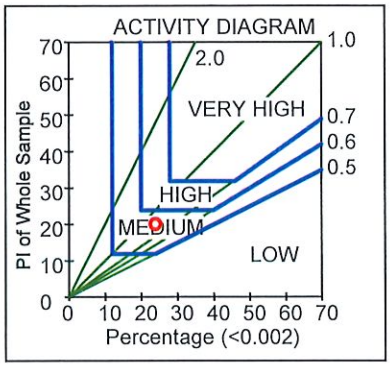
FOUNDATION INDICATOR (ASTM: D422)

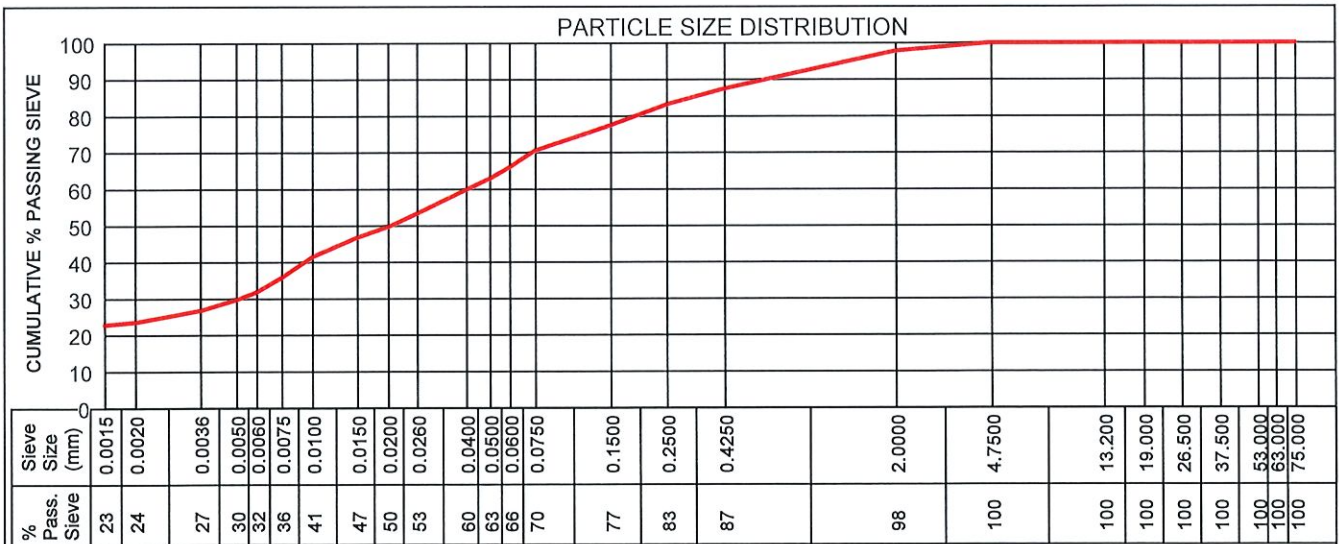
Sample No.	: A8/2581
Hole No.	: TP2
Depth	: 2500-3500
Liquid Limit (%)	: 55
Plasticity Index	: 23
Linear Shrinkage (%)	: 9.5
PI of Whole Sample	: 20
P.R.A. Classification	: A-7-5(15)
Unified Soil Classificati	: MH
Activity	: 0.83
Heave Classification	: MEDIUM
Grading Modulus	: 0.45
Percentage (<0.002)	: 24.0
Moisture Content (%)	: 0.0

Material Description : CLAYEY SILT

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	29.7	33.2	34.9	2.3	SANDY CLAY
Astm	29.7	40.7	29.5	0.0	CLAYEY SILT
British Standard	23.5	42.5	31.7	2.3	CLAYEY SILT







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	23	24	27	30	32	36	41	47	50	53	60	63	66	70	77	83	87	98	100	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax : (012) 800 3043
Email : bennie.vanniekerk@sgs.com

