REPORT
ON
THE ENGINEERING GEOLOGICAL INVESTIGATION
ON
PORTION 243
OF
THE FARM
KNOPPIESLAAGTE 385 JR
FOR
TOWNSHIP ESTABLISHMENT

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Client

PLAN ASSOCIATES

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON PORTION 243 OF THE FARM KNOPPIESLAAGTE 385 JR FOR TOWNSHIP ESTABLISHMENT

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REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON PORTION 243 OF THE FARM KNOPPIESLAAGTE 385 JR FOR TOWNSHIP ESTABLISHMENT

1. INTRODUCTION

Louis Kruger Geotechnics CC was appointed Plan Associates by to do an engineering geological investigation on Portion 243 of the farm Knoppieslaagte 385 JR for Township Establishment. The investigation was undertaken according to the normal requirements to assess the suitability of the site (SANS 634: Geotechnical Investigations For Township Development, SANS 633: Profiling, and Percussion and Core Borehole Logging In Southern Africa for Engineering Purposes, Home Building Manual Part 1 & 2", National Home Builders Registration Council, 1999). and Guidelines for Urban Engineering Geological Investigations 1997). The following aspects are addressed in this report:

- Geology and Soil profile
- Geohydrology
- Foundation conditions
- Construction material

2. TERMS OF REFERENCE

The appointment was to do an engineering geological investigation on Portion 243 of the farm Knoppieslaagte 385 JR for Township Establishment. The following aspects were to be addressed:

- The geotechnical characteristics of the site
- Geotechnical constraints
- Founding conditions
- NHBRC Zoning

The locality of the site is shown on Figure 1.

3. AVAILABLE INFORMATION

The following information was available:

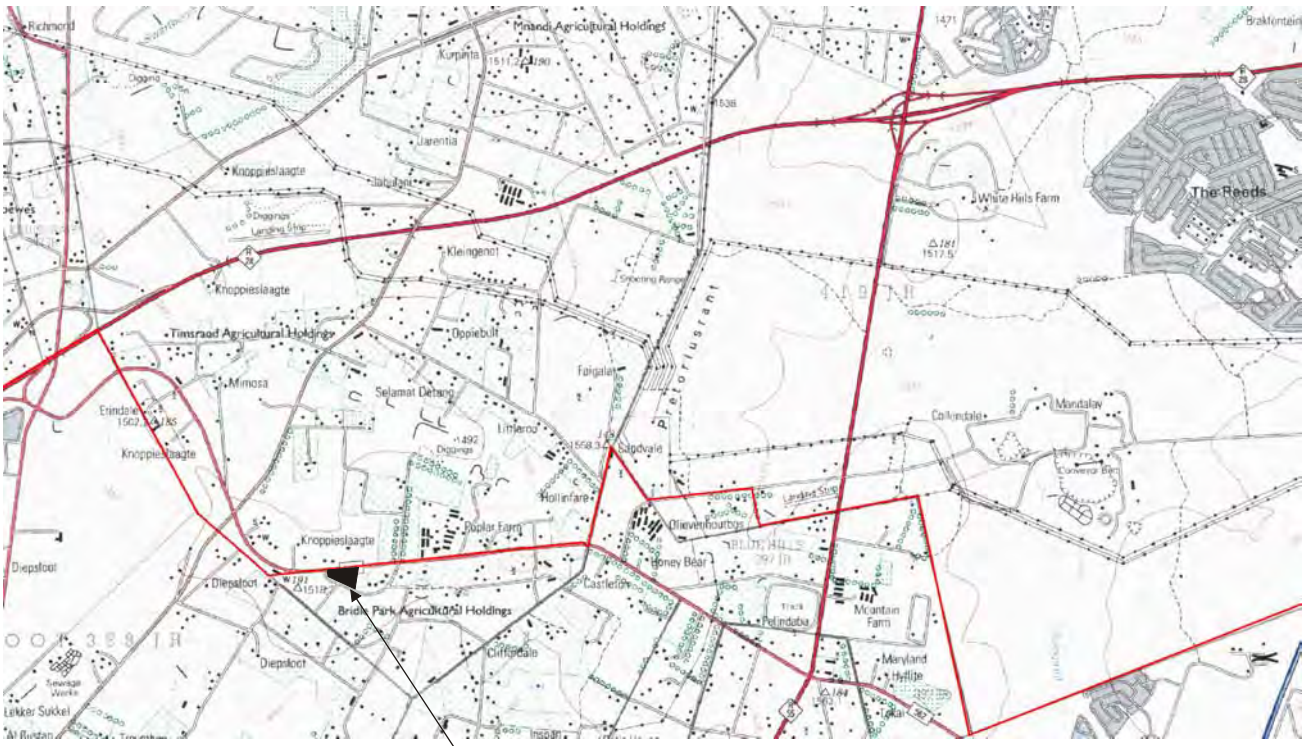
- 1 : 50 000 Geological Map 2528CC Lyttelton
- Site and contour plan

