A PHASE ONE GEOTECHNICAL INVESTIGATION REPORT FOR A PROPOSED NEW RESIDENTIAL TOWNSHIP ESTABLISHMENT IN SAMCOR PARK, TSHWANE

Report Number: 2017/J039/TAM

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1 INTRODUCTION

- *Appointment*: It has been proposed to establish new residential townships in Samcor Park in the City of Tshwane. To this end Soilkraft cc was appointed by Mrs Amanda Engelbrecht on behalf of Tambura 69 Trust to conduct a geotechnical investigation on the property as part of the project requirements.
- *Scope of Investigation*: The scope of the project was specified by the client. In this case a phase one geotechnical investigation was undertaken in accordance with SANS634. The investigation is suitable for township establishment or rezoning purposes, but does not serve as a detailed or structure specific foundation investigation.

2 AVAILABLE INFORMATION

The following sources of information were consulted:

- 1 : 50 000 scale geological map, 2528CB Silverton, published in 1973
- 1 : 250 000 scale geological map, 2528 Pretoria, published in 1978
- 1 : 50 000 scale topographical map, 2528CB Silverton, published in 2005
- Numerous reports on investigations in the surrounding areas

3 SITE DESCRIPTION

3.1 Site Location

The area of investigation measures 34.0253ha in total size and is situated on a part of the remainder of portion 601 of the farm Willows 340 JR. The site can be accessed from Propshaft Road and access is uncontrolled. The study area is bordered by the said road to the north and west, while the southern boundary is shared with open, vacant land. The eastern boundary is formed by the flood line of a perennial stream.

Figure 1 shows the position of the site.

3.2 Topography and Drainage

A surveyor's plan was provided by the client prior to commencement of the site work. The plan indicates that the site is situated between altitudes of 1299m and 1323m above mean sea level. A general, gentle gradient characterises the site, dipping eastwards, towards the stream bordering the site. While no topographical extremes were noted on site, much of the area has been modified by rubble and waste dumping.

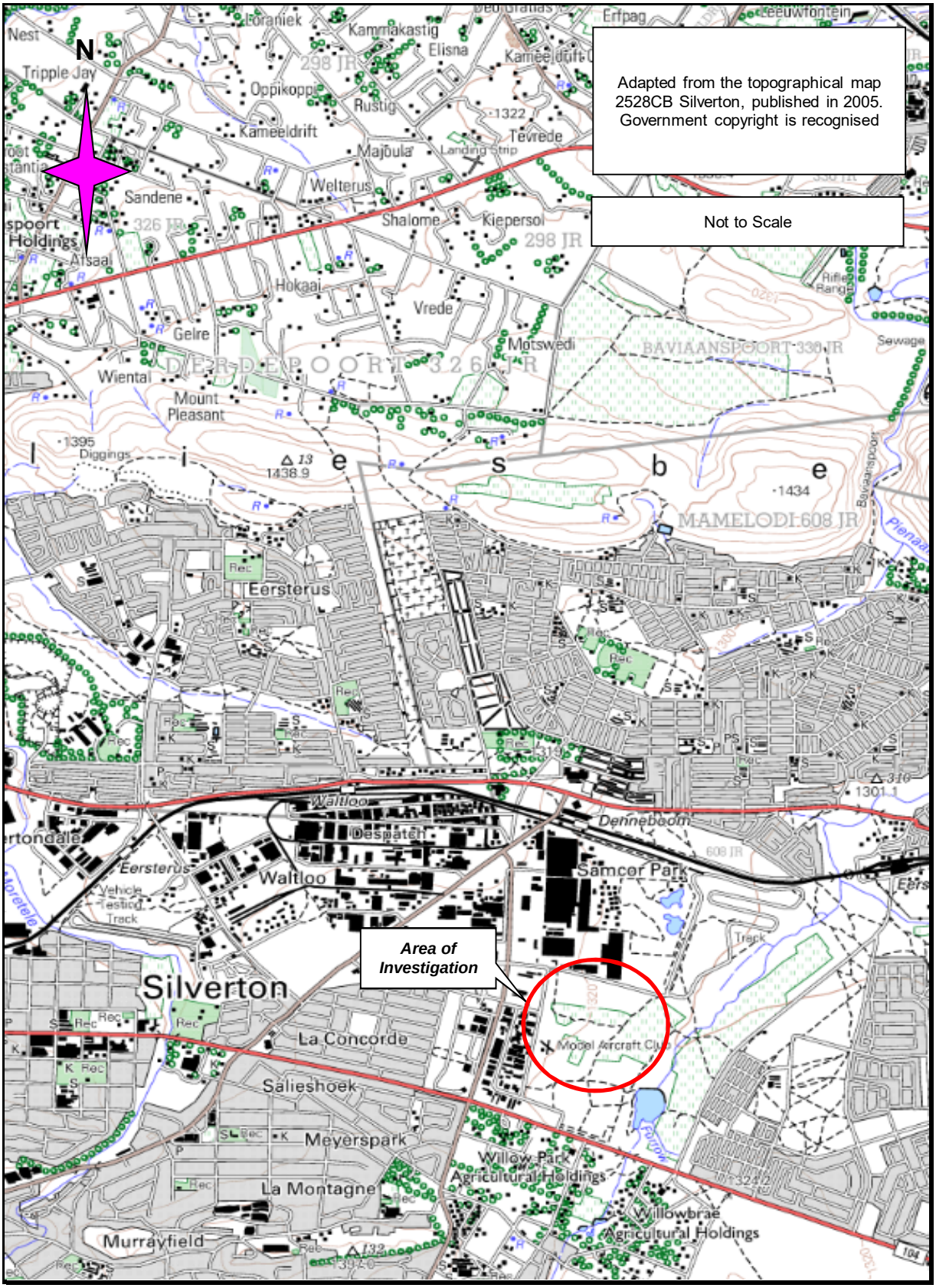
Site drainage takes place by means of sheets wash and infiltration. The former follows the site topography. Soil materials encountered on site may limit infiltration, resulting in significant surface water accumulation during or after intense or prolonged precipitation events.

3.3 Vegetation

Vegetation on site consisted largely of mixed species. While typical densely clustered thornveld Acacia species were found across large parts of the study area, areas of almost exclusively grassland were also noted. Notably some of the central parts of the site (where grassland now dominates) were used for agricultural purposes in the past, as indicated on the regional topographical map. Invasive, alien species were also fairly common.

3.4 Climate and Weather Conditions

The site is located in an area with an approximate Weinert N-value of 2.4 and a Thornthwaite Moisture Index between 0 and -20. Climatically the area may thus be described as sub-humid. This signifies that chemical weathering will dominate over mechanical weathering, resulting in the formation of active clay products – if suitable parent material is available. Minerals such as amphiboles, pyroxenes and olivine are particularly susceptible to chemical weathering. This, however,



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LOCALITY PLAN

FIGURE 1

does not mean that mechanical weathering will not play a significant role in the weathering. Mechanical weathering is still significant in brittle materials such as shale, sandstone, quartzite etc.

4 EXISTING FACILITIES

At the time of the investigation, the site largely constituted open, vacant land. An overhead electrical line crosses the north eastern part of the site and a pipeline servitude runs along the western boundary of the site, along Propshaft Road. Lastly, an electrical substation is located on the north western corner of the site.

It is unlikely that municipal services have been installed to the site, as it is undeveloped. However, municipal services are available in the vicinity and are connected to adjacent properties.

Photo 1: Site Conditions conveys the site conditions encountered at the time of the investigation.

5 SITE INVESTIGATION

5.1 Trial Holes

The site was investigated by means of conventional trial holes. A total of 27 trial holes were excavated on 25 October 2017. The trial holes were excavated using a Cat 428F backhoe supplied by Super Plant Hire. The machine was found to be in a good, well-maintained condition.

Trial holes were profiled by a professional engineering geologist according to the guidelines of SAICE and SAIEG[Reference 9.1] and SANS633. For the benefit of the non-geotechnical reader, these guidelines are summarised in the attached Table 1: Soil Profiling Parameters. The profiles of the trial holes may be found in Appendix A of this report. The profile descriptions reflect the impressions created by the pedological conditions and may sometimes vary from results of the soil tests.

The position of trial holes are illustrated in Figure 2: Site Layout.

5.2 Materials Tests

Material samples were collected for test analyses which were performed by Specialised Testing Laboratory (Pty) Ltd in Pretoria. STL is a SANAS accredited laboratory. Material tests included the following:

- *Foundation Indicators:* Foundation indicator tests were performed in order to determine the general geotechnical properties of in situ materials. This includes grading analysis, hydrometer analysis and the determination of Atterberg Limits.

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SITE CONDITIONS

PHOTO 1

TABLE 1: SOIL PROFILING PARAMETERS

CONSISTENCY : GRANULAR SOILS

SPT N	GRAVELS & SANDS Generally free draining soils		DRY DENSITY (kg/m^3)
<4	Very loose	Crumbles very easily when scraped with geological pick.	<1450
4-10	Loose	Small resistance to penetration by sharp pick point.	1450-1600
10-30	Medium dense	Considerable resistance to penetration by sharp pick point.	1600-1750
30-50	Dense	Very high resistance to penetration by sharp pick point. Requires many blows by pick point for excavation.	1750-1925
>50	Very dense	High resistance to repeated blows of geological pick. Requires power tools for excavation.	>1925

CONSISTENCY : COHESIVE SOILS

SPT N	SILTS & CLAYS and combinations with SANDS. Generally slow draining soils		UCS (kPa)
<2	Very soft	Pick point easily pushed in 100mm. Easily moulded by fingers.	<50
2-4	Soft	Pick point easily pushed in 30mm to 40mm. Moulded by fingers with some pressure.	50-125
4-8	Firm	Pick point penetrates to 10mm. Very difficult to mould with fingers.	125-250
8-15	Stiff	Slight indentation by pick point. Cannot be moulded by fingers. Penetrated by thumb nail.	250-500
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

COLOUR

Speckled	Very small patches of colour <2mm
Mottled	Irregular patches of colour 2-6mm
Blotched	Large irregular patches 6-20mm
Banded	Approximately parallel bands of varying colours
Streaked	Randomly orientated streaks of colour
Stained	Local colour variations : Associated with discontinuity surfaces

SOIL STRUCTURE

Intact	No structure present.
Fissured	Presence of discontinuities, possibly cemented.
Slickensided	Very smooth, glossy, often striated discontinuity planes.
Shattered	Presence of open fissures. Soil break into gravel size blocks.
Micro shattered	Small scale shattering, very closely spaced open fissures. Soil breaks into sand size crumbs.
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

FIGURE 2

LEGEND :

TP1 TRIAL HOLE

TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP12 TP13 TP14 TP15 TP16 TP17 TP18 TP19 TP20 TP21 TP22 TP23 TP24 TP25 TP26 TP27

PROPOSED EXTENSION OF ALWYN STREET 32,0m

PROPOSED 32,0m ROAD

PROPSHAFT ROAD

SAMCOR PARK

ERF 152
SAMCOR PARK EXT. 2

RE./PTN.89
THE WILLOWS
No.340-JR

REMAINDER/PORTION 3
THE WILLOWS No.340 - JR

PTN.707

ERF 6339

PARK 110

PARK 104

Sub-station

6,0m Pipeline servitude S.G.3271/2012

C/L Powerline servitude 22,0m wide S.G. 181/2007

C/L 4,0m Sewer

1:100 YEAR FLOODLINE

1:100 YEAR FLOODLINE

X +28 47 000
X +28 47 200
X +28 47 400
X +28 47 600
X +28 47 800

Y +99 800
Y +99 600
Y +99 400
Y +99 200
Y +99 000
Y +98 800

N

0m 20m 40m 60m 80m 100m

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TAAK: / JOB NAME: Proposed New Township Samcor Park Extension

KLIËNT: / CLIENT: Tambura 69 Trust

TEKENING NO: / DRAWING NO: Site Layout

DATUM: / DATE: 29 November 2017

- *Soil Chemistry:* Soil chemistry tests were comprised soil paste pH and conductivity determinations. The soil chemistry tests were performed to determine whether in situ soils are corrosive towards buried steel objects (e.g. services, utilities, anchoring points, etc.).

