

**A PHASE ONE GEOTECHNICAL REPORT ON THE REMAINDER OF THE
FARM PALMIETFONTEIN 3750 IN DANNHAUSER FOR A PROPOSED NEW
INDUSTRIAL TOWNSHIP ESTABLISHMENT**

Report Number: 2019/J018/KVD



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EXECUTIVE SUMMARY

Based on the findings of this investigation, the following issues must be taken into account:

- *Geology*: The site is underlain by the Vryheid Formation of the Ecca Group (Karoo Supergroup), with a dolerite intrusion along the western boundary of the site. The Vryheid Formation was verified by residual materials, while the dolerite was confirmed in bedrock outcrop.
- *Soil Profiles*: Soil profiles in the study area are generally characterised by successive horizons of residual sandstone or successive horizons of residual dolerite. Colluvial cover and fill materials are largely surficial, while bedrock outcrop (i.e. dolerite) also occurs with limited or no soil cover.
- *Groundwater*: Perched groundwater or seepage water is expected to occur on a seasonal basis and may prove problematic for founding and construction. The severity and extent of possible seepage water remain to be verified by specialist studies.
- *Founding Conditions*: The study area is divided into three geotechnical zones (**H3**, **H1/S2** and **S1/R**). Additional geotechnical problems were identified and discussed separately which must be taken into account for the proposed development. Detailed site and stand zoning must be verified during a phase two investigation and the outcome of a groundwater study may affect the geotechnical zoning of the property.
- *Conditions of Excavation*: Conditions of excavation are largely dominated by cohesive soils and the occurrence of dolerite corestones. The latter severely impeded excavation by backhoe. Excavation by backhoe proved feasible to depths between 700mm and 2600mm.
- *Corrossivity*: All materials tested proved to be extremely corrosive. While colluvial materials are considered corrosive on account of its acidity, the remaining soils are corrosive due to high conductivity.
- *Historic Monuments*: To the author's knowledge there are no historic monuments on the site. That being stated, dated topographical information suggests that a number of structures on prevailed on the study area.
- *Undermining*: The area is not subject to undermining.
- *Cemetery Sites*: No graves or cemeteries were encountered during the site investigation.
- *Dolomite Stability*: The site is not subject to a dolomite stability investigation.
- *Seismicity*: A 10% probability exists that an earthquake with Peak Ground Acceleration of 0.06g to 0.10g may take place once in 50 years.

Table of Contents

1 INTRODUCTION	5
1.1 Appointment	5
1.2 Scope of the Investigation.....	5
2 AVAILABLE INFORMATION	6
3 SITE DESCRIPTION	6
3.1 Site Location.....	6
3.2 Topography and Drainage.....	6
3.3 Vegetation.....	8
3.4 Climate and Weather Conditions	8
4 EXISTING FACILITIES	8
5 SITE INVESTIGATION	9
5.1 Trial Holes	9
5.2 Materials Tests	9
6 DISCUSSION.....	13
6.1 Regional Geology	13
6.2 Soil Profiles.....	13
6.3 Groundwater.....	18
6.4 Geotechnical Zoning.....	18
6.5 Conditions of Excavation.....	22
6.6 Seismicity	27
6.7 Soil Corrossivity.....	27
6.8 Other Considerations	29
7 CONCLUSIONS	29
8 RECOMMENDATIONS.....	30
8.1 Proposed Development and Structural Recommendations	30
8.2 Conditions of Excavation.....	33
8.3 Seismicity	34
8.4 Soil Corrossivity.....	34
8.5 Other Recommendations.....	34

9 SOURCES OF REFERENCE.....	34
APPENDIX A: TRIAL HOLE LOG SHEETS.....	36
APPENDIX B: MATERIAL TEST RESULTS.....	56



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PALMIETFONTEIN 3750 IN DANNHAUSER FOR A PROPOSED NEW INDUSTRIAL TOWNSHIP
ESTABLISHMENT**

1 INTRODUCTION

1.1 Appointment

Soilkraft cc was appointed by Mr Samuel Chauke on behalf of KV Development Group (Pty) Ltd to conduct a geotechnical investigation on the remainder of the farm Palmietfontein 3750, outside of Dannhauser, KwaZulu-Natal. The investigation forms part of the requirements for the proposed establishment of a new industrial township.

The purpose of the investigation was to:

- assess the suitability of the site for the proposed township establishment
- identify possible relevant geotechnical constraints
- propose preliminary and general recommendations regarding the founding of structures
- comment on any matters related to the geotechnical conditions

1.2 Scope of the Investigation

The report is compiled in such a way that it comprises a phase one geotechnical investigation, as described by the SANS634 specification for township establishment. The investigation therefore does not constitute a phase two, structure-specific or stand-specific investigation.

2 AVAILABLE INFORMATION

The following sources of information were consulted:

- 1 : 50 000 scale topographical map: 2830AA Dundee, published in 1982
- 1 : 250 000 scale geological map: 2830 Dundee, published in 1988
- Existing geotechnical investigation reports undertaken in the Dundee area

3 SITE DESCRIPTION

3.1 Site Location

The study area is located on the remainder of the farm Palmietfontein 3750, on the outskirts of Dannhauser, KwaZulu-Natal. The property is under the management and ownership of the Dannhauser Municipality and measures some 19ha in size. Geographically the study area lies east of the town, and east of the Dannhauser Railway station and the railway itself.

Site access can be obtained via Railway Street or Old Cambrian Road. These roads form the western and northern boundaries of the study area, respectively. To the south and east the site is bordered by open, vacant land. The study area is not fenced and access is readily available.

Pedestrian and vehicular movement is relatively easy across the study area, except in the south western part which is rocky and has a fairly steep gradient in places. This impedes vehicular movement significantly.

Figure 1 illustrates the approximate position of the study area.

3.2 Topography and Drainage

A topographical site survey plan provided by the client shows that the study area is situated between elevations of 1355m and 1373m above mean sea level. The majority of the site dips towards the north west at a gentle gradient. However, the western corner of the site has a fairly steep gradient characterised by bedrock outcrop. In addition, a localised northern part of the study area dips towards the north. Apart from these exceptions, the study area can be described as consisting of low undulating plains.

Drainage takes place by means of sheet wash and infiltration. Topographical information indicates a non-perennial stream to the east of the study area, while at least one erosion channel was observed in the northern part of the study area (between trial holes one and two). Surface drainage is dictated by the prevailing site topography.

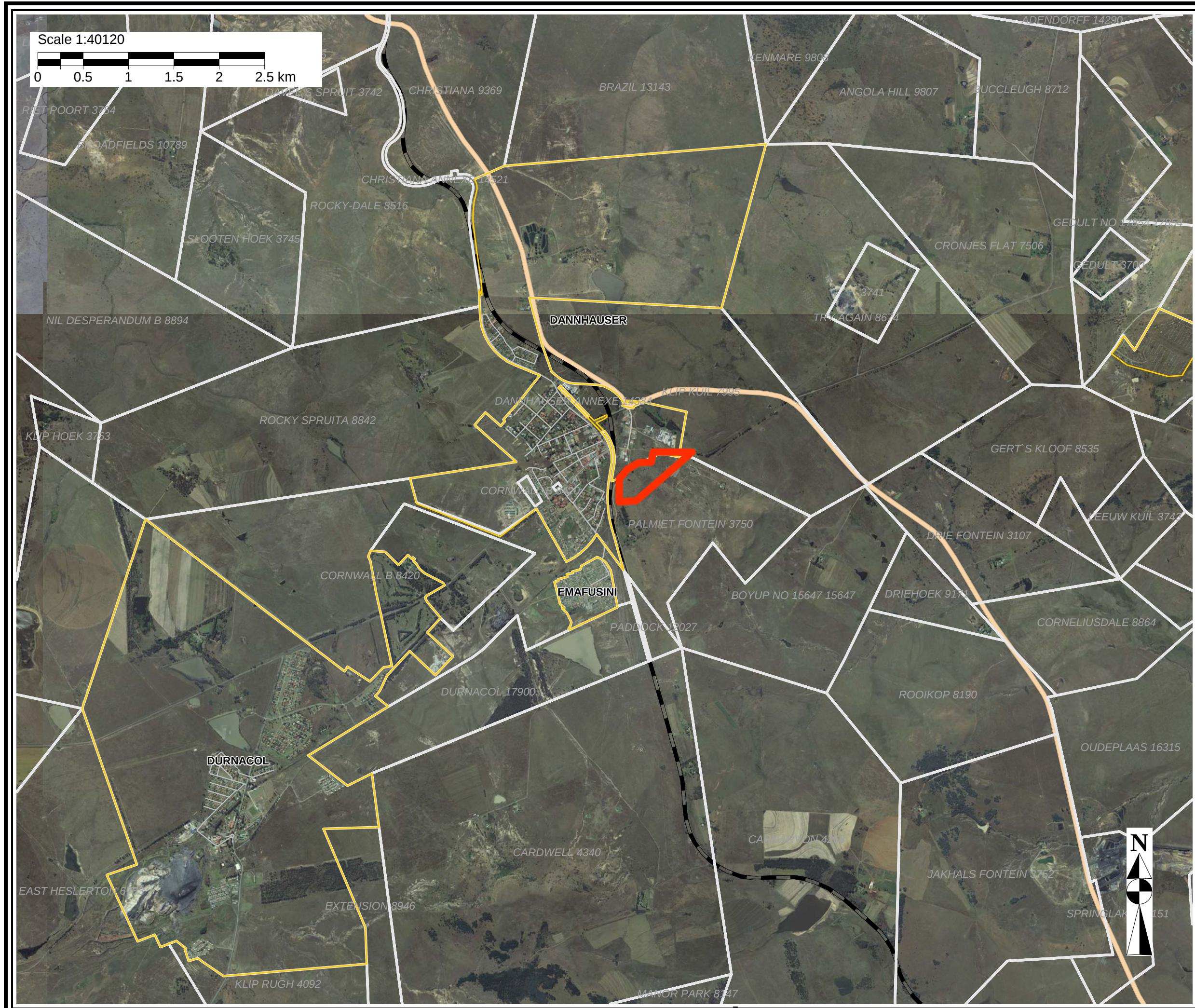


FIGURE 1

Legend

-  Railway
-  Secondary Roads
-  Study Area



TAAK:	REMAINDER OF THE FARM
JOB NAME:	PALMIETFONTEIN 3750
KLIËNT:	KV DEVELOPMENT GROUP
CLIENT:	
TEKENING NO:	SITE LOCALITY PLAN
DRWING NO:	
DATUM:	11 JULY 2019
DATE:	

Site observations further suggest that drainage may be problematic on a seasonal basis and that surface water accumulation may occur. At least one localised depression was found to be filled with water and it should be considered that the investigation was conducted in the middle of winter, when such conditions are most likely to be absent. A further indicator of poor drainage is a trench excavated along the north western most boundary of the site, which appears to serve as a cut-off trench. This will be discussed in more detail later in the report.

3.3 Vegetation

According to Mucina and Rutherford^{Reference 9.1}, the site hosts vegetation associated with the Northern Kwa-Zulu Natal Moist Grassland. The vegetation type is considered vulnerable and as suggested by the name, consists mostly of grass species such as *Themeda triandra* and *Hyparrhenia hirta*. Scattered *Acacia* trees and shrubs also occur.

Site conditions largely complied with the regional description, though scattered clusters of eucalyptus trees occurred on the western side of the study area. Topographical information also indicates that parts of the site was previously used for agriculture and was cultivated, but this has not been the case for a number of decades.

3.4 Climate and Weather Conditions

The site is located in an area with an approximate Weinert N-value between 1.8 and 2.3 and a Thornthwaite Moisture Index very close to 0. Average rainfall in the region is estimated by Mucina and Rutherford^{Reference 9.1} at 836mm, along with a mean annual temperature of 16.2°C.

With the above in mind the area may thus be described sub-humid. This signifies that chemical weathering of rock material will take place, rather than mechanical breakdown thereof, resulting in the formation of active clays if suitable parent material is available. Minerals such as amphiboles, pyroxenes and olivine are particularly susceptible to this type of weathering. That being stated, the effects of mechanical weathering cannot be disregarded, particularly where brittle materials are involved.

4 EXISTING FACILITIES

At the time of the investigation, the study area consisted of vacant, open land. Though topographical maps show that there were scattered structures on the property at some point in the past, no structures were found during the investigation.

As far as infrastructure is concerned, a defunct overhead telephone line crosses the eastern most part of the site. In addition, three separate overhead powerlines are also present on the site. One

powerline is found just inside the northern boundary of the study area, while the remaining two lines are found near the western boundary.

Photo 1: Site Conditions shows typical site conditions at the time of the site investigation.

5 SITE INVESTIGATION

5.1 Trial Holes

Site investigation was done by means of conventional trial holes and was undertaken on 14 June 2019. A total of eighteen trial holes were excavated across the study area and the positions of these trial holes were determined prior to undertaking site work, so as to ensure that the entire area is investigated in a representative fashion. The trial holes were excavated with the aid of a Hidromek HMK102B backhoe arranged by the client and supplied by Tony's Tool Hire in Dundee.

Only one part of the site proved difficult to access for trial hole excavation. The western and south western part of the site was characterised by a steep gradient and rocky conditions (or bedrock outcrop). The placement of trial holes is illustrated in Figure 2.

Trial holes were entered, inspected, profiled and periodically sampled by a professionally registered engineering geologist according to current specifications. For the non-geotechnical reader, these guidelines are summarised in the attached Table 1: Soil Profiling Parameters and the trial hole profile descriptions are included in Appendix A. The profile descriptions reflect the impressions created by the pedological conditions and may vary from the results of the soil tests.

5.2 Materials Tests

Material samples were collected from trial holes across the entire site in a representative fashion. The samples were delivered to Specialised Testing Laboratory (Pty) Ltd in Pretoria for analyses. STL is a SANAS accredited geotechnical laboratory. The tests performed as part of this investigation included the following:

- Foundation indicator tests were performed to determine the general geotechnical properties of soil materials. The test includes a grading analysis, hydrometer analysis and the determination of Atterberg Limits. Results are also used to estimate the materials' expansiveness empirically.
- Soil chemistry tests were done by assessing the soil paste acidity (i.e. pH) and conductivity. This is done to determine the corrosivity of soil materials, as it may affect the rate of corrosion of metallic services and utilities installed below ground level (e.g. pipes, joins, anchor poles, etc.).
- A single undisturbed block sample was collected to assess properties of material settlement. In this case the sample was used for a consolidation test in order to determine the total settlement that is expected during loading.