4. LOCALITY

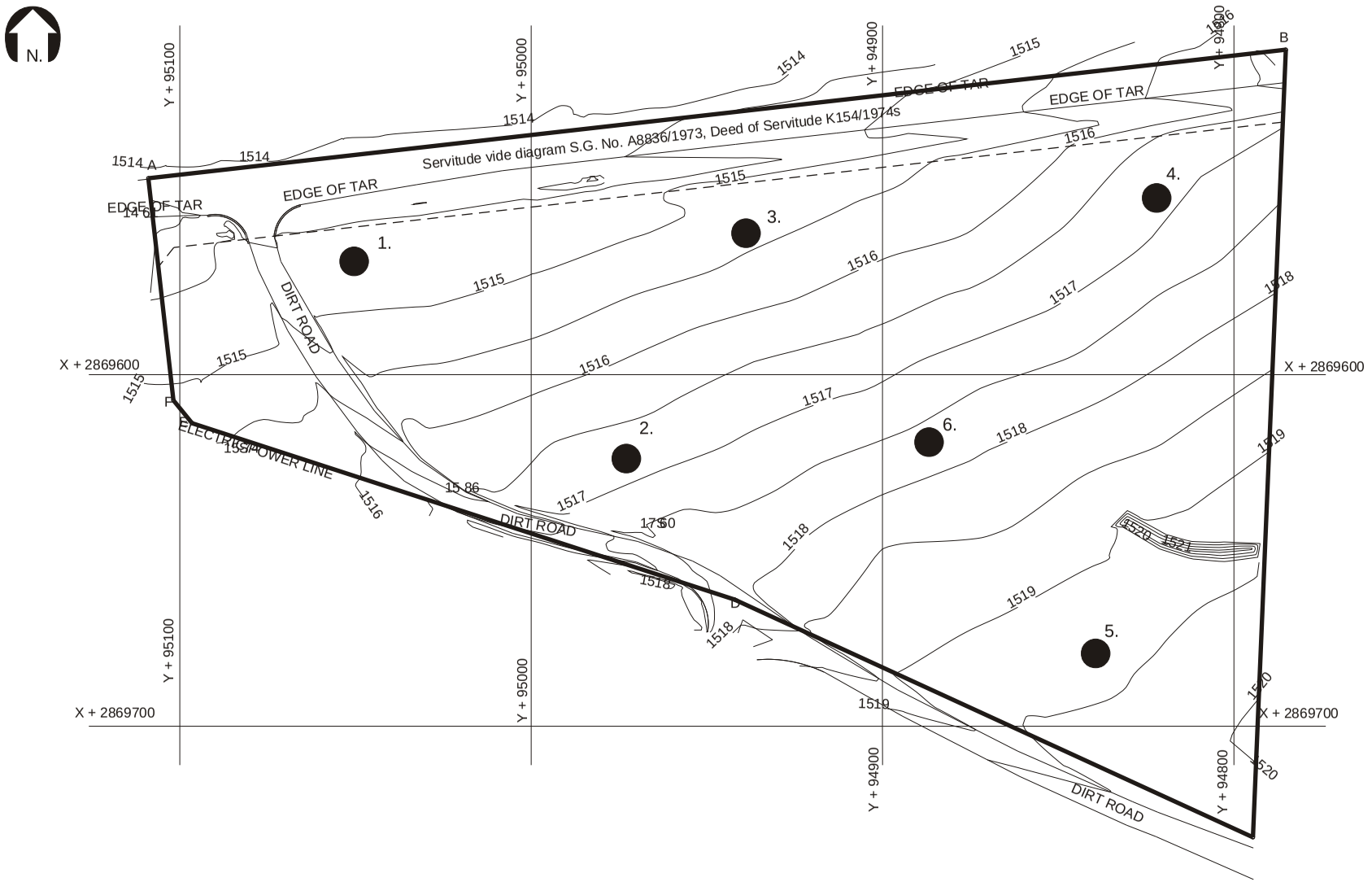
The proposed site is situated on Portion 243 of the farm Knoppieslaagte 385 JR on Summit road, approximately 2.5 kilometers from the R55 – Summit Road intersection. The site is bounded by Summit Road in the north and by Stirrup Road in the south and west. The locality of the proposed site is shown on Figure 1.

5. TOPOGRAPHY AND DRAINAGE

The site is relatively flat and slopes at an average of 4% towards the north-west. Surface water drains by means of sheetwash in the same direction. The topography is shown on Figure 2.



LOCALITY	FIGURE 1 NTS



TEST PIT POSITIONS	SCALE 1 : 1 750	FIGURE 2

6. METHOD OF INVESTIGATION

Six test pits were dug with a TLB on the site and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soils laboratory for foundation indicator tests. Due to the high gravel content of the materials encountered on the site, no undisturbed samples were taken.

7. GEOLOGY AND SOIL PROFILE

According to the 1 : 50 000 scale geological map the site is underlain by granite-gneiss of the Pretoria-Johannesburg inlier. This was confirmed during the investigation, granite bedrock was encountered in all the test pits. The test pit positions are shown on Figure 2 and the soil profiles are included as Appendix A. The following materials were encountered in the test pits:

7.1 Hillwash

Moist, light brown, loose, shattered, gravely sand with plant roots was encountered in all the test pits from surface up to an average depth of 0,4 meters.

7.2 Ferricrete

Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete was encountered in all the test pits from an average depth of 0,4 meters up to an average depth of 1,3 meters

7.3 Granite

Slightly moist, orange speckled white and black, very soft rock granite with soft silty patches in places was encountered in all the test pits from an average depth of 1,3 meters up to an average depth of 1,6 meters. The back actor refused on soft rock granite at an average depth of 1,6 meters in all the test pits.

8. GEOHYDROLOGY

No ground water was encountered in the test pits; the pedogenic material that was encountered in the test pits shows that a perched water table can be expected during and after periods of high rainfall.

