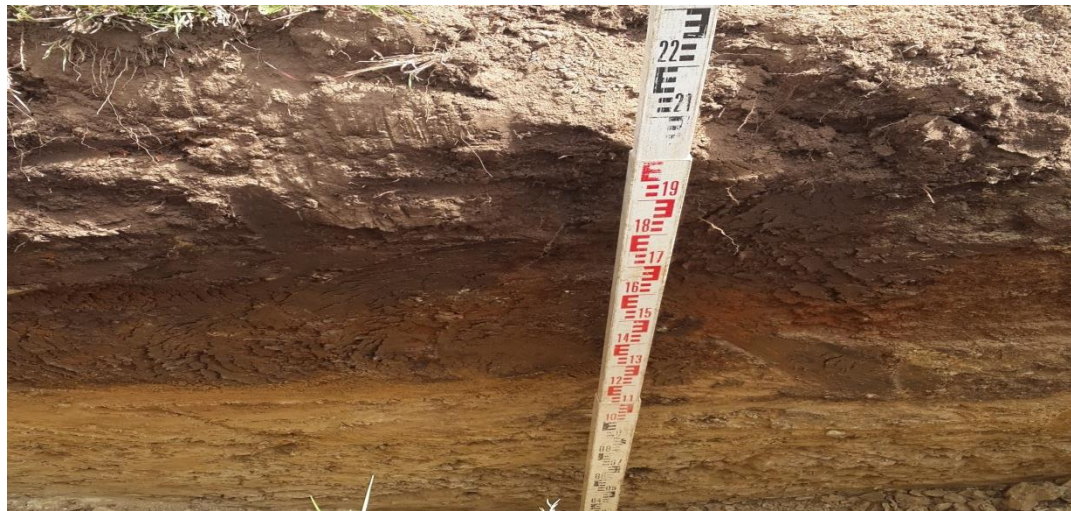


# Geotechnical Investigation Report for a proposed new Community Health Centre in Alexandria, Eastern Cape

Report Prepared for

**ArchWorXS**

Report Number 481913/1



Report Prepared by

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October 2014

# Preliminary Geotechnical Investigation Report for a proposed new Community Health Centre in Alexandria, Eastern Cape

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**SRK Project Number 481913**

**October 2014**

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## Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by ArchWorXS. The opinions in this Report are provided in response to a specific request from ArchWorXS to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

# 1 Introduction and Scope of Report

SRK Consulting (South Africa) (Pty) Ltd (SRK) was appointed by ArchWorXS to undertake a geotechnical investigation for the construction of a new Community Health Centre at a site located on the outskirts of Alexandria in the Eastern Cape (Figure 1).

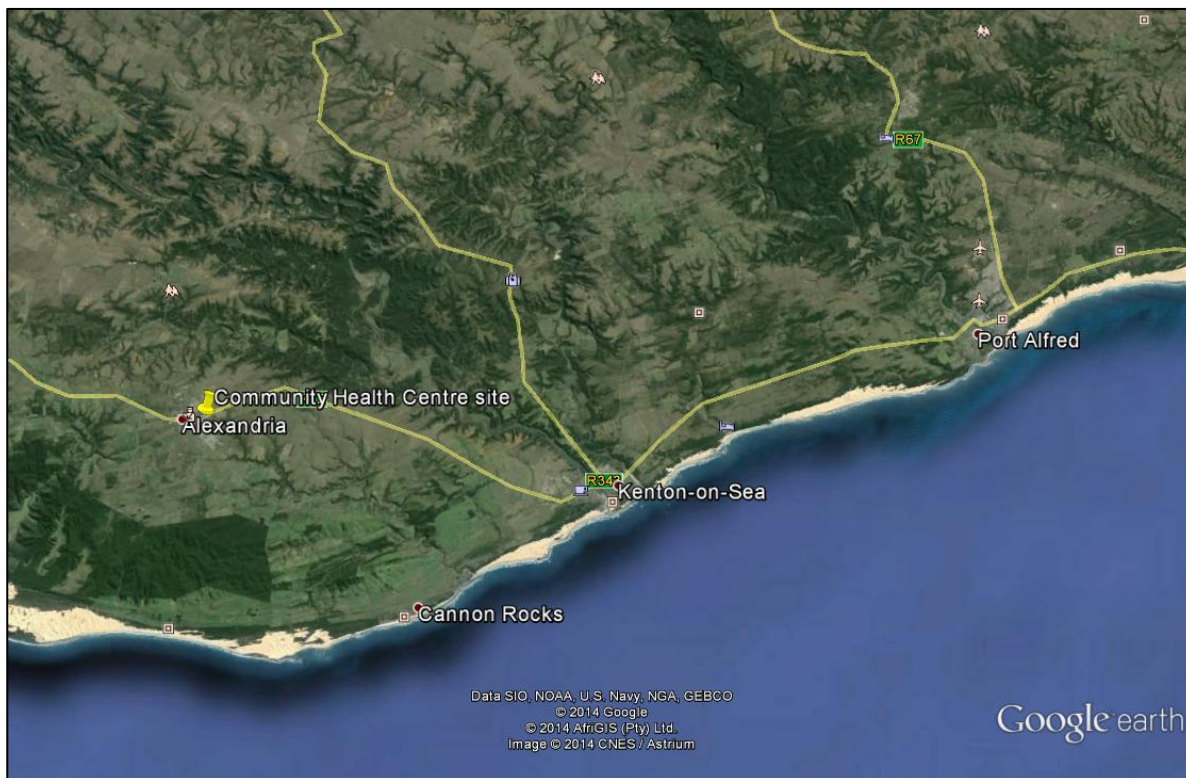


Figure 1: Site location.

## 1.1 Objectives

- Provide a summary of the underlying soil profile and geology;
- Assess the excavatability of the site according to SANS 1200 D for restricted excavations using a TLB excavator;
- Comment on groundwater seepage and depth to bedrock (if present);
- Comment on any problematic soils and their potential impact on the construction of the new health centre;
- Determine the suitability of the in situ soils for construction purposes; and
- Provide a suitable founding level and allowable bearing pressure.

## 1.2 Fieldwork

In order to meet the objectives listed in Section 1.1 the following tasks were completed:

- Excavation of nine test pits to a depth ranging from 1.5 m to 3.0 m below natural ground level (average depth 2.3 m). The positions of the test pits are shown in Figure 2. The test pit details are summarised in Table 1;
- Dynamic Probe Light (DPL) penetrometer tests were driven from surface to a depth ranging from 1.6 m to 3.0 m ( average of 2.0 m);

- Five bulk disturbed soil samples were collected and submitted to a soils laboratory for the following tests:
  - Sieve analysis including hydrometer;
  - Atterberg Limit determinations;
  - Moisture: density relationship at optimum moisture content; and
  - CBR analysis.

**Table 1: Test pit details.**

TP ID	Coordinates	GW	Depth (m)	Refusal conditions
TH 1	Figure 1 legend	No	2.5	Slow excavation within sandy clay
TH 2	Figure 1 legend	No	1.5	Slow excavation within sandy clay
TH 3	Figure 1 legend	No	2.2	Slow excavation within sandy clay
TH 4	Figure 1 legend	No	2.5	Slow excavation within sandy clay
TH 5	Figure 1 legend	No	2.0	Refusal within shale
TH 6	Figure 1 legend	No	3.0	No refusal
TH 7	Figure 1 legend	No	2.3	Slow excavation within sandy clay
TH 8	Figure 1 legend	No	2.6	slow excavation within shale
TH 9	Figure 1 legend	No	2.2	Refusal within shale

Datum: WGS 84

Format: Decimal Degrees

GPS Accuracy: 3 m

GW = Ground Water



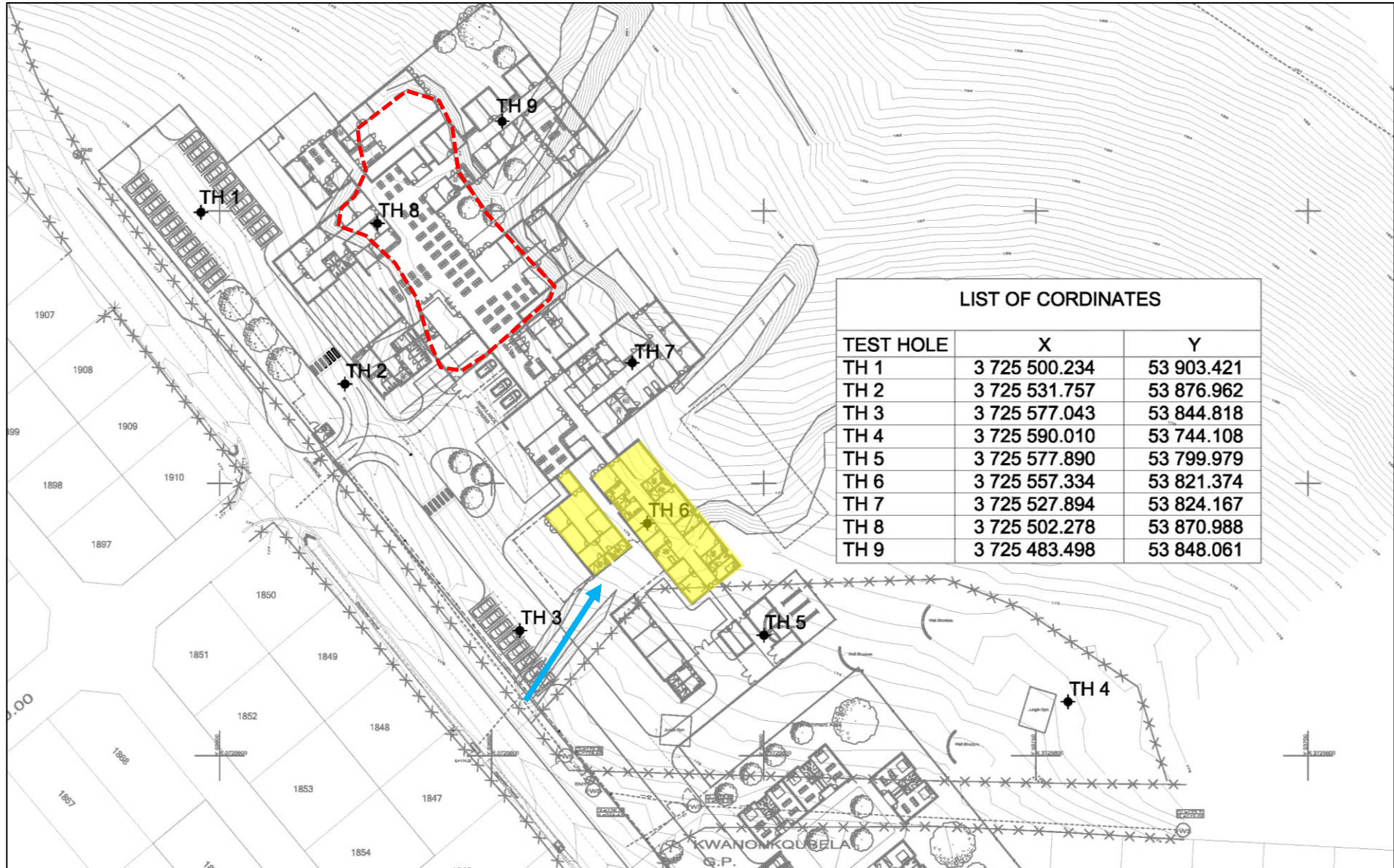


Figure 2: Test pit layout.