The test results may be found in Appendix B of this report. However, for easy reference the most important results are summarised in the attached Table 2: Results of Soil Tests.

6 DISCUSSION

6.1 Geology

The property is located in an area where a post Transvaal diabase sill is intrusive into the sediments associated with the Silverton Formation, Pretoria Group, Transvaal Supergroup. Diabase can be described as a dark grey, fine grained, basic intrusive igneous rock. The most important components making up the mineral assemblage of diabase are plagioclase and pyroxene. It is thus highly susceptible to weathering as described in section 3.4 of this report.

Based on the regional geological map, the study area spans both diabase and sedimentary materials (largely shale) of the Silverton Formation (Pretoria Group, Transvaal Supergroup). Bedrock and residual materials confirmed the geology.

Figure 3 allows an overview of the regional geology while Figure 4 shows the site geology extrapolated from trial hole data.

6.2 Soil Profiles

Prior to discussing the geotechnical zoning of the land, it is important to distinguish between the different materials encountered on site. Table 3 summarises the distribution of the different materials, which were simplified and summarised as follows:

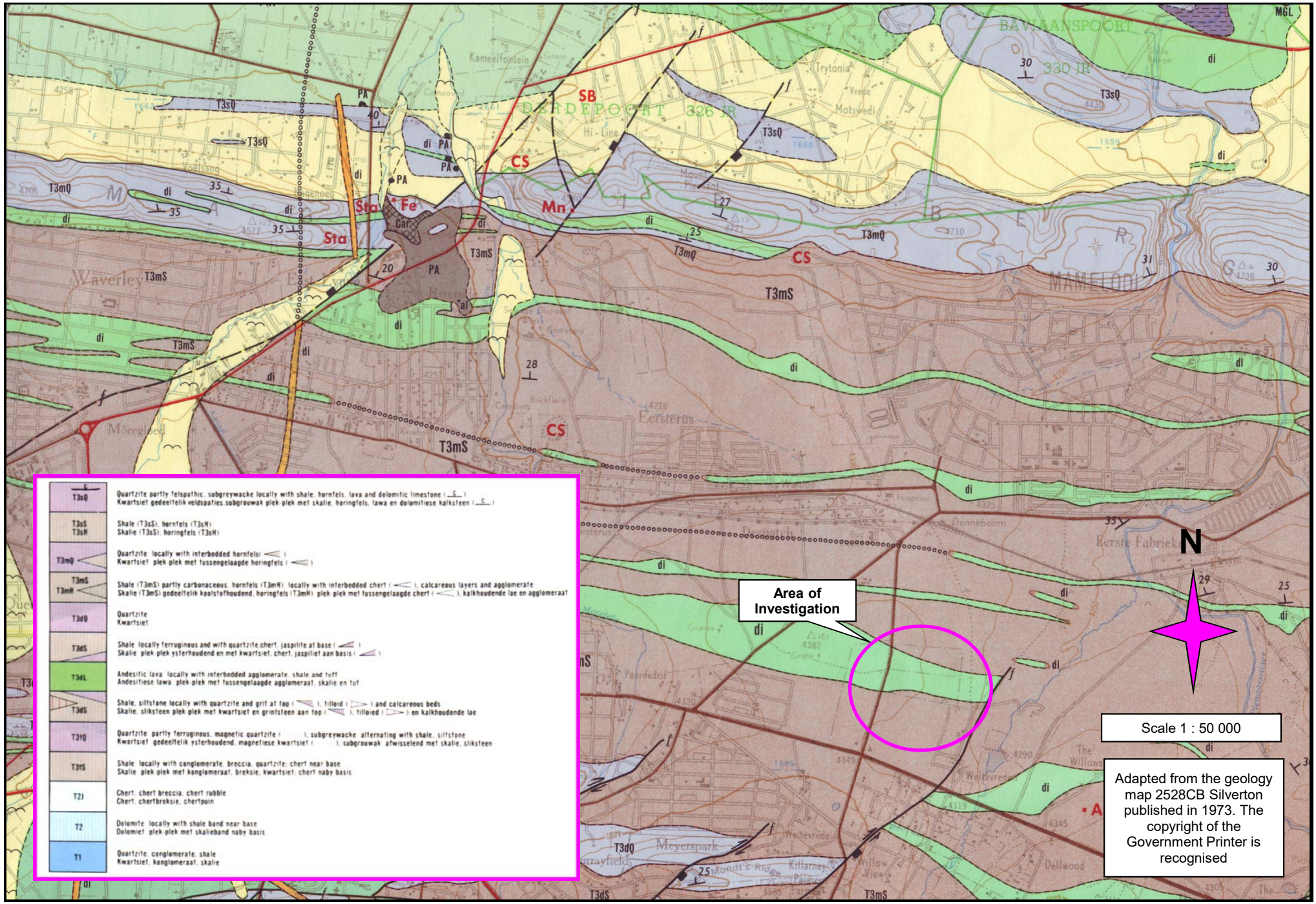
- *Fill:* Fill materials were encountered across most of the northern parts of the site, where extensive dumping has taken place over time. The rubble consisted of general refuse, waste and construction rubble. While the rubble was mostly avoided when excavating trial holes, it was not always possible to do so and consequently, fill or rubble materials were encountered in trial holes one and nine to eleven, where it spanned from surface to depths between 600mm and 1500mm. The composition of the fill was highly erratic, as is to be expected, and as a result of its composition, the fill was never sampled.

TABLE 2 : SUMMARY OF SOIL TESTS

TRIAL HOLE NO	SAMPLE NO	DEPTH (mm)	SOIL ORIGIN	SOIL TYPE	GM	PI	LL	ACTIVITY CLASS	pH	CONDUC-TIVITY (S/m)	SOIL CLASS	
											PRA	UNIFIED
2	SKT-51-426	0 - 1000	Colluvium 1	Sandy clay	0.61	30	55	High			A-7-6	CCH
5	SKT-51-427	0 - 1600	Colluvium 2	Sandy clay	0.47	31	60	High	7.40	0.0814	A-7-6	CH
8	SKT-51-428	1000 - 2300	Residual diabase	Clayey sand	0.75	15	38	Medium			A-7-6	CL
10	SKT-51-429	1500 - 2900	Alluvium	Sandy clay	0.30	43	77	Very high	7.50	0.1212	A-7-5	CH
12	SKT-51-430	800 - 2200	Residual diabase	Sandy clay	0.41	43	73	Very high			A-7-5	CH
15	SKT-51-431	500 - 800	Residual shale	Clayey sand	0.93	42	79	High	7.50	0.0842	A-7-5	CH
18	SKT-51-432	0 - 400	Colluvium 3	Gravelly sand	1.16	30	57	Medium			A-7-6	CH
21	SKT-51-433	0 - 800	Colluvium 1	Sandy clay	0.39	35	70	High	7.60	0.0688	A-7-5	MH

TABLE 2 : SUMMARY OF SOIL TESTS (CONTINUED)

TRIAL HOLE NO	SAMPLE NO	DEPTH (mm)	SOIL ORIGIN	SOIL TYPE	GM	PI	LL	ACTIVITY CLASS	pH	CONDUC-TIVITY (S/m)	SOIL CLASS	
											PRA	UNIFIED
23	SKT-51-434	700 - 1300	Residual shale	Clayey silt	0.72	23	43	Medium			A-7-6	CL
26	SKT-51-435	400 - 2000	Residual shale	Sandy clay	0.58	32	56	High	7.70	0.0663	A-7-6	CH



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REGIONAL GEOLOGY

FIGURE 3

FIGURE 4

LEGEND :

- TP1 — TRIAL HOLE
- DIABASE
- SHALE
- INFERRED MATERIAL BOUNDARY

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KLIËNT: / CLIENT: Tambura 69 Trust

TEKENING NO: / DRAWING NO: Site Geololgy

DATUM: / DATE: 29 November 2017

Table 3: Summary of Material Distribution

Material	Trial Holes	Vertical Thickness (mm)
Fill	1, 9 - 11	600 – 1500
Colluvium 1	1 – 4, 8, 11, 21	400 - 1000
Colluvium 2	5, 6, 9	500 – 1600
Colluvium 3	3, 6, 7, 12 – 20, 22, 24 - 26	300 – 800
Alluvium	10, 27	1400
Residual Diabase	5 – 9, 11, 12, 21, 22	600 – 1400
Residual Shale	1 – 4, 13 – 20, 23 - 27	100 - 1600

- *Colluvium 1:* The first colluvial material identified was described as sandy clay which was characterised by dark pink or dark red colour. The horizon generally had a firm to stiff consistency and a shattered structure. Vertically the horizon was between 400mm and 1000mm in thickness and occasionally contained diabase cobbles. The material proved to be highly expansive, with active clay content between 36% and 53%, and associated plasticity indices between 30% and 35%. The test samples had grading moduli between 0.39 and 0.61, while PRA classifications included A-7-5 and A-7-6.
- *Colluvium 2:* This material was summarised as grey brown or dark grey sandy clay. The horizon was mostly characterised by a firm consistency and a shattered structure. This material, too, was proven to be highly expansive. Laboratory analyses revealed that the test sample contained 48% active clay and had a plasticity index of 31%. The material had a grading modulus of 0.47 and was awarded a PRA classification of A-7-6.
- *Colluvium 3:* The third colluvial horizon found on site consisted of a more granular material, compared with the previously discussed colluvial horizons. In some instances the horizon was even described as gravelly sand. Nevertheless, the colluvium was mostly characterised by dark brown colour, a medium dense consistency and a shattered structure. Material tests analyses proved that the granular material is moderately expansive with active clay content and a plasticity index of 22% and 30%, respectively. A grading modulus of 1.16 was calculated and a PRA classification of A-7-6 was awarded. Diabase gravel and cobble inclusions were not uncommon in this horizon.
- *Alluvium:* Alluvial deposits were found in two trial holes, adjacent to the stream bordering the study area. The alluvium had dark grey or black grey colour, a firm or soft consistency and an intact or slickensided structure. Test results showed that the alluvium is very highly expansive, with active clay content of 56% and a plasticity index of 43%. The material had a grading modulus of 0.30 and a PRA classification of A-7-5.
- *Residual Diabase:* Residual diabase materials were characterised by varying physical properties and generally consisted of clayey sand with a medium dense consistency, or sandy clay with a firm consistency. Ferruginisation and the occurrence of diabase cobbles were not uncommon in

this material, while the horizon had intact, shattered or slickensided structures. Laboratory analyses revealed that the residual diabase varied from a moderately expansive material to a very highly expansive one. The sample materials had plasticity indices ranging from 15% to 43% and active clay content between 18% and 55%. Grading moduli ranged from 0.41 to 0.75 and PRA classifications included A-7-5 and A-7-6.

- *Residual Shale:* The residual shale materials were common across the study area, but highly variable in vertical thickness. As far as physical properties are concerned, a fair amount of variation was also observed. For the most part the horizon was described as clayey sand, clayey silt or sandy clay. Where the material consisted of cohesive soils, the consistency was mostly described as stiff or firm, while more granular soils were described as dense with few instances of medium dense materials. The horizon also had intact or slickensided structures and on many occasions the remnant laminations of the parent bedrock was still visible. Material test results showed that the residual shale ranges from a moderate to high expansiveness. Active clay contents were between 28% and 49%, with associated plasticity indices between 23% and 42%. Grading moduli were between 0.58 and 0.93 and as before, PRA classifications included A-7-5 and A-7-6. It should be noted that the residual shale often exhibited the tendency to grade from a cohesive soil into a gravelly material which tended to highly weathered bedrock.

6.3 Groundwater

- *Perched Water*: No seepage water or perched water levels were encountered in any of the trial holes. However, the occurrence of ferricrete nodules and traces of ferruginisation in trial holes suggest that seasonal groundwater may indeed occur on site and in areas with shallow bedrock, such conditions may adversely affect foundations. Seepage water is also expected to be more severe towards the eastern side of the study area, bordering the stream. It should be considered that perched water and groundwater seepage in this area is seasonal and that groundwater is most likely to occur between the middle and end of the rainy season.
- *Permanent Water*: Vegter[Reference 9.2] indicates the probability of drilling successfully for water in the area to be less than 40% and, should water be encountered, chances are between 10% and 20% that the yield of such a borehole will exceed 2l/s. Such groundwater that is present in the area is usually encountered at depths between 20m and 30m, occurring in fractures restricted to a zone directly below groundwater level. It must be anticipated that the site is situated on the contact between the diabase and shale and as such, may readily host groundwater.