9. LABORATORY TEST RESULTS

9.1 Indicator test results

The laboratory test results are attached as Appendix B and are summarized in the following table:

MATERIAL	TP	DEPTH (m)	PI	% Clay	% Silt	% Sand	% Gravel
Hillwash	1	0.2	SP	7	11	46	36
Hillwash	3	0.3	SP	7	9	53	31
Hillwash	5	0.3	SP	9	12	65	14
Nodular ferricrete	1	1.0	6	5	10	37	47
Nodular ferricrete	3	1.1	4	7	9	41	43

The predominantly sandy and gravelly nature of the materials encountered on the site is clearly reflected by the high sand- and gravel content of the samples. The difference between the hillwash and the nodular ferricrete is shown by the higher sand- and lower gravel content

of the hillwash. The laboratory test results furthermore clearly reflect the variation in the composition of the materials.

9.2 Potential expansiveness

The potential expansiveness of the materials encountered on the site was calculated according to the method proposed by Van der Merwe (1964). The following material characteristics are considered when applying this method:

- Plasticity index
- Clay fraction (< 0,002 mm)
- Thickness of expansive material
- Thickness of non - expansive material

Assuming the laboratory test results typify the material encountered on the site, the application of the method of Van der Merwe shows that all the materials classify as “Low” and are therefore considered to be non-expansive.

9.3 Collapse potential

Due to the high gravel content of the materials encountered on the site, no undisturbed samples were taken

10. ENGINEERING GEOLOGICAL ZONING

Due to the fairly uniform soil profile, the site was not divided into different engineering geological zones.

11. GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations, which could influence the proposed development, were identified:

11.1 Founding of structures

- Fill and building rubble is present on the south-western parts of this zone. The composition and consistency of the fill and building rubble vary considerably. If unadapted structures are founded on the fill or building rubble or partly on residual mudstone and fill or building rubble, unacceptable differential movements, with resultant cracking may occur in structures

- The consistency of the hillwash is loose and the gravel content varies considerably, therefore it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking.

- The consistency and composition of the nodular ferricrete vary considerably; therefore it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking.

- Although the overall consistency of the very soft rock granite is firm to stiff, soft patches are present. Therefore it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking.

11.2 Excavatability

The back actor refused at an average depth of 1,6 meters. The presence of the fill on the south-western part of the site should be noted.

11.3 Construction material

The hillwash and nodular ferricrete classifies as A-1-b. The Plasticity Index and Grading Modulus of the materials were used to assess the suitability of the materials as construction material (TRH 14). It should be noted that due to variations in the composition, the classification is expected to vary as well.

11.4 Groundwater

A periodical, shallow perched water table, which could cause the flooding of excavations, is expected to be present on the site during and after high rainfall. This is confirmed by the presence of pedogenic material.

12. GEOTECHNICAL CLASSIFICATION

The site was classified according to the Geotechnical Classification for Urban Development (after Partridge, Wood and Brink 1993). The criteria for the classification are shown in the following table:

GEOTECHNICAL CLASSIFICATION FOR URBAN DEVELOPMENT (after Partridge, Wood and Brink 1993)

	CONSTRAINT	MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness	Any collapsible horizon or consecutive horizons totalling a depth of more than 750 mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5 meters below surface	Permanent or perched water table less than 1,5 meters below surface	Swamps or marshes
C	Active soil	Low soil heave predicted	Moderate soil heave predicted	High soil heave predicted
D	Highly compressible soil	Low soil compressibility expected	Moderate soil compressibility expected	High soil compressibility expected
E	Erodibility of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of total volume
G	Undermined ground	Undermining at a depth greater than 100 m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 100 m below surface where stope closure has ceased	Mining within less than 100 m of surface or where total extraction mining has taken place
H	Instability in areas of soluble rock	Possibly unstable	Probably unstable	Known sinkholes and dolines
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less 2 degrees (all other regions)	More than 18 degrees (Natal and western Cape) More than 12 degrees (all other regions)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100 cm/s^2 within 50 years	Mining induced seismic activity more than 100 cm/s^2	Natural seismic activity more than 100 cm/s^2
L	Areas subject to flooding	A “most favourable” situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

Based on the above, the site is classified as 2A 1/2B 1C 2D 2E 1/2F 1I

13. NHBRC ZONING

Due to the consistency and the variation in the composition of the hillwash and nodular ferricrete and due to the presence of soft patches of clay in the very soft rock granite, collapse / settlement is expected if structures are founded on these material. The average thickness of this material is more than one meter (average 1,3meters), the collapse / settlement of this material could however not be quantified due to the consistency, the composition and the variation in composition and consistency. Therefore the site is zoned as C2-S2. The presence of the shallow perched water table is accommodated by adding a zoning of P(Perched water table). Due to the presence of fill and building rubble a zoning of P(Fill/rubble) is added.

The site is zoned as NHBRC Zone P(Perched water table, Fill/rubble)-C2-S2

It is important to note that since the investigation was done for township establishment the zoning is based on the profiling of test pits and the interpolation of information between test pits, therefore it is possible that variations from the expected conditions can occur. The zoning is shown on Figure 3.

14. CONCLUSIONS AND RECOMMENDATIONS

It is important to note that the recommendations are based on the profiling of test pits and the interpolation of information. It is therefore possible that variations from the expected conditions can occur.

