

ANNEXURE C— GEOTECHNICAL REPORT

Bara Precinct: Erf 24460 Diepkloof, Soweto: Preliminary Geotechnical Report for Foundations and Earthworks

Reference: 15-783R02

Date: 8 January 2015

EXECUTIVE SUMMARY

This report presents the findings of a shallow geotechnical investigation for the proposed development at erf 24460, Diepkloof, Soweto. The development will comprise industrial warehousing.

This report has been commissioned to provide geotechnical ground information to optimise the bulk earthworks and foundations of the development. Four test pits have been excavated for the foundation analysis together with limited soil sampling and laboratory testing.

The site is underlain by fill, residual soil and weathered quartzite bedrock of the Government Subgroup, Central Rand Group sediments which belong to the Witwatersrand Supergroup. Refusal of the TLB occurred at 0.95 m below surface.

Perched groundwater seepage was not encountered.

Soft excavation in terms of SABS 1200 is generally anticipated to a depth of at least 1 m below surface and intermediate or hard rock excavation is envisaged below this depth.

Construction materials are limited at the site. Commercial sources of concrete aggregate, building sand and dimension stone are available within a 10km radius of the site. The most critical aspects of the site and the proposed development are:

- The weathered quartzite at nominal depth is considered a very competent foundation horizon for the warehouse structure with an allowable bearing capacity of up to 300 kPa.*
- Standard spread foundations can be designed as strip or individual pad foundations.*
- All the materials encountered on site are considered excellent construction materials and can even be considered for upper subbase.*
- Difficult excavation may be encountered to install service to 1.5 m depth.*

Definitions and Abbreviations

Commercial:

GCS Geotechnical

Tppm

Groundwater Consulting Services (Pty) Ltd Geotechnical

Turning Point Project Managers

Technical:

CH	Chainage (metres)
mbgl	metres below ground level
masl	metres above sea level
NGL	Natural Ground Level
FL	Foundation Level
BH	Borehole
SPT	Standard Penetration Test
N	SPT N value (blows per 300 mm)
TLB	Tractor-mounted Loader Backhoe
IP	Inspection pit
TP	Test Pit
DCP	Dynamic Cone Penetrometer
DPSH	Dynamic Probe Super Heavy
EABC	Estimated Allowable Bearing Capacity
G1-G10	Standard classification of natural road building materials (TRH 14)
CBR	California Bearing Ratio
MDD	Maximum Dry Density (kg/m ³)
MADD	Modified AASHTO Dry Density
OMC	Optimum moisture Content (%)
PI	Plasticity Index
LL	Liquid Limit
LS	Linear Shrinkage
ACV	Aggregate Crushing Value (kN)
FACT	Fineness Aggregate Crushing Test (%)
RMR	Rock Mass Rating
GSI	Geological Strength Index
m _i	Hoek-Brown Constant (origin & texture dependent)
RQD	Rock Quality Designation (%)
UCS	Unconfined Compressive Strength (MPa)
C (c')	Cohesion (kPa) – total stress and (effective stress)
Φ (Φ')	Friction Angle (degrees) – total stress and (effective stress)
K _v	Modulus of Subgrade Reaction (MN/mm or kPa/mm)
CFA	Continuous Flight Auger (pile type)
DCI	Driven Cast In situ (pile type)
C _v	Coefficient of Consolidation (m ² /yr)
M _v	Modulus of Compressibility (m ² /MN)
MC1	Moisture Content Before Test (%)
MC2	Moisture Content After Test (%)
ρ	Dry Density (kg/m ³)

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1. INTRODUCTION & TERMS OF REFERENCE

Ms Gugu Hlophe of Turning Point Project Managers requested **GCS Geotechnical** to provide a cost estimate to carry out a geotechnical investigation for the above-mentioned proposed Bara Precinct development. The cost estimate referenced 15-783(Erf 24460 Diepkloof)L01 and dated 15 September 2015 was accepted in the letter of appointment dated 9 October 2015.

The site is located on erf 24460 Diepkloof Zone 6, Soweto.

This report presents the findings of the shallow geotechnical investigation carried out specifically for the proposed development and discusses the subsurface soil and founding conditions based on visual and tactile descriptions supplemented by laboratory test results and provides recommendations on how best to develop the site from a geotechnical point of view.

2. AVAILABLE INFORMATION

The following information was drawn upon for the purposes of the investigation:

- The 1:250 000 scale geological map titled "2528 West Rand" as compiled by the South African Geological Survey (now the CGS), dated 1986
- The 1:2 000 000 scale drainage map (DWAF Tertiary Drainage Regions), dated 1999
- The 1:500 000 scale hydrogeology map titled "2526 Johannesburg" (DWAF, 2000)
- De Beer, 1965: Geology of the Johannesburg CBD
- Anhaeusser, 1973: Geological Map of Johannesburg Dome at 1:50 000 scale
- Brink, 1981: Engineering Geology of Southern Africa

Table 1 below shows a summary of the available published physiographical characteristics of the site.