SITE CONDITIONS

PHOTO 1

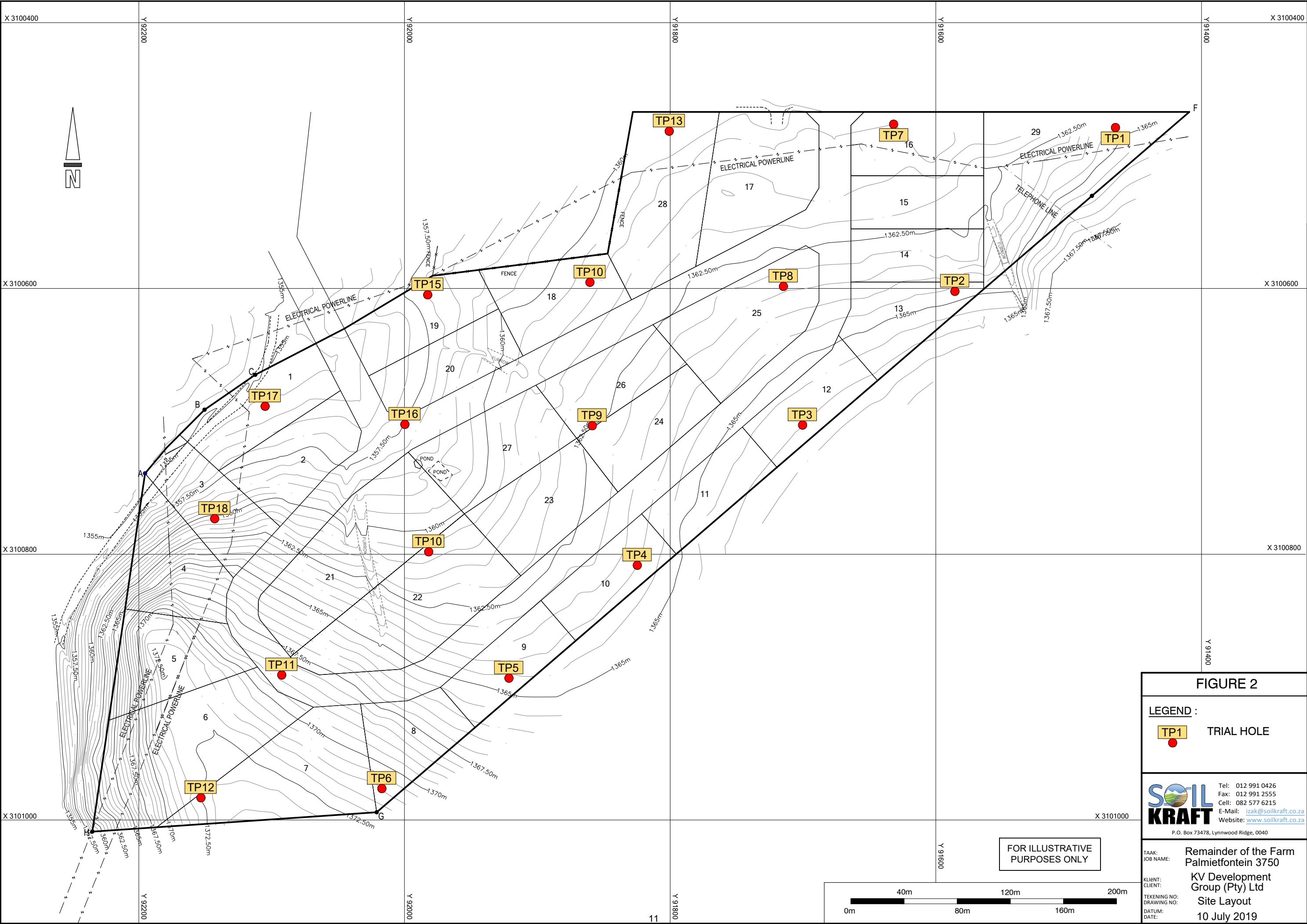


FIGURE 2

LEGEND :

TP1 TRIAL HOLE

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TAAK: Remainder of the Farm
JOB NAME: Palmietfontein 3750
KLIENT: KV Development
CLIENT: Group (Pty) Ltd
TEKENING NO: Site Layout
DRAWING NO:
DATUM: 10 July 2019
DATE:

TABLE 1: SOIL PROFILING PARAMETERS

CONSISTENCY : GRANULAR SOILS

CONSISTENCY : COHESIVE SOILS

SPT N	GRAVELS & SANDS Generally free draining soils			DRY DENSITY (kg/m ³)	SPT N	SILTS & CLAYS and combinations with SANDS. Generally slow draining soils			UCS (kPa)
<4	Very loose	Crumbles very easily when scraped with geological pick.		<1450	<2	Very soft	Pick point easily pushed in 100mm. Easily moulded by fingers.		<50
4-10	Loose	Small resistance to penetration by sharp pick point.		1450-1600	2-4	Soft	Pick point easily pushed in 30mm to 40mm. Moulded by fingers with some pressure.		50-125
10-30	Medium dense	Considerable resistance to penetration by sharp pick point.		1600-1750	4-8	Firm	Pick point penetrates to 10mm. Very difficult to mould with fingers.		125-250
30-50	Dense	Very high resistance to penetration by sharp pick point. Requires many blows by pick point for excavation.		1750-1925	8-15	Stiff	Slight indentation by pick point. Cannot be moulded by fingers. Penetrated by thumb nail.		250-500
>50	Very dense	High resistance to repeated blows of geological pick. Requires power tools for excavation.		>1925	15-30	Very stiff	Slight indentation by blow of pick point. Requires power tools for excavation.		500-1000

SOIL TYPE

SOIL TYPE	PARTICLE SIZE (mm)
Clay	<0.002
Silt	0.002-0.06
Sand	0.06-2.0
Gravel	2.0-60.0
Cobbles	60.0-200.0
Boulders	>200.0

MOISTURE CONDITION

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

SOIL STRUCTURE

COLOUR			
Speckled	Very small patches of colour <2mm	Intact	No structure present.
Mottled	Irregular patches of colour 2-6mm	Fissured	Presence of discontinuities, possibly cemented.
Blotched	Large irregular patches 6-20mm	Slickensided	Very smooth, glossy, often striated discontinuity planes.
Banded	Approximately parallel bands of varying colours	Shattered	Presence of open fissures. Soil break into gravel size blocks.
Streaked	Randomly orientated streaks of colour	Micro shattered	Small scale shattering, very closely spaced open fissures. Soil breaks into sand size crumbs.
Stained	Local colour variations : Associated with discontinuity surfaces	Residual structures	Residual bedding, laminations, foliations etc.

ORIGIN

Transported	Alluvium, hill wash, talus etc.
Residual	Weathered from parent rock e.g. residual granite
Pedocretes	Ferricrete, silcrete, calcrete etc.

DEGREE OF CEMENTATION OF PEDOCRETES

TERM	DESCRIPTION	UCS (MPa)
Very weakly cemented	Some material can be crumbled between finger and thumb. Disintegrates under knife blade to a friable state.	0.1-0.5
Weakly cemented	Cannot be crumbled between strong fingers. Some material can be crumbled by strong pressure between thumb and hard surface. Under light hammer blows disintegrate to a friable state.	0.5-2.0
Cemented	Material crumbles under firm blows of sharp pick point. Grains can be dislodged with some difficulty by a knife blade.	2.0-5.0
Strongly cemented	Firm blows of sharp pick point on hand-held specimen show 1-3mm indentations. Grains cannot be dislodged by knife blade.	5.0-10.0
Very strongly cemented	Hand-held specimen can be broken by single firm blow of hammer head. Similar appearance to concrete.	10.0-25.0

The results of the soil tests may be found in Appendix B to this report. For easy reference the foundation indicator test results are summarised in the attached Table 2: Results of Soil Tests.

6 DISCUSSION

6.1 Regional Geology

Based on the regional geological map of the area, the study area is largely underlain by the Vryheid Formation (Pv) of the Ecca Group, Karoo Supergroup. The Vryheid Formation typically consists of bedrock materials such as fine to coarse grained sandstone, grey micaceous shale or lenses of coal. The Vryheid Formation has been intruded extensively by dolerite (Jd) in this region and in fact, dolerite intrusions are indicated on the western and southern sides of the study area. No fault lines are indicated in the vicinity of the project area.

Trial holes revealed residual sandstone material in the majority of the trial holes, though no bedrock was reached within excavatable depths. In contrast, dolerite bedrock – in the form of outcrop – was found to form a ridge on the western side of the study area. With this in mind, the site geology complies with the regional description.

The attached Figure 3: Regional Geology Map allows an overview of the geology of the area.

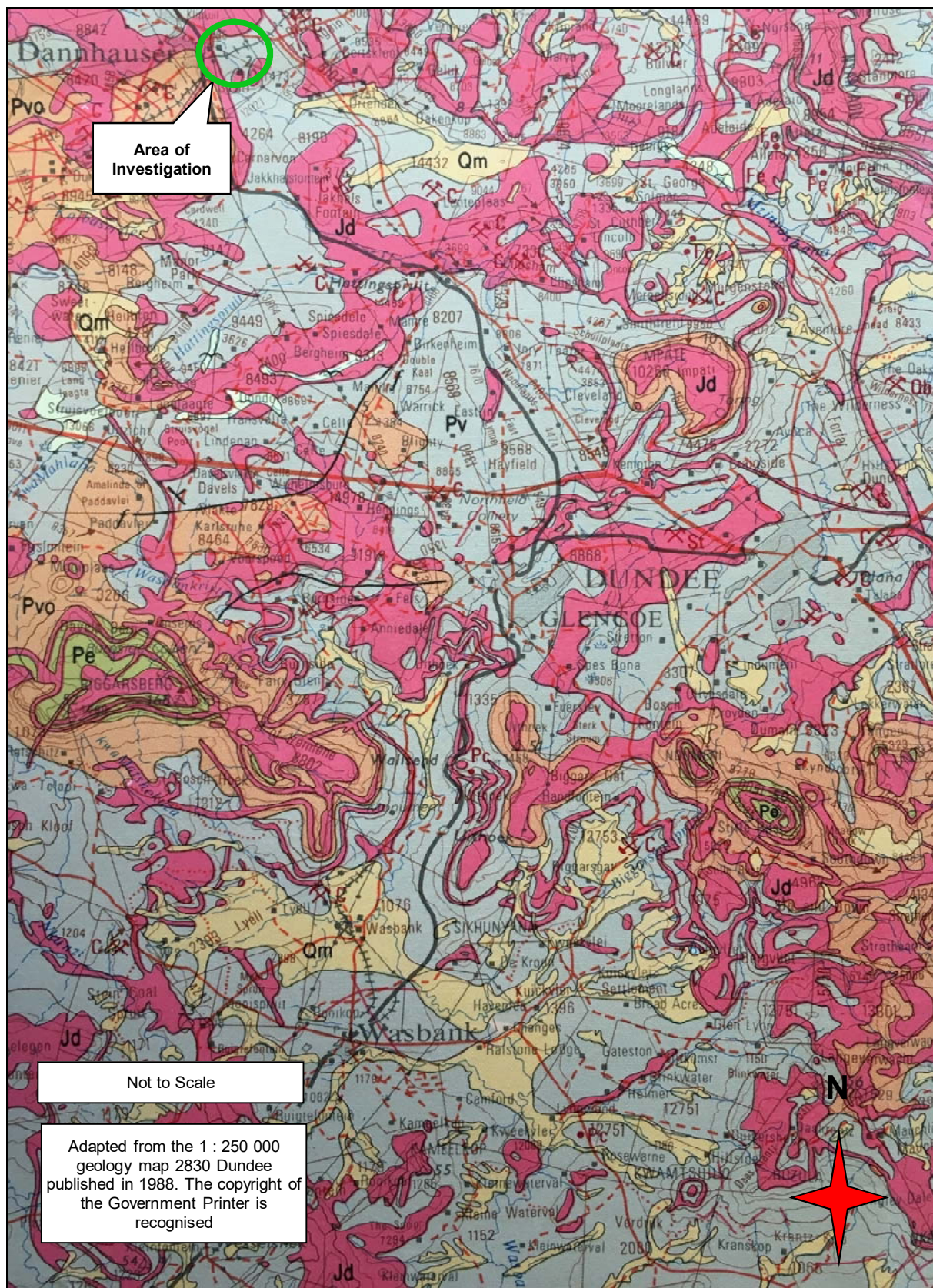
6.2 Soil Profiles

Prior to discussing the geotechnical zoning of the land, it is important to distinguish between the different materials present on site. Table 3 summarises the distribution of the materials and the following horizons were identified:

- *Fill Material:* The fill materials were encountered in limited trial holes; however site observation proved that there are numerous localised pockets of fill or rubble deposited across the study area. While most of the fill deposits are surficial, on some occasions it was found to extend to notable depth in the soil profile. The fill typically consisted of rubble mixed in soil material. Photo 2 shows a typical example of fill material which consisted of a soil matrix but also contained foreign objects such as bottles. The fill material was not sampled due to its mixed composition. Based on the foreign matter included in the fill horizon, it is deduced that some of these materials are at least four or five decades old. Remaining rubble largely consisted of surface dumps of mixed refuse and construction waste (e.g. broken concrete slabs etc.).
- *Colluvium:* The colluvial material encountered on site typically had grey brown or dark grey brown colour and consisted of clayey sand. The horizon mostly had an intact or shattered structure and a medium dense consistency. Material test analysis revealed that the colluvium is moderately expansive with active clay content of 30% and a plasticity index of 22%. The material had a grading modulus of 0.77 and was awarded a PRA classification of A-6.

TABLE 2 : SUMMARY OF SOIL TESTS

TRIAL HOLE NO	SAMPLE NO	DEPTH (mm)	SOIL ORIGIN	SOIL TYPE	GM	PI	LL	% CLAY (<0,002 mm)	ACTIVITY CLASS	pH	CON- DUCTIVITY (S/m)	SOIL CLASS	
												PRA	UNIFIED
1	SKT-84-760	400 - 1500	Colluvium	Clayey sand	0.77	22	40	30	Medium	3.9	0.0370	A-6	CL
3	SKT-84-761	400 - 2000	Residual sandstone 2	Silty clay	0.20	42	67	52	Very high			A-7-6	CH
5	SKT-84-762	800 - 2800	Residual sandstone 1	Silty clay	0.23	45	68	51	Very high	5.4	0.1010	A-7-6	CH
6	SKT-84-763	0 - 700	Residual dolerite 1	Silty sand	0.62	26	54	28	Medium			A-7-6	CH
9	SKT-84-765	600 - 2800	Residual sandstone 1	Sandy clay	0.47	35	53	38	High			A-7-6	CH
13	SKT-84-766	1500 - 2600	Residual dolerite 4	Silty sand	0.90	17	40	8	Low			A-6	SC
15	SKT-84-767	900 - 2500	Residual dolerite 3	Sandy clay	0.42	34	59	43	High to very high	6.0	0.162	A-7-6	CH
17	SKT-84-768	700 - 2100	Residual dolerite 3	Silty clay	0.22	41	67	50	Very high			A-7-6	CH





TYPICAL FILL MATERIAL

PHOTO 2

Table 3 : Material Distribution

Horizon	Trial Holes	Vertical Thickness (mm)
Fill Material	10, 15	900 – 1100
Colluvium	1 - 6, 9, 13, 14, 18	300 – 800
Residual sandstone 1	1 - 5, 9, 10	500 – 2200
Residual sandstone 2	2-5	600 – 1600
Residual dolerite 1	6, 11, 12, 17, 18	700 – 2200
Residual dolerite 2	7, 16	700 – 1300
Residual dolerite 3	7, 8, 13 - 17	700 – 2200
Residual dolerite 4	6, 13	400 - 1100

- *Residual Sandstone 1:* The first residual sandstone horizon identified consisted of silty clay or sandy clay with light grey or light grey brown colour. The horizon was often discoloured orange or black due to ferruginisation. The horizon had a soft to stiff consistency and a slickensided structure on most occasions. The latter is generally an indication of expansive soil and this was confirmed by material test results that suggest that the material is highly to very highly expansive. The results reported active clay contents between 38% and 51%, with associated plasticity indices between 35% and 45%. A PRA classification of A-7-6 was awarded on all occasions, while grading moduli were between 0.23 and 0.47.
- *Residual Sandstone 2:* The second residual sandstone horizon also consisted of silty clay material, but was mostly characterised by darker colours such as dark grey brown or dark grey. The horizon generally had a stiff consistency and a slickensided structure. This material was proven to be very highly expansive by material test analyses. Results reported active clay content and a plasticity index of 52% and 42%, respectively, while the grading modulus was calculated to be 0.20. Lastly, a PRA classification of A-7-6 was awarded.
- *Residual Dolerite 1:* This horizon occurred along the western side of the study area and consisted of distinctive dark red or red brown clayey, silty sand. The horizon had a loose consistency and a voided structure and also contained abundant cobbles and boulders (i.e. corestones) on some occasions. Despite its composition, test results suggest that the material is moderately expansive, with active clay content of 28% and a plasticity index of 26%. Samples were taken in such a way as to deliberately exclude coarse particles (i.e. cobbles and boulders) and the remaining soil matrix had a grading modulus of 0.62 and a PRA classification of A-7-6. A single consolidation test of the material revealed that the material is highly susceptible to consolidation, even at loads as low as 50kPa.
- *Residual Dolerite 2:* The second residual dolerite horizon was found on limited occasions and was easily identifiable by its distinctive black colour. The material was described as sandy clay with a very soft consistency and a slickensided structure, with the latter again being indicative of an expansive soil. However, the material only occurred on limited occasions and as a result, it was not sampled.

- *Residual Dolerite 3:* The penultimate horizon identified was a sandy clay or silty clay which had grey brown or light grey brown colour. The horizon was often discoloured due to ferruginisation. In general this material had a soft or firm consistency and a slickensided structure. As with the majority of the other materials found on the site, this horizon was also proven to be expansive and test results revealed a high to very high affinity to heave. Laboratory analyses recorded active clay contents between 43% and 50%, as well as plasticity indices between 34% and 41%. The fine nature of the material is reflected in its grading moduli, which range from 0.22 to 0.42, while both samples were classified as A-7-6 by the PRA system.
- *Residual Dolerite 4:* The final material identified was only encountered in two trial holes. This residual dolerite consisted of silty sand with variable colour. It was distinguishable in that it was virtually the only material encountered that was of a granular nature. The horizon had an intact structure and a medium dense or dense consistency and also hosted large corestones (i.e. up to 600mm in diameter) on occasion. Test results suggest that the material is not expansive, due to its lack of active clay content (i.e. 8%). The material had a plasticity index of 17% and a grading modulus of 0.90. Lastly, a PRA classification of A-6 was awarded.