14.1 Foundations

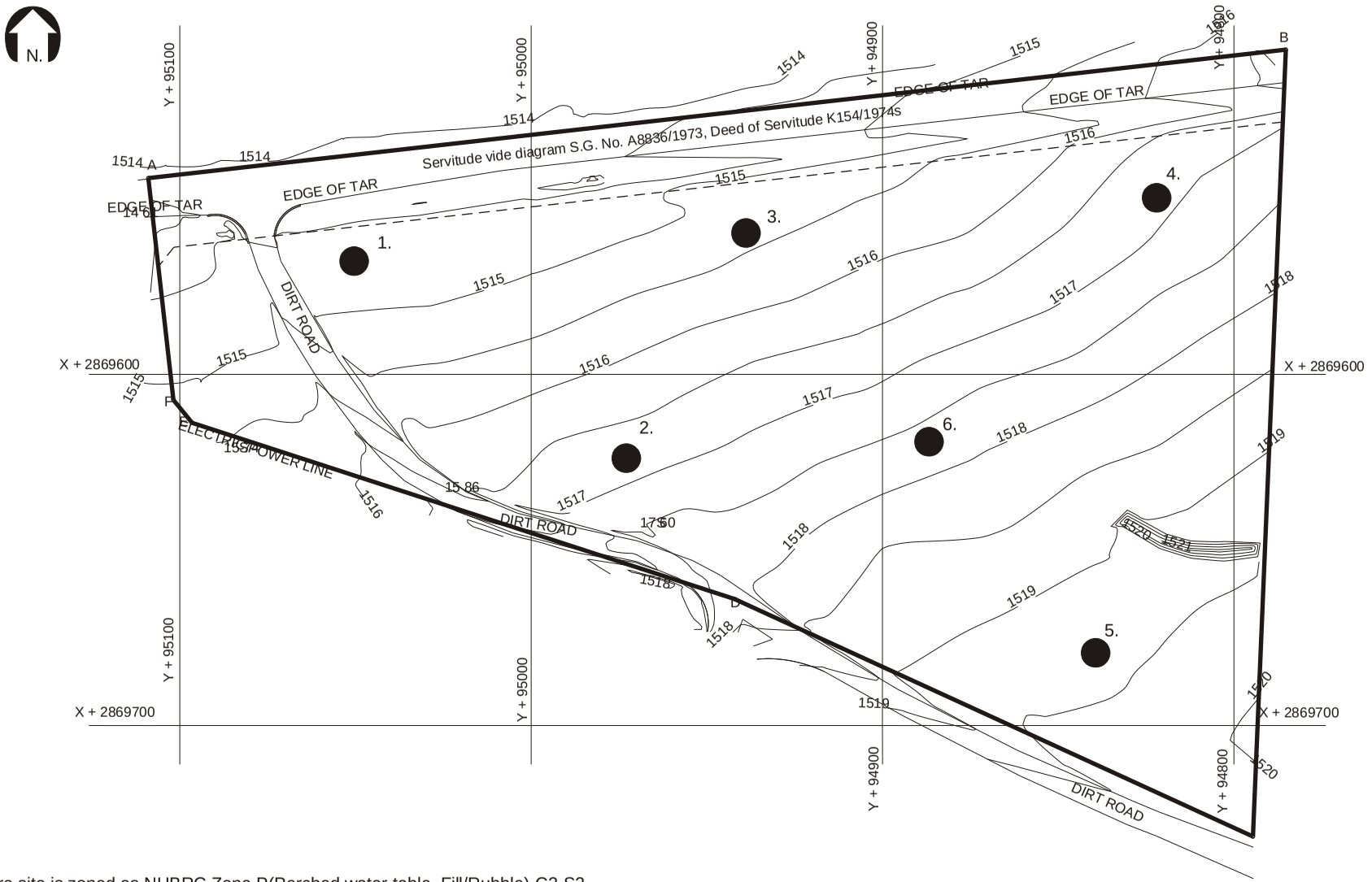
It is recommended that the fill and building rubble be removed. Collapse and/or settlement are expected if structures are founded on the hillwash, nodular ferricrete and very soft rock granite. Therefore these materials are considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

- *Deep strip footings:*
  Found structures on the soft rock granite at an average depth of 1,6 meters, below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

- *Stiffened strip footings, stiffened or cellular raft:*
  Found structures on stiffened strip footings or a stiffened or cellular raft with lightly reinforced masonry. The bearing pressure should not exceed 50 kPa and floor slabs should be reinforced.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled



The entire site is zoned as NHBRC Zone P(Perched water table, Fill/Rubble)-C2-S2

The zoning is based on the profiling of test pits and the interpolation of information between test pits.
Therefore a conservative approach to the use of boundaries of the zones is recommended.

NHBRC ZONING	SCALE 1 : 1 750	FIGURE 3

with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Piled or pier foundations:*
  Found structures on piled or pier foundations with reinforced ground beams or solid slabs on piled or pier foundations.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.3 Excavatability

The excavatability of the materials encountered on the site was evaluated according to the South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches). The excavatability is considered to classify as "soft to intermediate" up to at least an average depth of 1,5 meters. However the presence (although localized) of building rubble should be noted. *It is important to note that the evaluation is based primarily on the profiling of test pits and the interpolation of information between test pits. It is therefore possible that variations from the expected conditions can occur.*

14.4 Geohydrology

All excavations should be provided with adequate drainage, specific attention should be given to the fuel tanks. Structures should be provided with damp proofing and provision should be made to prevent the ingress of water into– and below foundations.

14.5 Construction material

The laboratory test results show that the hillwash and nodular ferricrete could be suitable as fill, selected subgrade and subbase. *It is recommended that the suitability of material that is to be used, be confirmed by detailed laboratory testing.*

14.6 Services

Due to the expected corrosivity, it is recommended that all services be protected.

14.7 Stability of excavations

It is recommended that all excavations be cut back or shored.

14.8 General recommendations

Water has a significant influence on the behaviour of the in-situ material. To reduce differential movements of structures it is necessary to maintain moisture equilibrium under the structures. Therefore it is recommended that the following measures regarding drainage around structures be implemented:

- No accumulation of surface water must be allowed around the perimeter of the structures and the entire development must be properly drained.