TEST RESULTS

DWALA GROUP (PTY)LTD
P.O BOX 1099
UMKOMAAS
KWA-ZULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project : Makwarela Student Accomodation

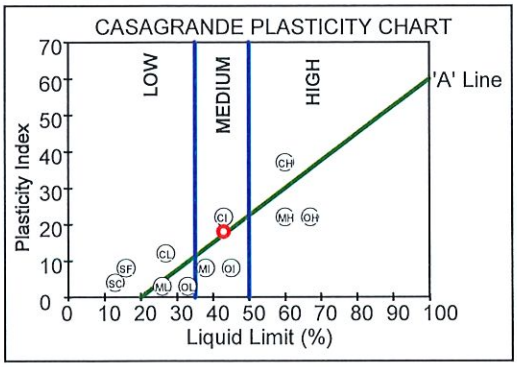
Your Ref :
Our Ref : PL/25329
Date Reported : 05.07.2018

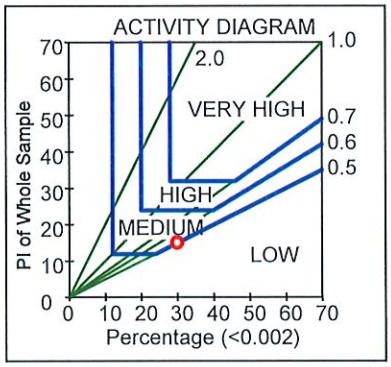
FOUNDATION INDICATOR (ASTM: D422)

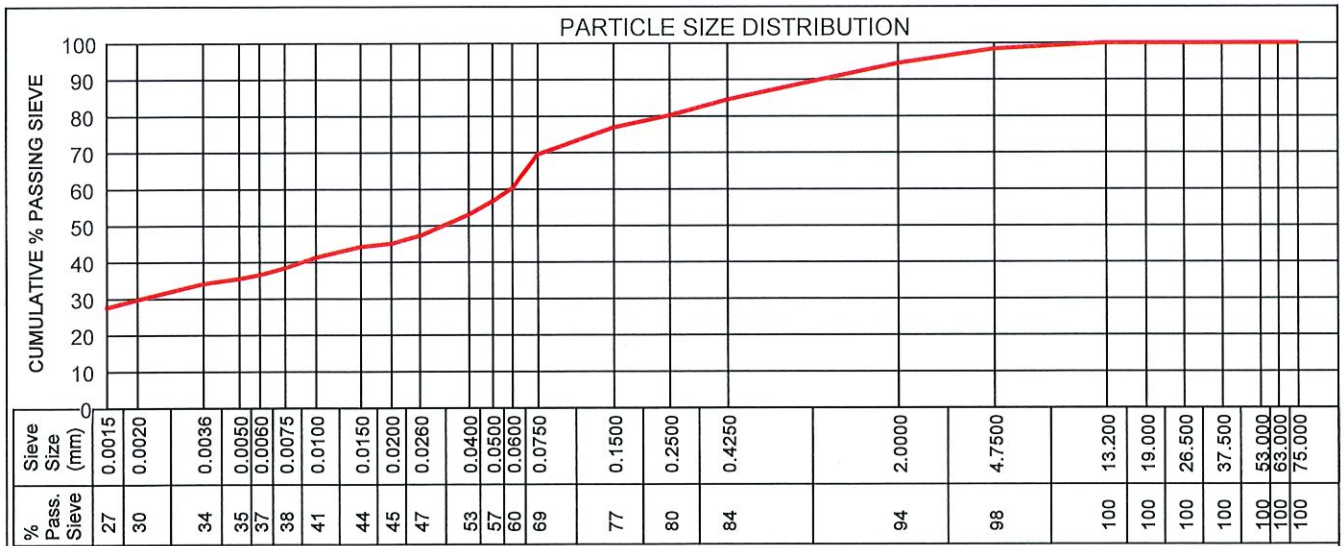
Sample No.	: A8/2582
Hole No.	: TP4
Depth	: 400-1700
Liquid Limit (%)	: 43
Plasticity Index	: 18
Linear Shrinkage (%)	: 9.5
PI of Whole Sample	: 15
P.R.A. Classification	: A-7-6(11)
Unified Soil Classificati	: CL
Activity	: 0.50
Heave Classification	: MEDIUM
Grading Modulus	: 0.53
Percentage (<0.002)	: 30.0
Moisture Content (%)	: 19.3

