APPENDIX C (iv)

Geotechnical Report

ANNEXURE I

PLAN

GEOTECHNICAL REPORT

YIHLA ENVIRONMENTAL AND CONSULTING

ENGINEERS

A GEO-TECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF 1100 HOUSES AT SIYABUSWA, WITHIN DR JS MOROKA LOCAL MUNICIPALITY OF NKANGALA DISTRICT MPUMALANGA

PREPARED BY: YINHLA ENVIRONMETAL AND CONSULTING ENGINEERS

P.O. BOX 422
GUMBANI
0953

CELL: 015 962 1639

FAX: 086 500 4469

EMAIL: igwebilaint@gmail.com

ON BEHALF OF: SEBOTHOMA L.P.

P.O. BOX 594

SESHEGO

0742

CELL: 015 962 1639

FAX: 086 500 4469

EMAIL: cliffbilankulu@yahoo.com

DATED: JULY 2014

PROJECT TEAM

M. NGOBELI	**GEOLOGIST (Pr.Sci.Nat)**
B. TAENZANA	**ENVIRONMENTAL ENGINEER (Pr.Sci.Nat)**
P. MUDAU	**ENGINEERING GEOLOGIST**
T. MADZIVHANDILA	**ENVIRONMENTAL GEOLOGIST**

CONTENTS

FIGURES

APPENDICES

1. INTRODUCTION

1.1. Preamble

In June 2014, Golden-Goal, appointed Yinhla Environmental Consultants to undertake a geotechnical investigation on portions; 42, 43, 47 of the farm Valschfontein 33 JS, in Siyabuswa Township, Dr. J.S. Moroka Local Municipality of Nkangala District, Mpumalanga Province of South Africa. Yinhla Environmental Consulting was also advised that the proposed development will include the construction of 1100 houses. This report discusses the findings and constraints of the investigation carried out to assess the geotechnical conditions and constraints of the site with regards to the proposed development.

1.2. Objectives

The objectives of the investigation were to complete a geotechnical survey of the site which would:

- Identify the soil/rock profile to a depth of approximately 3.0m or refusal of excavation
- Determine the engineering parameters of the near surface soils
- Recommend specific foundations for the structures
- Assess the suitability of the near surface soils for use in earthworks
- Comment on any geotechnical problems that may impact upon the construction
- Classify the site according to the site classifications recommended by the NHBRC Home Building Manuals.

2. FACTUAL REPORT

2.1. Programme of Works

Literary Review

Prior to the commencement of a field work, a literary review was conducted on the data obtained from previous investigations carried out by other consultants. A 1:250 000 geological map was consulted to determine the local geology.

Field Work

On the 26th of June 2014, a total of 4 trial pits were hand excavated across the site using picks and shovels, to refusal of excavation. The locations of trial pits were positioned on the field by a field geologist by taping and pacing from known points, and were later marked using a hand-held Garmin GPS with an accuracy of approximately 5m.

Each pit was internally profiled by the engineering geologist according to the "Guidelines for soil and rock logging in South Africa, 2nd Impression 2002", sampled where necessary and subsequently loosely backfilled. Detailed soil profiles appear in Appendix of the report, while the locations of the trial holes pits are indicated on the site plan which appears in Appendix 2.

Laboratory Testing

From various soil samples recovered during the field work, the following laboratory tests were undertaken and results are attached as Appendix to this report.

- ✓ Foundation Indicator Test 4
- ✓ CBR 3
- ✓ Grading analysis 3

The report was finally prepared using the data obtained from the entire source mentioned above.

2.2. Site Description

2.2.1. Location

The study area falls in terms of current political dispensation, within the jurisdiction of Dr. J.S. Moroka Local Municipality of Nkangala District refer to Locality Map 1.

The study area is located on the following coordinate:

Latitude: 25º 6' 167"S

Longitude: 29º 2' 22" E

2.3. Local Geology

The regional geology of the area is described in terms of Geological Sheet 2530 Barberton, 1: 250 000. The study area is underlined by Biotete-Trondhjemite Gneiss (Goudplaats-Houtriver Gneiss Suite, Paleoarchean Granitoid Intrusion).

2.4. Topography, Climate and Hydrology

The study area is located on a gentle to steep slope towards the westerly direction. The area exhibits an average slope of between 1.5° and 2° west. No prominent regional topographical features occur within the boundaries of the study area.

Climatic conditions in the area support variety of agricultural activities. Temperatures range between 18^{0}C and 28^{0}C with an average of 25.5^{0}C. Generally summer have a high number of sunshine hours with occasional afternoon thunderstorms. The general average rainfall of the area ranges between 450mm to 800mm. .

The study area is located in the Olifants Water Catchments Management Area. The site is drained by means of surface run off; with storm water collecting towards the southern western direction.