## 2 Site description

The natural ground surface slopes at a moderate gradient (approximately 1v:10h) towards the north east. The natural ground surface has been altered in certain areas with the construction of a small cut platform and southwest-northeast aligned soil berms. A storm water channel is located towards the south east of the site running parallel to TH3 and discharging in the direction of TH6. Vegetation is limited to grass with scattered small trees and occasional succulent type plant species. Small mounds of builders' rubble are noted to occur across the site.

## 3 Soil profile and underlying geology

### 3.1 Regional geology

Published geological maps extracted from a GIS database indicate that the northern portion of the site is underlain by the Sardinia Bay Formation and the southern portion by the Skurweberg Formation. Bedrock is expected to be quartzitic sandstone, phyllitic shale and subordinate small-pebble conglomerate or thickly-bedded, medium- to coarse-grained, cross-bedded, quartzitic sandstone. The bedrock intersected in the test pits is shale and the site is therefore inferred to be underlain by phyllitic shale of the Sardinia Bay Formation (Table Mountain Group, Cape Supergroup).

### 3.2 Soil profile

The soil profile is fairly consistent across the site generally characterised by topsoil, colluvium and ferruginised colluvium overlying shale in certain areas. The soil types identified beneath the site are individually described below.

#### Fill (0)

The fill material is characterised by dry to slightly moist, brown, *loose silty SAND* with plastic and builders' rubble. This material was intersected in TH4 only with a thickness of 0.9 m.

#### Topsoil (1)

The topsoil is characterised by slightly moist to moist, dark greyish brown, *medium dense silty SAND* with minor pinhole voids. The thickness ranges from 0.1 m to 0.9 m (average 0.5 m). Note that the topsoil was not intersected at TH4.

#### Colluvium (2)

The topsoil is underlain by slightly moist, mottled orange and grey, *very stiff*, shattered silty CLAY. The thickness ranges from 0.3m to 2.0 m (average 1.1 m).

#### Ferruginised colluvium (3)

The clay colluvium is underlain by slightly moist, mottled orange and brown, *very stiff*, fissured with occasional polished surfaces, rounded calcrete and iron oxide concretions, sandy CLAY with gravel becoming more gravelly in TH9. The thickness ranges from 0.1m to 0.9 m (average 0.6 m).

#### Residual soil of underlying shale (4)

The colluvium is underlain by slightly moist, yellow brown, *very dense*, matrix supported, angular clasts, silty GRAVEL. The thickness ranges from 0.3 m to 0.5 m (average 0.4 m). The residual shale was intersected in TH5, 8 and 9 only.



Sardinia Bay Formation shale (5)

The residual shale grades into slightly weathered, yellow brown, very closely jointed/fractured, *very soft rock to soft rock* SHALE (Sardinia Bay Formation, Table Mountain Group, Cape Supergroup). The depth to bedrock appears to increase in an upslope direction as the overlying colluvium increases in thickness.

In general, two main soil profile types have been identified at the site, These profiles are depicted in Figure 3 and Figure 4 with average contact depths for the soil layers.

The detailed soil profiles are included in Appendix A.

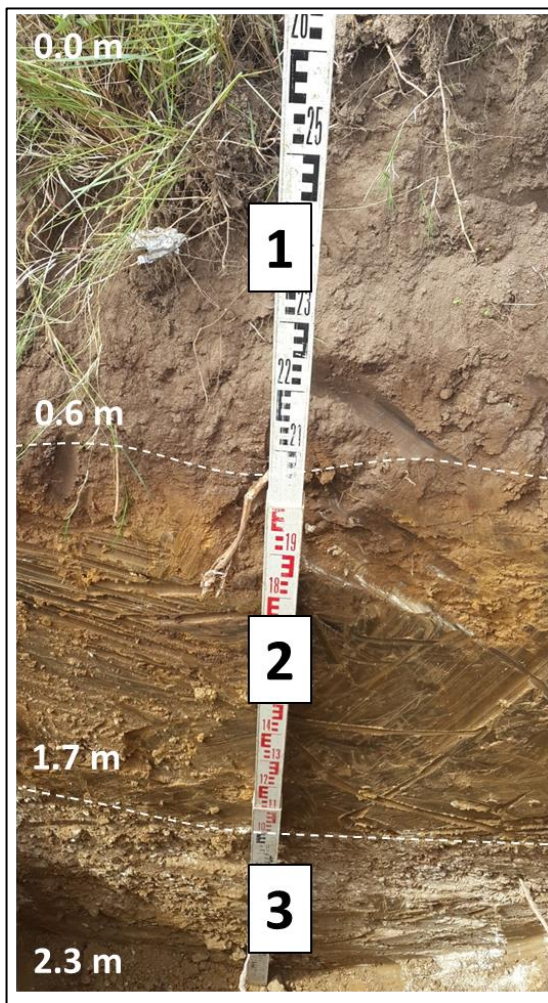


Figure 3: Topsoil, colluvium and ferruginised colluvium with calcrete nodules (TH 1).

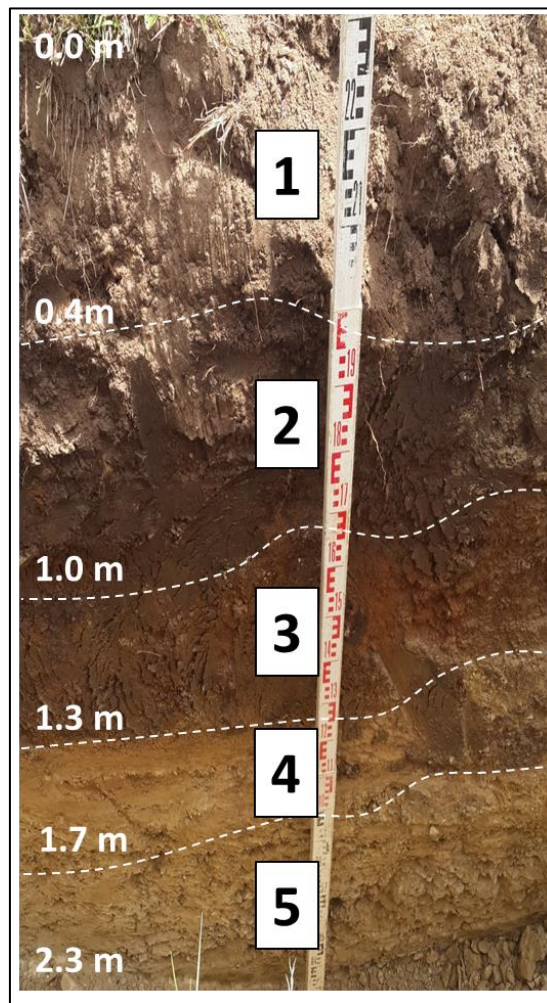


Figure 4: Topsoil, colluvium, ferruginised colluvium overlying residual shale and bedrock (TH 9).

**3.3 Groundwater seepage**

No ground water seepage was intersected within the excavation depth ranging from 1.5 m to 3.0 m below natural ground level.

**3.4 Soil consistency**

The soil consistency is fairly consistent across the site generally characterised by *loose to medium dense* sandy topsoil to approximately 0.5 m below surface underlain by *very stiff* cohesive colluvium overlying *very soft rock to soft rock* shale (Figure 5). Notable exceptions are at TH8 where *stiff* clay colluvium (Figure 5, pink line, average DPL penetration rate of 20 mm/blow) was intersected to 0.9 m

below surface followed by a sharp transition to *very stiff* (average 5 mm/blow); and TH6 where *loose sandy topsoil* (Figure 5, orange line, average 40 mm/blow) was intersected to 0.9 m followed by a gradual transition from *stiff* (26 to 12 mm/blow) to *very stiff* clay colluvium at 1.5 m below natural ground surface.

It is important to note that TH8 was positioned within an old cut platform where ponding of storm water is likely to occur after periods of heavy rainfall and TH6 is located down gradient of a storm water outlet from the adjacent settlement. In both cases the ponding of and/or the regular discharge of storm water appears to have 'softened' the cohesive clay soil and sandy topsoil.

The individual DPL graphs are included in Appendix B.