6.4 Geotechnical Zoning

The references contained in this section are applicable to township establishment only. The parameters were derived by considering expected movement at a founding depth of 600mm, considering a foundation load of approximately 50kPa (as assumed for single storey buildings of

masonry construction). When discussing the geotechnical conditions of the area, it is important to keep the following issues in mind:

- *Properties of Heave*: All materials sampled from this site proved to be expansive. Test results revealed moderate to very high expansiveness in colluvial, alluvial and residual materials.
- *Properties of Settlement*: Conditions of settlement will be dominated by conditions of soil heave.
- *Problematic Fill*: The majority of the site is covered by fill and rubble materials which are considered problematic. In addition, the north eastern part of the site near the stream, also appears to host fairly thick imported fill materials.

The geotechnical classification of the property is in accordance with the guidelines of the NHBRC[Reference 9.3]. Within the limitations of the scope of the investigation and based on the principles as explained above, the site was divided into the following zones, as illustrated in Figure 5:

- *Geotechnical Zone 1:* **H2 – H2/R**: This zone is characterised by highly and very highly expansive soils, expected to generate unrestrained heave of up to 30mm. Shallow shale bedrock occurs in parts of this zone.
- *Geotechnical Zone 2*: **H2-H3**: This zone hosts soil profiles with varying degrees of expansiveness. Refining this zone will be essential during the phase two geotechnical investigation. Unrestrained soil heave in this zone is expected to reach and occasionally exceed 30mm.
- *Geotechnical Zone 3*: **H3**: Soil movement in this zone is once again expected to be dominated by heave exceeding 30mm.

In addition to the zoning discussed above, cognisance must also be taken of problematic areas associated with fill materials and rubble on the surface. Figure 6 illustrates the distribution of such materials as observed at the time of the geotechnical investigation.

6.5 Conditions of Excavation

Based on the outcome of trial hole excavation, the following is deduced regarding conditions of excavation on this site:

- *Fill*: Fill materials proved excavatible by backhoe, but the rubble materials in particular may present a challenge to excavate due to highly irregular composition. It is also foreseen that sizable earthworks will need to be undertaken to remove all the fill and rubble material in order to render the site suitable for development. This task should not be underestimated. Fill materials adjacent to the stream on the eastern side of the study area may also be encountered in a wet state seasonally.

FIGURE 5

LEGEND :

TP1 TRIAL HOLE

INFERRED MATERIAL BOUNDARIES

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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	H2 - H2/R	41%	Unrestrained heave of up to 30mm	Colluvial horizons overlying mixed residual materials and mostly shale bedrock	Intermediate	Modified	Reinforced concrete raft OR Soil replacement raft	Clayey excavation Rubble materials Corrosive soils Shallow bedrock in places
2	H2 - H3	11%	Unrestrained heave up to and exceeding 30mm	Colluvial horizons overlying mixed residual materials	Intermediate	Modified	Reinforced concrete raft OR Soil replacement Raft	Clayey excavation Rubble materials Corrosive soils
3	H3	48%	Unrestrained heave exceeding 30mm	Colluvial horizons overlying mixed residual materials. Alluvium in places.	Intermediate	Modified	Reinforced concrete raft OR Soil replacement Raft	Clayey excavation Rubble materials Corrosive soils Problematic fill near stream

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KLIËNT: CLIENT: Tambura 69 Trust

TEKENING NO: DRAWING NO: Geotechnical Zoning

DATUM: DATE: 1 December 2017

FIGURE 6

LEGEND :

TP1 TRIAL HOLE

AREAS OF FILL AND RUBBLE

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TAAK: / JOB NAME: Proposed New Township Samcor Park Extension

KLIËNT: / CLIENT: Tambura 69 Trust

TEKENING NO: / DRAWING NO: Distribution of fill and rubble material

DATUM: / DATE: 1 December 2017

- *Colluvium*: All colluvial soils proved excavatible using a backhoe. Some skill and persistence was required on occasions where diabase cobbles were included in the horizon; however a skilled operator managed to remove the cobbles with great effect. The majority of the colluvial soils may be considered cohesive or clayey to excavate.
- *Alluvium*: Alluvial soils made for clayey, cohesive excavation. It is also expected that due to the alluvium's proximity to the adjacent stream, wet excavation will occur periodically. Excavation by backhoe proved effective.
- *Residual Diabase*: The residual diabase had variable excavatibility, mostly characterised by clayey, cohesive excavation. The horizon contained corestones on a number of occasions, which induced refusal of excavation and presented a notable impediment to the backhoe.
- *Residual Shale*: The residual shale required significant effort to excavate using a backhoe, largely due to the material's consistency. On few occasions the residual shale showed the tendency to grade into bedrock and under such circumstances, the material induced gradual refusal of excavation.
- *Diabase Bedrock*: No unweathered diabase bedrock was encountered in any of the trial holes.
- *Shale Bedrock*: Shale bedrock was encountered on a number of occasions in trial holes and generally induced refusal or gradual refusal of excavation. The bedrock hardness varied from very soft rock material to very hard rock material, with the latter being associated with come contact metamorphism in close proximity to the diabase. Machine excavation was only partially successful.
- *Excavation Stability*: Excavations through in situ materials proved stable during the investigation; however it is anticipated that stability may be limited due to the expansive nature of the soil profile. Expected water ingress on parts of the site will further detract from excavation stability. Lastly, fill materials are not considered stable in open, unsupported excavation.
- *Water Ingress*: Seepage water was not encountered in any of the trial holes, but may occur on a seasonal basis during years of normal or high rainfall.
- *General*: Excavation by backhoe proved possible to depths between 900mm and 2300mm.

6.6 Seismicity

Kijko[Reference 9.4] indicates the annual probability for an earthquake with intensity of 4.2 on the Modified Mercalli Scale to occur in the area to be less than 10^0 and with an intensity of 7.1 the probability is 10^{-3}. A 10% probability exists that an earthquake with Peak Ground Acceleration of 0.12g to 0.16g may take place once in 50 years.

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

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 flling 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	Disasterous	Ground cracks badly ; buildings destroyed ; railway lines bent ; landslides on steep slopes	7.0 to 7.3	400 to 700
XI	Very disasterous	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

6.7 Soil Corrossivity

When discussing soil corrossivity, it is applicable to consider the guidelines as proposed by Evans[Reference 9.5]. 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. Should the conductivity of the soil exceed 0.5mS/cm, the soil can be regarded as very corrosive. 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.

Soil samples were collected from horizons deemed most likely to host services and utilities in future and results revealed the following:

- *Colluvium 1*: This horizon had a soil paste pH of 7.60, indicating that it is a neutral to slightly alkaline soil and not corrosive with regard to acidity. In contrast to this, the material had a conductivity reading of 0.0688S/m, suggesting that it is extremely corrosive.
- *Colluvium 2*: The second colluvial soil had similar properties to the first and is not considered corrosive on account of its pH (i.e. 7.40), but proved extremely corrosive on account of its high soil conductivity (i.e. 0.0814S/m).
- *Alluvium*: The alluvium had a soil paste pH of 7.50, again indicating a slightly alkaline material. However, the material had an extremely high soil conductivity of 0.1212S/m, suggesting that it will be extremely corrosive.
- *Residual Shale*: The final material tested was the residual shale. Samples of this material revealed pH values between 7.50 and 7.70, continuing the trend of slightly alkaline materials. The material is also considered corrosive on account of high conductivity values, which were recorded between 0.0663S/m and 0.0842S/m.
- *Waterlogged Conditions*: Seasonal seepage water is expected across much of this site. Such conditions will exacerbate the corrosive nature of the in situ soils.

All things considered, extremely corrosive soils must be anticipated on this site.

6.8 Other Considerations

- *Historic Monuments*: There are no historic monuments on the site.
- *Undermining*: The area is not subject to undermining.
- *Cemetery Sites*: No graves or cemeteries were noted on the site during investigation. Considering the proposals of Fischer[Reference 9.6] the property is not suitable for development as a cemetery.
- *Dolomite*: The area is not subject to dolomite related instabilities.

7 CONCLUSIONS

The following main conclusions were made, based on the geotechnical site investigation:

- *Geology*: The property investigated appears to straddle a contact between a deeply weathered diabase feature and shale associated with the Silverton Formation (Pretoria Group, Transvaal Supergroup).
- *Soil Profiles*: The soil profiles encountered on site are variable and generally consisted of colluvium or alluvium overlying residual materials derived from shale or diabase. Shale bedrock was also encountered. All soil materials tested were expansive to some extent. Problematic fill and surface rubble was encountered across virtually the entire site.
- *Groundwater*: No perched groundwater or seepage was encountered during the investigation; however it is expected that seepage water may occur on a seasonal basis. The severity and extent of such conditions remain to be determined.
- *Founding Conditions*: The study area was divided into three zones, namely **H2 – H2/R**, **H2-H3** and **H3**. Foundation precautionary measures are therefore essential.
- *Conditions of Excavation*: Excavation by backhoe proved viable to depths between 900mm and 2300mm. Conditions of clayey, cohesive excavation characterise most of the site.
- *Corrossivity:* In situ soils proved to be extremely corrosive on account of high soil conductivity.
- *Cemetery Sites*: No graves or cemeteries were encountered.
- *Historic Monuments*: There are no historic monuments on the site.
- *Undermining*: The area is not subject to undermining.
- *Dolomite Stability*: The area is not subject to dolomite related instabilities.
- *Seismicity*: A 10% probability exists that an earthquake with Peak Ground Acceleration of 0.12g to 0.16g may take place once in 50 years.

8 RECOMMENDATIONS

8.1 Preliminary Proposals for Founding and Construction

All recommendations below are given as guidelines towards single storey masonry residential development for foundation loads not exceeding 50kPa. The recommendations do not serve as design parameters. It is essential that such parameters be determined by detailed and applicable investigations for each stand/item prior to design and construction of the infrastructure.

As founding conditions on this site are mostly dominated by soil heave, the recommendations for the different zones are very similar. **The recommendations are based on the assumption that all fill and rubble materials will be removed prior to construction** as these materials are not suitable for founding or construction. The following alternatives are recommended:

8.1.1 Geotechnical Zone 1: **H2 – H2/R**

Founding in this zone may be done by means of the following:

- *Reinforced Concrete Raft:* Firstly, founding may be done by means of a reinforced concrete raft capable of accommodating unrestrained heave of up to 30mm at a suitable safety factor to be selected by the structural engineer. The superstructure must contain articulation joints and/or lightly reinforced masonry.
- *Soil Replacement Raft:* Alternatively, founding may be done by means of a soil replacement raft. This entails the removal of all in situ soils to 1.0m beyond the building perimeter to a depth of 1.5m and replacing it with inert material of at least G7 COLTO quality. Materials must be emplaced in 150mm layers, compacted to 93% Mod AASHTO density at moisture contents between -1% and +2% of optimum moisture content. Founding may then be done by means of lightly reinforced strip footings, while the superstructure must contain lightly reinforced masonry.

If inspection by a competent person during the phase two geotechnical investigation finds shallow bedrock competent enough for founding, the option of founding directly on bedrock may be done at the discretion of the competent person and based on the recommendations of the structural engineer.

8.1.2 Geotechnical Zone 2: **H2-H3**

In this zone it is essential that the amount of free heave be determined during the phase two investigation in order to refine the classification between **H2** and **H3** conditions. As it stands, however, a conservative approach is adopted (i.e. **H3** conditions) and the following is recommended:

- *Reinforced Concrete Raft:* Founding may be done by means of a reinforced concrete raft capable of accommodating unrestrained heave exceeding 30mm at a suitable safety factor to be selected by the structural engineer. The raft must also be able to accommodate settlement exceeding 20mm and should preferably exert less than 50kPa. The exact amount of free heave must be verified for each stand during the phase two investigation. The superstructure must contain articulation joints and/or lightly reinforced masonry.
- *Soil Replacement Raft:* Alternatively, founding may be done by means of a soil replacement raft. This entails the removal of all in situ soils to 1.0m beyond the building perimeter to a depth of 1.5m and replacing it with inert material of at least G7 COLTO quality. Materials must be emplaced in 150mm layers, compacted to 93% Mod AASHTO density at moisture contents between -1% and +2% of optimum moisture content. Founding may then be done by means of lightly reinforced strip footings, while the superstructure must contain lightly reinforced masonry. Foundation pressures should again preferably be limited to 50kPa.