6.3 Groundwater

- *Perched Water:* Seepage water was not encountered in any of the trial holes during the investigation; however it must be taken into account that the investigation was undertaken in the middle of the region's dry season. It must also be considered that perched groundwater or seepage water is a strongly seasonal phenomenon which is most dominant between the middle and end of the rainy season, while mostly being absent during the dry season. Observations in trial holes (e.g. extensive ferruginisation) suggest that seasonal seepage water is likely to occur on this site and in fact, one instance of surface seepage was found between trial holes nine and ten. Photo 3 shows a small depression which was found to be filled with what appeared to be seepage water. With this in mind, it is expected that the majority of the site may experience shallow seepage water on a seasonal basis, but the severity and extent thereof remains to be verified.
- *Permanent Water:* Vegter^{Reference 9.2} indicates the probability for drilling successfully for water in the area to be between 40% and 60% but the probability that such a borehole will yield more than 2l/s is between 20% and 30%. Groundwater is expected to occur in compact arenaceous and argillaceous strata at depths between ten and twenty metres.

6.4 Geotechnical Zoning

The references contained in this section are applicable to township establishment only and describe general conditions encountered. When discussing the geotechnical conditions of the area, it is important to keep the following issues in mind:



WATER-FILLED SURFACE DEPRESSION

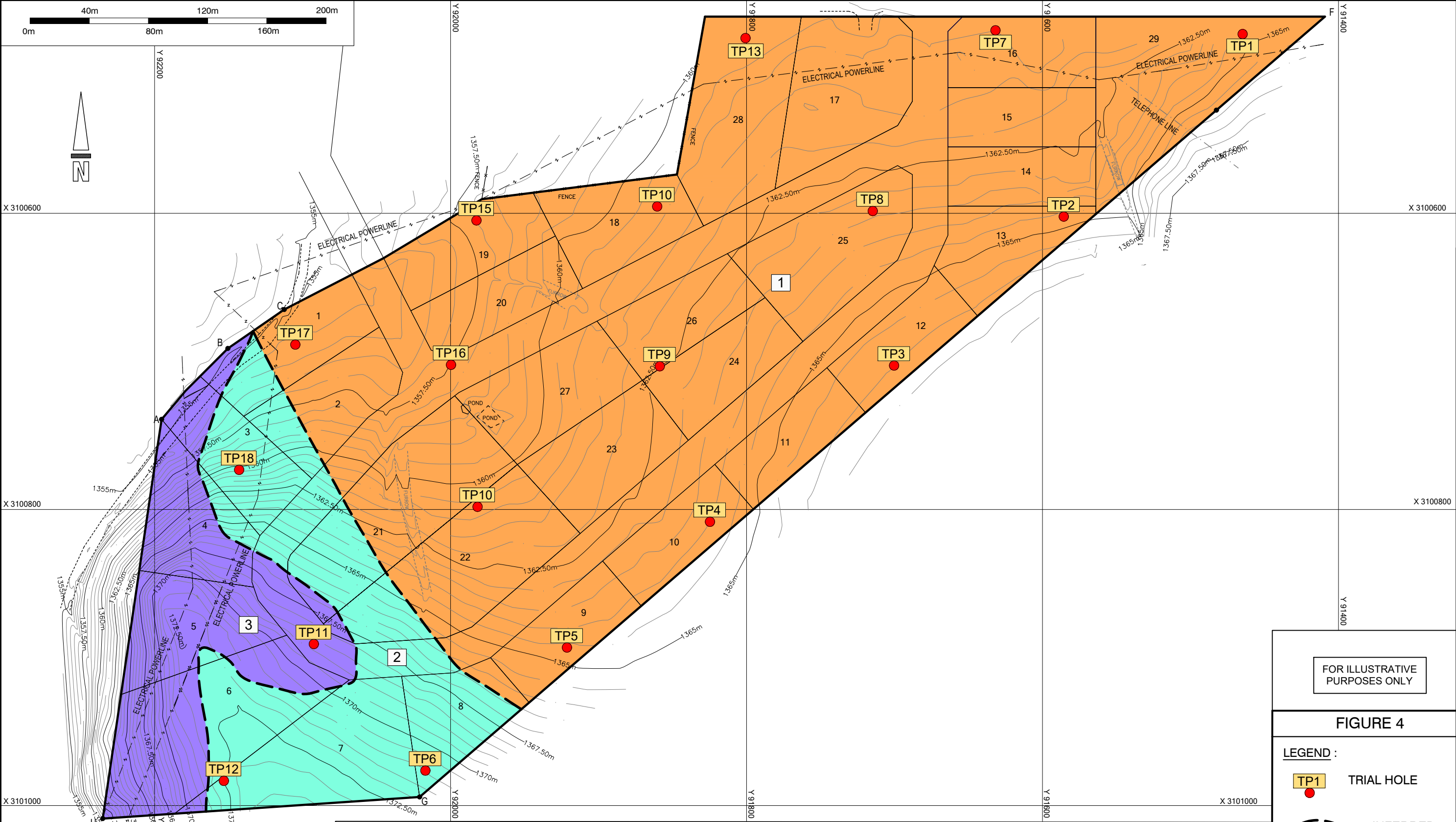
PHOTO 3

- *Properties of Heave:* Material test results indicate that (with few exceptions) in situ soils are expansive to varying degrees. The materials were proven to range from a medium to very highly expansive potential. Using the results of the soil tests in the parametric heave calculation method as proposed by Van der Merwe^{Reference 9.3}, free heave was calculated where relevant.
- *Properties of Settlement:* Conditions of soil settlement are largely expected to be limited to residual dolerite materials, some of which were proven to be highly susceptible to settlement, even at loads as low as 50kPa.
- *Perched Water and Seepage:* Groundwater seepage is expected to occur in lower-lying areas on a seasonal basis. However, the severity and extent of such seepage water remains to be verified in order to determine whether structures will be affected.
- *Areas of Bedrock Outcrop and Steep Slopes:* Bedrock outcrop occurs along the western boundary of the study area and is associated with steep gradients.
- *Disturbed Land and Fill Materials:* Portions of the site were identified where fill materials occur and in some cases, the ground appears to have been disturbed by localised diggings as well.

The geotechnical classification of the property is in accordance with the guidelines of the NHBRC^{Reference 9.4}. Though these specifications are not applicable to industrial townships or structures, they serve as a general guideline. Within the limitations of the scope of the investigation and based on the principles as explained above, the study area can be divided into three zones. These zones are discussed below, while problematic conditions mentioned above will be discussed in more detail in subsequent sections. The following zones were identified:

- *Zone 1: **H3**:* Zone 1 includes the majority of the study area. Soil profiles typically consist of mixed residual soils – mainly residual sandstone – overlain by colluvium. As a result, unrestrained soil heave in excess of 30mm is expected and severe soil heave (of up to 100mm) must be anticipated. Surficial fill and limited disturbed ground occur in this zone and will be discussed in following sections.
- *Zone 2: **H1/S2**:* The second zone essentially forms a buffer between zone 1 and zone 3. Profiles in this zone are associated with residual dolerite which has moderate expansiveness and high susceptibility to settlement. As a result, soil movement is expected to be a combination of up to 15mm unrestrained heave and consolidation settlement in excess of 20mm, even at relative low foundation loads. Soil horizons in this zone are plagued by the inclusion of large corestones (i.e. cobbles and boulders) which may affect founding conditions.
- *Zone 3: **S1/R**:* This zone includes the western-most part of the site and is characterised by limited soil cover (which is sometimes entirely absent) overlying shallow dolerite bedrock. Soil horizons also contain abundant corestones. This zone is also characterised by steep gradients (to be discussed in following sections) and bedrock outcrop.

The zonation is illustrated in Figure 4: Geotechnical Zoning. The indicated boundary lines between the individual zones are inferred and must not be considered as a set boundary. It is essential that the zoning be refined during the phase two investigation.



FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES								
AREA	GEOTECHNICAL CLASS	% OF TOTAL AREA	ESTIMATED SOIL MOVEMENT	SOIL PROFILE	DEVELOPMENT POTENTIAL	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS
1	H3	74,44%	Unrestrained heave exceeding 30mm	Limited colluvium overlying residual sandstone	Intermediate	Modified normal	Reinforced concrete raft OR soil replacement raft	Corrosive soils Possible seasonal groundwater Sporadic rubble/fill Localised diggings Clayey excavation
2	H1/S2	14,77%	Up to 15mm unrestrained heave; consolidation settlement exceeding 20mm	Successive horizons of residual dolerite	Intermediate	Modified normal	Reinforced strip footings OR soil replacement raft	Abundant boulders in profile Corrosive soils
3	S1/R	10,79%	Consolidation settlement of up to 20mm	Residual dolerite overlying bedrock	Unfavourable	N/A	N/A	Steep slopes Bedrock outcrop

FOR ILLUSTRATIVE PURPOSES ONLY

FIGURE 4

LEGEND :

TP1

TRIAL HOLE

INFERRED CONTACT

SOIL KRAFT

Tel: 012 991 0426
Fax: 012 991 2555
Cell: 082 577 6215
E-Mail: izak@soilkraft.co.za
Website: www.soilkraft.co.za
P.O. Box 73478, Lynnwood Ridge, 0040

TAAK: JOB NAME: Remainder of the Farm Palmietfontein 3750
KLIENT: CLIENT: KV Development Group (Pty) Ltd
TEKENING NO: Geotechnical Zoning
DRAUING NO:
DATUM: DATE: 11 July 2019

In addition to the geotechnical zoning, certain problematic aspects need to be highlighted that may further affect the proposed development. Though already discussed to some extent above, Figure 5 shows areas which require particular attention, as follows:

- *Areas of Rubble Dumping and Disturbed Ground:* The zone identified proved to host sporadic pockets of surficial fill. However, on many occasions (e.g. trial holes 10 and 15) the fill extended below ground level to substantial depths (i.e. approximately one metre) and were associated with areas where it appeared that surface diggings were undertaken. Photo 4 illustrates such an example. The vertical extent of the fill materials is expected to be variable.
- *Areas of Steep Slopes and Rock Outcrop:* Large parts of the western side of the study area are characterised by bedrock outcrop and associated steep slopes, as illustrated in Photo 5 and Photo 6. To complicate matters, the contact between geotechnical zones 2 and 3 is not clear, as zone 2 is associated with abundant dolerite boulders and cobbles, while zone 3 is associated with bedrock outcrop. It is therefore difficult to discern (on surface) which rock materials constitute bedrock and which constitute loose lying boulders protruding the surface.

6.5 Conditions of Excavation

Conditions of excavation encountered during the site investigation can be summarised as follows:

- *Fill Material:* The fill materials were machine excavatable with relative ease. However, it was noted that some of the construction rubble that had been dumped on the site is fairly coarse (i.e. broken concrete slabs, etc.) and would be difficult to manage using smaller plant equipment.
- *Colluvium:* Colluvial materials proved machine excavatable with relative ease.
- *Residual Sandstone:* Both residual sandstone horizons were excavatable by backhoe; however the materials made for conditions of clayey, cohesive excavation. These conditions are likely to become exacerbated when the material is in a very moist or wet state to the extent where it affects the work rate adversely.
- *Residual Dolerite 1:* This material had variable excavability. While the sandy matrix of the horizon is soft and easy to excavate, the inclusion of cobbles and boulders severely impedes excavation. The use of a backhoe was not always sufficient to remove the corestones in the profile.
- *Residual Dolerite 2:* The residual dolerite 2 material is also considered cohesive and makes for clayey excavation. The material will be challenging to excavate in a very moist or wet condition.
- *Residual Dolerite 3:* This material has similar excavation properties to the residual dolerite 2 horizon.
- *Residual Dolerite 4:* The final residual dolerite horizon was machine excavatable with relative ease where corestones were absent. However, where the horizon contained corestones, they induced refusal of excavation and could not be removed using a backhoe.