Material Description : SILTY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	35.5	21.2	37.8	5.6	SANDY CLAY
Astm	35.5	33.9	28.9	1.7	SILTY CLAY
British Standard	29.8	30.6	34.0	5.6	SANDY CLAY







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	27	30	34	35	37	38	41	44	45	47	53	57	60	69	77	80	84	94	98	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

DWALA GROUP (PTY)LTD
P.O BOX 1099
UMKOMAAS
KWA-ZULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project : Makwarela Student Accomodation

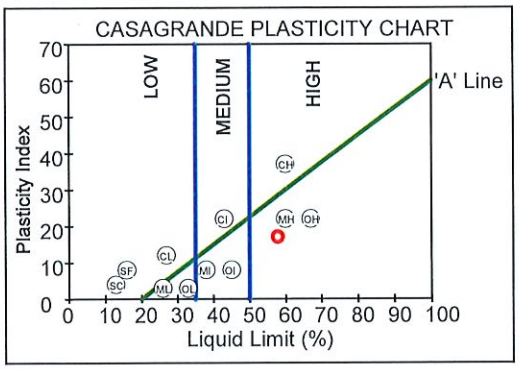
Your Ref :
Our Ref : PL/25329
Date Reported : 05.07.2018

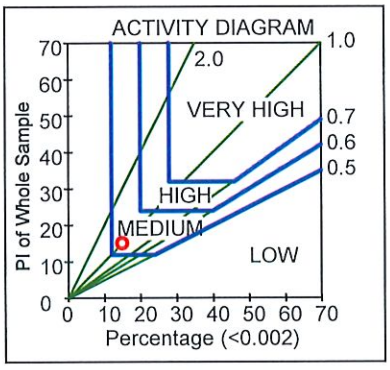
FOUNDATION INDICATOR (ASTM: D422)

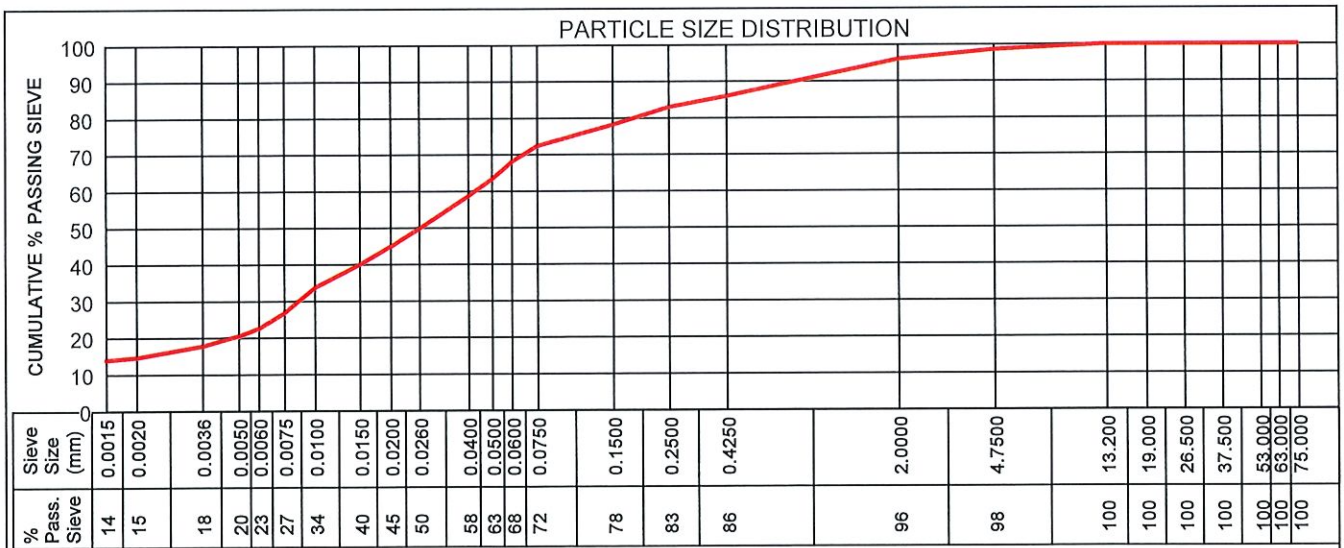
Sample No.	: A8/2583
Hole No.	: TP4
Depth	: 2300-3500
Liquid Limit (%)	: 58
Plasticity Index	: 17
Linear Shrinkage (%)	: 7.5
PI of Whole Sample	: 15
P.R.A. Classification	: A-7-5(14)
Unified Soil Classificati	: MH
Activity	: 1.00
Heave Classification	: MEDIUM
Grading Modulus	: 0.46
Percentage (<0.002)	: 15.0
Moisture Content (%)	: 23.2