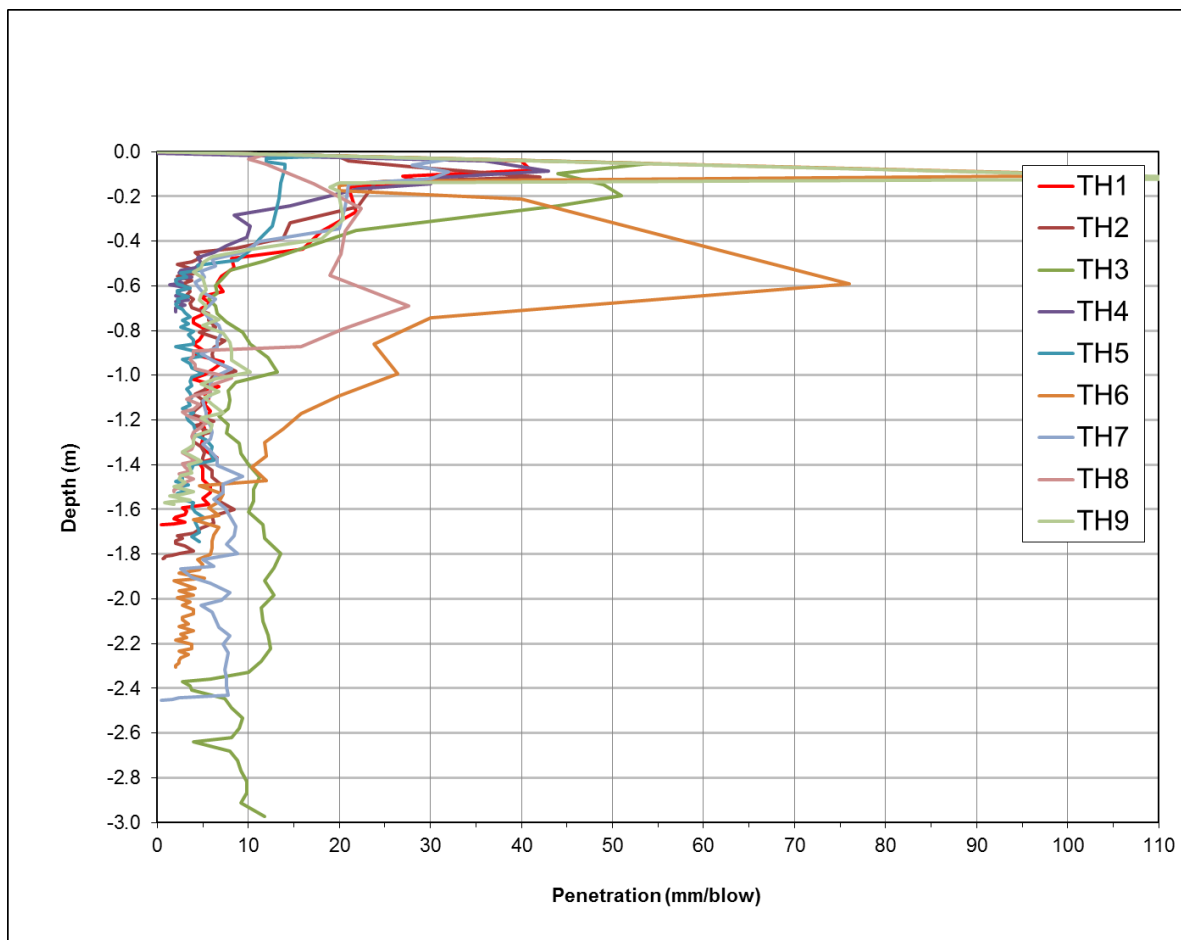


Figure 5: Combined DPL penetration profiles.

### 3.5 Material properties

A brief description of the material properties for the different soil types profiled are provided below. The laboratory results are summarised in Table 2 with the detailed certificates included in Appendix C.

#### Colluvium

The colluvium is characterised by a very high percentage passing through the 0.425 mm sieve (94 – 99 %) with low clay content (4 – 8 %). The plasticity of the whole sample ranges from 6 – 12 (generally low) with a low potential to exhibit expansive behaviour. The CBR values indicate that the colluvium is classified as lower than G10 according to the TRH14 standards i.e. poorer quality.

### Ferruginised colluvium

The ferruginised colluvium is coarse grained with 49 % retained on the 0.425 mm sieve i.e. medium to-coarse grained sand and gravel. The clay content is very low (2 %) with a low plasticity index for the whole sample. The potential to develop expansive behaviour is also low. The CBR values indicate that the colluvium is classified as lower than G10 according to the TRH14 standards i.e. poorer quality.

### Residual soil of underlying shale

The grading of the two residual shale samples is variable ranging from fine-grained (74 % passing through the 0.425 mm sieve) to coarse-grained (60 % retained on the 4.75 mm sieve i.e. gravel) with low clay content (3 – 8 %). The plasticity of the whole sample ranges from 4 – 10 (generally low) with a low potential to exhibit expansive behaviour. The CBR values indicate that the residual shale is classified as lower than G10 to G10 according to the TRH14 standards.

**Table 2: Summarised laboratory results.**

TP ID	Sample Interval (m)	Origin	Grading (%)						Atterberg Limits				Heave	Maximum Dry Density (kg/m <sup>3</sup> )	Optimum Moisture Content (%)	CBR					Swell	TRH14
			> 4.75 mm	2.00 - 4.75 mm	0.425 - 2.00 mm	0.075 - 0.425 mm	< 0.075 mm	< 0.002 mm	Liquid Limit	Plasticity Index (fines)	Plasticity Index (whole)	Linear Shrinkage				100%	98%	95%	93%	90%		
TH 2	0.5 - 1.0	Colluvium	0	0	1	52	39	8	28	12	12	5.5	Low	1825	13.7	5	4	3	1	0	1.0	<G10
TH 4	0.9 - 1.5	Colluvium	3	1	2	54	36	4	25	6	6	5.0	Low	1841	14.6	1	1	1	0	0	0.4	<G10
TH 1	1.6 - 1.9	Ferruginised colluvium	26	13	10	16	33	2	45	23	12	11.5	Low	1921	13.6	1	1	1	1	1	0.4	<G10
TH 5	1.4 - 1.7	Residual	14	6	6	34	32	8	30	14	10	6.5	Low	1838	12.4	43	24	10	5	2	0.4	<G10
TH 9	1.1 - 1.4	Residual	60	9	4	10	14	3	30	15	4	8.0	Low	2005	10.9	9	8	8	7	5	1.0	G10

## 4 Evaluation of the geotechnical properties

### 4.1 Excavatability

The *very stiff* clay and *very dense* ferruginised gravel colluvium and highly fractured shale bedrock proved difficult to excavate with TLB to an average depth below natural ground of 2.3 m (range 1.5 m to 3.0 m). Hand excavation methods will require a mechanical breaker which will prove time consuming. A TLB will suffice for shallow excavations e.g. foundation trenches less than 1.5 m deep provided extra time is allowed for the excavation given the slow (difficult) excavation conditions described above.

Soft excavation conditions are expected for deeper, non-restricted excavations (e.g. cut slope of engineered platform) provided a track mounted excavator is used.

### 4.2 Problematic soils

#### Heaving soils

The low clay content, generally low plasticity index, low potential expansion classification according to the van der Merwe method and low swell value recorded in the re-compacted CBR tests (0.4 – 1.0 %) all indicate that problems associated with heaving soils are not expected for this site.

#### Engineered fill

The CBR results for the colluvium, ferruginised colluvium and residual shale indicate that the material softens appreciably when saturated and will prove to be particularly difficult to re-compact if disturbed. These soils are therefore not well suited for use as engineered fill.

## 5 Summarised Ground Conditions

The site is underlain by a sequence of fine-grained clayey and ferruginised colluvium overlying a thin horizon of residual shale grading into *very soft rock* to *soft rock* shale. The thickness of the colluvial layers increases in an upslope direction.

The topography of the site indicates that the proposed health centre and associated infrastructure will need to be constructed on cut to-fill platforms. Depending on the depth of cut, the most likely founding material will be the colluvium and residual shale (to a lesser extent).

The colluvium was noted to be slightly fissured with occasional polished surfaces during soil profiling. These features indicate that some movement within the soil due to heave has taken place in the past. The foundation indicator results indicate that the potential for expansive soil behaviour to develop within the clayey colluvium will be low. SRK is of the opinion that soil movement associated with a heaving soil (after being exposed to wetting and drying cycles) will be limited and unlikely to impact on the foundations and structures to any great extent.

The soil consistency is generally *very stiff* within the cohesive colluvium with 'softer' intervals noted at TH 8 and TH 6 attributed to storm water ponding on the small cut platform and discharged from the storm water pipe outlet up slope of TH 6. The softening of the colluvium is confirmed by the CBR results. This will impact on the allowable bearing capacity and construction sequence in terms of keeping the founding soils dry.



## 6 Foundation Recommendations

Conventional strip foundations will suffice for the proposed structures cast within the *in situ* colluvium. The founding depth will need to be determined once final levels for the platforms have been approved but should not be less than 0.5 m below surface.

The strip foundations should be cast, as far as is practically possible, within the same soil horizon in order to limit the development of differential settlement. The foundations will need to be reinforced should they span two different soil horizons.

Foundations must be carried through any engineered fill (where present) to a depth of approximately 0.5 m into the underlying *in situ* material.

It is recommended that the foundations be designed using an allowable ground bearing capacity not exceeding 100 kPa.

The DPL profiles at TH 8 and TH 6 as well as the very low CBR results all indicate that the colluvial material softens appreciably when wetted. Foundation trenches and cut platforms should be under excavated by say 150 mm in case of inclement weather where the colluvium will be exposed for an extended period of time. This layer of 'soft' material can then be removed when required thereby exposing the less saturated material underneath for the placement of road layers, backfill beneath floor slabs or foundations.

Foundation trenches and cut platforms should also be constructed with a slight fall of ground to prevent ponding of storm water. A sump will be required to remove water from the trenches.

Structural fill material will need to be imported from a commercial source. The colluvium, ferruginised colluvium and residual shale material is NOT suitable for use as construction material. It is unlikely that the underlying shale bedrock will be intersected during the construction of the platforms. If bedrock is exposed, the volume of material will probably not be sufficient for the structural fill platform. Also, the appropriate suite of tests will need to be conducted to confirm its suitability for use as construction material.

Cut to-fill platforms will require stringent storm water management. Measures must be put in place to prevent storm water ingress behind any cut and fill slopes, behind retaining walls and to the *in situ* colluvium and structural fill.

### Prepared by

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481913/41940/Report  
7919-4129-6761-COCB  
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Senior Engineering Geologist

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Principal Engineering Geologist, Partner

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

# Appendices

## **Appendix A: Detailed soil profiles**

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 1

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725500

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53903

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.50 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<b>sandy SILT</b> Slightly moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			
0.6			
0.8			
1.0			
1.2			
1.4			
1.6		<b>F./MDD/C BR between 1.60 and 1.90 m</b>	<b>sandy CLAY with gravel</b> Slightly moist, yellow brown blotched creamish, <u>stiff</u> , fissured, sandy CLAY with calcrete nodules and iron concretions. Colluvium
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 2.50 m

GROUNDWATER: No

REFUSAL: TLB Refusal - slow excavation



PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 2

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725500

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53903

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 1.50 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2		F./MDD/C BR between 0.50 and 1.00 m	<b>sandy SILT</b> Slightly moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			<b>sandy CLAY with gravel</b> Slightly moist, yellow brown blotched creamish, <u>stiff</u> , fissured, sandy CLAY with calcrete nodules. Colluvium
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 1.50 m

GROUNDWATER: No

REFUSAL: TLB Refusal - slow excavation

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 3

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725577

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53844

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.20 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<p><b>sandy SILT</b> Moist, greyish brown, <u>soft to firm</u>, minor pinhole voids, sandy SILT. Topsoil</p>
0.4			
0.6			<p><b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u>, shattered, silty CLAY. Colluvium</p>
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			<p><b>sandy CLAY with gravel</b> Slightly moist, yellow brown blotched creamish, <u>stiff to very stiff</u>, fissured, sandy CLAY with calcrete nodules and iron concretions. Colluvium</p>
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 2.20 m