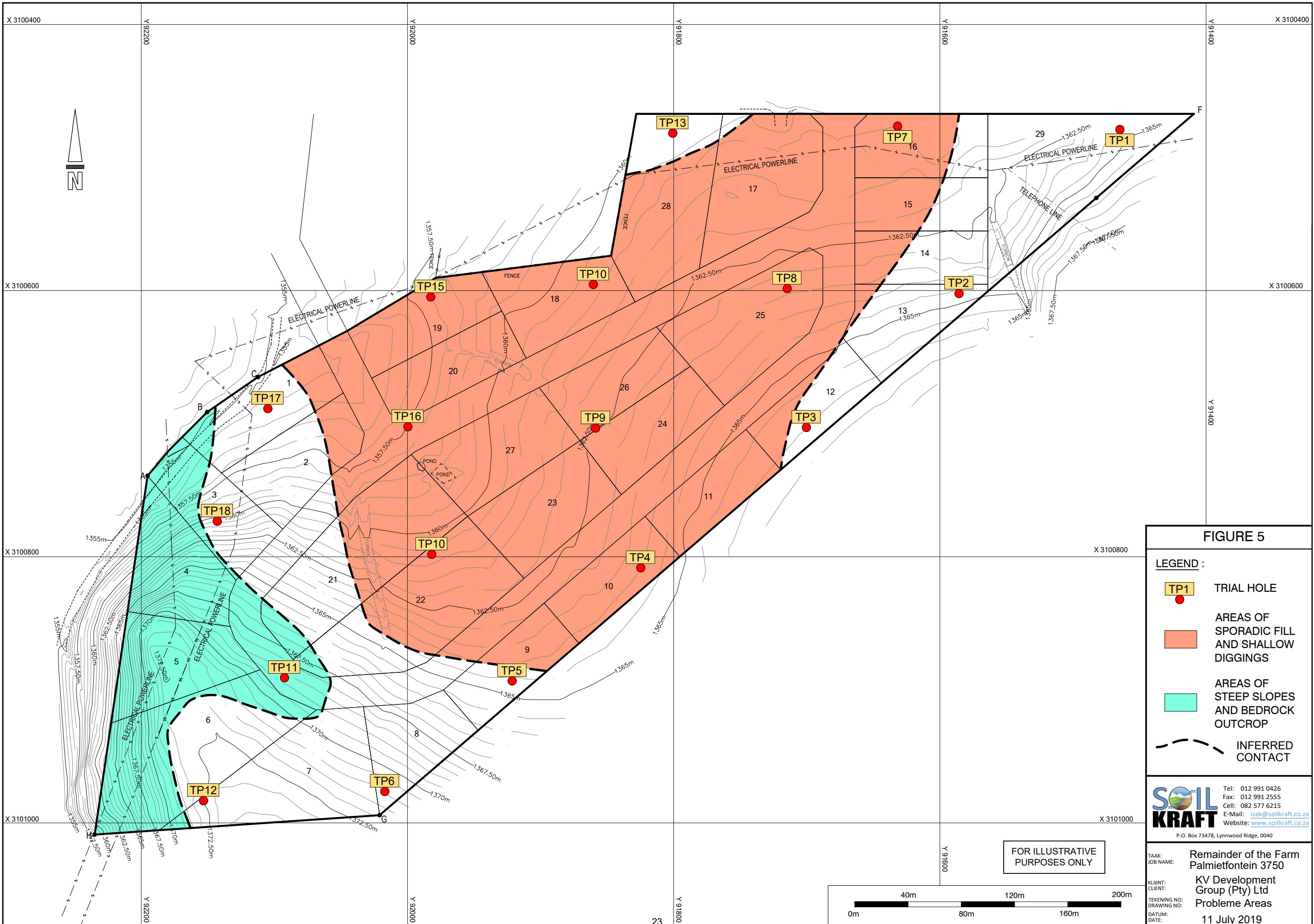


FIGURE 5

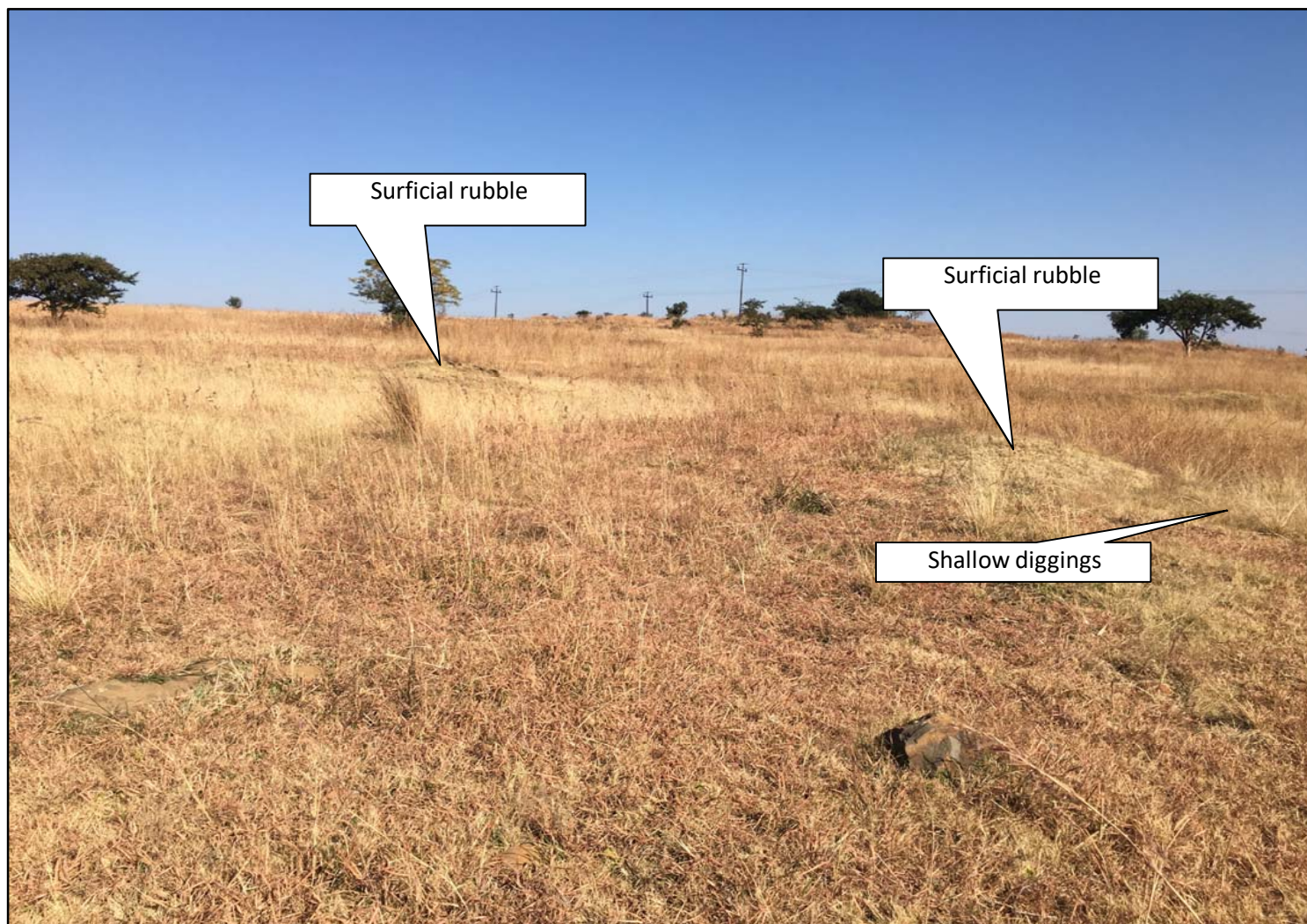
LEGEND :

- TP1** TRIAL HOLE
- AREAS OF SPORADIC FILL AND SHALLOW DIGGINGS
- AREAS OF STEEP SLOPES AND BEDROCK OUTCROP
- INFERRED CONTACT

SOIL KRAFT
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FOR ILLUSTRATIVE PURPOSES ONLY

TAAK: Remainder of the Farm
JOB NAME: Palmietfontein 3750
KLIENT: KV Development
CLIENT: Group (Pty) Ltd
TEKENING NO: Probleme Areas
DRAWING NO:
DATUM: 11 July 2019
DATE:





AREAS OF BEDROCK OUTCROP AND SURFACE BOULDERS

PHOTO 5



STEEP SLOPES, WESTERN BOUNDARY

PHOTO 6

- *Sandstone Bedrock*: No competent or unweathered sandstone bedrock was encountered in any of the trial holes inspected during this investigation.
- *Dolerite Bedrock*: Unweathered dolerite bedrock found on the western side of the study area is likely to constitute hard or very hard rock material, which would not be machine excavatable. Blasting would be required to remove such bedrock material.
- *Corestones*: The presence of dolerite corestones was proven during the investigation. The corestones varied in size and could not always be managed or excavated using a backhoe.
- *Excavation Stability*: Excavations made during the course of the investigation mostly proved to be stable. It is expected that perched or seepage water – if present – will severely detract from the excavation stability. It must also be taken into account that trial holes were left open for very short periods and that due to the expansive nature of the in situ soils, it is likely that unsupported excavations will be inherently unstable.
- *Wet Excavation*: Depending on the outcome of a groundwater study, it may be required to make provision for wet excavation on a seasonal basis.
- *General Comments*: Excavation by backhoe proved viable to depths between 700mm and 2600mm.

6.6 Seismicity

Kijko^{Reference 9.5} indicates the annual probability for an earthquake with intensity of 5.5 on the Modified Mercalli Scale to occur in the area to be less than 10^{-1} and with an intensity of 8.8 to occur the probability is 10^{-3} . A 10% probability exists that an earthquake with Peak Ground Acceleration of 0.06g to 0.10g may take place once in 50 years.

To put the above information into perspective, Table 4 is attached to this report.

6.7 Soil Corrossivity

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

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

The pH of a soil gives an indication of potential acid related problems. Should the soil pH be less than 6.0, corrosion may take place and should the pH be less than 4.50, the problem of corrosion may be serious. If the conductivity of the soil is less than 0.1mS/cm, corrossivity is generally not a problem. However, the corrosion potential of the soil increases with an increase in conductivity.

TABLE 4 : EARTHQUAKE MAGNITUDE AND INTENSITY

MODIFIED MERCALLI INTENSITY SCALE	INTENSITY	DESCRIPTION	RICHTER SCALE MAGNITUDE	RADIUS OF PERCEPTIBILITY (km)
I	Instrumental	Detected only by seismography		
II	Feeble	Noted only by sensitive people	3.5 to 4.2	3 to 24
III	Slight	Like the vibrations due to a passing lorry. Felt by people at rest, especially on upper floors		
IV	Moderate	Felt by people while walking. Rocking of loose objects, including vehicles	4.3 to 4.8	24 to 48
V	Rather strong	Felt generally ; most sleepers are awakened and bells ring		
VI	Strong	Trees sway and suspended objects swing ; damage by overturning and flinging of loose objects	4.9 to 5.4	48 to 112
VII	Very strong	General public alarm ; walls crack ; plaster falls	5.5 to 6.1	110 to 200
VIII	Destructive	Car drivers seriously disturbed; masonry fissured ; buildings damaged	6.2 to 6.9	200 to 400
IX	Ruinous	Houses collapse ; pipes break		
X	Disastrous	Ground cracks badly ; buildings destroyed ; railway lines bent ; landslides on steep slopes	7.0 to 7.3	400 to 700
XI	Very disastrous	Few buildings remain standing; bridges destroyed ; all services out of action ; great landslides and floods	7.4 to 8.1	400 to 700
XII	Catastrophic	Total destruction ; objects thrown into the air; ground rises and falls in waves	>8.1	400 to 700

Should the conductivity of the soil exceed 0.5mS/cm, the soil can be regarded as very corrosive and should exposed metal pipes pass from argillaceous soils to arenaceous soils (or vice versa), electrochemical cells are set up due to the different rates of oxygen diffusion of the soils. Sulphate reducing bacteria is usually present under anaerobic conditions, that is, typically saturated or waterlogged clays.

Samples were collected from the horizons most likely to host services and utilities in future. Results can be summarised as follows:

- *Colluvium*: A single sample of the colluvial material proved to be extremely corrosive on account of the soil acidity, with a measured pH of 3.9. In addition, the material is also considered corrosive on account of its fairly high soil paste conductivity result of 0.0370S/m.
- *Residual Sandstone 1*: The residual sandstone horizon proved to be mildly corrosive on account of its acidity. The material had a pH of 5.4. In contrast to this, the material is considered extremely corrosive due to its elevated soil conductivity result of 0.101S/m.
- *Residual Dolerite 3*: The final material assessed is not considered to be particularly corrosive on account of its pH (i.e. 6.0). However, as with previous samples, the soil is considered to be extremely corrosive based on its high soil paste conductivity (i.e. 0.162S/m).
- *Seepage Water*: Cognisance must be taken of the fact that any seepage water will have an oxidising effect on metal objects (e.g. utilities) installed below surface. This also applies to moisture influx into soil profiles from the non-perennial water courses found to the east of the site.

6.8 Other Considerations

- *Historic Monuments*: To the author's knowledge there are no historic monuments on the site. That being stated, dated topographical information suggests that a number of structures on prevailed on the study area.
- *Undermining*: The area is not subject to undermining.
- *Cemetery Sites*: No graves or cemeteries were encountered during the site investigation.
- *Dolomite Stability*: The site is not subject to a dolomite stability investigation.

7 CONCLUSIONS

Based on the findings of this investigation, the following issues must be taken into account:

- *Geology*: The site is underlain by the Vryheid Formation of the Ecca Group (Karoo Supergroup), with a dolerite intrusion along the western boundary of the site. The Vryheid Formation was verified by residual materials, while the dolerite was confirmed in bedrock outcrop.

- *Soil Profiles:* Soil profiles in the study area are generally characterised by successive horizons of residual sandstone or successive horizons of residual dolerite. Colluvial cover and fill materials are largely surficial, while bedrock outcrop (i.e. dolerite) also occurs with limited or no soil cover.
- *Groundwater:* Perched groundwater or seepage water is expected to occur on a seasonal basis and may prove problematic for founding and construction. The severity and extent of possible seepage water remain to be verified by specialist studies.
- *Founding Conditions:* The study area is divided into three geotechnical zones (**H3**, **H1/S2** and **S1/R**). Additional geotechnical problems were identified and discussed separately which must be taken into account for the proposed development. Detailed site and stand zoning must be verified during a phase two investigation and the outcome of a groundwater study may affect the geotechnical zoning of the property.
- *Conditions of Excavation:* Conditions of excavation are largely dominated by cohesive soils and the occurrence of dolerite corestones. The latter severely impeded excavation by backhoe. Excavation by backhoe proved feasible to depths between 700mm and 2600mm.
- *Corrossivity:* All materials tested proved to be extremely corrosive. While colluvial materials are considered corrosive on account of its acidity, the remaining soils are corrosive due to high conductivity.
- *Historic Monuments:* To the author's knowledge there are no historic monuments on the site. That being stated, dated topographical information suggests that a number of structures on prevailed on the study area.
- *Undermining:* The area is not subject to undermining.
- *Cemetery Sites:* No graves or cemeteries were encountered during the site investigation.
- *Dolomite Stability:* The site is not subject to a dolomite stability investigation.
- *Seismicity:* A 10% probability exists that an earthquake with Peak Ground Acceleration of 0.06g to 0.10g may take place once in 50 years.

8 RECOMMENDATIONS

8.1 Proposed Development and Structural Recommendations

It is essential that all rubble and fill materials be removed from the site prior to any construction being undertaken. Taking into consideration the findings of the geotechnical investigation, the following general recommendations can be given as guidelines only and are largely applicable to residential townships as mentioned in section 6.4:

8.1.1 Geotechnical Zone 1: **H3**

Founding in this zone must be done by means of a reinforced raft capable of accommodating unrestrained heave exceeding 30mm. The exact amount of heave must be determined for each stand during the phase 2 geotechnical investigation and could potentially be as high as 100mm. The

superstructure must contain articulation joints and masonry must be lightly reinforced. A soil replacement raft may be considered as alternative.

8.1.2 Geotechnical Zone 2: **H1/S2**

Founding in this zone can be done by means of reinforced strip footings or reinforced concrete rafts; however this is only applicable where cobbles and boulders are absent from the soil profile. This method sees founding by means of reinforced strip footings or reinforced raft capable of accommodating a combination of 15mm unrestrained heave and consolidation settlement in excess of 20mm at a suitable safety factor. The superstructure is to contain articulation joints at all internal and external doors and openings, as well as lightly reinforced masonry. Foundation pressures should be limited to 50kPa and where relevant, floor slabs must be fabric reinforced.

In areas where the soil profile contains cobbles and boulders, founding must be done by means of a soil replacement raft. Such a raft must be designed by a suitably qualified structural engineer and must see the removal of all cobbles and boulders from the building footprint in order to avoid differential settlement.

8.1.3 Geotechnical Zone 3: **S1/R**

This zone is not considered suitable for development due to the combined effects of undesirably steep slopes and the extensive areas of bedrock outcrop. It is unlikely that this zone can be rendered suitable for development in a financially feasible manner and hence it should be considered to use the zone as public open space only.

8.1.4 General Remarks

Site drainage of the project area must be planned carefully and no storm water or surface water should be allowed to accumulate within 1.5m of individual structures. It is also expected that storm water management would need to be planned carefully.

The anticipated soil movements, geotechnical zoning and proposed foundation precautions are summarised in the attached Table 5: Foundation Design, Building Procedures and Precautionary Measures.

It is essential that zoning and individual stand zoning be verified during a phase two geotechnical investigation in accordance with SANS634. Also, the zoning as discussed above may be altered based on the outcome of a groundwater study.

TABLE 5 : FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES

GEOTECH NICAL ZONE	GEOTECH NICAL CLASS	% OF TOTAL AREA	ESTIMATED SOIL MOVEMENT	SOIL PROFILE	DEVELOPMENT POTENTIAL	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS
1	H3	77.4%	Unrestrained heave exceeding 30mm	Limited colluvium overlying residual sandstone	Intermediate	Modified normal	Reinforced concrete raft OR soil replacement raft	Corrosive soils Possible seasonal groundwater Sporadic rubble/fill Localised diggings Clayey excavation
2	H1/S2	14.8%	Up to 15mm unrestrained heave; consolidation settlement exceeding 20mm	Successive horizons of residual dolerite	Intermediate	Modified normal	Reinforced strip footings OR soil replacement raft	Abundant boulders in profile Corrosive soils
3	S1/R	10.8%	Consolidation settlement of up to 20mm	Residual dolerite overlying bedrock	Unfavourable	N/A	N/A	Steep slopes Bedrock outcrop

8.2 Conditions of Excavation

Considering the parameters of “Conditions of Excavation” as per SANS 1200, one must allow amongst others the following for the prevailing site conditions:

- *Fill Materials:* The fill materials will be difficult to excavate or handle using hand tools due to the material's composition. As a result, machine excavation of the fill should be undertaken. It is also recommended that provision be made for additional earthmoving plant (e.g. bulldozer) to clear surficial rubble on the site effectively.
- *Colluvium:* Colluvial materials can potentially be excavated by hand, but it would be far more effective to use machine excavation and hence the latter option is recommended.
- *Residual Sandstone:* Both residual sandstone horizons should be excavatable by machine. Hand excavation is not recommended due to the cohesive and clayey nature of the material, which would severely impede efforts. In this regard, provision must also be made in anticipation of clayey, cohesive excavation.
- *Residual Dolerite 1:* The first residual dolerite horizon should be excavated by machine and provision must be made to remove boulders in the horizon. The use of large excavation equipment (e.g. 20ton excavator) or breaking equipment is recommended.
- *Residual Dolerite 2:* This material should also be excavated by machine and hand excavation is not recommended due to the clayey, cohesive nature of the soil. Conditions of clayey excavation must be anticipated.
- *Residual Dolerite 3:* Excavation recommendations for this material are the same as for the residual dolerite 2 horizon.
- *Residual Dolerite 4:* The final residual dolerite horizon was partially machine excavatable and refusal of excavation was encountered on corestones in one trial hole. As such, the material will be best excavated using large excavation equipment (e.g. 20 ton excavator), though it is possible that excavation using such equipment may still be impeded by corestones. Provision should therefore be made to break corestone during excavation.
- *Sandstone Bedrock:* No unweathered sandstone bedrock was encountered during the investigation.
- *Dolerite Bedrock:* Unweathered dolerite bedrock was not found in trial holes, but was found in outcrop on the western side of the study area. The dolerite constitutes hard to very hard rock material and blasting or chemical blasting will be required to remove this rock material from the profile.
- *Corestones:* The presence of dolerite corestones was proven during the investigation. The corestones varied in size and could not always be managed or excavated using a backhoe. While a 20ton (or larger) excavator will be more efficient at removing corestone, it is recommended that provision be made to break (i.e. small scale demolition) corestone into smaller, more manageable pieces to allow easier removal and handling. Corestones are expected to occur in the residual dolerite horizons only; however surface boulders may also occur in tangential areas.