- Down pipes should discharge into a lined or precast furrow. This furrow should discharge the water 1,5 meters away from the foundation onto a paved or grassed

surface sloping away from the building.

C Preferably, if no gutters or paving is to be provided around structures, a 1,5 meter wide sealed concrete apron should be cast along the perimeter of the structures the water must be channeled away from the foundation.

C Leaks in water bearing services should be attended to without undue delay.

C No large shrubs or trees should be planted closer to structures than the distances provided in the following Table:

DESCRIPTION	**MATURE HEIGHT OF TREE**		
	Up to 8m	**8m tot 15m**	**Over 15m**
Buildings other than single storey buildings of lightweight construction	-	0.5	1,2
Single storey buildings of lightweight construction (e.g. timber framed)	-	0.7	1,5
Free standing masonry walls	-	1,0[1] 0,5[2]	2,0[1] 1,0[2]
Drains and underground services • less than 1 meter deep • more than 1 meter deep	 0,5 -	 1,5 1,0	 3,0 2,0

Note:
1) These distances will generally avoid all direct damage
2) These distances assume that some movement and minor damage, which may be tolerated, might occur.

This table provides guidance on the acceptable proximity of young trees or new planting to allow for future growth. This table should not be taken to imply that construction work can occur at the specified distances from existing trees; as such work might damage the tree, or render it

L.J Kruger Pr. Sci. Nat.

15. REFERENCES

- "Guidelines for Urban Engineering Geological Investigations", SAIEG & SAICE, 1995
- "Home Building Manual Part 1 & 2", National Home Builders Registration Council, 1999
- "Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa", Jennings Brink and Williams, The Civil Engineer in SA, 1973
- "The Prediction of Soil Heave from the Plasticity Index and Percentage Clay Fraction of Soils", D.H van der Merwe, The Civil Engineer in South Africa, 1964
- "A Guide to Construction on or with Materials Exhibiting Additional Settlement due to Collapse of Grain Structure", Jennings and Knight 1975
- "A Short Workshop on Suggested Interpretation Techniques of Soil Movement with Emphasis on Heave and Collapse Conditions": SAIEG, 1999
- "The Engineering Geology of Southern Africa", Volumes 1, 2 , 3 and 4, A.B.A Brink
- "Soil Survey for Engineering", Brink, Partridge & Williams
- South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches) SABS 1200 DB-1982
- Technical Recommendations for Highways, TRH 14 of 1985

APPENDIX A

SOIL PROFILE

PROJECT: PORTION 243

SITE: KNOPPIESLAAGTE 385 JR

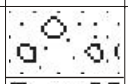
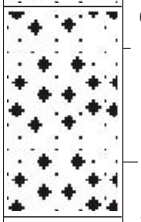
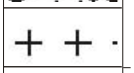
CLIENT: PLAN ASSOCIATES

LOGGED BY: LK

MACHINE: TLB

DATE: 15/02/2013

TEST PIT: 1.

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Moist, light brown, loose, shattered, gravely sand with plant roots - Hillwash
		 0,3	Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete
		 1,3	Slightly moist, orange speckled white and black, very soft rock granite
		1,5	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL/FAX (012) 348 4819

SOIL PROFILE

PROJECT: PORTION 243

SITE: KNOPPIESLAAGTE 385 JR

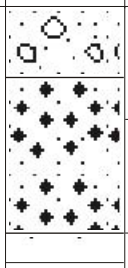
CLIENT: PLAN ASSOCIATES

LOGGED BY: LK

MACHINE: TLB

DATE: 15/02/2013

TEST PIT: 2.

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Moist, light brown, loose, shattered, gravely sand with plant roots - Hillwash
			0,3
			Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete
			1,0
			Slightly moist, orange speckled white and black, very soft rock granite
			1,2
			Refusal on soft rock granite
			No ground water

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SOIL PROFILE

PROJECT: PORTION 243

SITE: KNOPPIESLAAGTE 385 JR

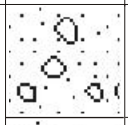
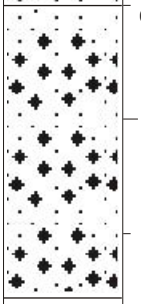
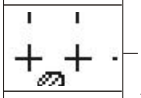
CLIENT: PLAN ASSOCIATES

LOGGED BY: LK

MACHINE: TLB

DATE: 15/02/2013

TEST PIT: 3.

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Moist, light brown, loose, shattered, gravely sand with plant roots - Hillwash
			0,5 Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete
			1,8 Slightly moist, orange mottled grey speckled white and black, very soft rock granite with patches of soft silty clay
			2,2 Refusal on soft rock granite No ground water

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SOIL PROFILE

PROJECT: PORTION 243

SITE: KNOPPIESLAAGTE 385 JR

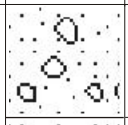
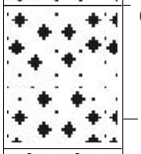
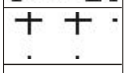
CLIENT: PLAN ASSOCIATES

LOGGED BY: LK

MACHINE: TLB

DATE: 15/02/2013

TEST PIT: 4.