8.1.3 Geotechnical Zone 3: **H3**

This zone is once more dominated by soil heave. As a result, the recommendations are as follows:

- *Reinforced Concrete Raft:* Firstly, founding may be done by means of a reinforced concrete raft capable of accommodating unrestrained heave exceeding 30mm at a suitable safety factor to be selected by the structural engineer. The raft must also be capable of accommodating 10mm settlement. The exact amount of free heave must be verified for each stand during the phase two investigation. The superstructure must contain articulation joints and/or lightly reinforced masonry.
- *Soil Replacement Raft:* Alternatively, founding may be done by means of a soil replacement raft. This entails the removal of all in situ soils to 1.0m beyond the building perimeter to a depth of 1.5m and replacing it with inert material of at least G7 COLTO quality. Materials must be emplaced in 150mm layers, compacted to 93% Mod AASHTO density at moisture contents between -1% and +2% of optimum moisture content. Founding may then be done by means of lightly reinforced strip footings, while the superstructure must contain lightly reinforced masonry.

It is also critical that site drainage and storm water be planned carefully to ensure efficient drainage. No storm water or surface runoff should accumulate or pond within 1.5m of the structures. Services and plumbing precautions must be put in place to ensure that underground services are not disrupted by the heave action of expansive in situ soils.

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

TABLE 5 : FOUNDATION DESIGN, BUILDING PROCEDURES AND PRECAUTIONARY MEASURES

GEOTECHNICAL ZONE	GEOTECHNICAL CLASS	% OF TOTAL AREA	ESTIMATED SOIL MOVEMENT	SOIL PROFILE	DEVELOPMENT POTENTIAL	CONSTRUCTION TYPE	FOUNDATION DESIGN	ASSOCIATED PROBLEMS
1	**H2 - H2/R**	41.0%	Unrestrained heave of up to 30mm	Colluvial horizons overlying mixed residual materials and mostly shale bedrock	Intermediate	Modified	Reinforced concrete raft OR Soil replacement Raft	Clayey excavation Rubble materials Corrosive soils Shallow bedrock in places
3	**H2-H3**	11.0%	Unrestrained heave up to and exceeding 30mm	Colluvial horizons overlying mixed residual materials	Intermediate	Modified	Reinforced concrete raft OR Soil replacement Raft	Clayey excavation Rubble materials Corrosive soils
4	**H3**	48.0%	Unrestrained heave exceeding 30mm	Colluvial horizons overlying mixed residual materials . Alluvium in places.	Intermediate	Modified	Reinforced concrete raft OR Soil replacement Raft	Clayey excavation Rubble materials Corrosive soils Problematic fill near stream

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:* Provision should be made for significant and well-planned earthworks to remove all rubble and fill materials from the site prior to construction. Provision should be made for highly variable material composition which may include (amongst others) household refuse, spoiled earth and an array of construction rubble.
- *Colluvium*: All colluvial soils should preferably be excavated by machine. While hand excavation is possible, the cohesive nature of the material makes hand excavation less suitable.
- *Alluvium*: Alluvial soils should also best be excavated by mechanical equipment. Provision should be made to address expected seepage water ingress originating from the adjacent stream.
- *Residual Diabase*: The residual diabase is machine excavatible, but additional provision will be required to demolish and remove corestones in the horizon. Alternatively, the use of an excavator would be more sufficient at removing corestones.
- *Residual Shale*: The residual shale requires significant to excavate and hence machine excavation is recommended above hand excavation.
- *Shale Bedrock*: The shale bedrock is only considered partially machine excavatible. While the use of an excavator with a rock bucket will be more effective at excavating the shale, areas where the shale has been baked (i.e. contact metamorphism) may require the use of a pecker or even blasting to excavate effectively.
- *Cohesive Excavation*: In general provision should be made for clayey, cohesive excavation on this site.
- *Excavation Stability*: It is recommended that provision be made for lateral support systems in all open excavations. The safety of all persons working in or near open excavation must be ensured.
- *Water Ingress*: It is likely that additional measures may be required to pump dry excavations on a seasonal basis (refer to 8.5 below).

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

Considering that extremely corrosive soils prevail on site, it is recommended that precautionary measures be put in place to protect buried steel services or anchoring poles (e.g. fences) from enhanced corrosion. The use of PVC piping or protectively coated metal piping may be considered.

8.5 Groundwater Investigation

In light of site observations, it is recommended that a groundwater study of the site be undertaken to determine whether seasonal seepage water will occur on this site, and what the severity and extent of such seepage water might be. The outcome of such an investigation may supersede the recommendations given in this report and the findings of such an investigation must advise whether additional sub-surface drainage measures might be required.

9 SOURCES OF REFERENCE

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

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

9.3 NHBRC: *Home Building Manual Part 1 & 2*, Revision 1, page 18, published in February 1999.

9.4 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.

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

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

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

IJ Breytenbach (Pr. Sci. Nat.)
1 December 2017
For Soilkraft cc

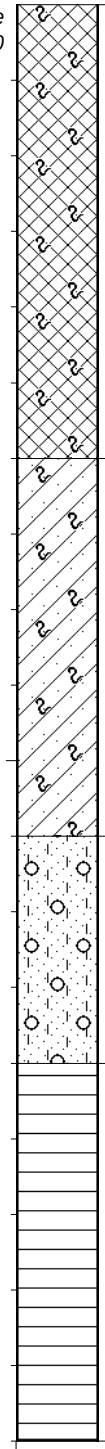
APPENDIX A: TRIAL HOLE LOG SHEETS

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 1
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Slightly moist, grey brown, medium dense, silty sand containing rubble such as bricks, plastic, ash, pieces of hose pipe, etc. Fill. Roots.

0.60 Moist, dark pink, stiff, shattered, sandy clay. Colluvium. Roots.

1.10 Most, green grey, dense, partially laminated, silty gravelly sand. Residual shale.

1.40 Light green grey, very fine grained, moderately weathered, very closely jointed, very soft to soft rock: SHALE. Joints are smooth, closed, clean and often discoloured black.

1.90

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 46.4S
Y-COORD : 28° 20 09.3E

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

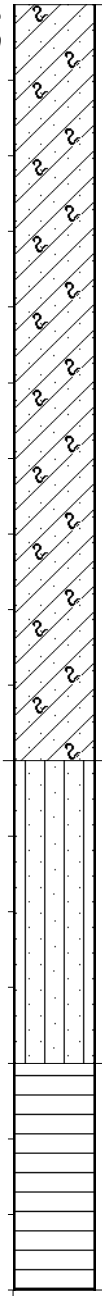
HOLE No: 1
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 2
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00

Moist, dark pink, stiff, shattered, sandy clay. Colluvium. Roots.

SKT-51-426:

1.00

Moist, pale yellow mottle black, stiff, intact, sandy silt. Residual shale.

1.40

Light green grey, very fine grained, moderately weathered, very closely jointed, very soft to soft rock: SHALE. Joints are smooth, closed, clean and often discoloured black.

1.70

NOTES

1) Gradual refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-51-426: 0.50m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 43 47.1S
Y-COORD : 28° 20 12.1E

HOLE No: 2
Geotechnical Investigation

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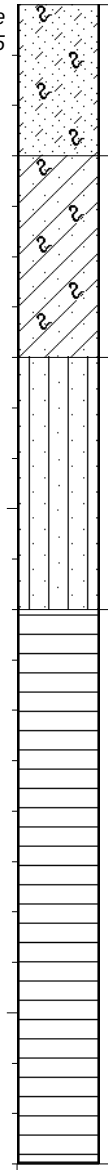
Samcor Park Extensions

HOLE No: 3
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Slightly moist, dark brown, medium dense, shattered, clayey sand. Colluvium. Roots.

0.30 Moist, dark pink, stiff, shattered, sandy clay. Colluvium. Roots.

0.70 Moist, pale yellow mottle black, stiff, intact, sandy silt. Residual shale.

1.20 Light grey brown, very fine grained, moderately to highly weathered, very closely jointed, very soft rock: SHALE. Material resembles silty gravel .

2.30

NOTES

1) No refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 47.9S
Y-COORD : 28° 20 15.1E

HOLE No: 3
Geotechnical Investigation

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

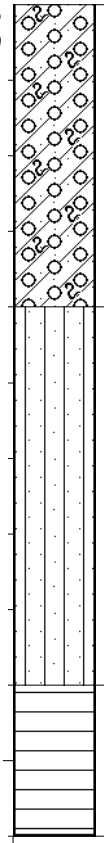
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 4
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Moist, dark pink, stiff, shattered, sandy clay containing fine shale gravel. Colluvium. Roots.

0.40 Moist, pale yellow mottle black, stiff, intact, sandy silt. Residual shale.

0.90 Dark grey, very fine grained, moderately to slightly weathered, very closely jointed, very hard rock: baked SHALE. Joints are undulating to smooth, closed or open (less than 1mm) and discoloured red brown.

1.10

NOTES

1) Refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 48.8S
Y-COORD : 28° 20 18.8E

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

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HOLE No: 4
Geotechnical Investigation

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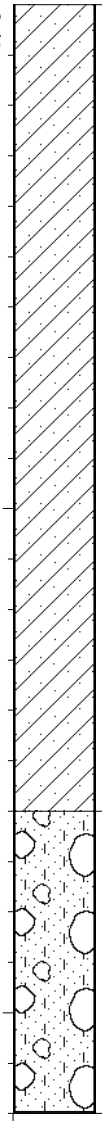
Samcor Park Extensions

HOLE No: 5
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Moist, grey brown, firm, shattered, sandy clay. Colluvium.

1.60 Slightly moist, light grey speckled black, dense, intact, silty sand. Residual diabase containing rare, small cobbles.

2.20

NOTES

1) No refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-52-427: 0.80m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 49.7S
Y-COORD : 28° 20 22.1E

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

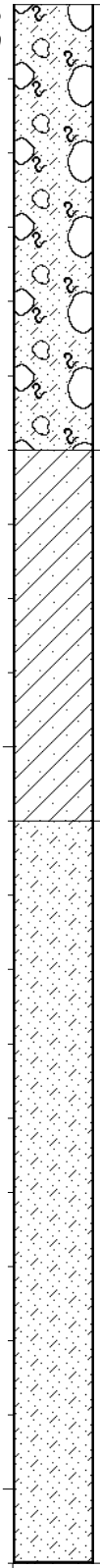
HOLE No: 5
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 6
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Moist, dark brown, medium dense, shattered, clayey sand containing diabase cobbles. Colluvium. Roots.

0.60 Moist, grey brown, firm, shattered, sandy clay. Colluvium.

1.10 Slightly moist, light brown grey, medium dense, intact, clayey sand grading into silty sand . Residual diabase.

2.10

NOTES

1) No refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 50.5S
Y-COORD : 28° 20 26.2E

HOLE No: 6
Geotechnical Investigation

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

DATE : 28/11/2017 14:32
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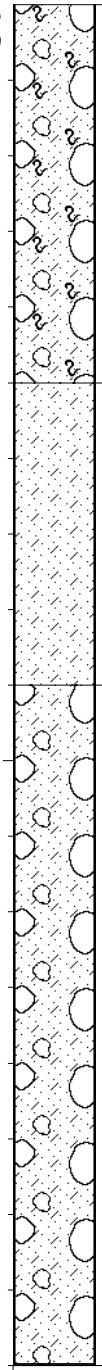
Tambura 69 Trust
Samcor Park Extensions

HOLE No: 7
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Moist, dark brown, medium dense, shattered, clayey sand containing diabase cobbles. Colluvium. Roots.