Material Description : CLAYEY SILT

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	20.5	42.7	32.7	4.1	CLAYEY SILT
Astm	20.5	51.8	26.2	1.6	CLAYEY SILT
British Standard	14.6	53.5	27.9	4.1	SANDY SILT







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	14	15	18	20	23	27	34	40	45	50	58	63	68	72	78	83	86	96	98	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

DWALA GROUP (PTY)LTD
P.O BOX 1099
UMKOMAAS
KWA-ZULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project : Makwarela Student Accomodation
Your Ref :
Our Ref : PL/25329
Date Reported : 06.07.2018

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR, UCS(SANS 3001:GR1,GR10,GR12,GR30,GR40)

SAMPLE NO.	A8/2583			
HOLE NO.	TP4			
ROAD NO.				
DEPTH	2300-3500			
CHAINAGE				
LAYER TYPE	Natural			
STABILISED WITH				
SUPPLIER				
CURING METHOD				
DESCRIPTION				
SIEVE ANALYSIS (% PASSING)				
100 mm				
75 mm				
63 mm				
50 mm				
37.5 mm				
28.0 mm				
20.0 mm				
14.0 mm	100			
5.0 mm	98			
2.0 mm	96			
0.425 mm	86			
0.075 mm	72			
SOIL MORTAR				
COARSE SAND <2.0mm >0.425mm	10			
FINE SAND <0.425mm >0.075mm	15			
MATERIAL <0.075mm	75			
CONSTANTS				
GRADING MODULUS	0.46			
PRA CLASSIFICATION	A-7-5(14)			
COLTO CLASSIFICATION	---			
LIQUID LIMIT (%)	58			
PLASTICITY INDEX (0.425mm)	17			
LINEAR SHRINKAGE (%)	7.5			
MOD AASHTO				
MAXIMUM DRY DENSITY (kg/m^3)	1665			
OPTIMUM MOISTURE CONTENT(%)	16.4			
MOULDING MOISTURE (%)	9.0			
TYPE OF TEST	CBR			
CBR-UCS @ 100% MOD AASHTO	2.5			
CBR-UCS @ 98% MOD AASHTO	2.4			
CBR-UCS @ 97% MOD AASHTO	2.3			
CBR-UCS @ 95% MOD AASHTO	2.2			
CBR-UCS @ 93% MOD AASHTO	2.1			
CBR-UCS @ 90% MOD AASHTO	1.8			

CBR-UCS @ % MOD AASHTO derived from calculation.