- *General Comments:* Excavation by backhoe proved viable to depths between 700mm and 2600mm.
- *Wet Excavation:* Depending on the outcome of a groundwater study, it is likely the provisions would need to be made to address wet excavations. It should also be noted that the introduction of seepage water into the soil profile will have a severely negative impact on excavation stability.
- *Safety:* The safety of all persons working in or near open excavations must be ensured. Provision must be made to counter the expected inherent instability of expansive materials in the soil profile. Deep excavations should preferably be braced, shored or battered to a safe slope of (1 (V): 2 (H)).

8.3 Seismicity

The guidelines of the National Housing Board ^{Reference 9.7} indicate the level of seismicity of the area to be within acceptable limits. In terms of seismicity the development potential of the area is regarded as favourable.

8.4 Soil Corrossivity

Provision must be made to protect metallic objects (e.g. services, utilities, anchoring cables, etc.) which are buried below ground level from extremely corrosive soils and possible exposure to seasonal groundwater. It is recommended that protective coating be considered for piping. Alternatively, the use of PVC pipes may be considered.

All services must take into account the expansive nature of some in situ soils to avoid being damaged or disrupted by soil heave.

8.5 Other Recommendations

It is recommended that a groundwater study be undertaken to assess the possibility, severity and extent of expected seasonal groundwater fluctuations. Based on the outcome of such a report, a decision must be taken whether additional measures (e.g. sub-surface drains, etc.) will be required to manage any seepage water. Such a groundwater investigation should preferably be undertaken between the middle and the end of the region's wet season.

9 SOURCES OF REFERENCE

9.1 Mucina L. and Rutherford M.C. (eds): *The Vegetation of South Africa, Lesotho and Swaziland*, page 335, published in 2006 by SANBI

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9.3 Van der Merwe, D (1964).: *The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils*, published in the Civil Engineer in South Africa, pages 103 to 107.

9.4 NHBRC (1999): *Home Building Manual Part 1 & 2*, Revision 1, page 18, published by the National Home Builders Registration Counsel, Pretoria.

9.5 Kijko A., Graham, G., Bejaichund, D.L., Roblin, D.L. and Brandt, M.B.C. (2003): *Probabilistic Peak Ground Acceleration and Spectral Seismic Hazard Maps for South Africa*, Report 2003-0053, Council for Geoscience.

9.6 Evans, U.R. (1971): *The Corrosion and Oxidation of Metals*, published by Edward Arnold.

9.7 National Department of Housing (2002): *Geotechnical Site Investigations for Housing Developments – Generic Specifications GFSH-2*, pages 9 and 10.

A handwritten signature in black ink, appearing to read 'IJ Breytenbach', with a stylized, flowing script.

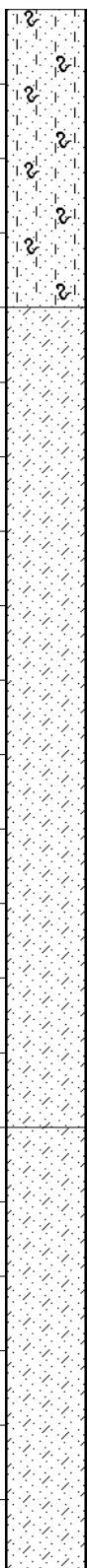
IJ Breytenbach (Pr. Sci. Nat.)

11 July 2019

For Soilkraft cc

APPENDIX A: TRIAL HOLE LOG SHEETS

Scale
1:10



0.00

Slightly moist, grey brown, medium dense, intact, silty sand. Colluvium containing roots.

0.40

Slightly moist, yellow brown mottled orange and black, loose to medium dense, voided, clayey sand. Colluvium.

SKT-84-760:

1.50

Slightly moist, light grey, medium dense to dense, intact, clayey sand. Residual sandstone.

2.10

NOTES

- 1) No refusal of excavation.
- 2) No seepage.
- 3) Disturbed Sample SKT-84-760: 0.95m.
- 4) Termite nesting.

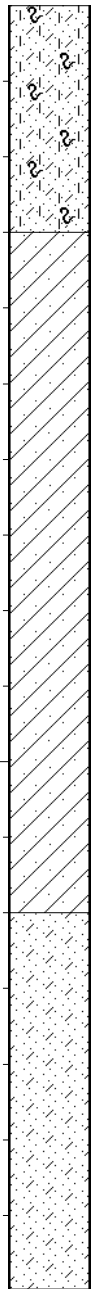
CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFIED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 54.9S
Y-COORD : 30° 04 12.0E

HOLE No: 1
Geotechnical Investigation

Scale
1:10



0.00

Slightly moist, dark grey brown, medium dense, intact, clayey silty sand. Colluvium containing roots.

0.30

Slightly moist, dark grey brown, stiff, slickensided, sandy clay. Residual sandstone.

1.20

Moist, light grey brown speckled light grey, medium dense, intact, clayey sand. Residual sandstone.

1.70

NOTES

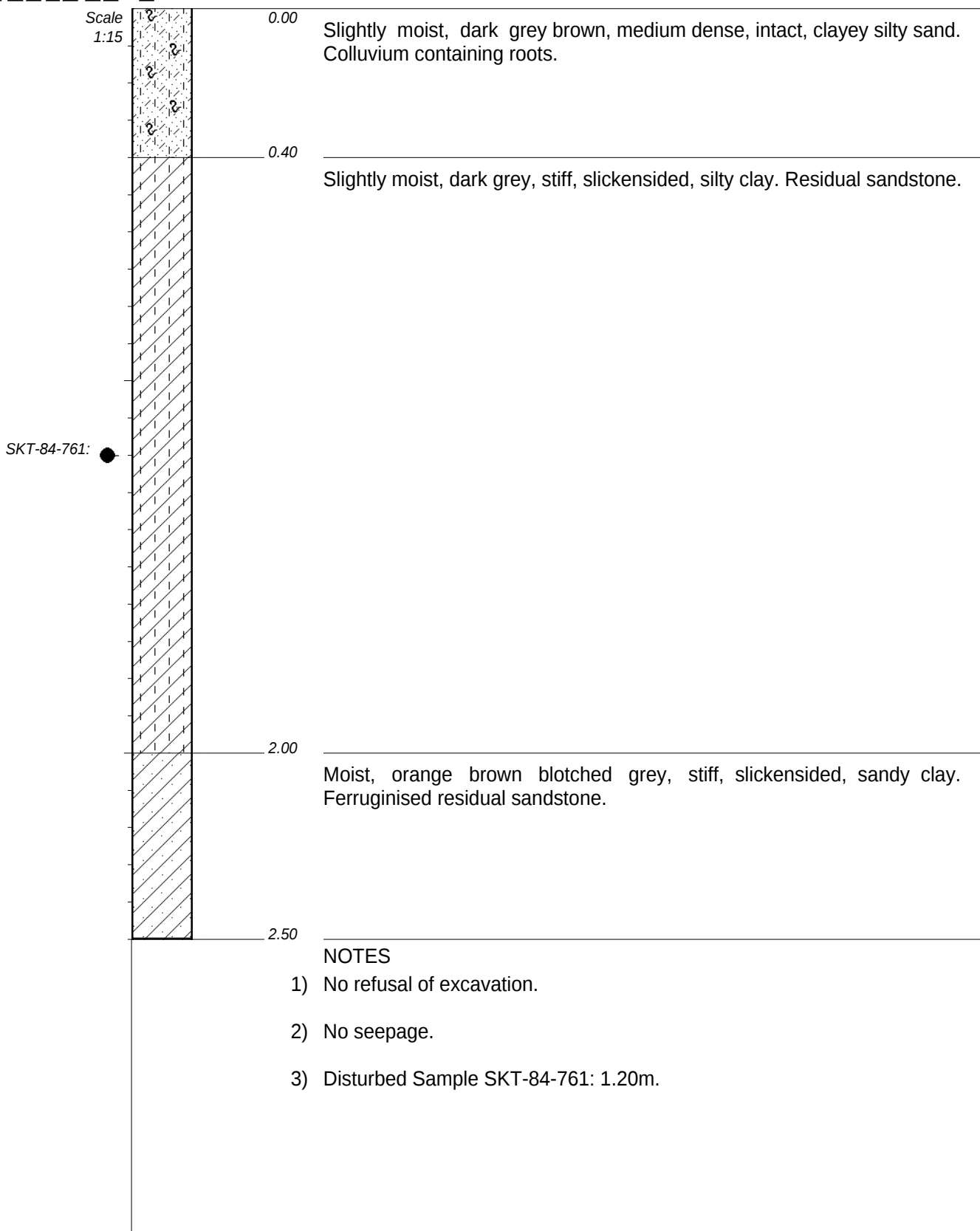
- 1) Instant refusal of excavation, presumably on sandstone bedrock.
- 2) No seepage.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 58.8S
Y-COORD : 30° 04 07.6E

HOLE No: 2
Geotechnical Investigation

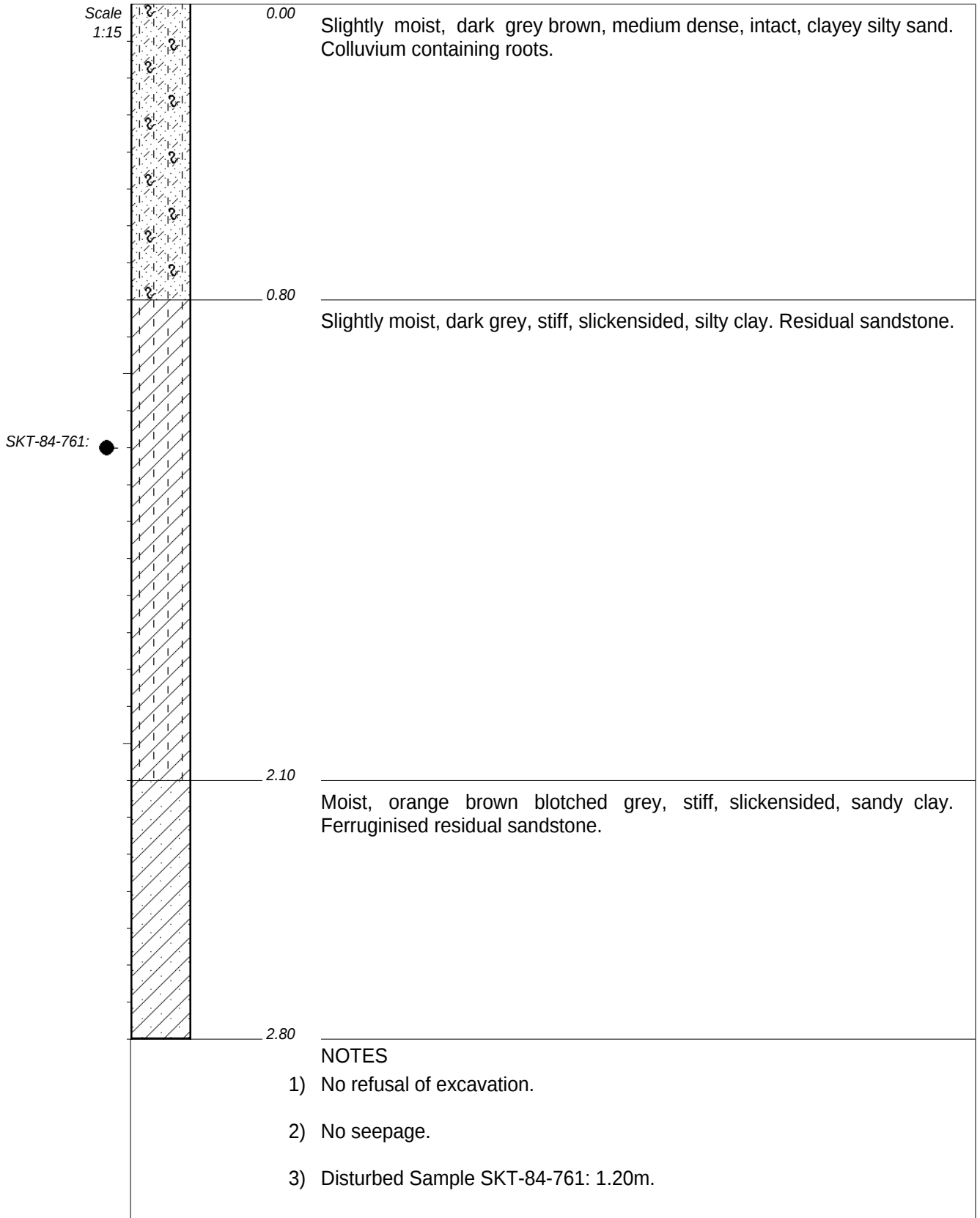


CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFIED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 02.1S
Y-COORD : 30° 04 03.4E

HOLE No: 3
Geotechnical Investigation



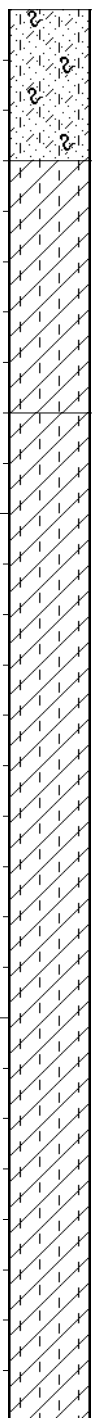
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TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 05.5S
Y-COORD : 30° 03 58.8E

HOLE No: 4
Geotechnical Investigation

Scale
1:15



0.00

Slightly moist, dark grey brown, medium dense, intact, clayey silty sand. Colluvium containing roots.

0.30

Slightly moist, dark grey, stiff, slickensided, silty clay. Residual sandstone.

0.80

Moist to very moist, light grey brown blotched orange, soft, slickensided, silty clay. Slightly ferruginised residual sandstone.