GROUNDWATER: No

REFUSAL: No

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 4

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725590

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53744

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.50 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<b>Fill</b> Dry to slightly moist, brown, <u>loose to medium dense</u> , silty SAND with plastics and rubble.Fill
0.4			
0.6			
0.8		<b>F./MDD/C BR between 0.90 and 1.50 m</b>	<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			<b>sandy CLAY with gravel</b> Slightly moist, yellow brown blotched creamish, <u>stiff to very stiff</u> , fissured, sandy CLAY with calcrete nodules and iron concretions. Colluvium
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 2.50 m  
 GROUNDWATER: No  
 REFUSAL: Slow excavation TLB refusal

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 5

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725577

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53799

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.00 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2		<b>F./MDD/C BR between 1.40 and 1.70 m</b>	<b>sandy SILT</b> Slightly moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
0.6			<b>sandy silty GRAVEL</b> Slightly moist, yellow brown, <u>dense to very dense</u> , subangular, medium gravel within sandy silt matrix. Matrix supported sandy silt GRAVEL. Residual Mudstone.
0.8			<b>MUDSTONE</b> Slightly weathered, yellow brown, bedded, very closely jointed, <i>very soft to soft rock</i> , MUDSTONE.
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 2.00 m

GROUNDWATER: No

REFUSAL: TLB Refusal - slow excavation

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 6

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725557

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53821

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 3.00 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<b>sandy SILT</b> Moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			
0.6			
0.8			<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
1.0			
1.2			
1.4			
1.6			
1.8			
2.0			<b>sandy CLAY with gravel</b> Slightly moist, yellow brown blotched creamish, <u>stiff to very stiff</u> , fissured, sandy CLAY with calcrete nodules and iron concretions. Colluvium
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 3.00 m

GROUNDWATER: No

REFUSAL: No



PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 7

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725527

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53824

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.30 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<b>sandy SILT</b> Slightly moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
0.6			
0.8			
1.0			
1.2			
1.4			
1.6			
1.8			<b>sandy CLAY with gravel</b> Slightly moist, yellow brown blotched creamish, <u>stiff to very stiff</u> , fissured, sandy CLAY with calcrete nodules and iron concretions. Colluvium
2.0			
2.2			
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 2.30 m

GROUNDWATER: No

REFUSAL: TLB Refusal - slow excavation

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 8

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725502

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53870

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.60 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<b>sandy SILT</b> Slightly moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			
0.6			<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
0.8			
1.0			<b>silty sandy GRAVEL</b> Slightly moist, mottled orange brown, <u>dense to very dense</u> , subrounded fine gravel within silty sandy matrix. Matrix supported silty sandy GRAVEL. Colluvium
1.2			
1.4			
1.6			<b>sandy silty GRAVEL</b> Slightly moist, yellow brown, <u>very dense</u> , subangular, medium gravel within sandy silt matrix. Matrix supported sandy silt GRAVEL.
1.8			
2.0			Residual Mudstone.
2.2			<b>MUDSTONE</b> Slightly weathered, yellow brown, bedded, very closely jointed, <u>very soft to soft rock</u> , MUDSTONE.
2.4			
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

EXCAVATIBILITY: Soft 0.00 - 2.60 m

GROUNDWATER: No

REFUSAL: TLB Refusal - slow excavation

PROJECT NUMBER: 481913



TEST PIT NUMBER: TH 9

PROJECT: ALEXANDRIA COMMUNITY HC GEOTECH

NORTHING (X): 3725483

EXCAVATION METHOD: TLB Excavator

EASTING (Y): 53848

CONTRACTOR: Venter Stene

LOCATION: Alexandria, Eastern Cape

DEPTH: 2.20 m

ELEVATION (m msl):

LOGGED BY: David Mahlakahlaka

DATE: 9 October 2014

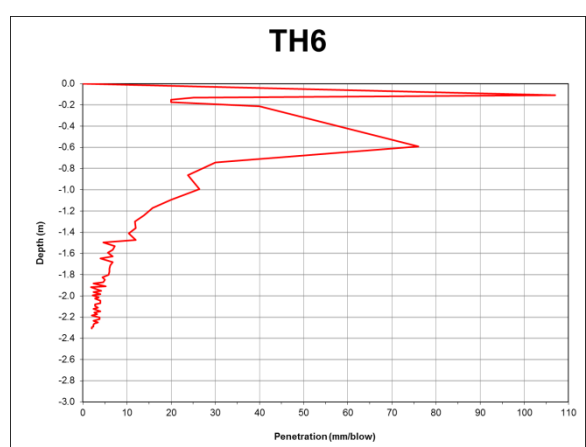
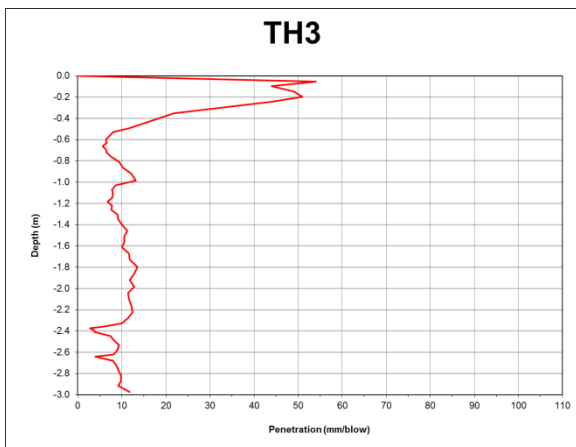
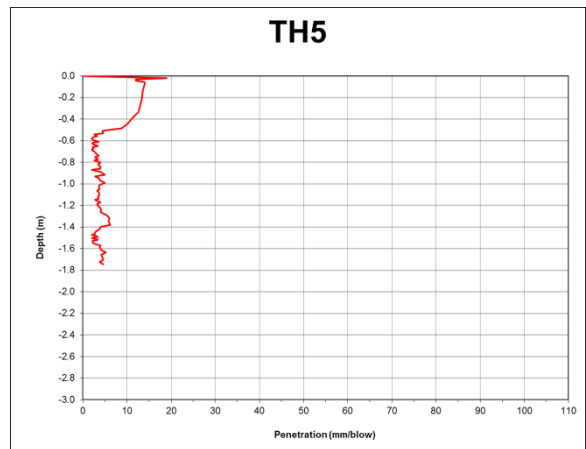
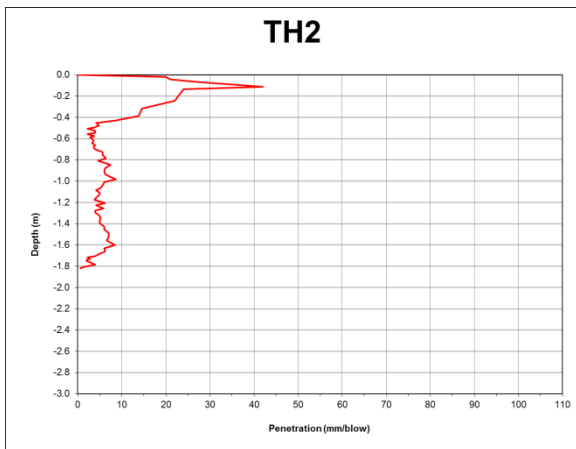
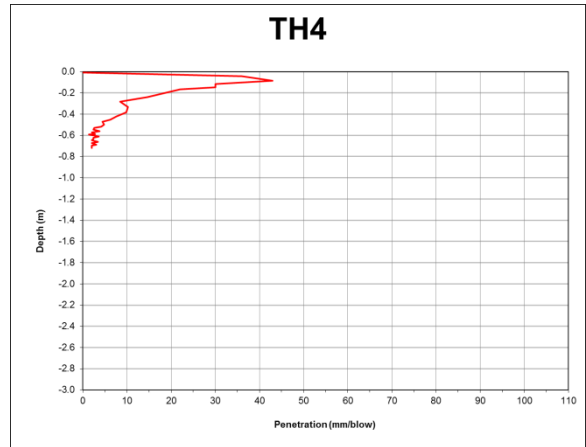
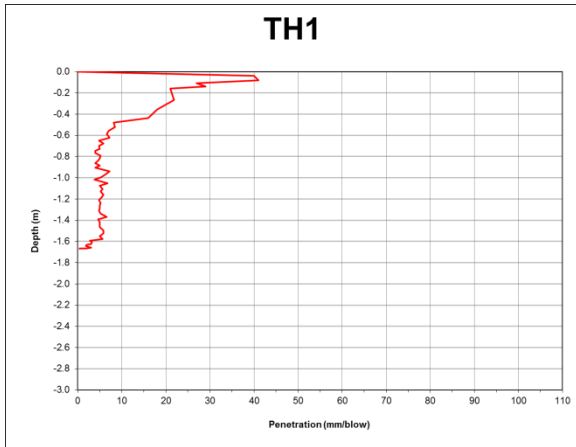
DEPTH	LEGEND	SAMPLE	DESCRIPTION
0.2			<b>sandy SILT</b> Slightly moist, greyish brown, <u>soft to firm</u> , minor pinhole voids, sandy SILT. Topsoil
0.4			<b>silty CLAY</b> Slightly moist, mottled orange grey, <u>firm to stiff</u> , shattered, silty CLAY. Colluvium
0.6			
0.8			<b>silty sandy GRAVEL</b> Slightly moist, mottled orange brown, <u>dense to very dense</u> , subrounded fine gravel within silty sandy matrix. Matrix supported silty sandy GRAVEL. Colluvium
1.0			
1.2			
1.4			
1.6		<b>F./MDD/C BR between 1.60 and 1.90 m</b>	<b>sandy silty GRAVEL</b> Slightly moist, yellow brown, <u>dense to very dense</u> , subangular, medium gravel within sandy silt matrix. Matrix supported sandy silt GRAVEL. Residual Mudstone.
1.8			
2.0			
2.2			
2.4			<b>MUDSTONE</b> Slightly weathered, yellow brown, bedded, very closely jointed, <i>very soft to soft rock</i> , MUDSTONE.
2.6			
2.8			
3.0			
3.2			
3.4			
3.6			
3.8			
4.0			
4.2			
4.4			
4.6			
4.8			
5.0			
5.2			
5.4			