Table 1: Summary of Published Physiological Characteristics

Parameter	Value	Reference
Development	Warehousing	Turning Point PM
Site coordinates	26 15 27.6S 27 56 29.0E	Google Earth and Garmaps
Weinerts N-value	2.2	Weinert (1974)
Climatic Region	Sub-humid warm	TRH 2 (1978)
Rainfall	600-800mm	2928 Durban (2001) 1:500 000 scale
Temperature	15-17.5°C	After DWAF (1986)
Evaporation	1600-1800mm	After DWAF (1986)
Water Balance	Water deficit	Schulze (1985)
Weathering Type	Moderate decomposition	Fookes et al (1971) & Embleton et al (1979)
General geology	Weathered lava	De Beer, 1965 scale 1:5 000
Soil cover	Thin residuum	Brink (1985) Vol 4
Origin	Transported & residual	Brink (1985) Vol 4
Topography	Gentle to south	Visual
Drainage region	A21	DWAF (1999)
Hydrogeology	Intergranular and fractured, 0.1-0.5 l/s	2628 Johannesburg (2001) 1:500 000 scale
Erodibility Index	16-20 (Low)	WRC (1992)
Seismic Intensity	VI (MMS)	Fernandez et al (1972)
Liquefaction Potential	>200 cm/s ² (Very likely)	Welland (2002)

3. SITE DESCRIPTION

The site is located on erf 24460 Diepkloof Zone 6, Soweto. The approximate central coordinates are 26 15 27.6S and 27 56 29.0E.

The site occupies an area of approximately 0.5 ha and at the time of the investigation was bordered to the west by Giyani School, to the north by a road and parking area and to the south by an existing commercial development.

Topographically the site slopes gently to the south. The layout of the site is shown in Figure 1.

4. FIELDWORK

The fieldwork for the site was completed on the 1 October 2015 and comprised the excavation of four test pits by a CAT 422DE TLB. Profiling and sampling of the various soil and rock layers encountered has been supplemented by laboratory testing and analysis. The positions of the various tests are shown in Figure 1.

4.1 Test Pits

Four test pits, designated TP1 to TP4 were excavated to refusal of the TLB at between 0.5m and 1.2m below ground level (average 0.85m) to allow for profiling and sampling of the soils which underlie the site. The test pits were backfilled on completion. A summary of the profiles is provided below with the full logs in Appendix A:

Table 2: Summary of Test Pit Profiles

Depth (m-m)	Description	EABC (kPa)	Kv (kPa/mm)	E (MPa)
Fill				
0.0-0.1	Slightly moist, grey brown, LOOSE, silty gravelly SAND.	N/A	N/A	N/A
Pebble marker				
0.1-0.4	Slightly moist, grey brown, MEDIUM DENSE, silty sandy GRAVEL.	75-125	50-80	5-10
Residuum to Saprolite				
0.4-0.85	Moist, orange pink brown, MEDIUM DENSE to DENSE, silty fine- to medium-grained SAND.	300-500	80-100	10-30
Weathered quartzite				
0.85+	Highly weathered, light pinkish grey mottled yellow, friable, medium to coarse-grained, VERY SOFT ROCK QUARTZITE.	500+	100+	30+

EABC = estimated allowable bearing capacity

Kv = modulus of subgrade reaction

E = elastic modulus

5. GEOLOGY

The general geology of underlying the area comprises of medium- to coarse-grained quartzite of the Turffontein Subgroup, Central Rand Group, Witwatersrand Supergroup. The bedrock is gently dipping (20 degrees) to the south. The published geological map also shows a diabase dyke/sill striking east-west and also a syenite dyke trending north-south.

The geology at the site is represented by the following layers:

5.1 Fill

Generally not more than 0.1 to 0.2m thick and comprises loose, silty gravelly sand.

5.2 Pebble Marker

Only encountered in TP2 from surface to 0.4m depth and comprises medium dense silty sandy gravel.

5.3 Residuum

The residual quartzite was encountered at an average depth of 0.65m and comprises medium dense to dense silty sand.

5.4 Weathered Quartzite

The weathered quartzite was encountered at between 0.1m and 1.0m below surface and was easily excavated to an average depth of 0.9m where the quartzite became medium to hard rock consistency.

6. GROUNDWATER

Groundwater seepage was not encountered in the test pits. The water level will generally reflect the undulating topography and the regional water level which has been recorded at not less than 30 m depth (Barnard, 2000).