% SWELL AT [MOD][NRB][PROC]	1.00	1.00	1.00									

Remarks : Sampled by client.

FORM: A1

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

DWALA GROUP (PTY)LTD
P.O BOX 1099
UMKOMAAS
KWA-ZULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project : Makwarela Student Accomodation

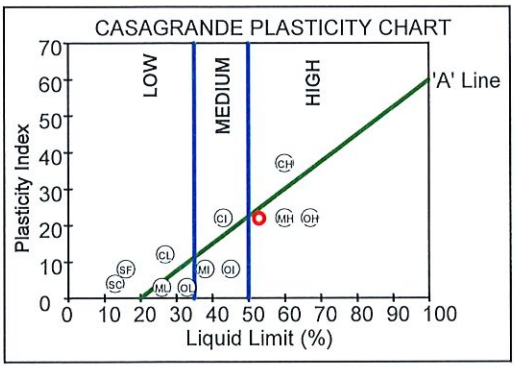
Your Ref :
Our Ref : PL/25329
Date Reported : 09.07.2018

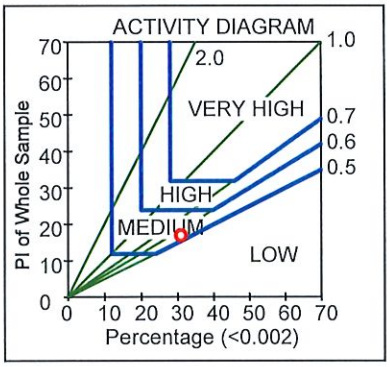
FOUNDATION INDICATOR (ASTM: D422)

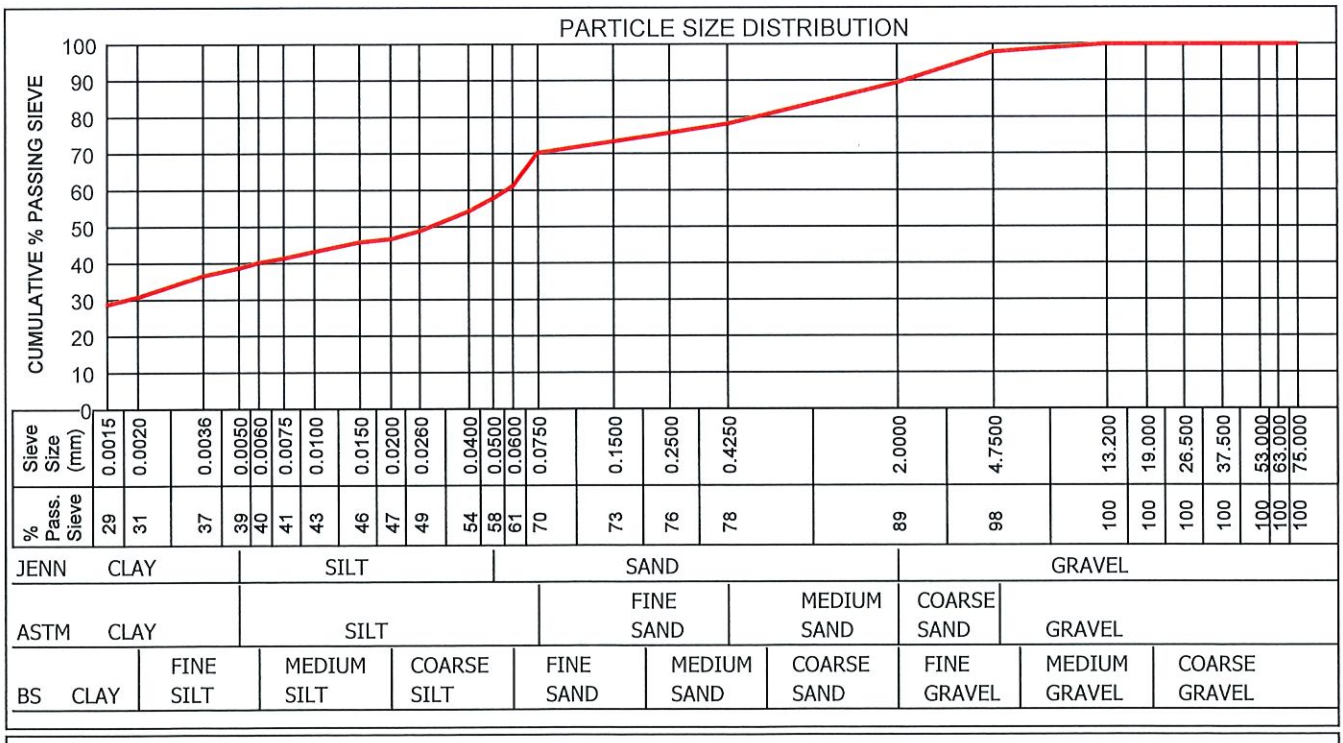
Sample No.	: A8/2584
Hole No.	: TP6
Depth	: 1600-2300
Liquid Limit (%)	: 53
Plasticity Index	: 22
Linear Shrinkage (%)	: 11.0
PI of Whole Sample	: 17
P.R.A. Classification	: A-7-5(14)
Unified Soil Classificati	: MH
Activity	: 0.55
Heave Classification	: MEDIUM
Grading Modulus	: 0.63
Percentage (<0.002)	: 31.0
Moisture Content (%)	: 20.8