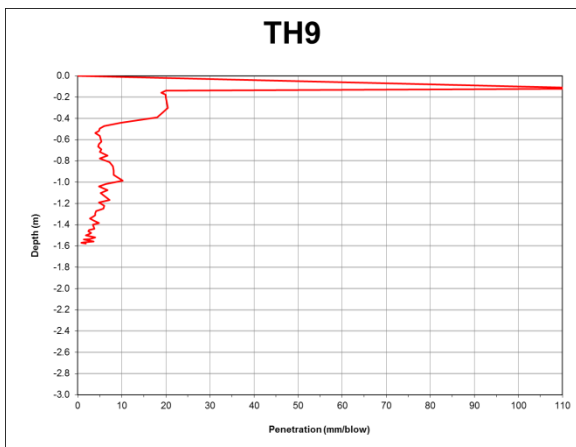
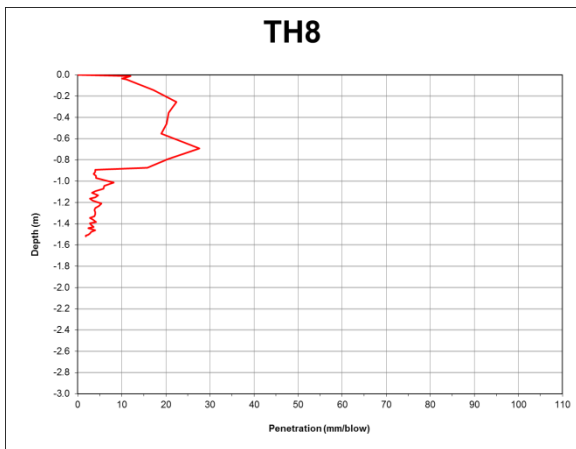
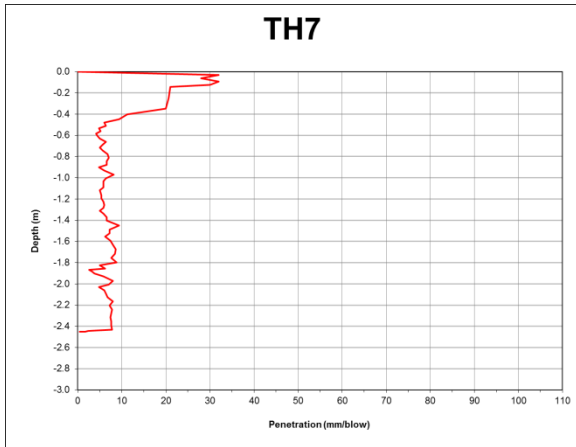
EXCAVATIBILITY: Soft 0.00 - 2.20 m

GROUNDWATER: No

REFUSAL: TLB Refusal - slow excavation

## **Appendix B: DPL graphs**





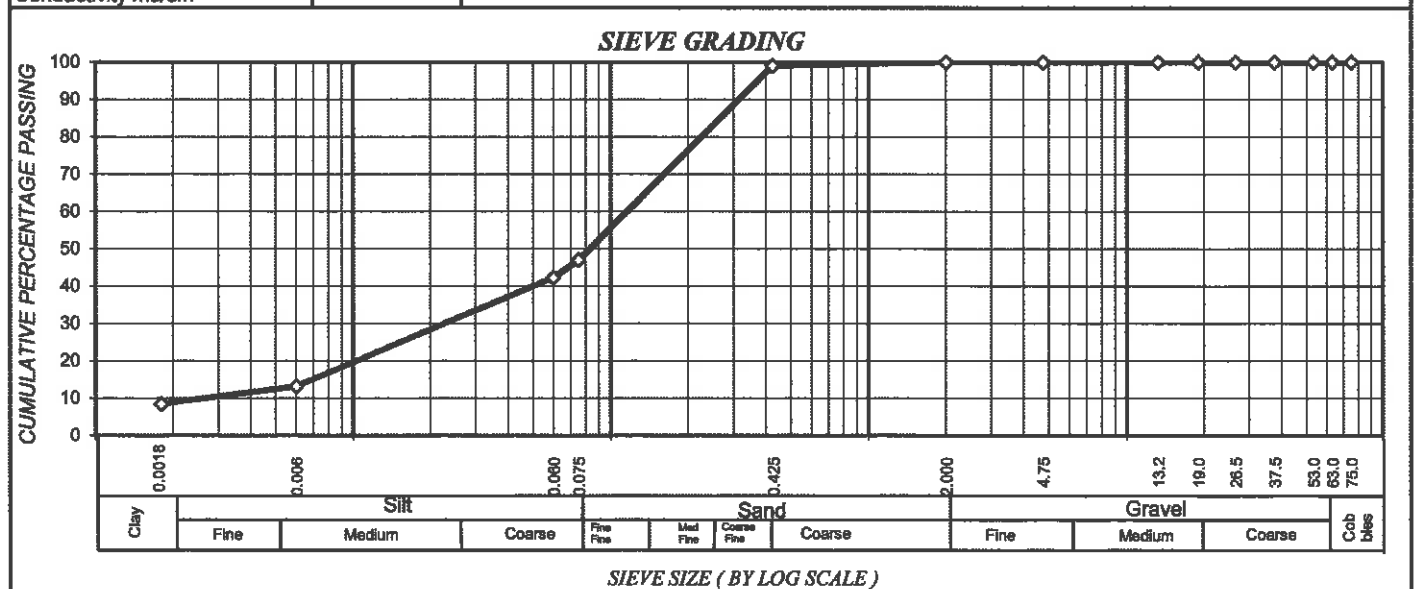
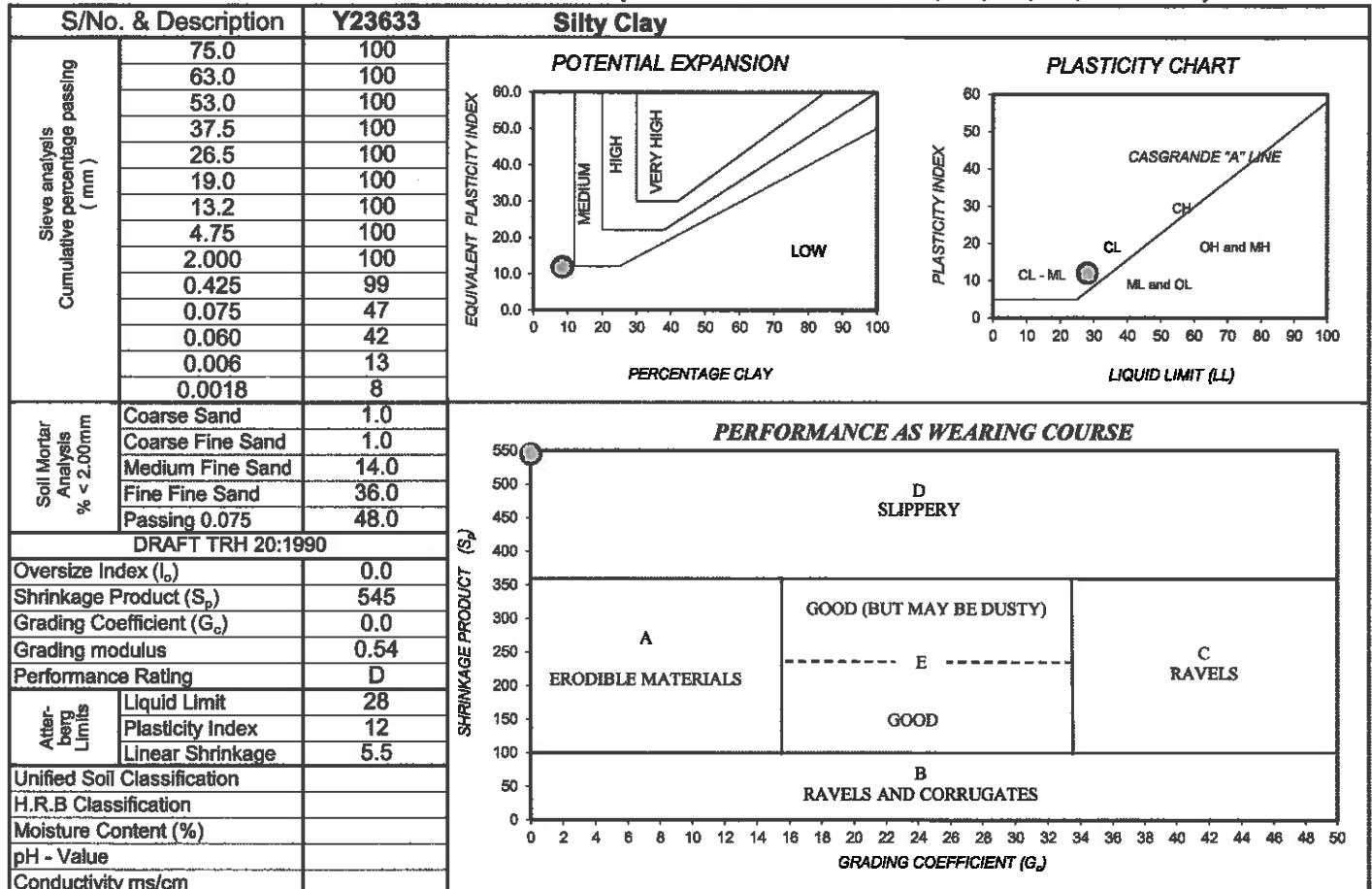
## **Appendix C: Detailed laboratory certificates**

**CLIENT :** SRK Consulting (South Africa) Pty Ltd  
 P. O. Box 21842  
 Port Elizabeth  
 6000

**PROJECT :** Alexandria Community HC (481913)  
**JOB CARD No :** C23142 / Q 20933  
**SUBMISSION DATE :** 10.10.2014  
**DATE TESTED :** 21.10.2014  
**REPORT DATE :** 21.10.2014 SD  
**SAMPLING PROCEDURE:** Delivered to the Laboratory  
**OFFSET :** -  
**POSITION :** TH 2 @ 0.50 - 1.00m

**ATT :** Mr. B. Cock

## FOUNDATION INDICATOR ( TMH 1 :1979 methods A1, A2, A3, A4, A5 & A6\* )



The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Labco. Tests marked with \* are "Not SANAS Accredited" and are not included in the SANAS schedule of Accreditation for this laboratory.