0.50 Slightly moist, light grey brown, medium dense, intact, clayey sand. Residual diabase.

0.90 Slightly moist, light brown grey, medium dense, intact, clayey sand grading into silty sand containing diabase cobbles. Residual diabase.

1.80

NOTES

1) Refusal of excavation on diabase cobbles.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 43 51.4S
Y-COORD : 28° 20 29.6E

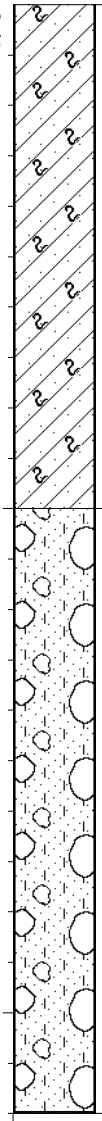
HOLE No: 7
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 8
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Moist, dark pink, stiff, shattered, sandy clay. Colluvium. Roots.

1.00 Slightly moist, light brown grey, medium dense, intact, silty sand containing diabase cobbles. Residual diabase.

2.20

NOTES

1) Refusal of excavation on diabase cobbles.
2) No seepage.
3) Disturbed Sample SKT-51-428m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 52.5S
Y-COORD : 28° 20 32.3E

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

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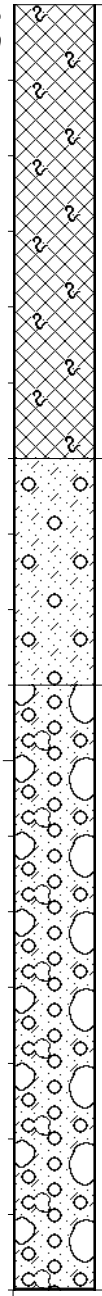
HOLE No: 8
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 9
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00

Moist, yellow brown, loose, gravelly silty sand . Fill. Roots.

0.60

Moist, light grey brown, medium dense, shattered, gravelly clayey sand. Colluvium.

0.90

Slightly moist, grey brown blotched orange and black, medium dense to dense, shattered clayey sand containing gravel and cobbles of diabase . Ferruginised residual diabase.

1.70

NOTES

1) Refusal of excavation on diabase cobbles.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 53.5S
Y-COORD : 28° 20 36.9E

HOLE No: 9
Geotechnical Investigation

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

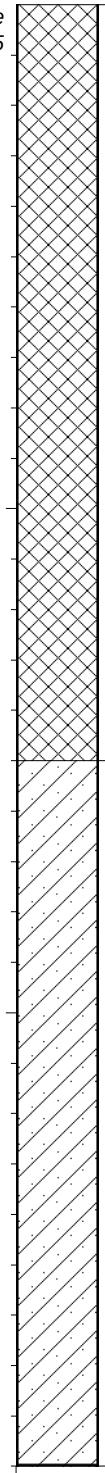
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 10
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Slightly moist, grey brown, medium dense, clayey sand containing mixed gravel and refuse. Fill.

1.50 Moist, dark grey, firm, intact, sandy clay. Alluvium.

2.90

NOTES

1) No refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-51-429m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 55.4S
Y-COORD : 28° 20 39.9E

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

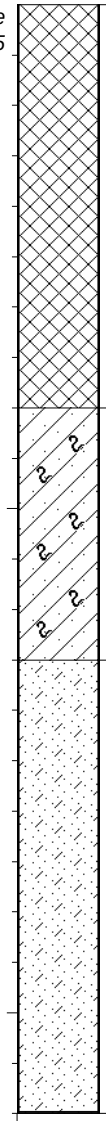
HOLE No: 10
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 11
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Slightly moist, grey brown, medium dense, clayey sand containing mixed gravel and refuse. Fill.

0.80 Moist, dark pink, stiff, shattered, sandy clay. Colluvium. Roots.

1.30 Slightly moist, orange brown, dense, intact, clayey sand. Ferruginised residual diabase.

2.20

NOTES

1) No refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 43 56.4S
Y-COORD : 28° 20 37.2E

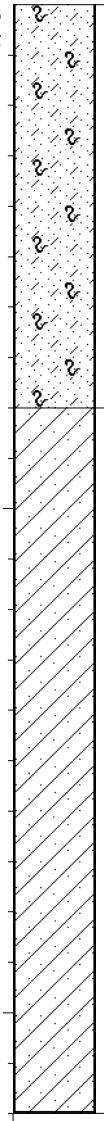
HOLE No: 11
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 12
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Slightly moist, black brown, medium dense, shattered, clayey sand. Colluvium. Roots.

0.80 Moist, light brown speckled white, firm, slickensided, sandy clay. Residual diabase.

2.20

NOTES

1) No refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-51-430: 1.50m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 58.9S
Y-COORD : 28° 20 37.8E

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

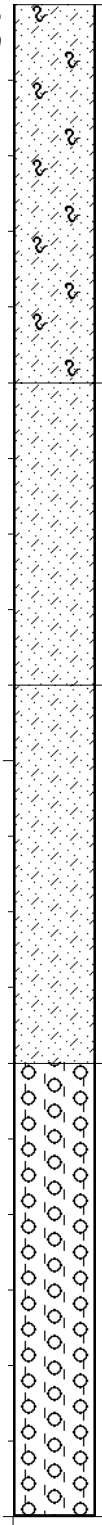
HOLE No: 12
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 13
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Slightly moist, black brown, medium dense, shattered, clayey sand. Colluvium. Roots.

0.50 Slightly moist, orange brown speckled black, medium dense, intact, clayey sand. Ferruginised residual shale.

0.90 Moist, light brown speckled black, dense, slickensided, clayey sand. Slightly ferruginised residual shale.

1.40 Slightly moist, light brown, dense, laminated, silty gravel. Residual shale grading into weathered bedrock.

2.00

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 59.0S
Y-COORD : 28° 20 33.6E

HOLE No: 13
Geotechnical Investigation

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

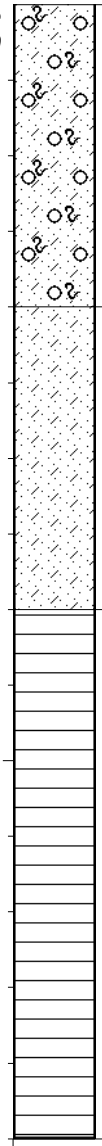
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 14
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Slightly moist, dark brown, loose to medium dense, shattered, clayey gravelly sand. Colluvium. Roots.

0.40 Slightly moist, light brown grey, dense, slickensided, clayey sand. Residual shale.

0.80 Light grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.

1.50

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 43 58.2S
Y-COORD : 28° 20 31.1E

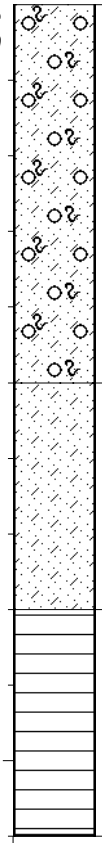
HOLE No: 14
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 15
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00

Slightly moist, dark brown, loose to medium dense, shattered, clayey gravelly sand. Colluvium. Roots.

0.50

Slightly moist, light brown grey, dense, slickensided, clayey sand. Residual shale.

SKT-51-431:

0.80

Dark grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.

1.10

NOTES

1) Gradual refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-51-431: 0.65m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 57.6S
Y-COORD : 28° 20 28.0E

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

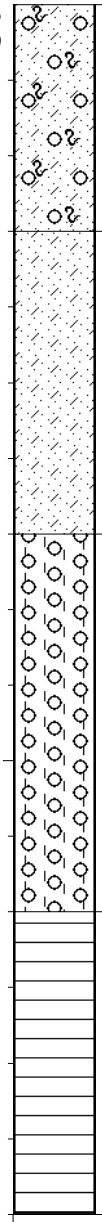
HOLE No: 15
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 16
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00	Slightly moist, dark brown, loose to medium dense, shattered, clayey gravelly sand. Colluvium. Roots.
0.30	Slightly moist, light brown grey, dense, slickensided, clayey sand. Residual shale.
0.70	Slightly moist, light grey, medium dense to dense, intact, silty gravel. Residual shale.
1.20	Dark grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.
1.60	

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 56.5S
Y-COORD : 28° 20 24.3E

HOLE No: 16
Geotechnical Investigation

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

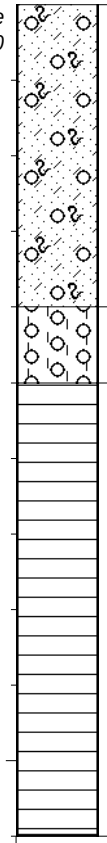
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 17
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Slightly moist, dark brown, loose to medium dense, shattered, clayey gravelly sand. Colluvium. Roots.

0.40 Slightly moist, yellow grey, medium dense, intact, silty gravel. Residual shale.

0.50 Light grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.

1.10

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 55.6S
Y-COORD : 28° 20 20.6E

HOLE No: 17
Geotechnical Investigation

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

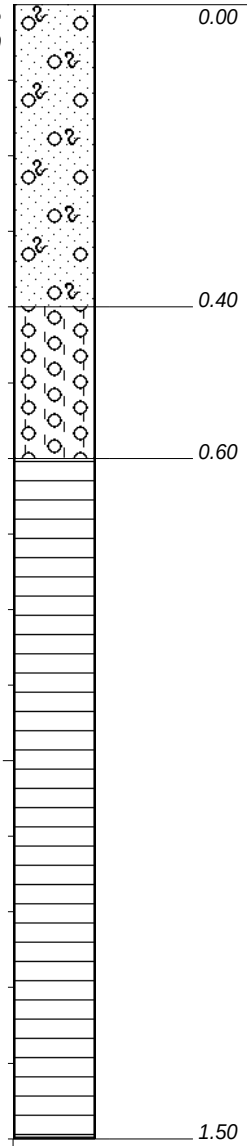
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 18
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Moist, dark brown, loose, intact, gravelly sand. Colluvium. Roots.

0.40 Moist, light grey, medium dense, silty gravel. Residual shale.

0.60 Light grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are very moist, undulating to smooth, clean, closed and discoloured black and red.

1.50

NOTES

1) Gradual refusal of excavation.
2) No seepage.
3) Disturbed Sample SKT-51-432: 0.20m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 54.6S
Y-COORD : 28° 20 17.4E

HOLE No: 18
Geotechnical Investigation

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

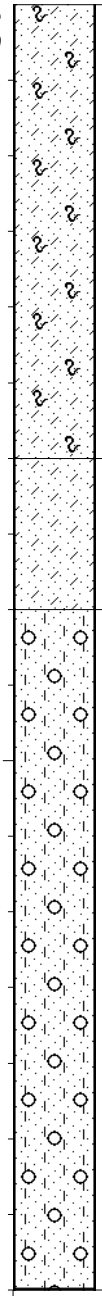
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 19
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Moist, dark brown, loose, shattered, clayey sand. Colluvium containing roots.

0.60 Moist, light brown, dense, slickensided, clayey sand. Residual shale.

0.80 Slightly moist, grey white, dense, intact, gravelly silty sand. Calcified residual contact between shale and diabase.

1.70

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 53.4S
Y-COORD : 28° 20 13.4E

HOLE No: 19
Geotechnical Investigation

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

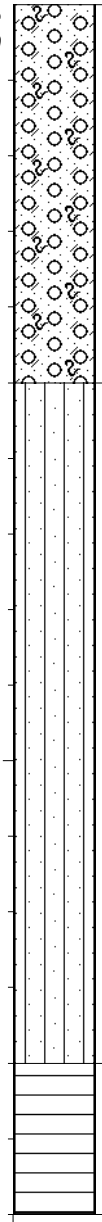
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 20
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00

Moist, dark brown, loose, shattered, clayey sand containing diabase gravel. Colluvium containing roots.

0.50

Slightly moist, yellow grey, stiff, intact, sandy silt. Residual shale.

1.40

Dark grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.