Material Description : SILTY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	38.7	19.0	31.7	10.6	SANDY CLAY
Astm	38.7	31.5	27.5	2.3	SILTY CLAY
British Standard	30.9	30.4	28.1	10.6	SANDY CLAY







Remarks : Sampled by client.

FORM: A6

4.4.0(SGS)(2016.08.31)

Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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TEST RESULTS

DWALA GROUP (PTY)LTD
P.O BOX 1099
UMKOMAAS
KWA-ZULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project : Makwarela Student Accomodation

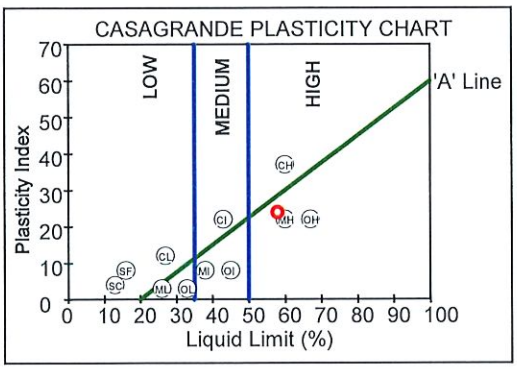
Your Ref :
Our Ref : PL/25329
Date Reported : 09.07.2018

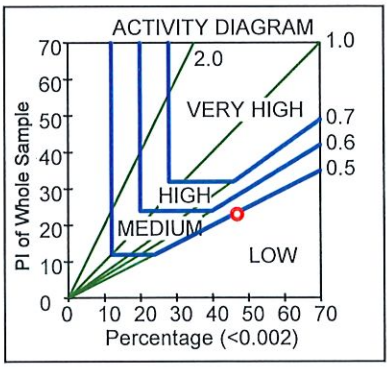
FOUNDATION INDICATOR (ASTM: D422)