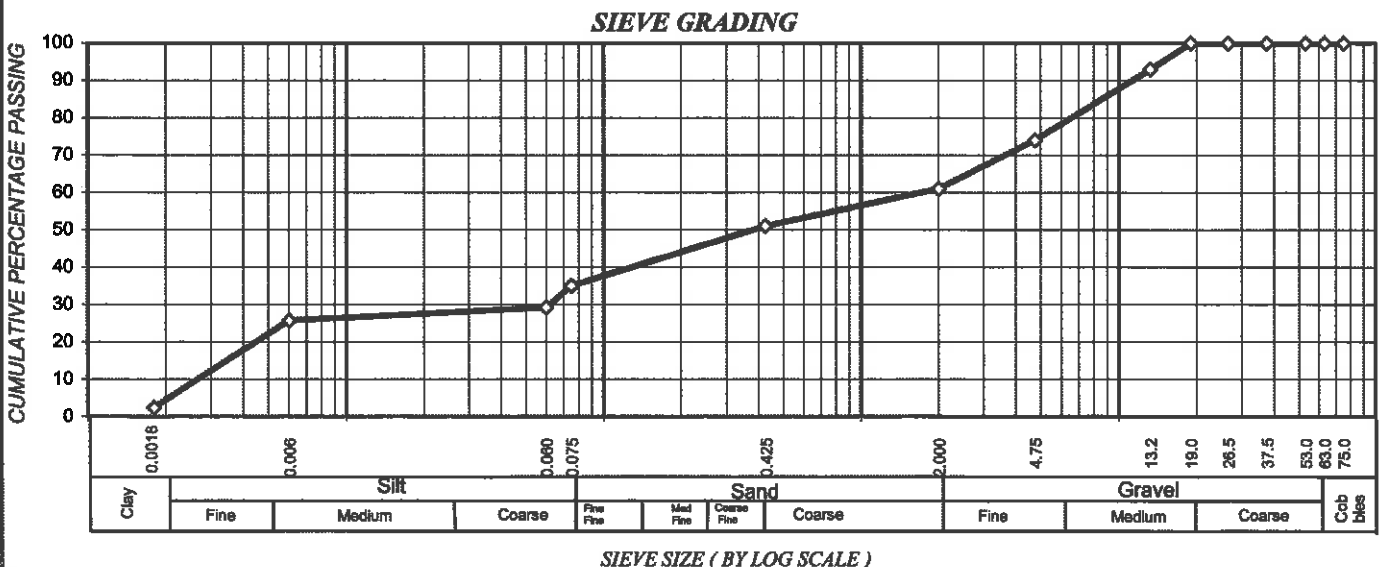
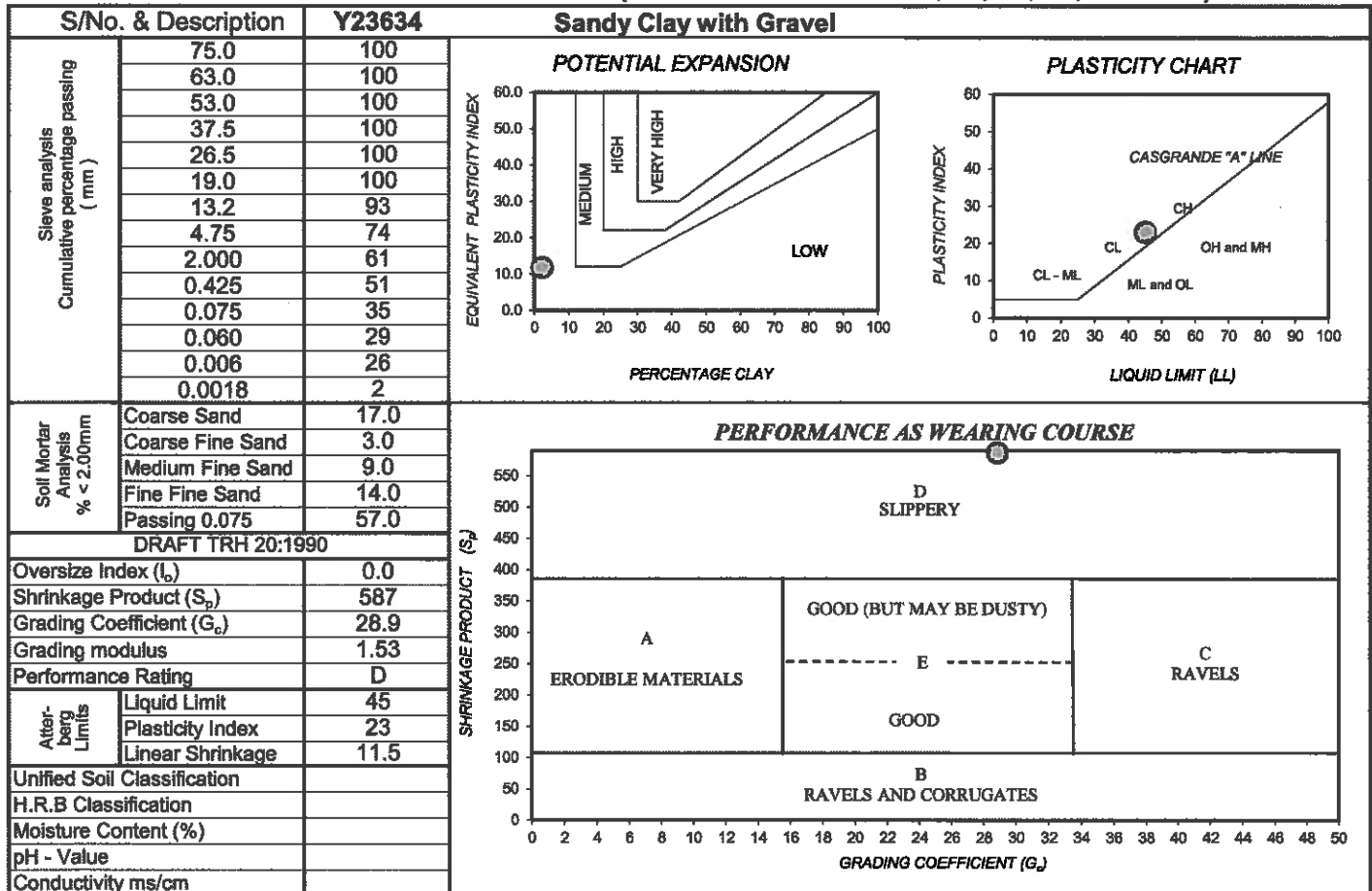


**CLIENT :** SRK Consulting (South Africa) Pty Ltd  
 P. O. Box 21842  
 Port Elizabeth  
 6000

**PROJECT :** Alexandria Community HC (481913)  
**JOB CARD No :** C23142 / Q 20933  
**SUBMISSION DATE :** 10.10.2014  
**DATE TESTED :** 21.10.2014  
**REPORT DATE :** 21.10.2014 SD  
**SAMPLING PROCEDURE:** Delivered to the Laboratory  
**OFFSET :** -  
**POSITION :** TH 1 @ 1.60 - 1.90m

**ATT :** Mr. B. Cock

## FOUNDATION INDICATOR ( TMH 1 :1979 methods A1, A2, A3, A4, A5 & A6\* )



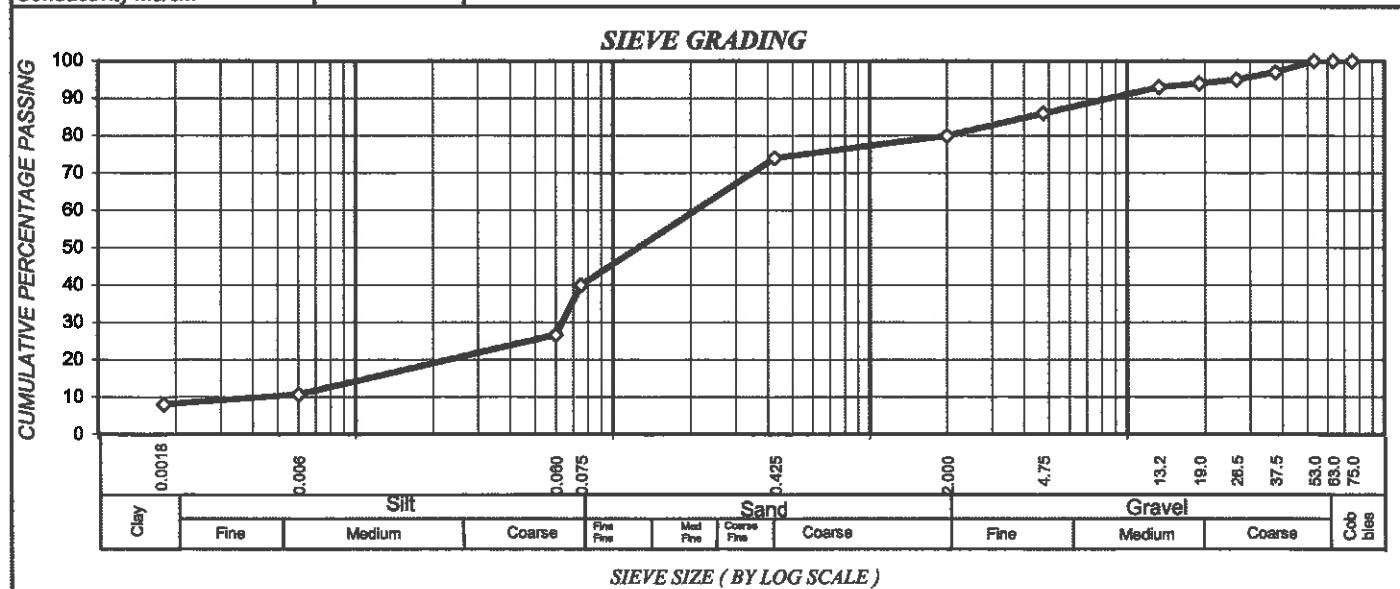
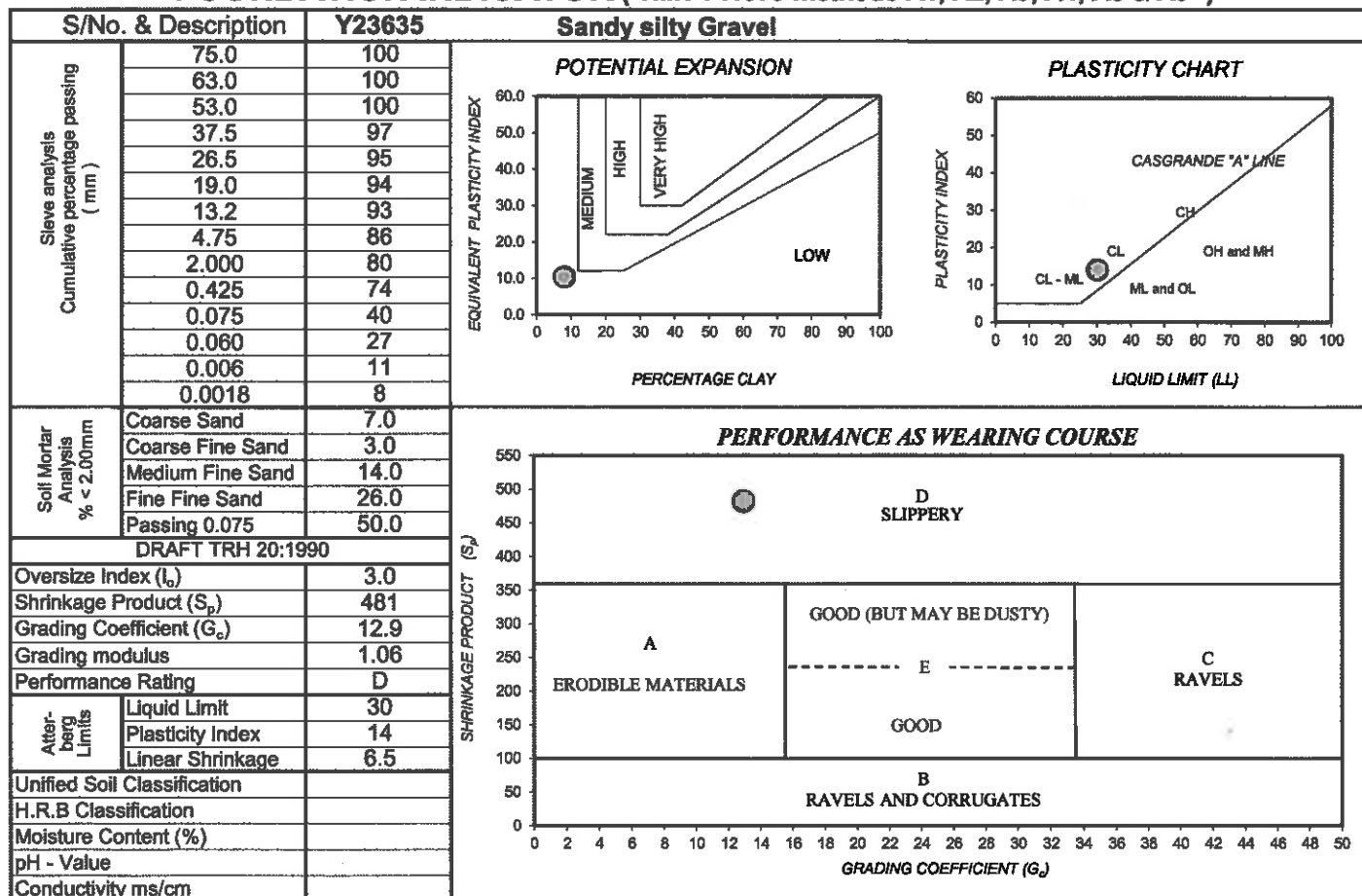
The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Labco. Tests marked with \* are "Not SANAS Accredited" and are not included in the SANAS schedule of Accreditation for this laboratory.