2.80

NOTES

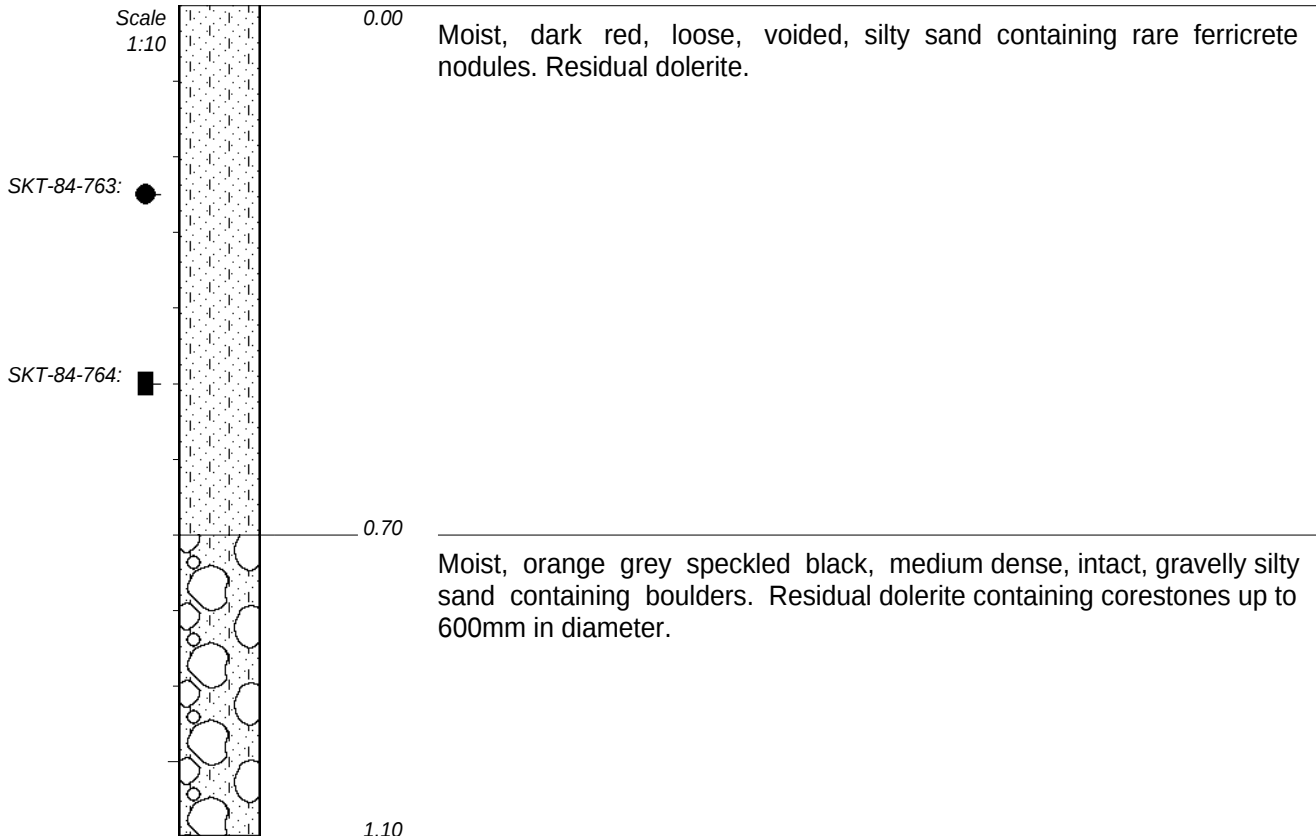
- 1) No refusal of excavation.
- 2) No seepage.
- 3) Disturbed Sample SKT-84-762: 1.80m.
- 4) Seasonal seepage is expected.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 08.2S
Y-COORD : 30° 03 55.2E

HOLE No: 5
Geotechnical Investigation



NOTES

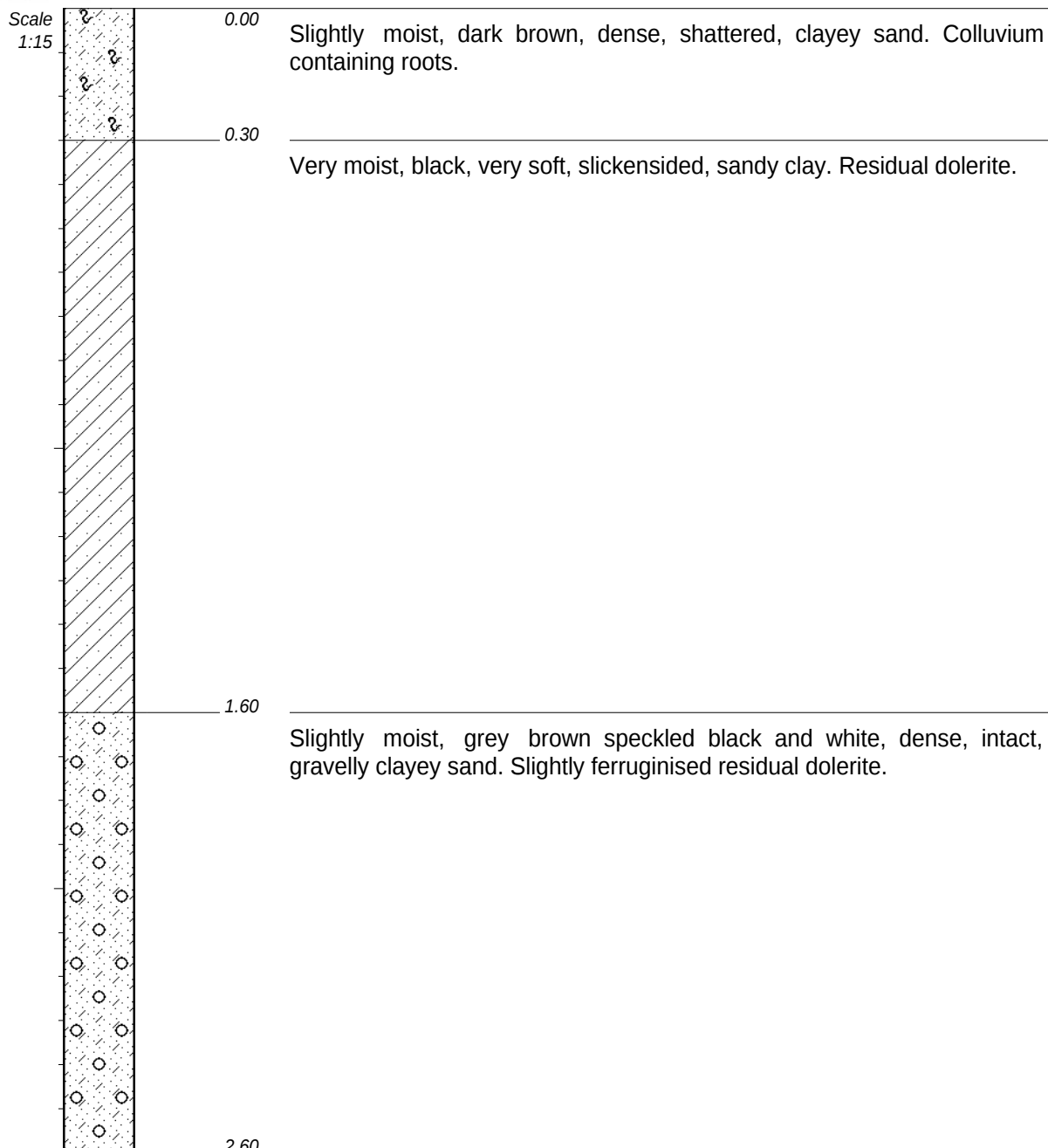
- 1) Refusal of excavation on corestones.
- 2) No seepage.
- 3) Disturbed Sample SKT-84-763: 0.25m.
- 4) Undisturbed Sample SKT-84-764: 0.50m.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFIED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 10.9S
Y-COORD : 30° 03 51.7E

HOLE No: 6
Geotechnical Investigation



NOTES

- 1) No refusal of excavation.
- 2) No seepage.

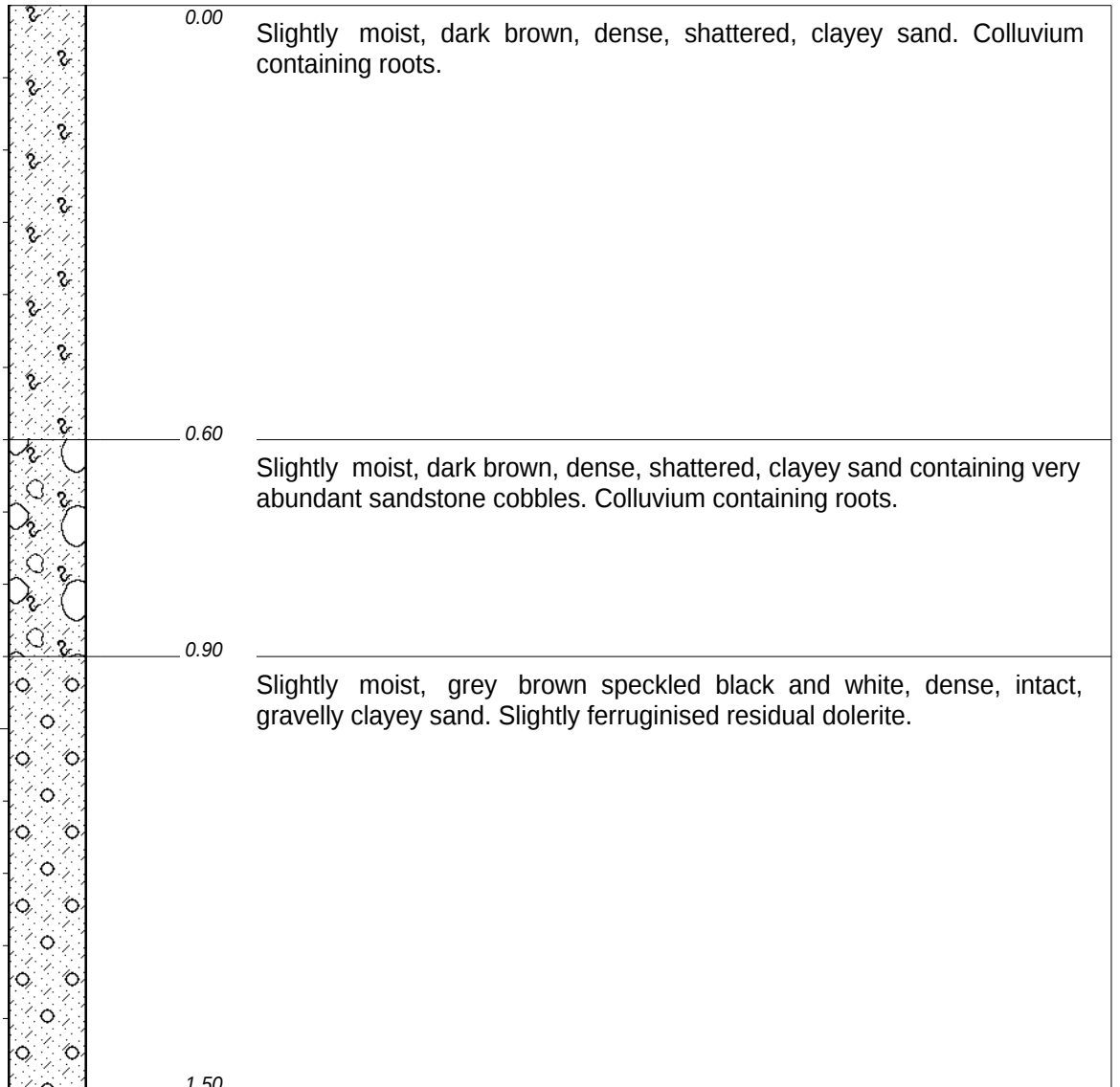
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MACHINE : Hidromek HMK102B
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PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 54.7S
Y-COORD : 30° 04 05.9E

HOLE No: 7
Geotechnical Investigation

Scale
1:10



NOTES

- 1) Instant refusal of excavation, presumably on dolerite bedrock.
- 2) No seepage.

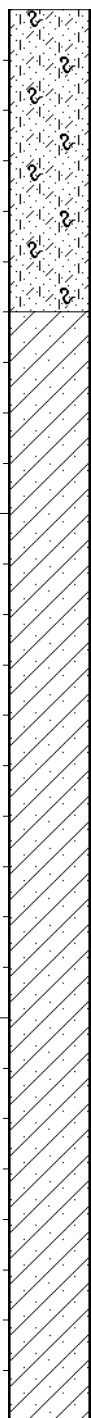
CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 58.7S
Y-COORD : 30° 04 02.9E

HOLE No: 8
Geotechnical Investigation

Scale
1:15



0.00

Slightly moist, dark grey brown, medium dense, shattered, clayey silty sand. Colluvium containing roots.

0.60

Moist, light grey brown mottled black blotched orange, soft, slickensided, sandy clay. Ferruginised residual sandstone.

2.80

SKT-84-765:

NOTES

- 1) No refusal of excavation.
- 2) No seepage.
- 3) Disturbed Sample SKT-84-765: 1.70m.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 02.0S
Y-COORD : 30° 03 57.6E

HOLE No: 9
Geotechnical Investigation

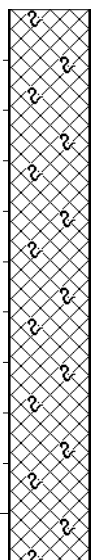


KV Development Group
Palmietfontein

HOLE No: 10
Sheet 1 of 1

JOB NUMBER: 2019/J018/KVD

Scale
1:15



0.00

Slightly moist, dark grey, loose, silty sand containing bottles, metal and other rubble. Fill containing roots.

1.10

Moist, yellow brown blotched orange mottled black, medium dense, intact, clayey sand grading into silty sand. Residual micaceous sandstone.

2.80

NOTES

- 1) No refusal of excavation.
- 2) No seepage.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 05.1S
Y-COORD : 30° 03 53.0E

HOLE No: 10
Geotechnical Investigation

Scale
1:10



0.00

Moist, dark red, loose to medium dense, voided clayey silty sand containing dolerite boulders and gravel. Residual dolerite.

0.70

NOTES

- 1) Refusal of excavation on corestones.
- 2) No seepage.
- 3) Bedrock outcrop in vicinity of trial hole.

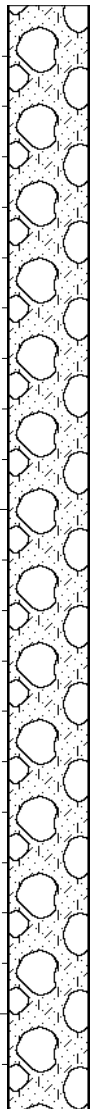
CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFIED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 08.1S
Y-COORD : 30° 03 49.0E

HOLE No: 11
Geotechnical Investigation

Scale
1:15



0.00

Moist, dark red, loose to medium dense, voided clayey silty sand containing boulders. Residual dolerite.

2.20

NOTES

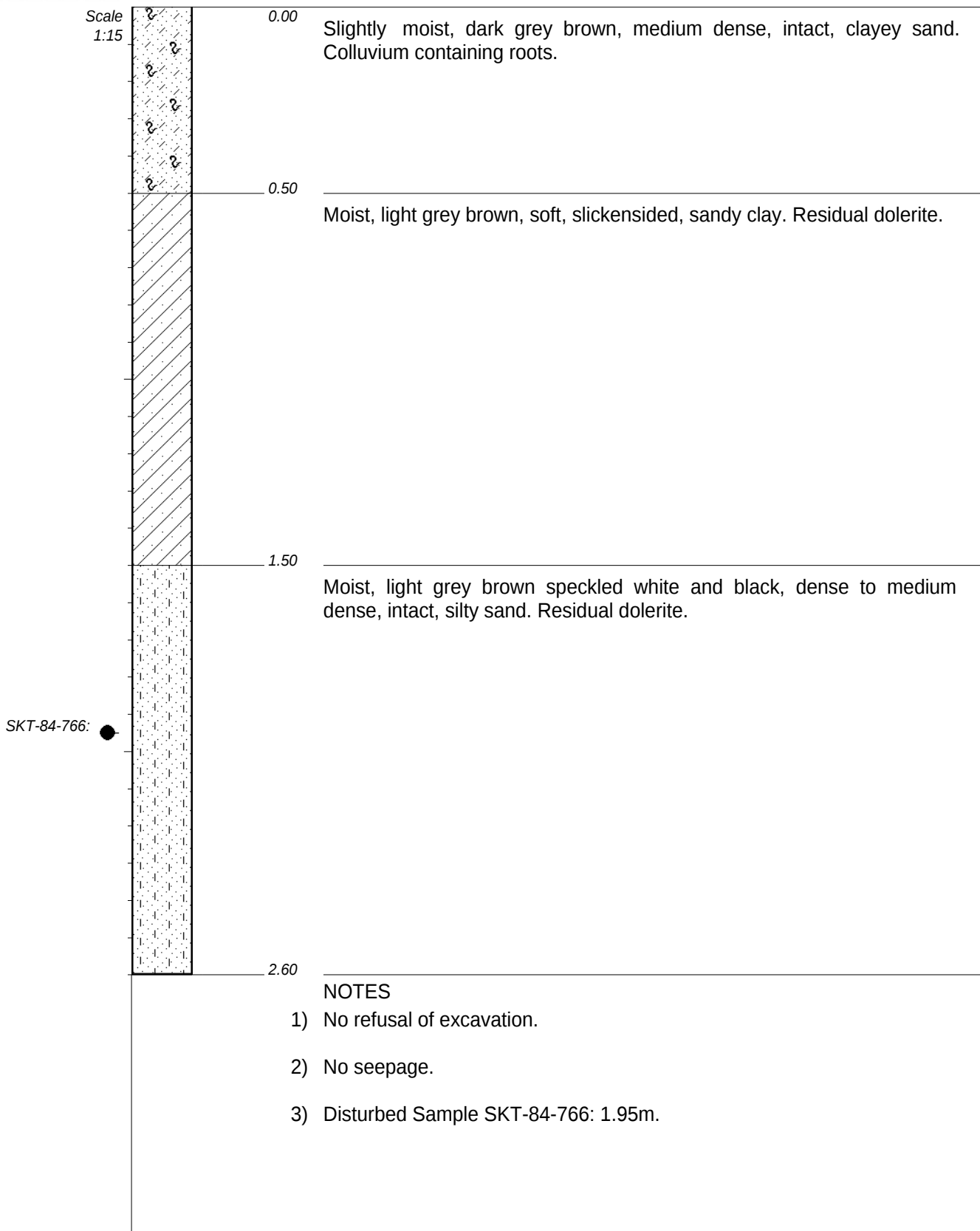
- 1) Refusal of excavation on corestones.
- 2) No seepage.
- 3) Bedrock outcrop in vicinity of trial hole.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 11.1S
Y-COORD : 30° 03 46.7E

HOLE No: 12
Geotechnical Investigation



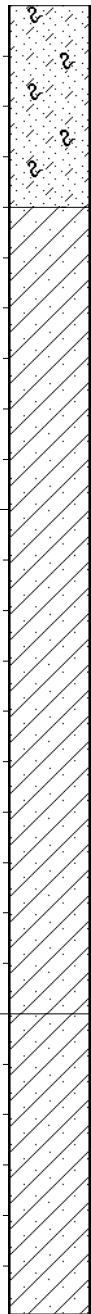
CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 54.9S
Y-COORD : 30° 03 59.7E

HOLE No: 13
Geotechnical Investigation

Scale
1:15



0.00

Slightly moist, dark grey brown, medium dense, intact, clayey sand.
Colluvium containing roots.