The site resides in the A21 tertiary drainage region (DWAF, 1999) and receives a mean annual precipitation of approximately 600 to 800 mm and evaporation of 1600 to 1800 mm per annum. The site therefore resides in a water deficit region. The underlying rock aquifer is of an inter-granular and fractured type providing a good borehole yield in excess of 2 l/s (DWAF, 1999 & Barnard, 2000). The site is also on the southern slope of the major inter-continental water divide which occurs further north along the Braamfontein ridge.

7. LABORATORY TESTING

A number of samples were taken to determine foundation indicators and corrosivity and a summary and interpretation of the results is given below:

Table 3: Summary of Foundation Indicator Results

TP No	Depth (m-m)	LL	PI	GM	CBR*	PRA	TRH14	USCS
<i>Pebble marker</i>								
2	0-0.4	NP	NP	2.12	60+	A.1.b	G5+	GM
<i>Residuum/saprolite</i>								
2	0.4-1.0	NP	NP	1.65	46+	A.2.4	G5+	SM
<i>Weathered quartzite</i>								
1	0.1-0.6	NP	NP	1.32	36+	A.2.4	G6	SM
4	0.45-0.7	NP	NP	2.33	60+	A.1.b	G5+	GP-GC

*CBR estimated at 93% MADD (Dept Trans, 1994)

The results show the residuum and weathered quartzite to be medium-grained, inert and non-expansive, silty gravely sand. The material are excellent quality for construction purposes to upper subbase generally.

Further empirical correlations will probably show the modulus of subgrade reaction (k) to be in the range 50 to 150 kPa/mm.

The residuum and weathered rock layers are suitable for layerworks up to at least upper subbase and possibly even basecourse if proven by further testing.

The residuum weathered quartzite is corrosive to very corrosive based on TDS count in excess of 100 ppm and resistivity in excess of 3500 Ohm/cm.

8. DEVELOPMENT RECOMMENDATIONS

8.1 Proposed Development

It is understood that the proposed development will be a warehouse development.

8.2 Rippability & Trenchability

Soft excavation in terms of SABS 1200 is anticipated to an average depth of 0.8m. Soft rock quartzite is expected below this level and may require heavy ripping with pneumatic assistance.

8.3 Earthworks

It is recommended that all restricted earthworks be carried out in accordance with SABS 1200 (current version) or COLTO.

8.4 Drainage

One of the most important factors in the promotion of a stable site is the control and removal of both surface and groundwater seepage from the property. It is important that the design of the stormwater management system allow for the drainage of accumulated surface water and that it is collected and disposed of in a responsible manner.

Both during and after construction, the site should be well graded to permit water to readily drain from the site, and to prevent ponding of water anywhere on the surface of the basement excavation. All terraces and earthworks in general should be graded at 1:50 (or 2%) to prevent ponding and ingress of water into the subsurface soils.

8.5 Surface Drainage

Surface water collected on any hardened areas or tarred roads should be directed to and collected in open, lined drains and pumped off the site downslope of the property. Run-off from the panels should be discharged into the adjacent drainage trenches.

8.6 Sub-Surface Drainage

The need for subsurface soil drainage will be addressed in the final report but at this stage it does not appear to be a necessity.

8.7 Foundation Recommendations

8.7.1 General

The site geology is characterised by medium-grained quartzite of the Central Rand Group, Witwatersrand Supergroup. It is clear that the underlying rock mass or soil properties will influence the performance of the spread foundations if competent rockmass has been exposed at a deeper level.

Inspection of the existing adjacent structures show that no significant differential settlement has taken place as shown by the absence of cracking.

In order to determine the structure-soil interaction, the foundation soil/rock parameters and the structural loads and tolerances need to be ascertained. The former has been completed by the process of this report and the structural loads estimated as follows:

Warehouse structure = steel-framed brick infill

Foundation dimension = 1x1 pad

Required bearing capacity = 75 to 150 kPa for column loads

8.7.2 *Bearing Capacity*

The bearing capacity of the weathered rock is dependent on the internal shear strength of the rock mass (c and ϕ), the dry density, foundation embedment depth and associated bearing capacity factors. The ultimate bearing capacity is given by:

$$Q_f = 0.3 \cdot 20 \cdot 10 \cdot N_y + 1.3 \cdot 100 \cdot N_c + 20 \cdot 10 \cdot N_q = 7990 \text{ kPa}$$

Where $N_y = 15$, $N_c = 30$ and $N_q = 20$. Therefore:

$$Q_a = Q_f / F_oS = 2.7 \text{ MPa.}$$

8.7.3 *Settlement*

An estimation of the settlement beneath foundations is based on the elastic modulus ($E = 30 \text{ MPa}$) and modulus of compressibility ($M_v = 1/E = 0.033 \text{ m}^2/\text{MN}$). Assuming a square base of at least 1m for the column footings and a contact bearing pressure of 150 kPa, the settlements are estimated at less than 1 mm.