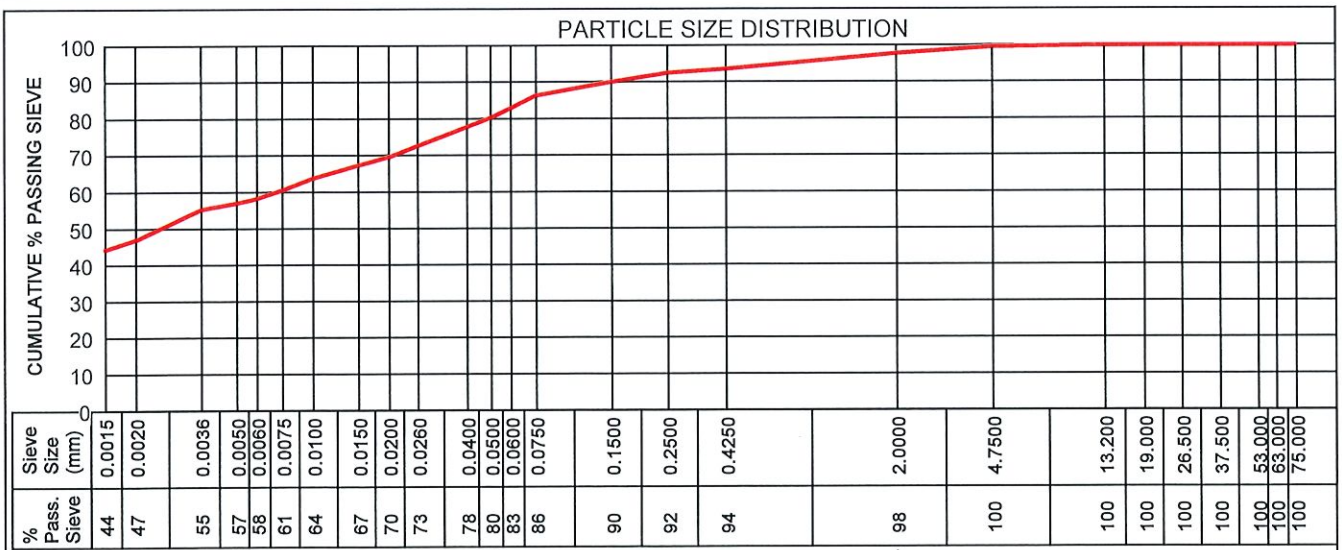
Sample No.	: A8/2585
Hole No.	: TP7
Depth	: 350-1400
Liquid Limit (%)	: 58
Plasticity Index	: 24
Linear Shrinkage (%)	: 12.0
PI of Whole Sample	: 23
P.R.A. Classification	: A-7-5(17)
Unified Soil Classificati	: MH
Activity	: 0.49
Heave Classification	: LOW
Grading Modulus	: 0.22
Percentage (<0.002)	: 47.0
Moisture Content (%)	: 22.3

Material Description : CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	57.0	23.3	17.4	2.3	CLAY
Astm	57.0	29.3	13.2	0.5	CLAY
British Standard	46.9	36.0	14.8	2.3	SILTY CLAY







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	44	47	55	57	58	61	64	67	70	73	78	80	83	86	90	92	94	98	100	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

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Technical Signatory : B.Van Niekerk / A.Verwey / S.Dewnath

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256 Brander street, Jan Niemand Park,
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Email : lizette.breiting@sgs.com

TEST RESULTS

CLIENT: DWALA GROUP (PTY)LTD
ADDRESS: P.O BOX 1099
UMKOMAAS
KWAZAULU NATAL 4170
Attention: Mr Nhlanhla Magigaba

Project: Makwarela Student Accomodation
Your Ref:
Our Ref: PL/25329
Date Reported: 06.07.2018

PROPERTIES OF AGGREGATE AND SAND

Test description	Sample Description / Source / Additional Info / Client Ref No	Test method	Lab no / UOM	A8/2581 TP2 (2500-3300)	A8/2584 TP6 (1600-2300)	A8/2585 TP7 (350-1400)
pH		SANS 5854	pH	7.6	7.5	7.7
Conductivity		SANS 6240	S/m	0.0095	0.0161	0.0029

Remarks: Sampled by client.

Test covered, not part of scope of accreditation

for SGS Matrolab (Pty) Ltd. Technical Signatory: B. van Niekerk/L. Breiting

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