1.60

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 43 52.2S
Y-COORD : 28° 20 10.6E

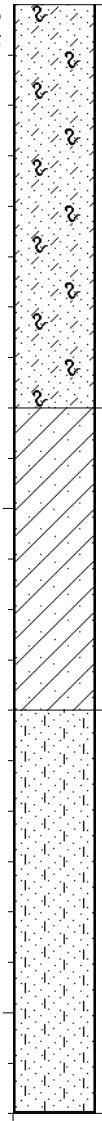
HOLE No: 20
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 21
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Moist, dark red, medium dense, shattered, clayey sand. Colluvium with roots.

0.80 Moist, light grey brown, stiff, slickensided, sandy clay. Residual diabase.

1.40 Slightly moist, pale yellow, medium dense, intact, silty sand. Residual diabase.

2.20

NOTES

1) No refusal of excavation.
2) No seepage.
3) Disturbed Sample SKT-51-433: 0.40m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 43 51.1S
Y-COORD : 28° 20 07.0E

HOLE No: 21
Geotechnical Investigation

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

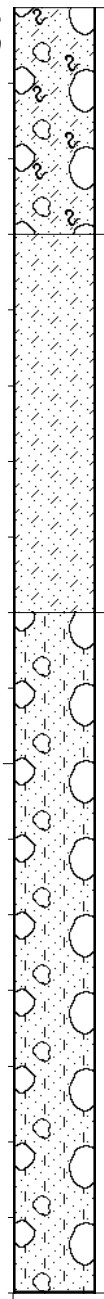
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 22
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Moist, dark brown, loose, shattered, clayey sand containing diabase cobbles. Colluvium. Roots.

0.30 Moist, red brown, dense, slickensided, clayey sand. Residual diabase.

0.80 Slightly moist, pale yellow, medium dense becoming dense with depth, intact, silty sand containing diabase cobbles. Residual diabase.

1.70

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 43 59.7S
Y-COORD : 28° 20 15.3E

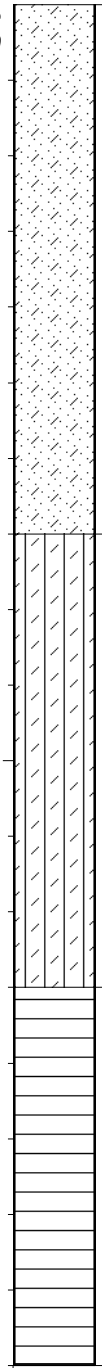
HOLE No: 22
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 23
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00

Moist, red brown, dense, slickensided, clayey sand. Residual diabase.

0.70

Slightly moist, yellow grey, stiff, intact, clayey silt. Residual shale.

SKT-51-434:

1.30

Light grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.

1.80

NOTES

1) Gradual refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-51-434: 1.00m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 44 00.9S
Y-COORD : 28° 20 18.7E

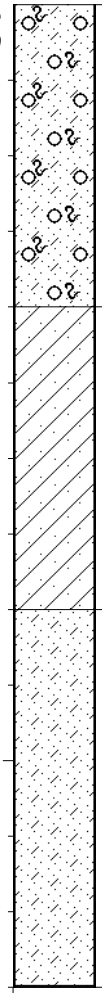
HOLE No: 23
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 24
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Slightly moist, dark brown, loose to medium dense, shattered, clayey gravelly sand. Colluvium. Roots.

0.40 Moist, yellow mottled orange, stiff, intact, sandy clay. Ferruginised residual shale.

0.80 Slightly moist, light brown grey mottled orange, dense, slickensided, clayey sand. Residual shale.

1.30

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 44 02.1S
Y-COORD : 28° 20 22.2E

HOLE No: 24
Geotechnical Investigation

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

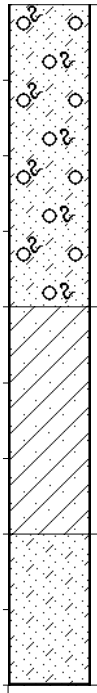
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 25
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Slightly moist, dark brown, loose to medium dense, shattered, clayey gravelly sand. Colluvium. Roots.

0.40 Moist, yellow mottled orange, stiff, intact, sandy clay. Ferruginised residual shale.

0.70 Slightly moist, light brown grey, dense, slickensided, clayey sand. Residual shale.

0.90

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 44 03.3S
Y-COORD : 28° 20 25.6E

HOLE No: 25
Geotechnical Investigation

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

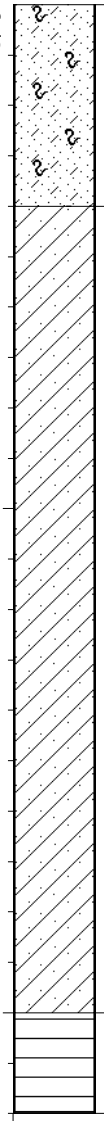
DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 26
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:15



0.00 Moist, dark brown, loose, shattered, clayey sand. Colluvium containing roots.

0.40 Moist, brown grey, firm, slickensided, sandy clay. Ferruginised residual shale.

2.00 Light grey, very fine grained, very closely jointed, soft to very soft rock: SHALE. Joints are undulating to smooth, clean, closed and discoloured black and red.

2.20

NOTES

1) No refusal of excavation.

2) No seepage.

3) Disturbed Sample SKT-51-435: 1.20m.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

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

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

ELEVATION :
X-COORD : 25° 44 04.7S
Y-COORD : 28° 20 29.5E

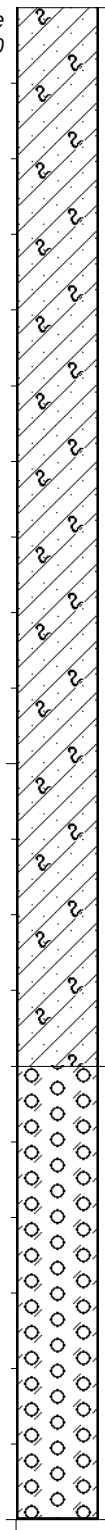
HOLE No: 26
Geotechnical Investigation

Tambura 69 Trust
Samcor Park Extensions

HOLE No: 27
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

Scale 1:10



0.00 Very moist, black grey, soft, slickensided, sandy clay. Alluvium with roots.

1.40 Slightly moist, grey brown, medium dense becoming dense with depth, intact, clayey gravel. Residual shale grading into weathered bedrock.

2.00

NOTES

1) Gradual refusal of excavation.

2) No seepage.

CONTRACTOR : Super Plant Hire
MACHINE : Cat 428F
DRILLED BY : Thompson
PROFILED BY : Izak Breytenbach

INCLINATION :
DIAM : 700mm
DATE :
DATE : 25/10/2017

ELEVATION :
X-COORD : 25° 44 02.1S
Y-COORD : 28° 20 32.0E

HOLE No: 27
Geotechnical Investigation

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

Tambura 69 Trust
Samcor Park Extensions

LEGEND
Sheet 1 of 1

JOB NUMBER: 2017/J039/TAM

	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILT	{SA06}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	SHALE	{SA12}
	FILL	{SA32}
Name ●	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}
	COBBLES	{SA58}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

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

DATE : 28/11/2017 14:32
TEXT : ..corParkWJ\TPProfiles.txt

LEGEND
SUMMARY OF SYMBOLS

APPENDIX B: MATERIAL TEST RESULTS

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Quality | Excellence | On Time

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Gerrie | 082 309 4448 | gerrie@stlab.co.za
www.stlab.co.za

Client Name: Soilkraft
Project Name: Samcor Park
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 2	TH 5	TH 8	Sample	TH 2	TH 5	TH 8
Depth (mm)	0 - 1000	0 - 1600	1000 - 2300	Depth (mm)	0 - 1000	0 - 1600	1000 - 2300
Lab No	SKT-51-426	SKT-51-427	SKT-51-428	Lab No	SKT-51-426	SKT-51-427	SKT-51-428
75.0	**100**	**100**	**100**	Liquid Limit (%)	**55**	**60**	**38**
63.0	**100**	**100**	**100**	Plastic Limit (%)	**25**	**29**	**23**
53.0	**100**	**100**	**100**	Plasticity Index (%)	**30**	**31**	**15**
37.5	**100**	**100**	**100**	Linear Shrinkage (%)	**15.3**	**15.3**	**7.7**
26.5	**100**	**100**	**100**	PI of whole sample	**24**	**27**	**12**
19.0	**100**	**100**	**100**				
13.2	**100**	**100**	**99**	% Gravel	**8**	**6**	**6**
9.5	**100**	**100**	**98**	% Sand	**34**	**26**	**49**
6.7	**99**	**99**	**97**	% Silt	**22**	**20**	**27**
4.75	**98**	**99**	**97**	% Clay	**36**	**48**	**18**
2.00	**92**	**94**	**94**	Activity	**0.8**	**0.7**	**0.8**
1.00	**86**	**91**	**89**				
0.425	**81**	**87**	**77**	% Soil Mortar	**92**	**94**	**94**
0.250	**77**	**83**	**72**				
0.150	**71**	**79**	**65**	Grading Modulus	**0.61**	**0.47**	**0.75**
0.075	**66**	**72**	**54**	Moisture Content (%)	**N / T**	**N / T**	**N / T**
0.050	**53**	**65**	**39**	Relative Density (SG)*	**2.65**	**2.65**	**2.65**
0.020	**48**	**60**	**29**				
0.006	**41**	**53**	**21**	Unified (ASTM D2487)	**CH**	**CH**	**CL**
0.002	**36**	**48**	**18**	AASHTO (M145-91)	**A - 7 - 6**	**A - 7 - 6**	**A - 6**

Remarks: *: Assumed
N / T: Not Tested

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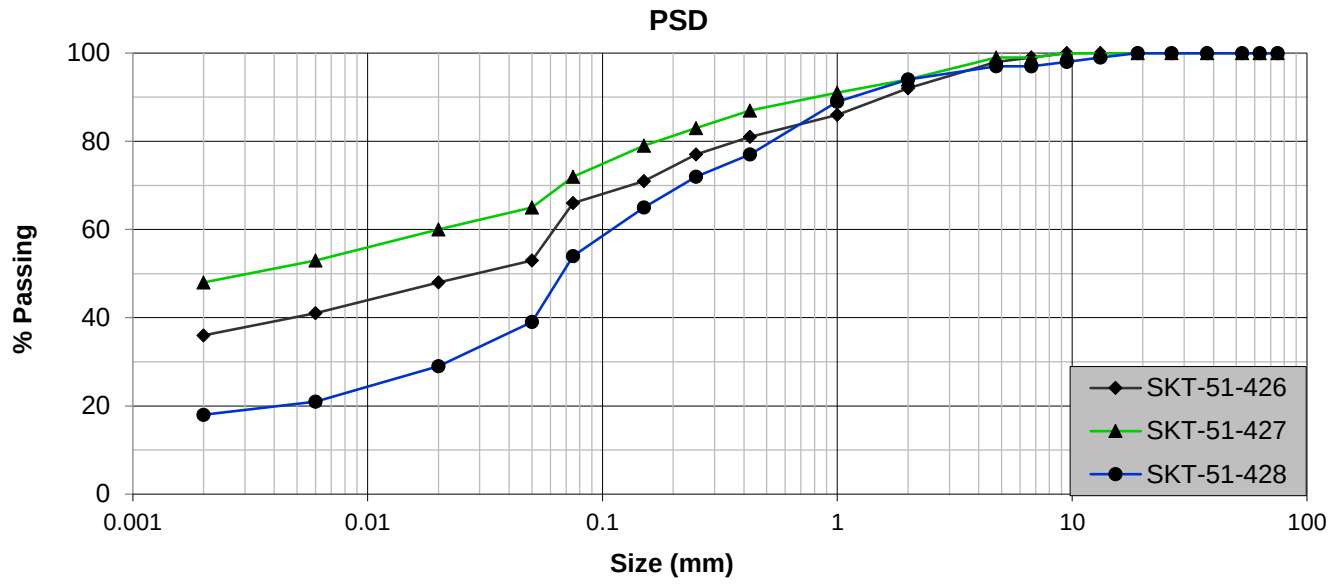
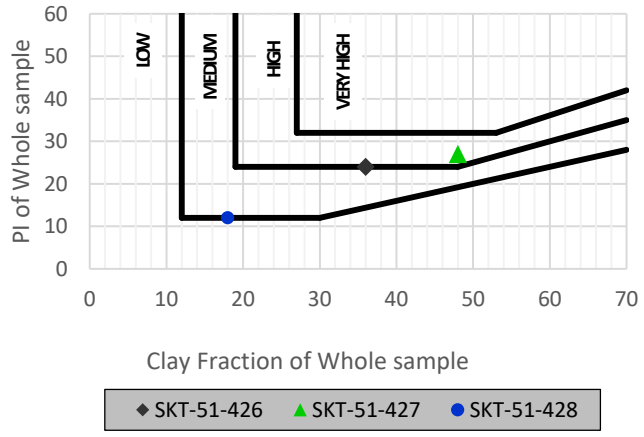
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