8.7.4 *Subgrade Beneath Floor Slabs*

The subgrade that will remain ranges from loose fill to medium dense to dense pebble marker. The layerworks design beneath floor slabs should be cognisant of these very high subgrade CBR values and will probably only require subgrade infill to provide a homogenous bedding layer. The modulus of subgrade reaction K_v is estimated at between 50 and 150 kPa/mm at the proposed excavation level.

8.7.5 *Standard Pad Footings*

Based on visual and tactile descriptions of the test pit profiles the competent, weathered quartzite at the proposed nominal level of the foundation excavation at between 0.5m and 1.0m is at least medium hard rock consistency. This would probably translate to a minimum estimated allowable bearing capacity (EABC) of not more than 300 kPa with an elastic settlement of less than 1mm.

8.8 *Construction Materials*

The residual and weathered quartzite is generally suitable for any engineering application based on the medium-grained nature and low plasticity.

Commercial sources of concrete aggregate, building sand and dimension stone have been identified within a 10km radius of the site to the south and south-east.

9. CONCLUSIONS & RECOMMENDATIONS

General

- This report represents the preliminary results of a geotechnical investigation for the proposed development at erf 24460 Diepkloof Zone 6, Soweto and presents the conclusions and preliminary recommendations for the foundations and earthworks.
- The most critical aspect of this site in relation to the proposed development is the expected hard excavation to achieve minimum trench depth of between 1m and 1.5m for services.

Geology & Ground Conditions

- The site is underlain by medium-grained quartzite which has been weathered to a shallow depth less than a metre below surface. Perched groundwater seepage is not expected.
- The soil cover conditions are homogeneous and can be described as loose to medium dense silty sand overlain by a 100mm thick fill layer.

Excavatability

- Soft excavation in terms of SABS 1200 is generally anticipated up to 0.8m depth but can be as shallow as 0.5m. Thereafter, hard excavation is expected requiring heavy ripping with percussion assistance.

Foundations

- The main structures will require conventional pad foundations at nominal depth with a bearing pressure of not more than 300 kPa.

Construction Materials

- The residuum and weathered rock are of good quality and can be used for general fill purposes and in layerworks up to upper subbase and possibly even basecourse.
- Commercial sources of concrete aggregate, building sand and dimension stone have been identified within a 10km radius from the site to the south and south-east.
- Finally, the ground conditions described in this final report refer specifically to those encountered at the test positions on the site. It is therefore possible that conditions at variance with those discussed above may be encountered elsewhere on the property. In this regard it is critical that material management be maintained continuously on site and that **GCS Geotechnical** carry out periodic inspections of the site during construction to ensure that any variation in the anticipated ground conditions can be assessed and revised recommendations made to avoid unnecessary delays and expense. Furthermore it is important that the construction phase of the project be treated as an augmentation of the geotechnical investigation.



For **GCS Geotechnical**

8 January 2016

www.gcs-sa.biz

APPENDIX A

Test Pit Profiles

Job Description:	9 Charles Street NHBRC Phase I				
Job No.:	15-1101				
Client:	Vsruct				
Machine:	Manual				
Location:	Bryanston				
Logged by:	AMW				
Date:	23-Jun-15	Sheet:	1	of	1

	<h1>Test Pit Profile</h1>	Test Pit No.
		<h1>TP1</h1>
63 Wessels St, Rivonia Tel: +27 (0)82 567 1561 e-mail: nlnow@gcs-sa.biz		

Co-ordinates: x y Elevation: Co-ord System:	Job Description:	Erf 24460 Diepkloof
	Job No.:	15-783
	Client:	TPPM
	Machine:	Cat 422DE
	Logged by:	PR
	Date:	01-Oct-15 Sheet: 1 of 1

From:	To:	Thickness (m)	Description
0.00	0.10	0.10	Slightly moist, grey brown, LOOSE (pp=10-15mm), intact, silty gravely SAND . FILL.
0.10	0.60	0.50	Light pinkish grey mottled yellow, highly weathered, friable, medium to coarse-grained, VERY SOFT ROCK SANDSTONE.

Notes:

- 1) No groundwater seepage encountered
- 2) Refusal of TLB at 0.6 m
- 3) No visible sidewall collapse
- 4) Sample at 0.1 to 0.6m



Test Pit Profile

Test Pit No.

TP2

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-za.biz

Co-ordinates:	Job Description:	Erf 24460 Diepkloof
x	Job No.:	15-783
y	Client:	TPPM
Elevation:	Machine:	Cat 422DE
Co-ord System:	Logged by:	PR
	Date:	01-Oct-15
	Sheet:	1 of 1

From:	To:	Thickness (m)	Description
0.00	0.40	0.40	Slightly moist, gray brown, MEDIUM DENSE (pp=5-10mm), intact, silty sandy GRAVEL. PEBBLE MARKER.
0.40	1.00	0.60	Moist, orange pink brown, MEDIUM DENSE to DENSE (pp=2-5mm), silty fine to medium-grained SAND. RESIDUUM.
1.00	1.20	0.20	Light pinkish grey mottled yellow, highly weathered, friable, medium to coarse-grained, VERY SOFT ROCK SANDSTONE.