0.40

Moist, light grey brown, firm, slickensided, sandy clay. Residual dolerite.

2.00

Moist, light grey brown mottled black, firm, slickensided, sandy clay.
Residual dolerite containing abundant ferricrete nodules.

2.60

NOTES

- 1) No refusal of excavation.
- 2) No seepage.

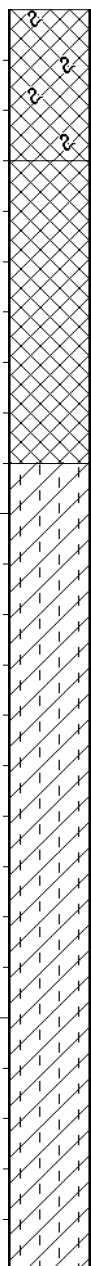
CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 58.5S
Y-COORD : 30° 03 57.5E

HOLE No: 14
Geotechnical Investigation

Scale
1:15



0.00

Slightly moist, dark grey brown, medium dense, clayey sand. Fill material containing roots.

0.30

Slightly moist, orange grey, firm, clayey sand containing scattered rubble. Fill.

0.90

Moist, light grey brown streaked orange brown, soft, slickensided, silty clay. Residual dolerite?

SKT-84-767:

2.50

NOTES

- 1) No refusal of excavation.
- 2) No seepage.
- 3) Disturbed Sample SKT-84-767: 1.70m.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 00 58.8S
Y-COORD : 30° 03 53.1E

HOLE No: 15
Geotechnical Investigation

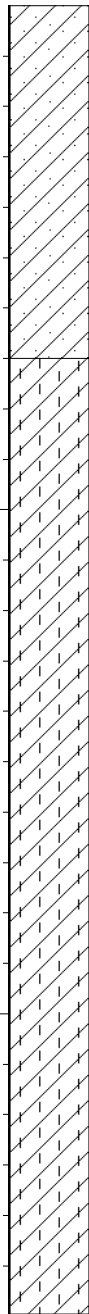


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Palmietfontein

HOLE No: 16
Sheet 1 of 1

JOB NUMBER: 2019/J018/KVD

Scale
1:15



0.00

Slightly moist, black grey, firm, shattered and slickensided, sandy clay.
Residual dolerite.

0.70

Moist, light grey brown streaked orange brown, soft, slickensided, silty
clay. Residual dolerite?

2.60

NOTES

- 1) No refusal of excavation.
- 2) No seepage.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 02.0S
Y-COORD : 30° 03 52.4E

HOLE No: 16
Geotechnical Investigation

Scale
1:10

0.00

Moist, red brown, medium dense, voided, clayey silty sand. Residual dolerite containing roots.

0.70

Moist, light grey brown streaked orange brown, soft, slickensided, silty clay. Residual dolerite?

SKT-84-768:

2.10

NOTES

- 1) No refusal of excavation.
- 2) No seepage.
- 3) Disturbed Sample SKT-84-768: 1.40m.

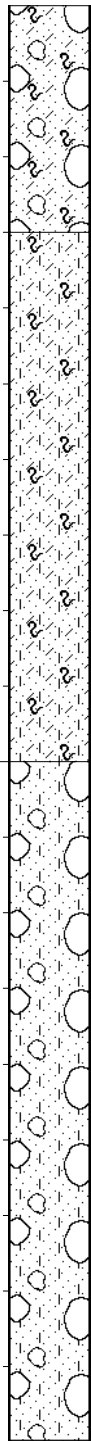
CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 01.5S
Y-COORD : 30° 03 48.6E

HOLE No: 17
Geotechnical Investigation

Scale
1:10



0.00

Slightly moist, dark brown, medium dense, shattered, clayey sand containing dolerite cobbles. Colluvium. Roots.

0.30

Moist, red brown, medium dense, voided, clayey silty sand. Residual dolerite containing roots.

1.00

Slightly moist, light grey speckled white, medium dense, intact, silty sand containing dolerite cobbles. Residual dolerite.

1.90

NOTES

- 1) Refusal of excavation on cobbles.
- 2) No seepage.

CONTRACTOR : Tony s Tool Hire Dundee
MACHINE : Hidromek HMK102B
DRILLED BY : Siya
PROFILED BY : Izak Breytenbach
TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 700mm
DATE :
DATE : 14/06/2019
DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD : 28° 01 04.2S
Y-COORD : 30° 03 47.1E

HOLE No: 18
Geotechnical Investigation



KV Development Group
Palmietfontein

LEGEND
Sheet 1 of 1

JOB NUMBER: 2019/J018/KVD

	BOULDERS	{SA01}
	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	FILL	{SA32}
Name 	UNDISTURBED SAMPLE	{SA37}
Name 	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}
	COBBLES	{SA58}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFIED BY :

TYPE SET BY : Izak Breytenbach
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE :

DATE : 09/07/2019 16:23
TEXT : ..etfontein\TPProfiles.txt

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

APPENDIX B: MATERIAL TEST RESULTS



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Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerle | 082 309 4448 | gerle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: Soilkraft
Project Name: Palmietfontein
Job Number: SKT-84
Date: 2019-07-05
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 1	TH 3	TH 5	Sample	TH 1	TH 3	TH 5
Depth (mm)	400 - 1500	400 - 2000	800 - 2800	Depth (mm)	400 - 1500	400 - 2000	800 - 2800
Lab No	SKT-84-760	SKT-84-761	SKT-84-762	Lab No	SKT-84-760	SKT-84-761	SKT-84-762
53.0	100	100	100	Liquid Limit (%)	40	67	68
37.5	100	100	100	Plastic Limit (%)	18	25	23
26.5	100	100	100	Plasticity Index (%)	22	42	45
19.0	100	100	100	Linear Shrinkage (%)	10.5	26.0	29.5
13.2	100	100	100	PI of whole sample	17	41	43
9.5	98	100	100				
6.7	96	100	100	% Gravel	14	0	1
4.75	94	100	100	% Sand	31	22	23
2.00	86	100	99	% Silt	25	26	25
1.00	81	99	98	% Clay	30	52	51
0.425	75	97	96	Activity	0.7	0.8	0.9
0.250	72	91	92				
0.150	69	88	87	% Soil Mortar	86	100	99
0.075	62	83	82				
0.060	55	78	76	Grading Modulus	0.77	0.20	0.23
0.050	52	75	74	Moisture Content (%)	N / T	N / T	N / T
0.035	47	69	69	Relative Density (SG)*	2.65	2.65	2.65
0.020	43	64	63				
0.006	37	58	56	Unified (ASTM D2487)	CL	CH	CH
0.002	30	52	51	AASHTO (M145-91)	A - 6	A - 7 - 6	A - 7 - 6

Remarks: *: Assumed
N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



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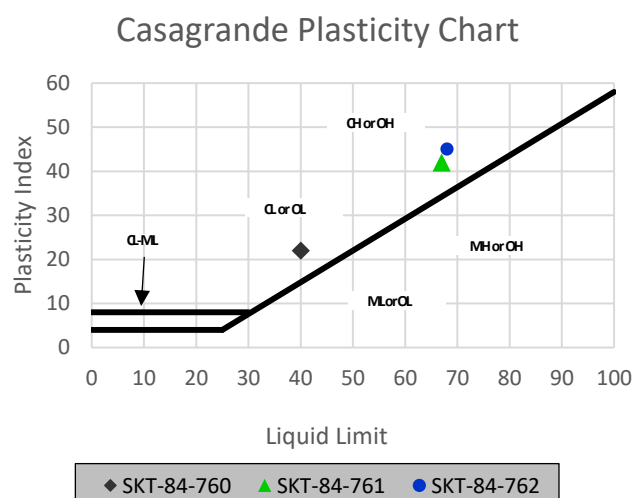
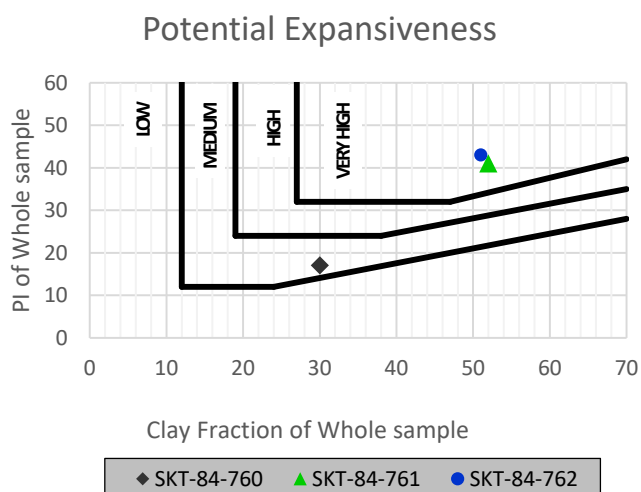
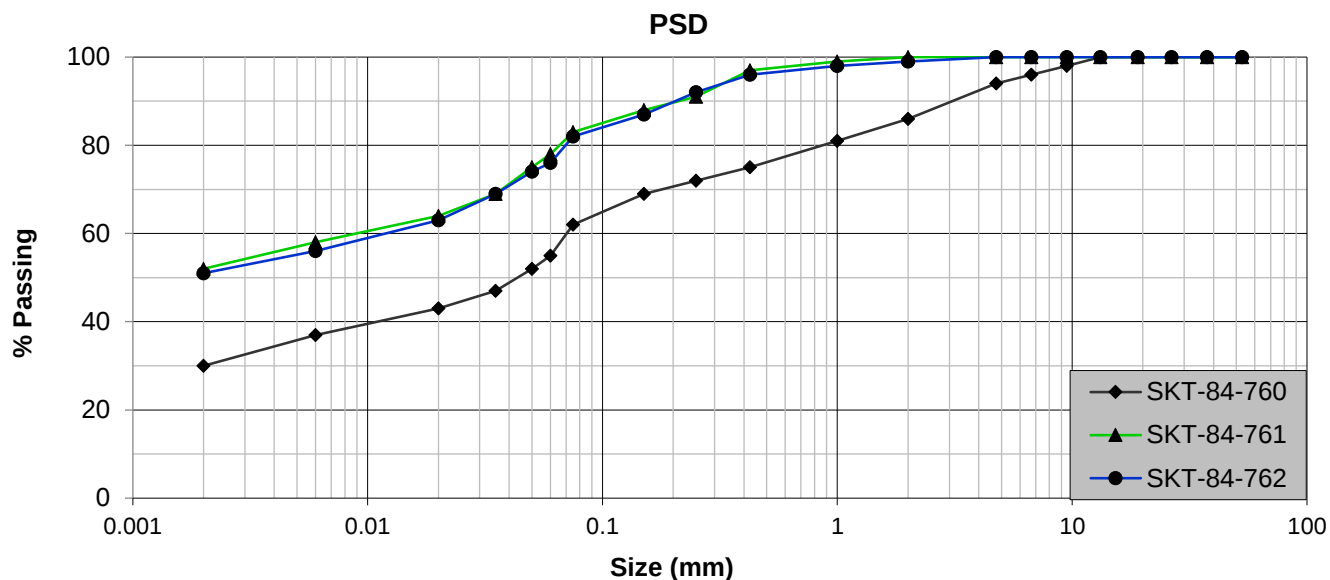
Gerle | 082 309 4448 | gerle@stlab.co.za

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Client Name: Soilkraft
Project Name: Palmietfontein
Job Number: SKT-84
Date: 2019-07-05
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

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Client Name: Soilkraft
Project Name: Palmietfontein
Job Number: SKT-84
Date: 2019-07-05
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 6	TH 9	TH 13	Sample	TH 6	TH 9	TH 13
Depth (mm)	0 - 700	600 - 2800	1500 - 2600	Depth (mm)	0 - 700	600 - 2800	1500 - 2600
Lab No	SKT-84-763	SKT-84-765	SKT-84-766	Lab No	SKT-84-763	SKT-84-765	SKT-84-766
53.0	100	100	100	Liquid Limit (%)	54	53	40
37.5	100	100	100	Plastic Limit (%)	28	18	23
26.5	100	100	100	Plasticity Index (%)	26	35	17
19.0	100	100	100	Linear Shrinkage (%)	13.0	24.5	8.5
13.2	100	100	100	PI of whole sample	20	30	12
9.5	100	100	100				
6.7	100	100	100	% Gravel	9	6	1
4.75	99	99	100	% Sand	34	30	66
2.00	91	94	99	% Silt	29	26	25
1.00	83	90	87	% Clay	28	38	8
0.425	78	87	72	Activity	0.9	0.9	2.1
0.250	76	80	62				
0.150	73	76	49	% Soil Mortar	91	94	99
0.075	69	72	39				
0.060	57	64	33	Grading Modulus	0.62	0.47	0.90
0.050	55	61	30	Moisture Content (%)	N / T	N / T	N / T
0.035	49	55	24	Relative Density (SG)*	2.65	2.65	2.65
0.020	44	51	19				
0.006	36	43	12	Unified (ASTM D2487)	CH	CH	SC
0.002	28	38	8	AASHTO (M145-91)	A - 7 - 6	A - 7 - 6	A - 6