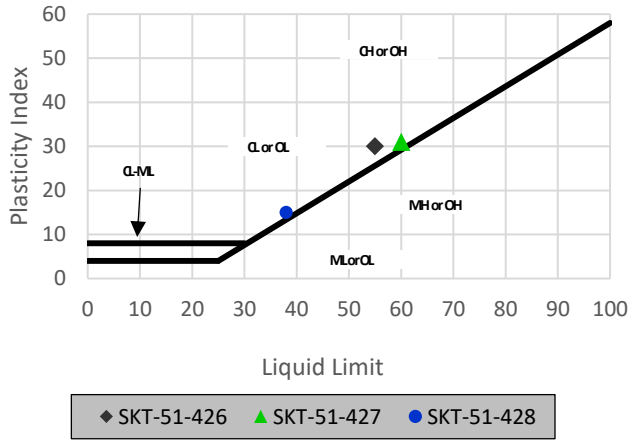
FOUNDATION INDICATOR



Potential Expansiveness



Casagrande Plasticity Chart



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Client Name: Soilkraft
Project Name: Samcor Park
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 10	TH 12	TH 15	Sample	TH 10	TH 12	TH 15
Depth (mm)	1500 - 2900	800 - 2200	500 - 800	Depth (mm)	1500 - 2900	800 - 2200	500 - 800
Lab No	SKT-51-429	SKT-51-430	SKT-51-431	Lab No	SKT-51-429	SKT-51-430	SKT-51-431
75.0	**100**	**100**	**100**	Liquid Limit (%)	**77**	**73**	**79**
63.0	**100**	**100**	**100**	Plastic Limit (%)	**34**	**30**	**37**
53.0	**100**	**100**	**100**	Plasticity Index (%)	**43**	**43**	**42**
37.5	**100**	**100**	**100**	Linear Shrinkage (%)	**20.3**	**18.9**	**19.1**
26.5	**100**	**100**	**100**	PI of whole sample	**40**	**38**	**28**
19.0	**100**	**100**	**100**				
13.2	**100**	**100**	**100**	% Gravel	**3**	**5**	**16**
9.5	**100**	**100**	**99**	% Sand	**27**	**24**	**38**
6.7	**99**	**100**	**99**	% Silt	**14**	**16**	**17**
4.75	**99**	**99**	**97**	% Clay	**56**	**55**	**29**
2.00	**97**	**95**	**84**	Activity	**0.8**	**0.8**	**1.5**
1.00	**95**	**91**	**74**				
0.425	**94**	**88**	**67**	% Soil Mortar	**97**	**95**	**84**
0.250	**91**	**85**	**65**				
0.150	**86**	**80**	**62**	Grading Modulus	**0.30**	**0.41**	**0.93**
0.075	**79**	**76**	**56**	Moisture Content (%)	**N / T**	**N / T**	**N / T**
0.050	**64**	**68**	**39**	Relative Density (SG)*	**2.65**	**2.65**	**2.65**
0.020	**60**	**63**	**35**				
0.006	**57**	**57**	**31**	Unified (ASTM D2487)	**CH**	**CH**	**CH**
0.002	**56**	**55**	**29**	AASHTO (M145-91)	**A - 7 - 5**	**A - 7 - 5**	**A - 7 - 5**

Remarks: *: Assumed
N / T: Not Tested

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Client Name: Soilkraft
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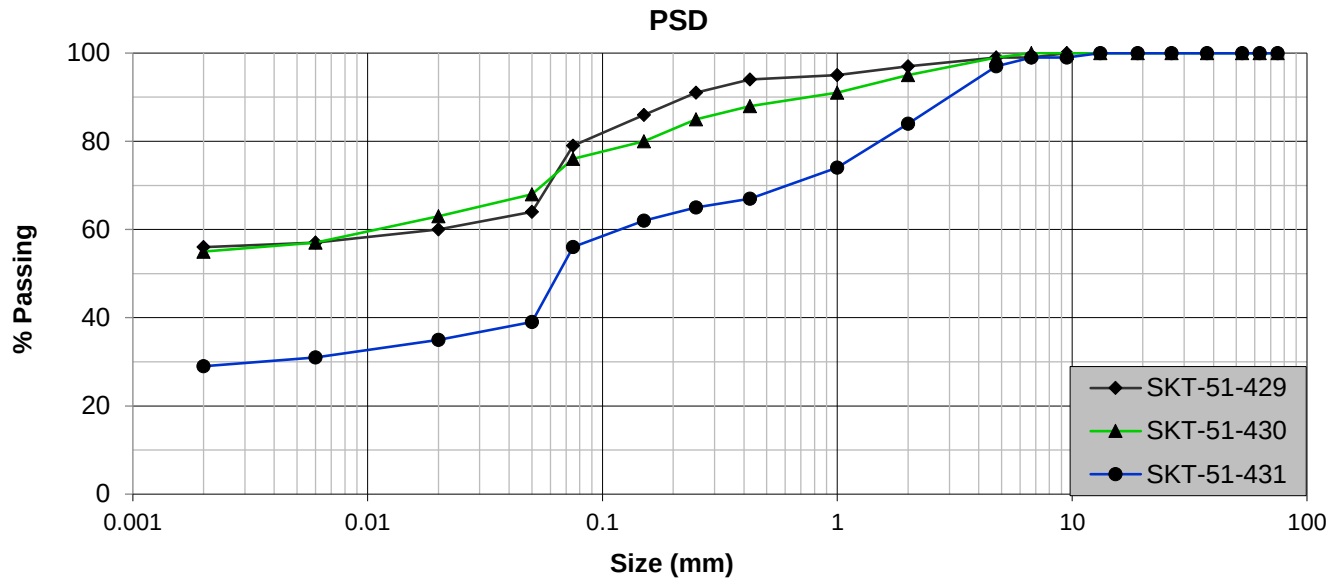
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

FOUNDATION INDICATOR



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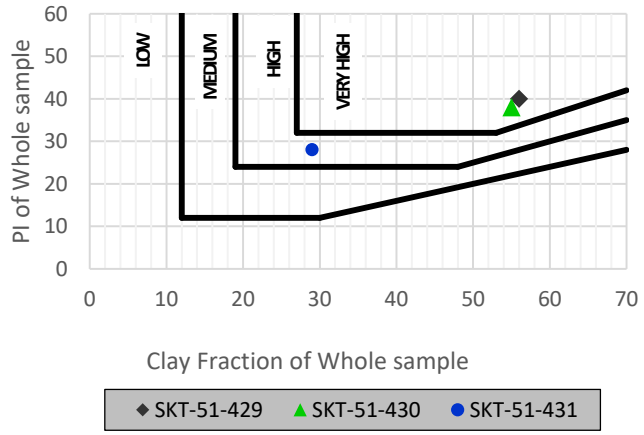
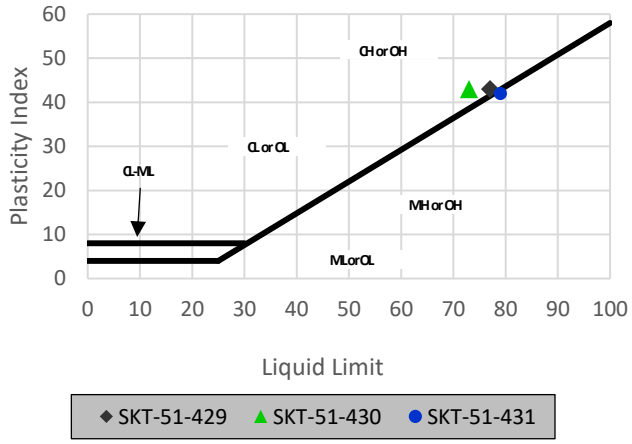


Casagrande Plasticity Chart



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Client Name: Soilkraft
Project Name: Samcor Park
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 18	TH 21	TH 23	Sample	TH 18	TH 21	TH 23
Depth (mm)	0 - 400	0 - 800	700 - 1300	Depth (mm)	0 - 400	0 - 800	700 - 1300
Lab No	SKT-51-432	SKT-51-433	SKT-51-434	Lab No	SKT-51-432	SKT-51-433	SKT-51-434
75.0	**100**	**100**	**100**	Liquid Limit (%)	**57**	**70**	**43**
63.0	**100**	**100**	**100**	Plastic Limit (%)	**27**	**35**	**20**
53.0	**100**	**100**	**100**	Plasticity Index (%)	**30**	**35**	**23**
37.5	**100**	**100**	**100**	Linear Shrinkage (%)	**14.5**	**17.1**	**11.8**
26.5	**100**	**100**	**100**	PI of whole sample	**18**	**31**	**17**
19.0	**100**	**100**	**100**				
13.2	**99**	**100**	**100**	% Gravel	**26**	**4**	**13**
9.5	**97**	**100**	**99**	% Sand	**33**	**25**	**25**
6.7	**93**	**100**	**99**	% Silt	**19**	**18**	**34**
4.75	**89**	**99**	**97**	% Clay	**22**	**53**	**28**
2.00	**74**	**96**	**87**	Activity	**1.4**	**0.7**	**0.8**
1.00	**65**	**92**	**80**				
0.425	**60**	**89**	**75**	% Soil Mortar	**74**	**96**	**87**
0.250	**58**	**87**	**73**				
0.150	**55**	**83**	**70**	Grading Modulus	**1.16**	**0.39**	**0.72**
0.075	**50**	**76**	**66**	Moisture Content (%)	**N / T**	**N / T**	**N / T**
0.050	**35**	**67**	**60**	Relative Density (SG)*	**2.65**	**2.65**	**2.65**
0.020	**30**	**60**	**47**				
0.006	**25**	**56**	**35**	Unified (ASTM D2487)	**CH**	**MH**	**CL**
0.002	**22**	**53**	**28**	AASHTO (M145-91)	**A - 7 - 6**	**A - 7 - 5**	**A - 7 - 6**