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**PROJECT :** Alexandria Community HC (481913)  
**JOB CARD No :** C23142 / Q 20933  
**SUBMISSION DATE :** 10.10.2014  
**DATE TESTED :** 21.10.2014  
**REPORT DATE :** 21.10.2014 SD  
**SAMPLING PROCEDURE:** Delivered to the Laboratory  
**OFFSET :** -  
**POSITION :** TH 5 @ 1.40 - 1.70m

ATT : Mr. B. Cock

## FOUNDATION INDICATOR ( TMH 1 :1979 methods A1, A2, A3, A4, A5 & A6\* )



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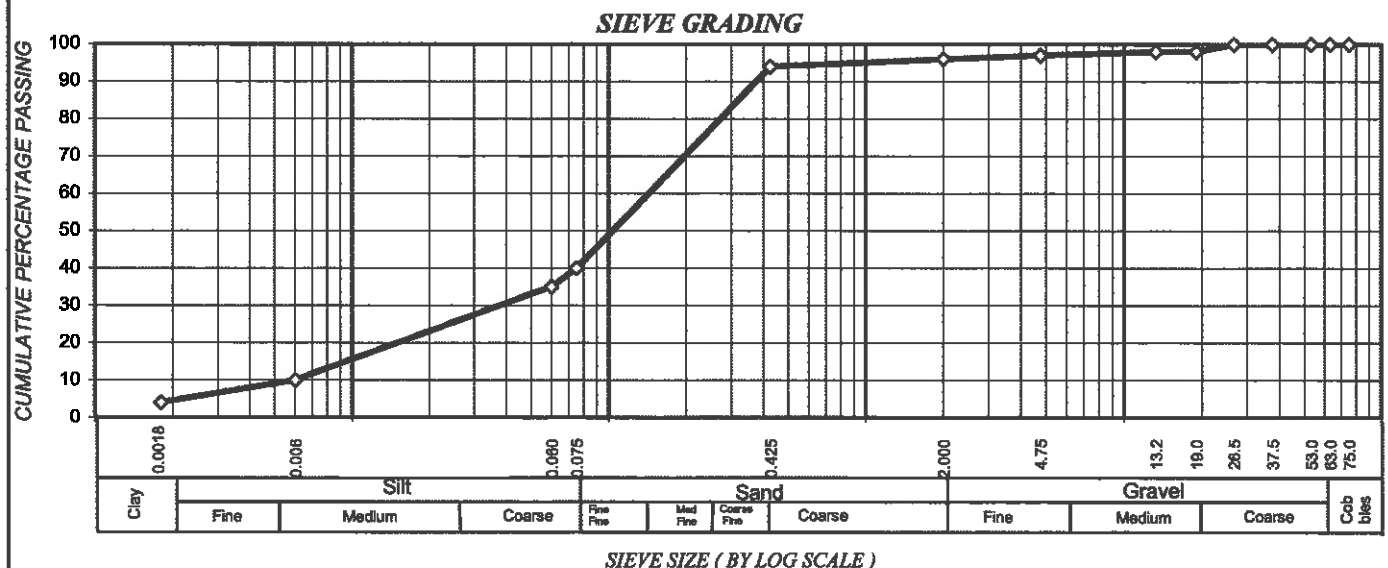
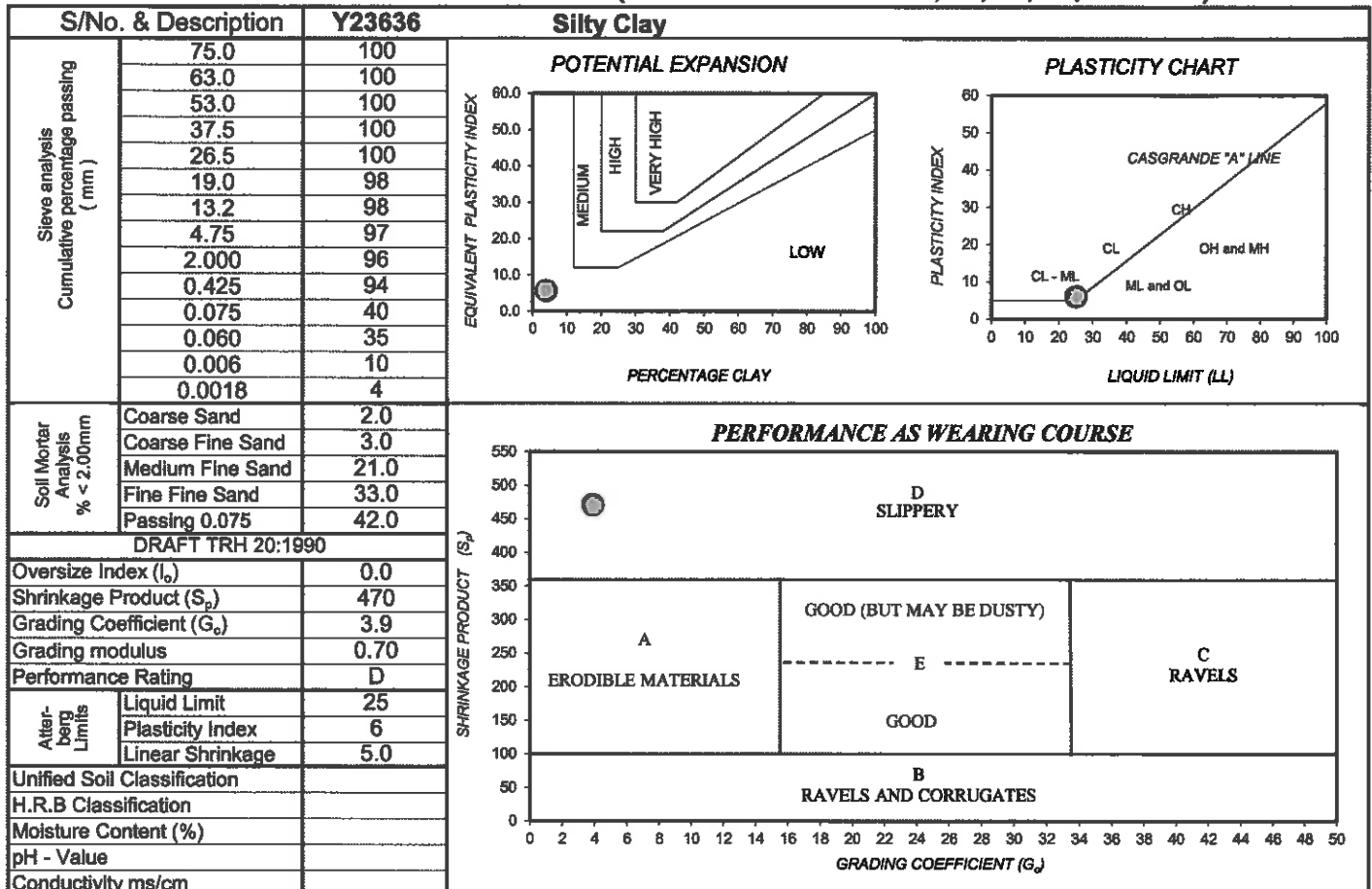
CIVIL ENGINEERING MATERIALS TESTING SERVICES (PTY) Ltd

**CLIENT :** SRK Consulting (South Africa) Pty Ltd  
 P. O. Box 21842  
 Port Elizabeth  
 6000

**PROJECT :** Alexandria Community HC (481913)  
**JOB CARD No :** C23142 / Q 20933  
**SUBMISSION DATE :** 10.10.2014  
**DATE TESTED :** 21.10.2014  
**REPORT DATE :** 21.10.2014 SD  
**SAMPLING PROCEDURE:** Delivered to the Laboratory  
**OFFSET :** -  
**POSITION :** TH 4 @ 0.90 - 1.50m