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Moist, light brown, loose, shattered, gravely sand with plant roots - Hillwash
			0,5 Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete
			1,2 Slightly moist, orange speckled white and black, very soft rock granite
			1,4 Refusal on soft rock granite No ground water

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SOIL PROFILE

PROJECT: PORTION 243

SITE: KNOPPIESLAAGTE 385 JR

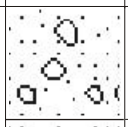
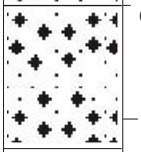
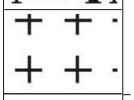
CLIENT: PLAN ASSOCIATES

LOGGED BY: LK

MACHINE: TLB

DATE: 15/02/2013

TEST PIT: 5.

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Moist, light brown, loose, shattered, gravely sand with plant roots - Hillwash
			0,5 Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete
			1,2 Slightly moist, orange speckled white and black, very soft rock granite
			1,5 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL/FAX (012) 348 4819

SOIL PROFILE

PROJECT: PORTION 243

SITE: KNOPPIESLAAGTE 385 JR

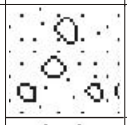
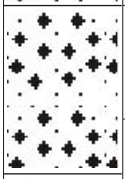
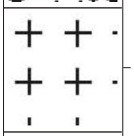
CLIENT: PLAN ASSOCIATES

LOGGED BY: LK

MACHINE: TLB

DATE: 15/02/2013

TEST PIT: 6.

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Moist, light brown, loose, shattered, gravely sand with plant roots - Hillwash
			0,5 Moist to slightly moist, brown becoming mottled black and red, loose, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and small quartz pebbles - Nodular ferricrete
			1,3 Slightly moist, orange speckled white and black, very soft rock granite
			Refusal on soft rock granite
			1,8 No ground water

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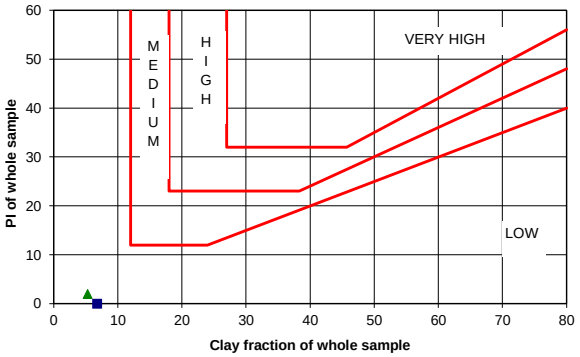
APPENDIX B

PARTICLE SIZE ANALYSIS

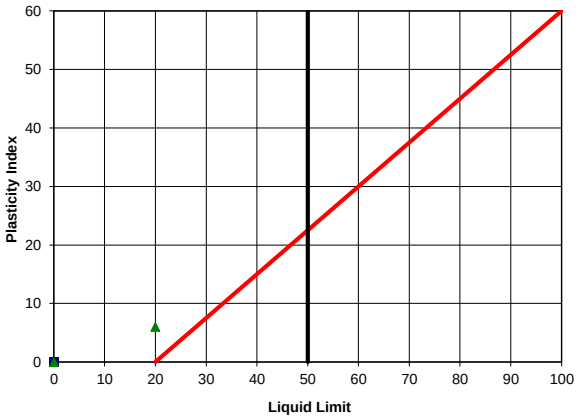
Sample No.	KL1	KL2
Soillab sample no.	S13-0206-1	S13-0206-2
Depth (m)		
Position		
Material Description	LIGHT GREY FERRICRETE+QUARTZ GRAVELLY SAND	DARK R BROWN FERRICRETE+QUARTZ SANDY GRAVEL
Moisture (%)		
Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	97	93
4.75 mm	77	70
2.00 mm	64	53
0.425 mm	42	33
0.075 mm	20	17
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	14	13
0.027 mm	13	11
0.013 mm	11	9
0.005 mm	8	7
0.002 mm	7	5
% Clay	7	5
% Silt	11	10
% Sand	46	37
% Gravel	36	47
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		20
Plasticity Index	SP	6
Linear Shrinkage (%)	1.0	3.0
Grading Modulus	1.74	1.97
Uniformity coefficient	173	152
Coefficient of curvature	2.0	1.7
Classification	A-1-b (0)	A-1-b (0)
Unified Classification	SM	SM & SC
Chart Reference		

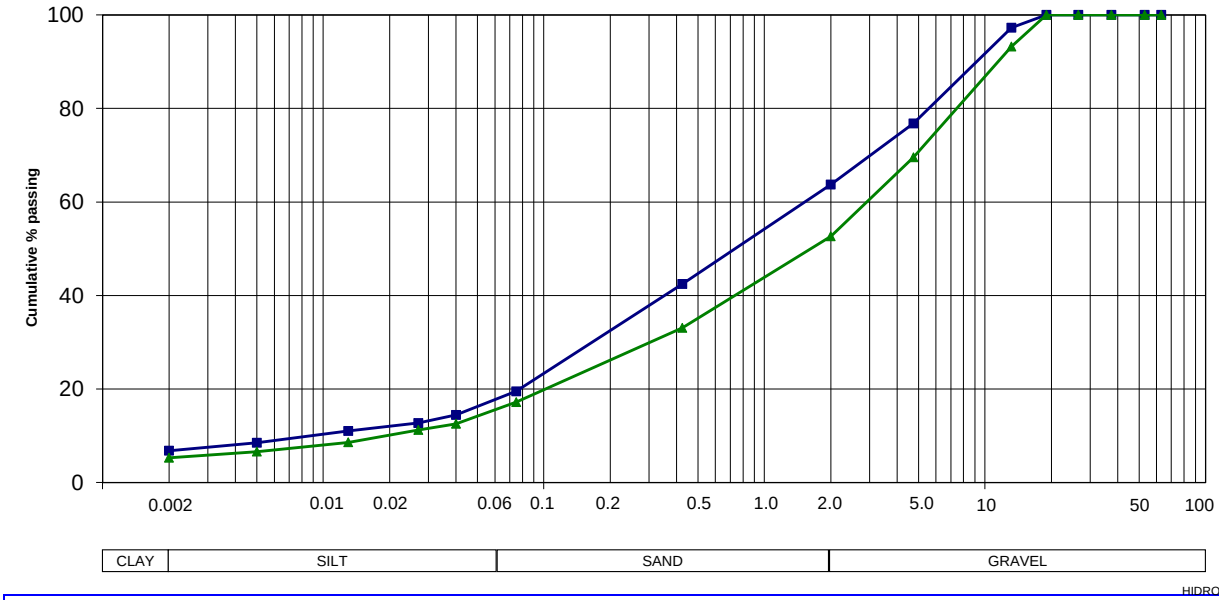
PROJECT : KNOPPIES LAAGTE
JOB No. : S13-0206
DATE : 2013-02-15