Remarks: *: Assumed
N / T: Not Tested

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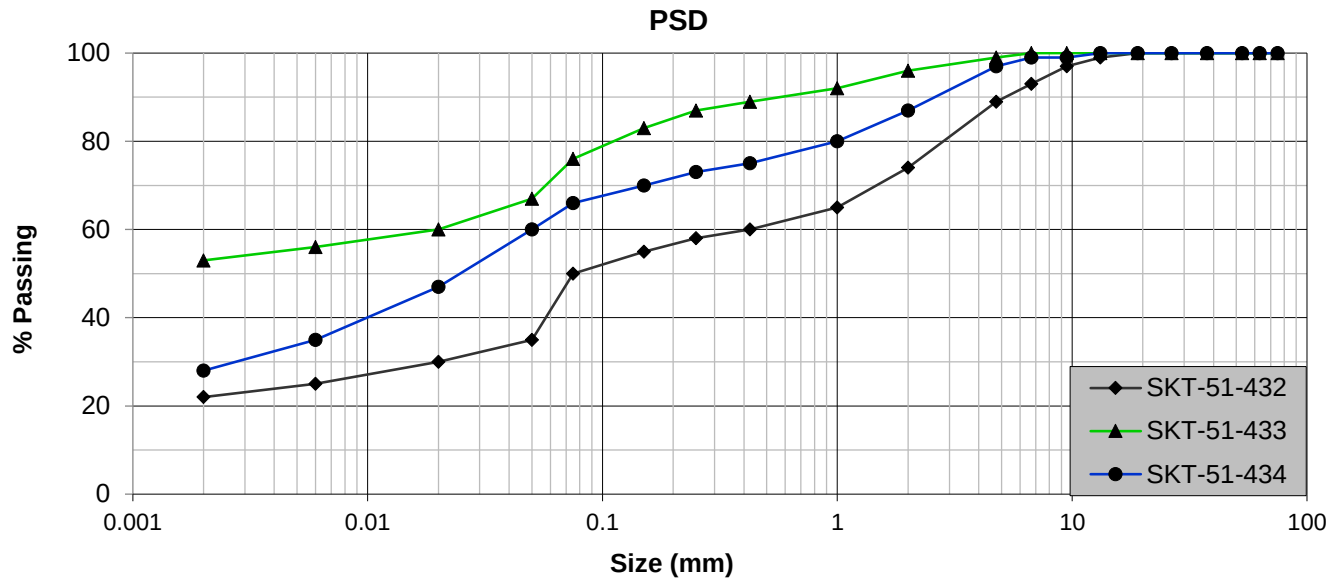
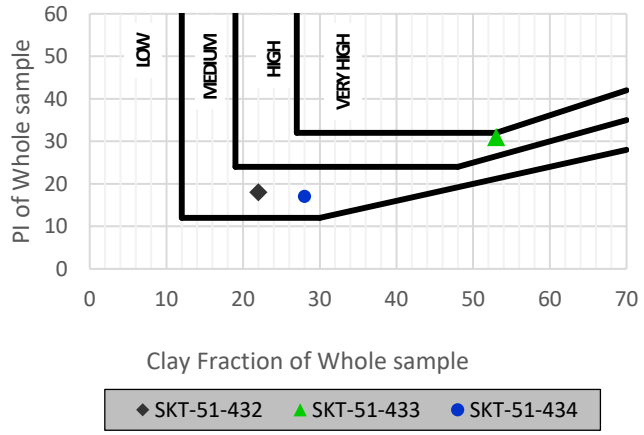
Client Name: Soilkraft
Project Name: Samcor Park
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

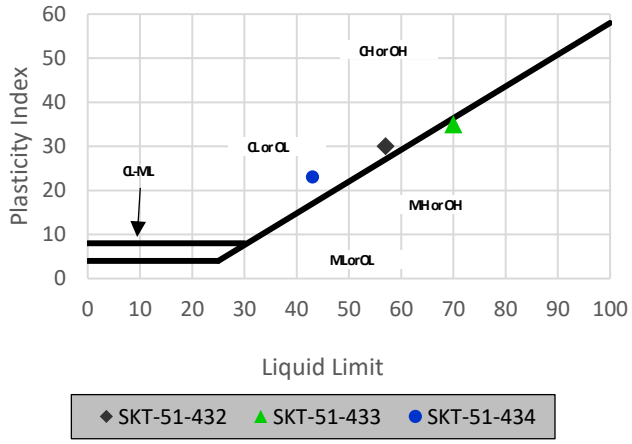
FOUNDATION INDICATOR



Potential Expansiveness



Casagrande Plasticity Chart



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Project Name: Samcor Park
Job Number: SKT-51
Date: 2017-11-22
Method: SANS 3001 GR1, GR10 & ASTM D422

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TH 26			Sample	TH 26		
Depth (mm)	400 - 2000			Depth (mm)	400 - 2000		
Lab No	SKT-51-435			Lab No	SKT-51-435		
75.0	**100**			Liquid Limit (%)	**56**		
63.0	**100**			Plastic Limit (%)	**24**		
53.0	**100**			Plasticity Index (%)	**32**		
37.5	**100**			Linear Shrinkage (%)	**15.1**		
26.5	**100**			PI of whole sample	**26**		
19.0	**100**						
13.2	**100**			% Gravel	**7**		
9.5	**100**			% Sand	**31**		
6.7	**100**			% Silt	**13**		
4.75	**99**			% Clay	**49**		
2.00	**93**			Activity	**0.7**		
1.00	**85**						
0.425	**80**			% Soil Mortar	**93**		
0.250	**77**						
0.150	**74**			Grading Modulus	**0.58**		
0.075	**69**			Moisture Content (%)	**N / T**		
0.050	**58**			Relative Density (SG)*	**2.65**		
0.020	**55**						
0.006	**50**			Unified (ASTM D2487)	**CH**		
0.002	**49**			AASHTO (M145-91)	**A - 7 - 6**		

Remarks: *: Assumed
N / T: Not Tested

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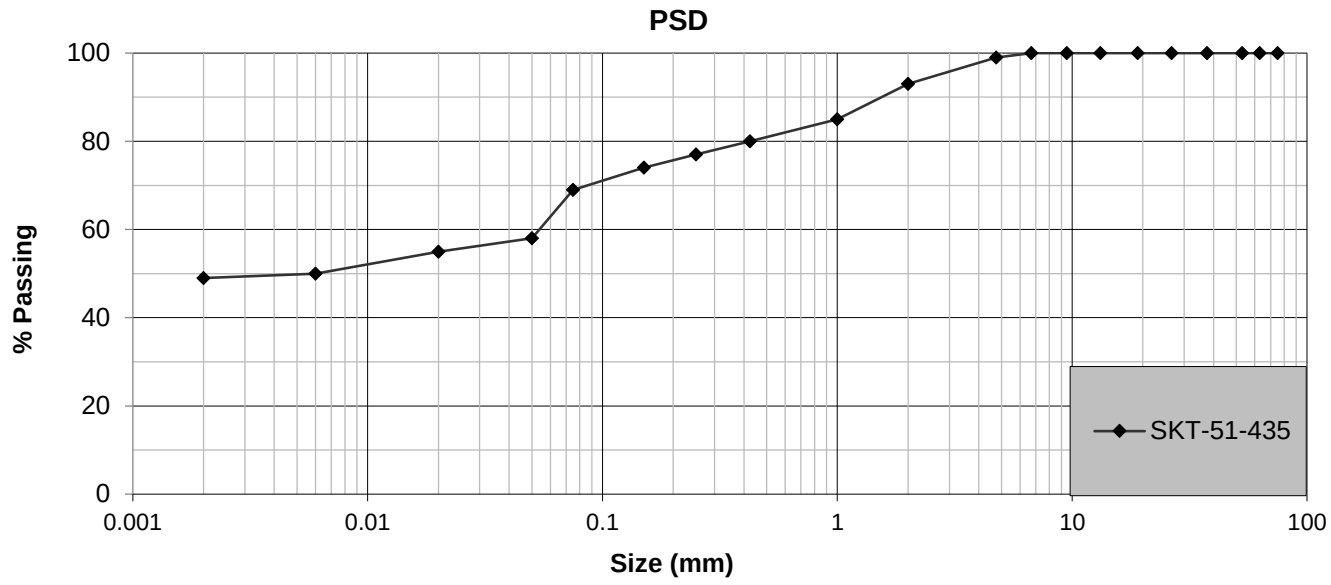
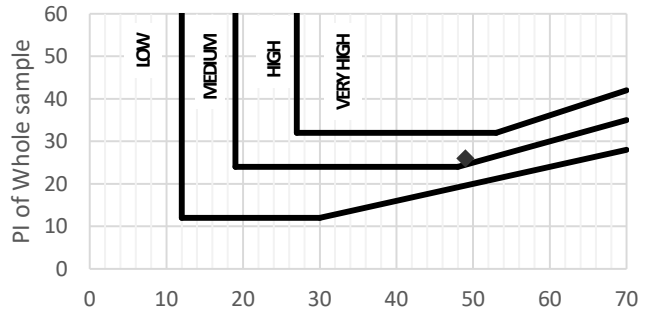
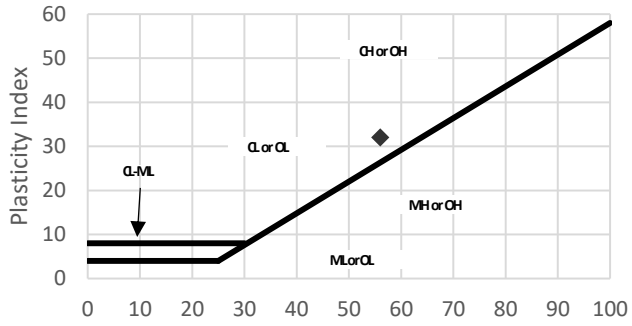


Potential Expansiveness



◆ SKT-51-435

Casagrande Plasticity Chart



◆ SKT-51-435

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Specialised Testing Laboratory (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical
Quality | Excellence | On Time

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Client Name: Soilkraft
Project Name: Samcor Park
Job Number: SKT-51
Date: 22-Nov-17
Method: SANS 3001 GR1, GR10, GR20, GR30, GR31, GR40, GR50, GR53, GR54 & ASTM D422 * (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TH 2	TH 5	TH 8	TH 10	TH 12	TH 15	TH 18	TH 21
Depth (mm)	0 - 1000	0 - 1600	1000 - 2300	1500 - 2900	800 - 2200	500 - 800	0 - 400	0 - 800
Lab No	SKT-51-426	SKT-51-427	SKT-51-428	SKT-51-429	SKT-51-430	SKT-51-431	SKT-51-432	SKT-51-433
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**	**99**	**100**	**100**	**100**	**99**	**100**
9.5	**100**	**100**	**98**	**100**	**100**	**99**	**97**	**100**
6.7	**99**	**99**	**97**	**99**	**100**	**99**	**93**	**100**
4.75	**98**	**99**	**97**	**99**	**99**	**97**	**89**	**99**
2.00	**92**	**94**	**94**	**97**	**95**	**84**	**74**	**96**
1.00	**86**	**91**	**89**	**95**	**91**	**74**	**65**	**92**
0.425	**81**	**87**	**77**	**94**	**88**	**67**	**60**	**89**
0.250	**77**	**83**	**72**	**91**	**85**	**65**	**58**	**87**
0.150	**71**	**79**	**65**	**86**	**80**	**62**	**55**	**83**
0.075	**66**	**72**	**54**	**79**	**76**	**56**	**50**	**76**
0.050	**53**	**65**	**39**	**64**	**68**	**39**	**35**	**67**
0.020	**48**	**60**	**29**	**60**	**63**	**35**	**30**	**60**
0.006	**41**	**53**	**21**	**57**	**57**	**31**	**25**	**56**
0.002	**36**	**48**	**18**	**56**	**55**	**29**	**22**	**53**
GM	**0.61**	**0.47**	**0.75**	**0.30**	**0.41**	**0.93**	**1.16**	**0.39**

Atterberg Limits

LL (%)	**55**	**60**	**38**	**77**	**73**	**79**	**57**	**70**
PI (%)	**30**	**31**	**15**	**43**	**43**	**42**	**30**	**35**
LS (%)	**15.3**	**15.3**	**7.7**	**20.3**	**18.9**	**19.1**	**14.5**	**17.1**

pH & Conductivity

pH		**7.4**		**7.5**		**7.5**		**7.6**
EC (S/m)		**0.0814**		**0.1212**		**0.0842**		**0.0688**

MDD / OMC

MDD (kg/m³)								
OMC (%)								

CBR

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

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

Remarks: _____

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Date: 22-Nov-17
Method: SANS 3001 GR1, GR10, GR20, GR30, GR31, GR40, GR50, GR53, GR54 & ASTM D422 * (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TH 23	TH 26						
Depth (mm)	700 - 1300	400 - 2000						
Lab No	SKT-51-434	SKT-51-435						
53.0	**100**	**100**						
37.5	**100**	**100**						
26.5	**100**	**100**						
19.0	**100**	**100**						
13.2	**100**	**100**						
9.5	**99**	**100**						
6.7	**99**	**100**						
4.75	**97**	**99**						
2.00	**87**	**93**						
1.00	**80**	**85**						
0.425	**75**	**80**						
0.250	**73**	**77**						
0.150	**70**	**74**						
0.075	**66**	**69**						
0.050	**60**	**58**						
0.020	**47**	**55**						
0.006	**35**	**50**						
0.002	**28**	**49**						
GM	**0.72**	**0.58**						

Atterberg Limits

LL (%)	**43**	**56**						
PI (%)	**23**	**32**						
LS (%)	**11.8**	**15.1**						

pH & Conductivity

pH		**7.7**						
EC (S/m)		**0.0663**						

MDD / OMC

MDD (kg/m³)								
OMC (%)								

CBR

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

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

Remarks: _____

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