Notes:

- 1) No groundwater seepage encountered
- 2) Refusal of TLB at 1.2 m
- 3) No visible sidewall collapse
- 4) Sample at 0 to 0.4m (disturbed) and 0.4-1.0m (disturbed)



Test Pit Profile

Test Pit No.

TP3

Tel: +27 (0)82 567 1561 e-mail: nlnow@gcs-sa.biz

Co-ordinates:	Job Description:	Erf 24460 Diepkloof
x	Job No.:	15-783
y	Client:	TPPM
Elevation:	Machine:	Cat 422DE
Co-ord System:	Logged by:	PR
	Date:	01-Oct-15
	Sheet:	1 of 1

From:	To:	Thickness (m)	Description
0.00	0.10	0.10	Slightly moist, grey brown, LOOSE (pp=10-15mm), intact, silty gravely SAND . FILL.
0.10	0.50	0.40	Light pinkish grey mottled yellow, highly weathered, friable, medium to coarse-grained, VERY SOFT ROCK SANDSTONE.

Notes:

- 1) No groundwater seepage encountered
- 2) Refusal of TLB at 0.5 m
- 3) No visible sidewall collapse
- 4) Sample at 0.45 to 0.7m



Test Pit Profile

Test Pit No.

TP4

Tel: +27 (0)82 567 1561 e-mail: ninow@gcs-sa.biz

Co-ordinates:	Job Description:	Erf 24460 Diepkloof
x	Job No.:	15-783
y	Client:	TPPM
Elevation:	Machine:	Cat 422DE
Co-ord System:	Logged by:	PR
	Date:	01-Oct-15
	Sheet:	1 of 1

From:	To:	Thickness (m)	Description
0.00	0.20	0.20	Slightly moist, grey brown, LOOSE (pp=10-15mm), intact, silty gravelly SAND. FILL.
0.20	0.45	0.25	Slightly moist, grey brown, MEDIUM DENSE (pp=5-10mm), intact, silty sandy GRAVEL. PEBBLE MARKER.
0.45	0.70	0.60	Moist, orange pink brown, MEDIUM DENSE to DENSE (pp=2-5mm), silty fine to medium-grained SAND. RESIDUUM.
0.70	1.10	0.40	Light pinkish grey mottled yellow, highly weathered, friable, medium to coarse-grained, VERY SOFT ROCK SANDSTONE.

Notes:

- 1) No groundwater seepage encountered
- 2) Refusal of TLB at 1.1 m
- 3) No visible sidewall collapse
- 4) Sample at 0.45-0.7m (disturbed)

APPENDIX B

Laboratory Test Results



SOILS & MATERIALS TESTING
P.O.BOX 227, MARAISBURG, 1700

TEL: (011) 674 1926
FAX: (011) 674 4513
e mail: lab@gcsopracitica.co.za

FOUNDATION INDICATOR

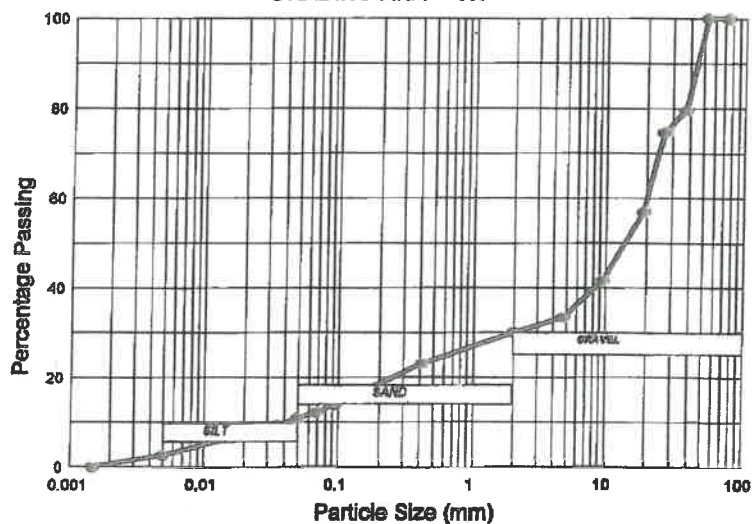
Client	GCS GEOTECHNICAL ENGINEERING		
Location	ERF 24480 - DIEPKLOOF	IP 4 @ 0.45 - 0.7m	
Date	04 SEPTEMBER 2015	Test No	1807
Job No	15279	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	79.66
26.50	74.62
19.00	57.00
9.50	41.62
4.75	33.47
2.00	30.03
0.425	23.28