Remarks: *: Assumed
N / T: Not Tested

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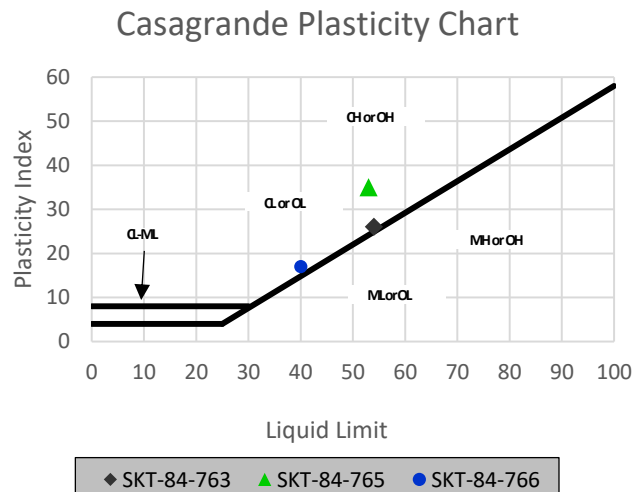
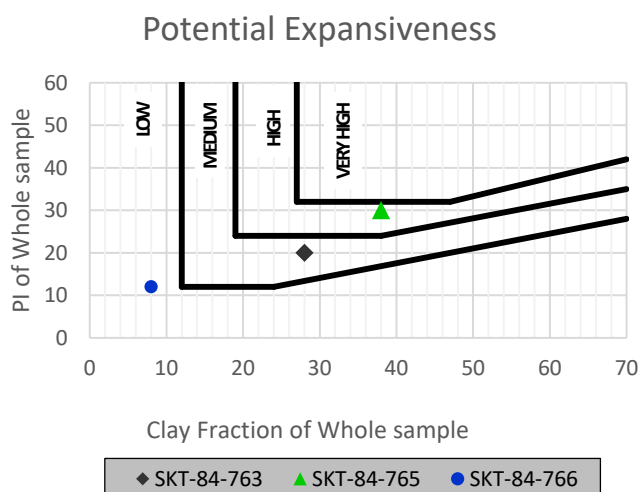
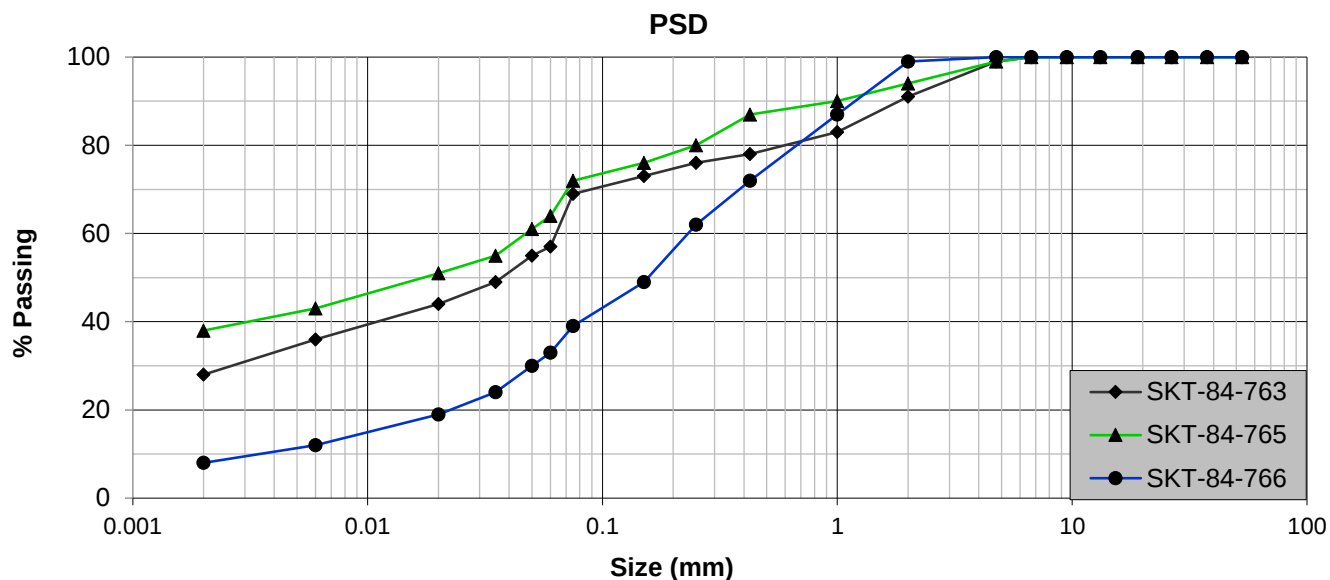
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Client Name: Soilkraft
Project Name: Palmietfontein
Job Number: SKT-84
Date: 2019-07-05
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



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Quality | Excellence | On Time

Client Name: Soilkraft
Project Name: Palmietfontein
Job Number: SKT-84
Date: 2019-07-05
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 15	TH 17		Sample	TH 15	TH 17	
Depth (mm)	900 - 2500	700 - 2100		Depth (mm)	900 - 2500	700 - 2100	
Lab No	SKT-84-767	SKT-84-768		Lab No	SKT-84-767	SKT-84-768	
53.0	100	100		Liquid Limit (%)	59	67	
37.5	100	100		Plastic Limit (%)	25	26	
26.5	100	100		Plasticity Index (%)	34	41	
19.0	100	100		Linear Shrinkage (%)	23.5	27.5	
13.2	100	100		PI of whole sample	31	39	
9.5	100	100					
6.7	100	100		% Gravel	5	1	
4.75	99	100		% Sand	25	23	
2.00	95	99		% Silt	27	26	
1.00	92	98		% Clay	43	50	
0.425	90	96		Activity	0.8	0.8	
0.250	84	93					
0.150	79	89		% Soil Mortar	95	99	
0.075	73	83					
0.060	70	76		Grading Modulus	0.42	0.22	
0.050	68	73		Moisture Content (%)	N / T	N / T	
0.035	64	67		Relative Density (SG)*	2.65	2.65	
0.020	57	63					
0.006	51	56		Unified (ASTM D2487)	CH	CH	
0.002	43	50		AASHTO (M145-91)	A - 7 - 6	A - 7 - 6	

Remarks: *: Assumed
N / T: Not Tested

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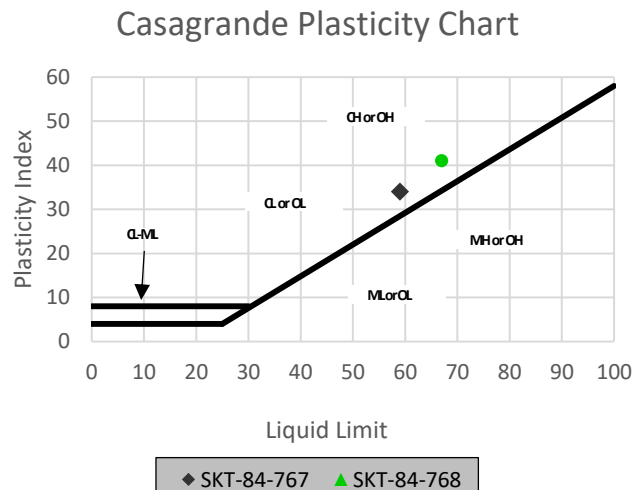
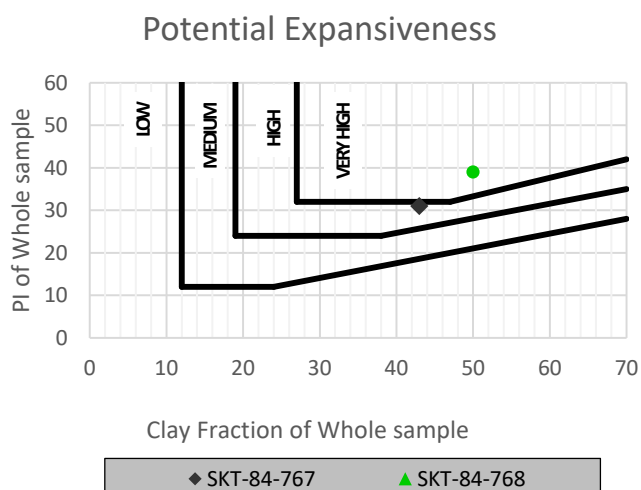
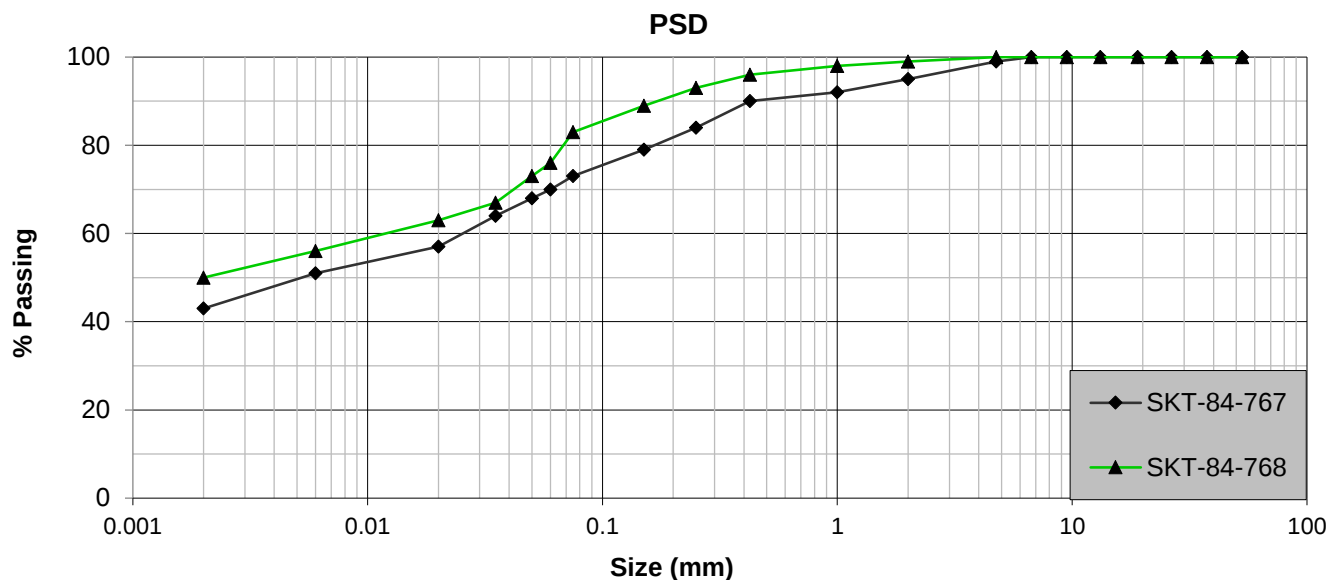
Gerle | 082 309 4448 | gerle@stlab.co.za

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Quality | Excellence | On Time

Client Name: Soilkraft
Project Name: Palmietfontein
Job Number: SKT-84
Date: 2019-07-05
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



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Quality | Excellence | On Time

Client Name: Soilkraft

Project Name: Palmietfontein

Job Number: SKT-84

Date: 05-Jul-19

Method: SANS 3001 GR1, GR3 GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TH 1	TH 3	TH 5	TH 6	TH 9	TH 13	TH 15	TH 17
Depth (mm)	400 - 1500	400 - 2000	800 - 2800	0 - 700	600 - 2800	1500 - 2600	900 - 2500	700 - 2100
Lab No	SKT-84-760	SKT-84-761	SKT-84-762	SKT-84-763	SKT-84-765	SKT-84-766	SKT-84-767	SKT-84-768
53.0	100	100	100	100	100	100	100	100
37.5	100	100	100	100	100	100	100	100
26.5	100	100	100	100	100	100	100	100
19.0	100	100	100	100	100	100	100	100
13.2	100	100	100	100	100	100	100	100
9.5	98	100	100	100	100	100	100	100
6.7	96	100	100	100	100	100	100	100
4.75	94	100	100	99	99	100	99	100
2.00	86	100	99	91	94	99	95	99
1.00	81	99	98	83	90	87	92	98
0.425	75	97	96	78	87	72	90	96
0.250	72	91	92	76	80	62	84	93
0.150	69	88	87	73	76	49	79	89
0.075	62	83	82	69	72	39	73	83
0.060	55	78	76	57	64	33	70	76
0.050	52	75	74	55	61	30	68	73
0.035	47	69	69	49	55	24	64	67
0.020	43	64	63	44	51	19	57	63
0.006	37	58	56	36	43	12	51	56
0.002	30	52	51	28	38	8	43	50
GM	0.77	0.20	0.23	0.62	0.47	0.90	0.42	0.22

Atterberg Limits

LL (%)	40	67	68	54	53	40	59	67
PI (%)	22	42	45	26	35	17	34	41
LS (%)	10.5	26.0	29.5	13.0	24.5	8.5	23.5	27.5

pH & Conductivity

pH	3.9		5.4				6.0	
EC (S/m)	0.037		0.101				0.162	

MDD / OMC

MDD (kg/m ³)								
OMC (%)								

CBR

100%								
98%								
97%								
95%								
93%								
90%								
Swell (%)								

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

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Remarks:

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Quality | Excellence | On Time

Client Name: Soilkraft
Project Name: Palmietfontein
Sample: TH 6
Depth: (m) 0 - 0.7

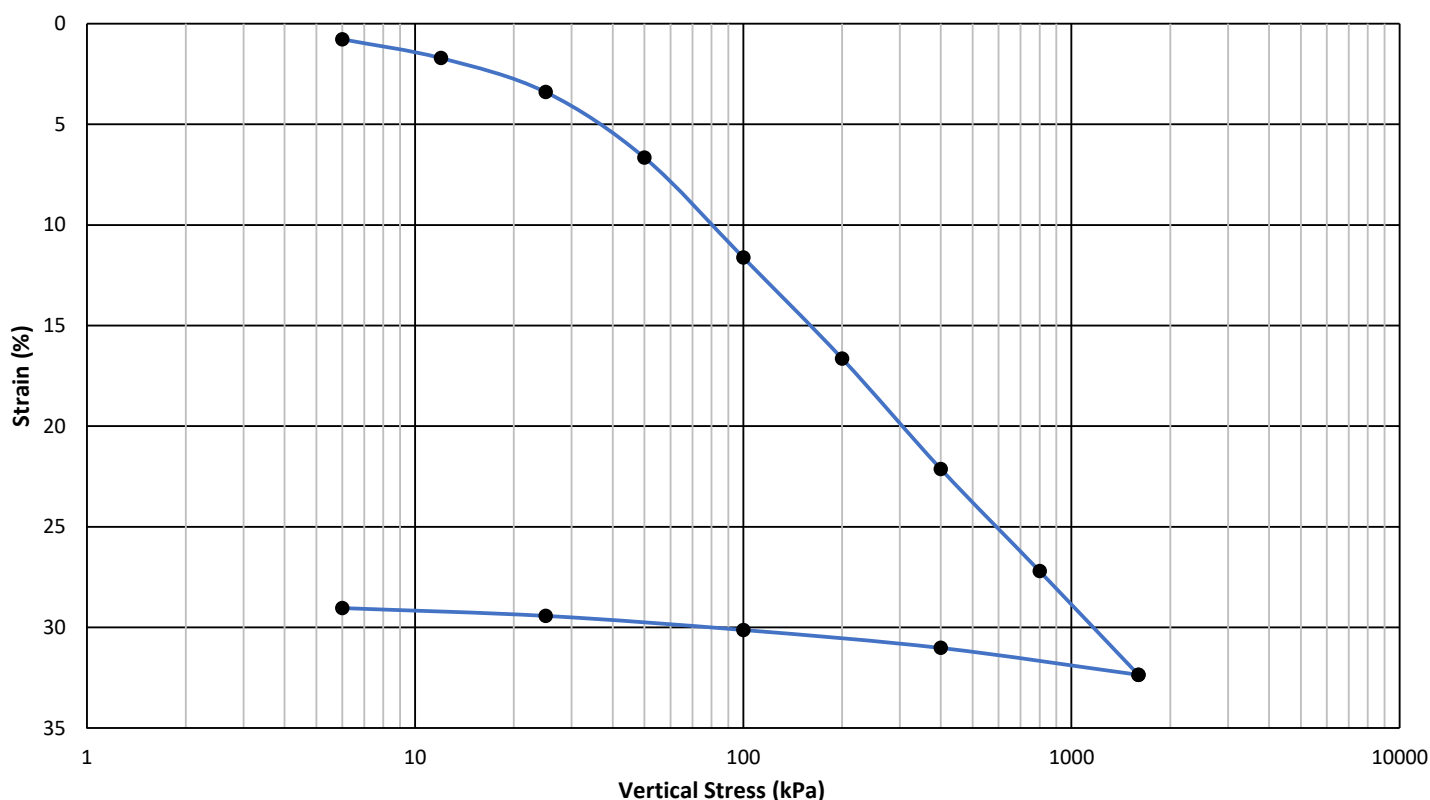
Job Number: SKT-84
Lab Number: SKT-84-764
Method: BS 1377 Part 5
Date: 05/07/2019

ONE DIMENSIONAL CONSOLIDATION TEST

Sample Info		Unit	Initial	Test Remarks:
Test Specimen Height		mm	25.4	Undisturbed
Moisture Content	Initial	%	32.0	
	Final	%	34.5	
Dry Density		kg/m ³	1000	
Void Ratio		-	1.804	
Degree of Saturation		%	49.7	
Relative Density (SG)		-	2.803	Determined

Vertical Stress Applied:	kPa	6	12	25	50	100	200	400	800	1600	400	100	25	6
Load applied for:	Hrs	12	12	12	12	12	12	12	12	12	3	3	3	3
Height after increment	mm	25.20	24.96	24.54	23.71	22.45	21.17	19.78	18.49	17.18	17.52	17.75	17.92	18.02
Total Strain	%	0.78	1.71	3.40	6.66	11.62	16.64	22.13	27.21	32.36	31.02	30.13	29.43	29.04
Void Ratio	-	1.783	1.756	1.709	1.618	1.478	1.338	1.184	1.041	0.897	0.934	0.959	0.979	0.990
Mv (1/Mpa)	-	-	1.576	1.322	1.348	1.063	0.568	0.329	0.163	0.088	0.016	0.043	0.133	0.291

Strain vs Log Stress





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Project Name: Palmietfontein
Sample: TH 6
Depth: (m) 0 - 0.7

Job Number: SKT-84
Lab Number: SKT-84-764
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Void Ratio vs Log Stress