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





HIDROMETER/0206-01

SOILLAB (PTY) LTD
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La Montagne 0184
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P O Box 72928
Lynnwood Ridge 0040
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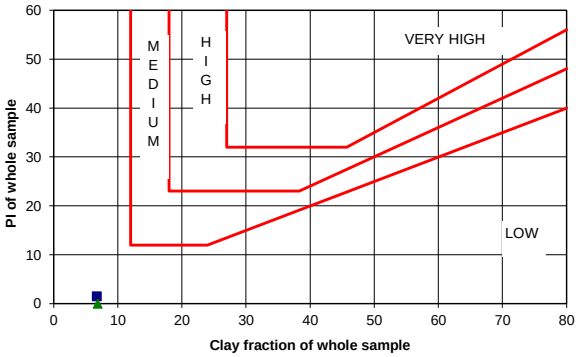
PARTICLE SIZE ANALYSIS

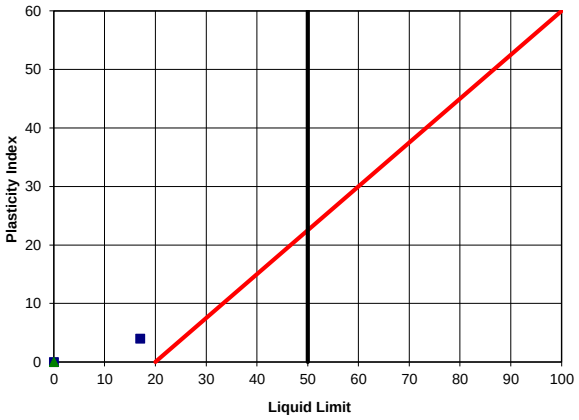
Sample No.	KL3	KL4
Soillab sample no.	S13-0206-3	S13-0206-4
Depth (m)		
Position		
Material Description	DARK BROWN FERRICRETE+QUARTZ SANDY GRAVEL	DARK BROWN FERRICRETE+QUARTZ GRAVELLY SAND
Moisture (%)		
Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	94	94
4.75 mm	68	77
2.00 mm	57	69
0.425 mm	37	43
0.075 mm	18	17
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	14	14
0.027 mm	13	12
0.013 mm	10	10
0.005 mm	8	9
0.002 mm	7	7
% Clay	7	7
% Silt	9	9
% Sand	41	53
% Gravel	43	31
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit	17	
Plasticity Index	4	SP
Linear Shrinkage (%)	2.0	1.0
Grading Modulus	1.88	1.72
Uniformity coefficient	186	106
Coefficient of curvature	1.4	2.5
Classification	A-1-b (0)	A-1-b (0)
Unified Classification	SM & SC	SM
Chart Reference		

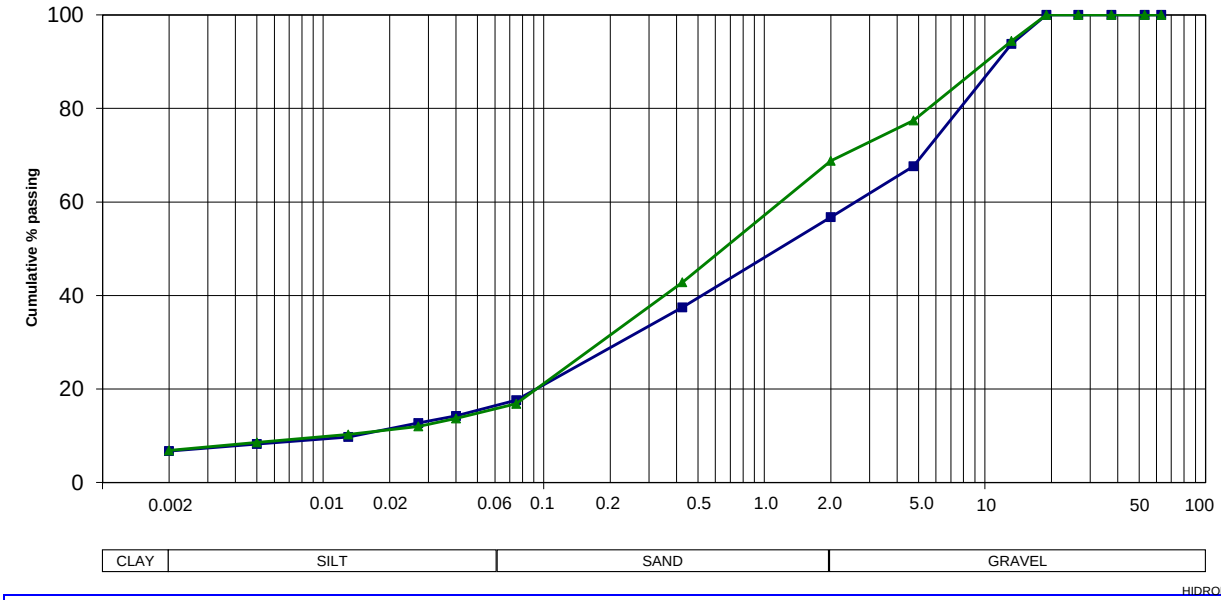
PROJECT : KNOPPIES LAAGTE
JOB No. : S13-0206
DATE : 2013-02-15