GRADING ANALYSIS



HYDROMETER ANALYSIS

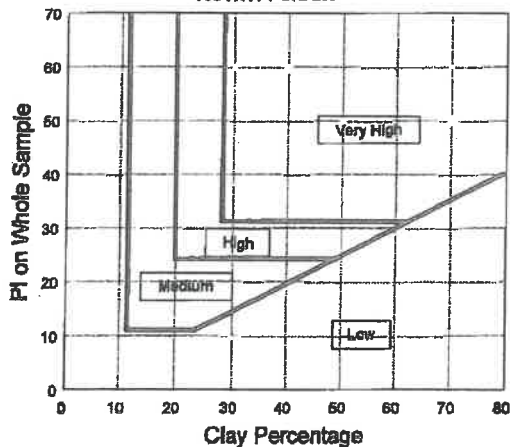
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0946	13.95
0.0687	12.21
0.0495	10.90
0.0358	9.16
0.0050	2.62
0.0015	0.00

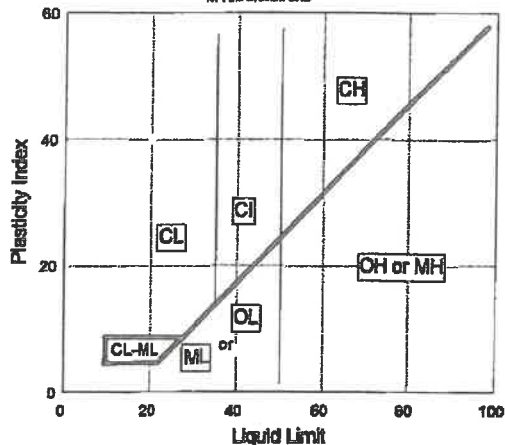
ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	2.33
Moisture Content	3.54
PI on Whole Sample	Non Plastic
PRA Classification	A.1.a
Unified Classification	GP - GC

ACTIVITY CHART



PLASTICITY CHART



FOUNDATION INDICATOR

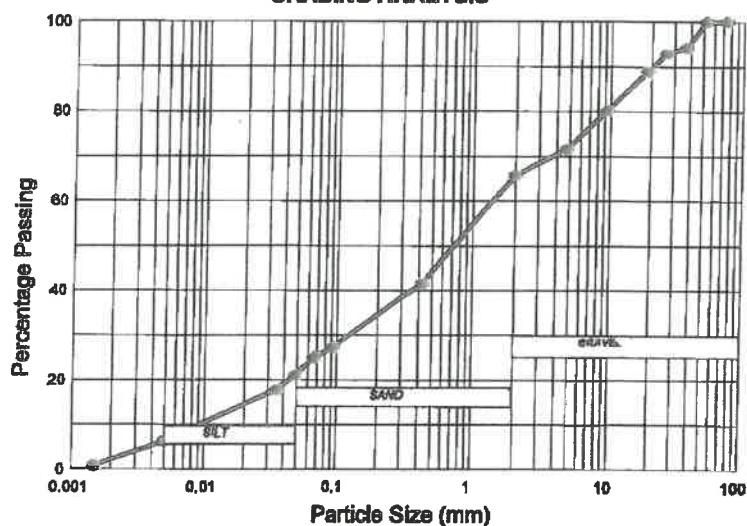
Client	GCS GEOTECHNICAL ENGINEERING		
Location	ERF 24460 - DIEPKLOOF	IP 2 @ 0.4 - 1.0m	
Date	04 SEPTEMBER 2015	Test No	1804
Job No	15279	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	94.25
26.50	92.98
19.00	88.93
9.50	80.24
4.75	71.67
2.00	65.80
0.425	41.63

GRADING ANALYSIS



HYDROMETER ANALYSIS

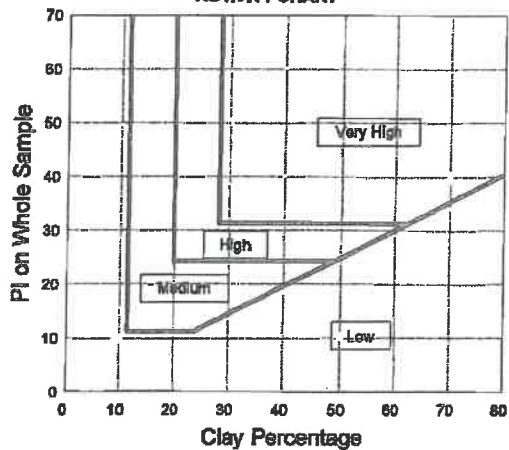
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0927	27.29
0.0869	24.95
0.0489	21.05
0.0354	17.93
0.0050	6.24
0.0016	0.78