ATT : Mr. B. Cock

## FOUNDATION INDICATOR ( TMH 1 :1979 methods A1, A2, A3, A4, A5 & A6\* )



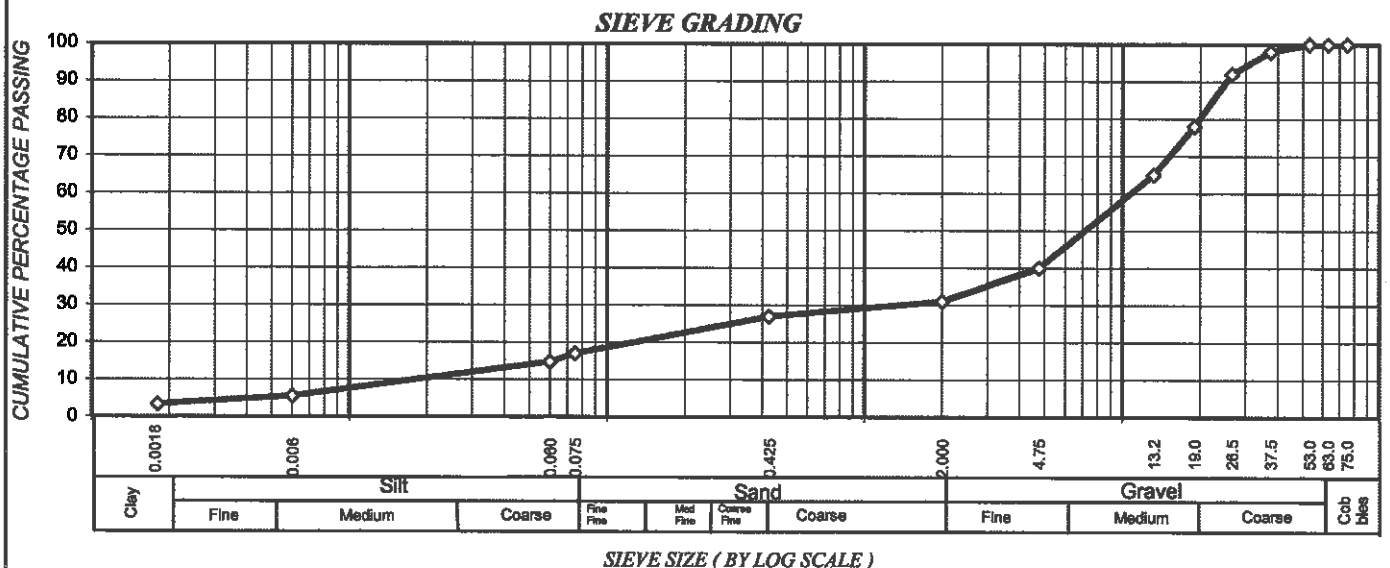
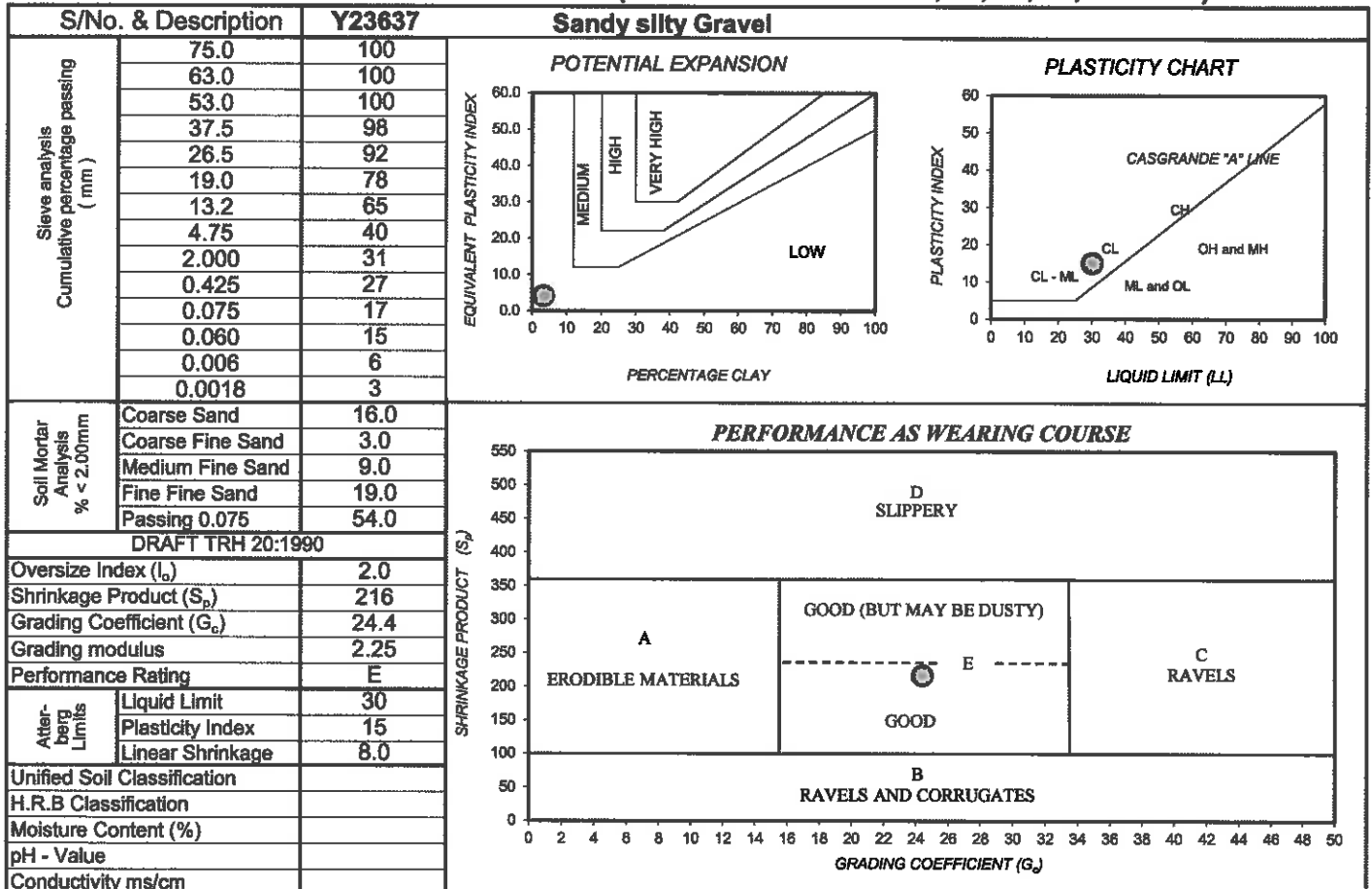
The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Labco. Tests marked with \* are "Not SANAS Accredited" and are not included in the SANAS schedule of Accreditation for this laboratory.

**CLIENT :** SRK Consulting (South Africa) Pty Ltd  
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**PROJECT :** Alexandria Community HC (481913)  
**JOB CARD No :** C23142 / Q 20933  
**SUBMISSION DATE :** 10.10.2014  
**DATE TESTED :** 21.10.2014  
**REPORT DATE :** 21.10.2014 SD  
**SAMPLING PROCEDURE:** Delivered to the Laboratory  
**OFFSET :** -  
**POSITION :** TH 9 @ 1.10 - 1.40m

**ATT :** Mr. B. Cock

## FOUNDATION INDICATOR ( TMH 1 :1979 methods A1, A2, A3, A4, A5 & A6\* )



The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Labco. Tests marked with \* are "Not SANAS Accredited" and are not included in the SANAS schedule of Accreditation for this laboratory.

## Civil Engineering Materials Testing Services (Pty) Ltd

**CUSTOMER :** SRK Consulting (South Africa) (Pty) Ltd  
 P. O. Box 21842  
 Port Elizabeth  
 6000

**PROJECT :** Alexandria Community HC  
 Geotechnical Investigation  
 (481913)

**ATTENTION :** Mr. B. Cock

**JOB CARD No. :** C23142 / Q 20933

**SUBMISSION DATE :** 10.10.2014

**DATE TESTED :** 21.10.2014

**REPORT DATE :** 21.10.2014 **SD**

**SAMPLING PROCEDURE:** Samples delivered to the laboratory

### INDICATOR / CBR RESULT SUMMARY

SAMPLE NUMBER	Y23633	Y23634	Y23635	Y23636	Y23637	
LAYER	-	-	-	-	-	
CO-ORDINATES	-	-	-	-	-	
STAKE VALUE	TH 2	TH 1	TH 5	TH 4	TH 9	
OFF SET	-	-	-	-	-	
DEPTH (m)	0.50 - 1.00	1.60 - 1.90	1.40 - 1.70	0.90 - 1.50	1.10 - 1.40	
DESCRIPTION	Silty Clay	Sandy Clay with Gravel	Sandy silty Gravel	Silty Clay	Sandy silty Gravel	
Indicator & CBR results comply to TRH 14 Specification of	< G10	< G10	< G10	< G10	G9	

### SIEVE ANALYSIS - TMH 1 Test Method A1(a)

% PASSING	105.0 mm					
75.0 mm						
63.0 mm						
53.0 mm			100		100	
37.5 mm			97		98	
26.5 mm			95	100	92	
19.0 mm		100	94	98	78	
13.2 mm		93	93	98	65	
4.75 mm		74	86	97	40	
2.00 mm	100	61	80	96	31	
0.425 mm	99	51	74	94	27	
0.075 mm	47	35	40	40	17	

### SOIL MORTAR ANALYSIS - TMH 1 Test Method A5

COARSE SAND (%)	1	17	7	2	16
COARSE FINE SAND (%)	1	3	3	3	3
MEDIUM FINE SAND (%)	14	9	14	21	9
FINE FINE SAND (%)	36	14	26	33	19
PASSING 0.075mm (%)	48	57	50	42	54
GRADING MODULUS	0.54	1.53	1.06	0.70	2.25

### ATTERBERG LIMITS : TMH 1 Test Method A2 - A4

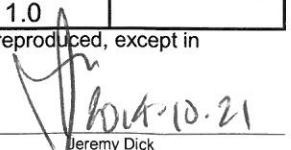
LIQUID LIMIT	28	45	30	25	30
PLASTICITY INDEX	12	23	14	6	15
LINEAR SHRINKAGE	5.5	11.5	6.5	5.0	8.0

### C.B.R. : TMH 1 Test Method A7 - A8

MOD AASHTO (Kg/m <sup>3</sup> )	1825	1921	1838	1841	2005
O.M.C. (%)	13.7	13.6	12.4	14.6	10.9
C.B.R. @ 100% COMPACTION	5	1	43	1	9
C.B.R. @ 98 % COMPACTION	4	1	24	1	8
C.B.R. @ 95 % COMPACTION	3	1	10	1	8
C.B.R. @ 93 % COMPACTION	1	1	5	0	7
C.B.R. @ 90 % COMPACTION	0	1	2	0	5
SWELL ( MAASHTO ) %	1.0	0.4	0.4	0.4	1.0

The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Labco Civil Engineering Materials Testing Services (Pty) Ltd  
 Deviation from Test Method : Moisture Contents dried overnight at 105 - 110°C.

Name :



Jeremy Dick

Position :

Technical Signatory

## SRK Report Distribution Record

Report No. 481913/1

Copy No. Electronic

Name/Title	Company	Copy	Date	Authorised by
Xabiso Sidloyi	ArchWorXS	Electronic	30 October 2014	Brent Cock
Project File	SRK	Electronic	30 October 2014	Brent Cock

Approval Signature:



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