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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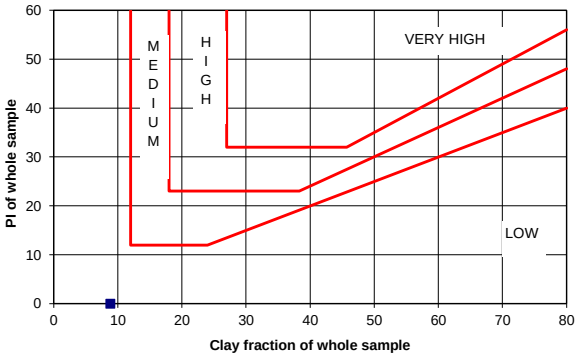
PARTICLE SIZE ANALYSIS

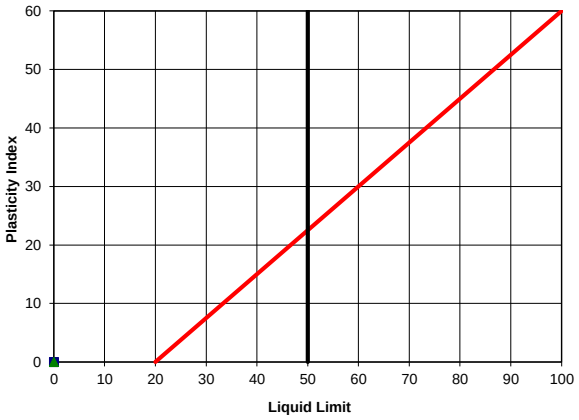
Sample No.	KL5	
Soillab sample no.	S13-0206-5	
Depth (m)		
Position		
Material Description	DARK BROWN QUARTZ GRAVELLY SAND	
Moisture (%)		
Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	
53.0 mm	100	
37.5 mm	100	
26.5 mm	100	
19.0 mm	100	
13.2 mm	99	
4.75 mm	97	
2.00 mm	86	
0.425 mm	55	
0.075 mm	23	
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	19	
0.027 mm	17	
0.013 mm	13	
0.005 mm	11	
0.002 mm	9	
% Clay	9	
% Silt	12	
% Sand	65	
% Gravel	14	
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	SP	
Linear Shrinkage (%)	1.0	
Grading Modulus	1.36	
Uniformity coefficient	167	
Coefficient of curvature	7.0	
Classification	A-2-5 (0)	
Unified Classification	SM	
Chart Reference		

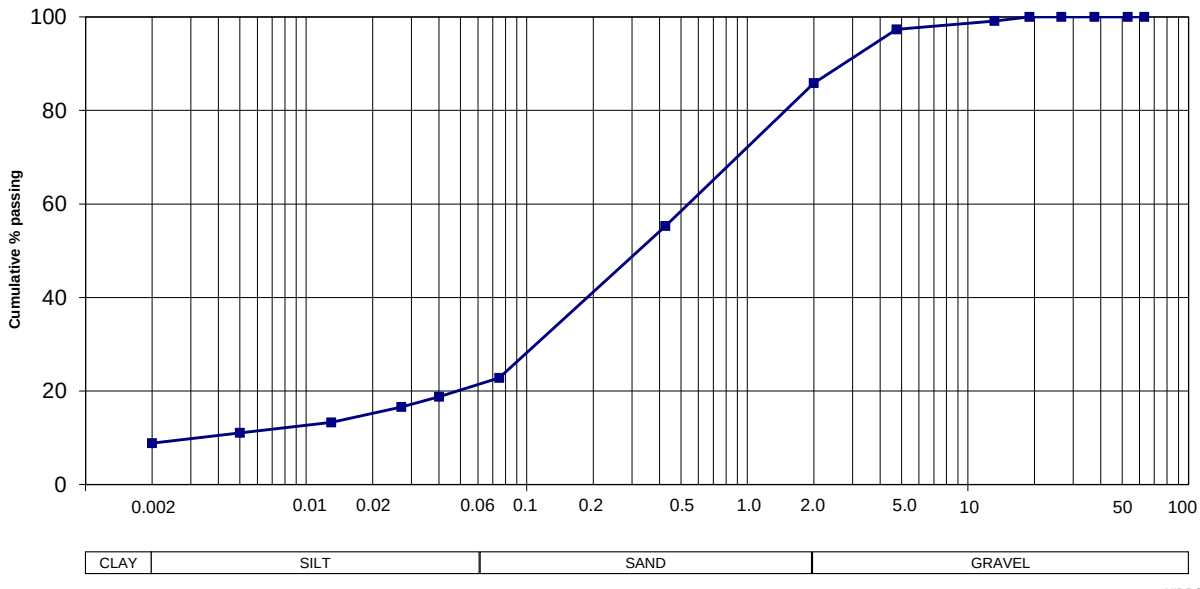
PROJECT : KNOPPIES LAAGTE
JOB No. : S13-0206
DATE : 2013-02-15

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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