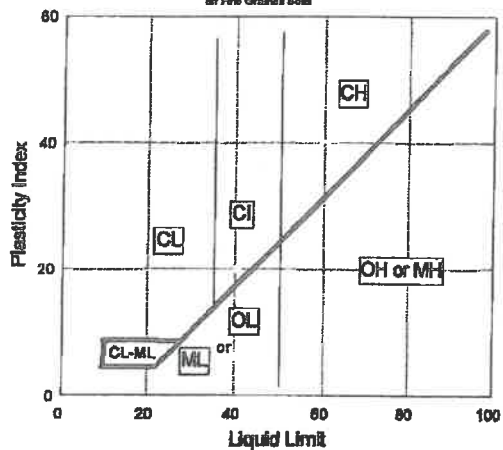
ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	1.65
Moisture Content	5.40
PI on Whole Sample	Non Plastic
PRA Classification	A.2.4
Unified Classification	SM

ACTIVITY CHART



PLASTICITY CHART



FOUNDATION INDICATOR

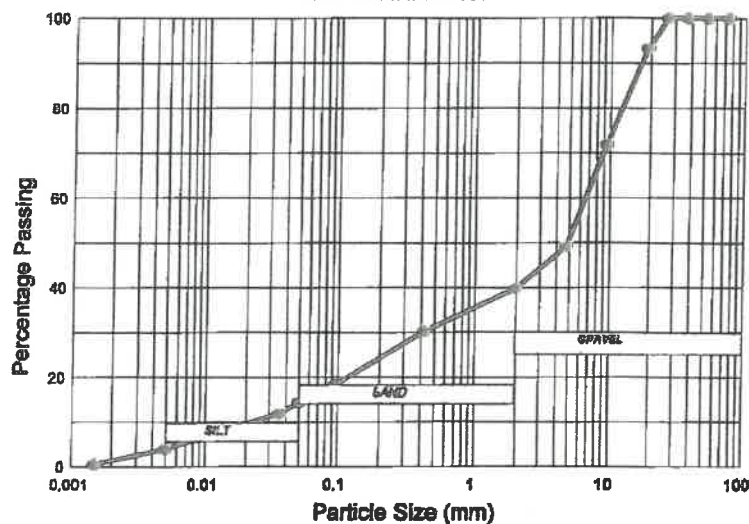
Client	GCS GEOTECHNICAL ENGINEERING		
Location	ERF 24460 - DIEPKLOOF	IP 2 @ 0,0-0,4m	
Date	04 SEPTEMBER 2015	Test No	1802
Job No	15279	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	93.42
9.50	71.90
4.75	49.15
2.00	39.85
0.425	30.34

GRADING ANALYSIS



HYDROMETER ANALYSIS

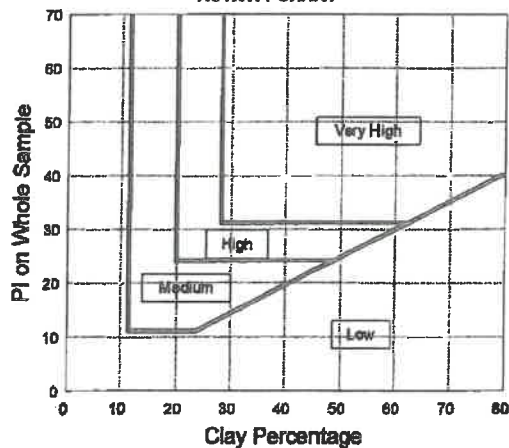
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0946	18.18
0.0682	16.48
0.0495	14.20
0.0358	11.93
0.0050	3.98
0.0015	0.57

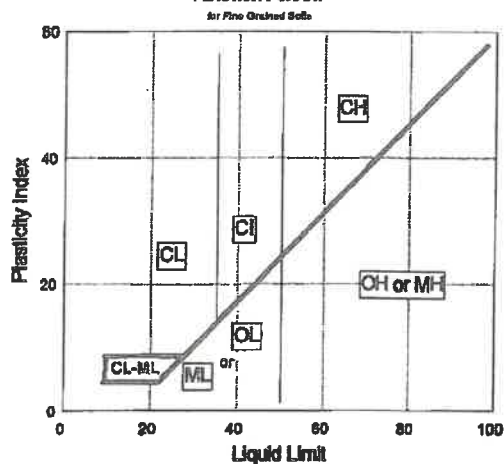
ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	2.12
Moisture Content	3.55
PI on Whole Sample	Non Plastic
PRA Classification	A.1.b
Unified Classification	GM

ACTIVITY CHART



PLASTICITY CHART





SOIL and MATERIAL TESTING
P.O. BOX 227
MARAISBURG 1700

TEL: (011) 674 1325
FAX: (011) 674 4513
e mail: satisfied@geopractica.co.za

SOIL pH and CONDUCTIVITY TEST RESULT

Client	GCS		
Location	erf 24480 Diepkloof		
Date	10 November 2015	Test No	1801, 1803, 1805, 1806
Job No	15257	Checked By	SG

Sample Description	pH	Electrical Conductivity EC ($\mu\text{S}/\text{cm}$)	Total Dissolved Salts TDS (ppm)	Resistivity R (Ohms/cm)
IP 1 @ 0.10 - 0.60	7.3	263	122	3802
IP 2 @ 0.00 - 0.40	7.2	280	140	3571
IP 2 @ 0.40 - 1.00	7.0	226	106	4425
IP 4 @ 0.45 - 0.70	6.8	218	100	4587

pH	Degree of Acidity
<4	Extremely Acidic
4.0 - 5.4	Strongly Acidic
5.5 - 6.4	Moderately Acidic
6.5 - 7.0	Slightly Acidic
7.1 - 7.4	Slightly Alkaline
7.5 - 8.4	Moderately Alkaline
>8.4	Strongly Alkaline

Resistivity (Ohms/cm)	Degree of Corrosivity
0 - 2 000	Extremely Corrosive
2 000 - 4 000	Very Corrosive
4 000 - 5 000	Corrosive
5 000 - 6 000	Mildly Corrosive
>10 000	Not Generally Corrosive

FOUNDATION INDICATOR

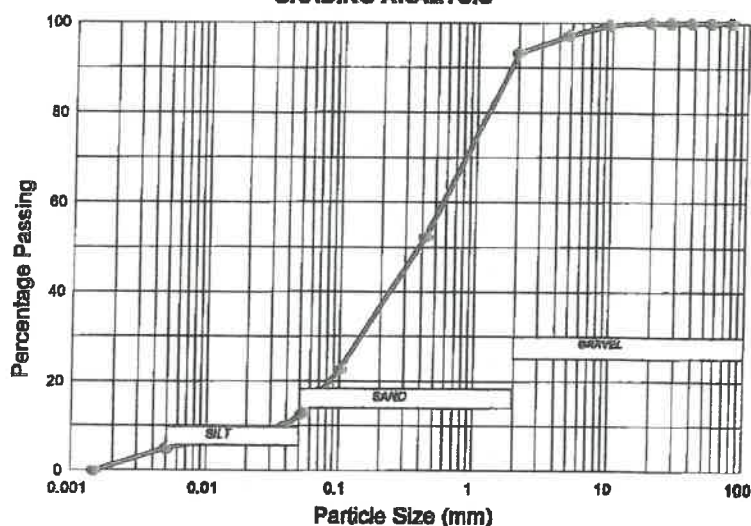
Client	GCS GEOTECHNICAL ENGINEERING		
Location	ERF 24460 - DIEPKLOOF	IP 1 @ 0.1-0.6m	
Date	04 SEPTEMBER 2015	Test No	1800
Job No	15279	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
28.50	100.00
19.00	100.00
9.50	98.48
4.75	97.21
2.00	93.23
0.425	52.34

GRADING ANALYSIS



HYDROMETER ANALYSIS

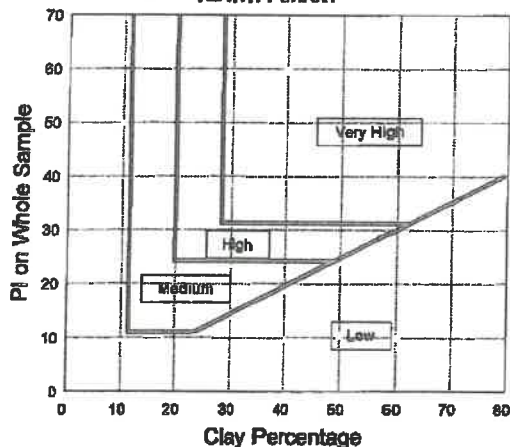
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.1001	22.54
0.0729	17.64
0.0530	12.74
0.0380	9.80
0.0050	4.90
0.0015	0.00

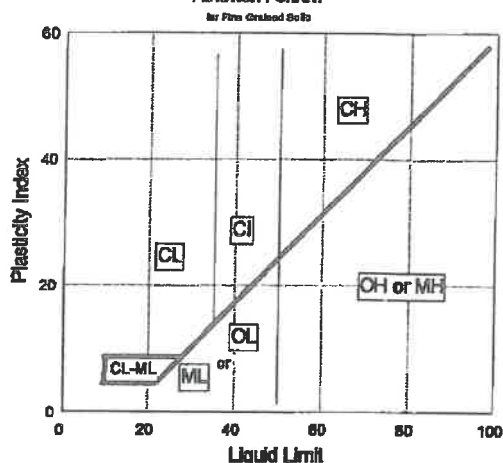
ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	1.32
Moisture Content	3.87
PI on Whole Sample	Non Plastic
PRA Classification	A.2.4
Unified Classification	SM

ACTIVITY CHART



PLASTICITY CHART



FIGURES

6/26/2015

Google



2000

27°56'30.31" E elev 1662 m eye alt