2.5. Field Observation

Several soil horizons were encountered across the site and their descriptions has been discussed below.

Fill Materials

On all the trial pits, a horizon of hill wash which results as surface run-off forms the upper most soil horizon. This hill wash is described as generally greyish brown, soft and fine sandy silt. The average thickness ranges from 0-0.3m

Residuals

Immediately below the fill soils are horizons of residual materials with different alterations. The materials have generally been described as red brown mottled yellow with depth, slightly fissured clayey silt with yellowish stained weathering runnels and occasionally semi-ferruginesed ferricrete concretions. Its consistency varies from soft to firm grading to stiff. Its thickness was not determined as maximum allowance of excavation or trial pit termination on very stiff horizon was reached respectively.

Laboratory Results

.

Summaries of the laboratory results have been shown below, whilst the detailed results are presented in Appendix of this report

Table 1: Summary of laboratory test results

TP No.	Depth (m)	Material	PI (%)	PI (ws)	GM	MC (%)	Activity
(A1 & A2)	0.6-1.1	Residual	8	8	1.48	9.6	Medium
(C2 & C1)	0.5-0.7	Residual	8	8	1.00	9.6	Medium
(E1 & E2)	0.7-1.0	Residual	8	8	1.24	12.6	Medium
(G1 & G2)	1.2-1.3	Residual	3	3	1.44	8.8	Medium

3. INTERPRETATIVE REPORT

3.1. Discussion of Results

Fill Materials

Due to the nature of its source and its sporadic distribution across the site, no laboratory testing was undertaken. Its consistency has also been described as loose and as such it is not recommended for founding medium for the proposed development.

Residuals

Laboratory tests were conducted within residuals show that these materials exhibit a medium heave potential. It should be mentioned that the expansive potential of material is instigated by change in its moisture content where an increase in the moisture content will result in expansion of the material and a reduction will result in shrinkage of similar material. This effectively implies that if the current moisture content or present moisture during construction is kept constant an insignificant movement can be anticipated, hence less damage/distress to structures.

However, due to insignificant expansive and compressible potentials this horizon is recommended as a founding medium for the proposed development.

3.2. Watertable

It should be mentioned that this fieldwork was undertaken during winter season just after a week of rains and this is evident by the amount of moisture that is present within the soils. However no water seepage was encountered in any of the trial pits. The depth of the water table is unknown.

3.3. Excavatibility of the ground

As it was mentioned that there are no double storey structures on the proposed development, the trial pits were hand-excavated using picks and shovels. The average depth of excavation up to refusal is 1.42m

3.4. Geotechnical Classification

The site has been classified according to the " Geotechnical Classification for Urban Development" after Watermeyer and Tromp (1992) and the Joint Structural Division. The following classes designated across the site while its site classification reference has been presented in Appendix 4 to this report

- ✓ **Class H (< 7.5mm of heave movement)**

3.5. Founding Solution

It is recommended that the development be founded on Stiffened or Concrete Raft, a suitably reinforced concrete raft.

Alternatively these structures should be founded on a Soil Raft and the details are:

- ✓ An area at least 0.5m larger than the foot print of the structure will need to be excavated to a depth of not less than 0.5m below the current ground level.

3.6. General

As mentioned above that the trial pits were loosely backfilled, where foot prints of the proposed structures are to be placed directly on top of these trial pits, the holes should be identified and properly backfilled.

3.7. Additional investigations

No further investigation will be necessary for the proposed development.

4. CONSTRUCTION MONITORING

4.1. Excavation Inspection

It is recommended that all foundations be inspected by a competent person prior to placing any concrete.

4.2. Control Testing

Regular checks on the quality and compaction of the backfill to the terraces should be made

Report Provision

While every effort is made during the fieldwork phase to identify the various soil horizon ,areas subject to perched water Table ,areas of poor drainage ,areas underlain by hard rock ,and to estimate their distributions ,it is impossible to guarantee that isolated zones of poorer foundation materials or harder rock have not been overlooked .

For this reason, this investigation has sought to highlight areas of potential foundation, groundwater and excavation problems, as well as to provide prior warning to the developers.

All information and deductions contained within this report are dependent not only on access to the site and previous information, but also on the accuracy of the results received from the accredited laboratories and the proposed site map supplied by the Client.

.....

Proffessional Natural Scientist (Earth Sciences)
M. NGOBELI (Pr.Sci.Nat)

.....

Engineering Geologist
P. Mudau

REFERENCE

Jennings JE et al . "Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa" – Civil Engineer in South Africa, January 1973

Van der Merwe DH. "The prediction of heave from the Plasticity Index and percentage clay fraction of soils" – Civil Engineer in South Africa Vol 6, 1964

Guidelines for Soil and Rock Logging in South Africa – AEG-SA section, SAICE, SAIEG – 2002.

Code of Practice – The safety of Persons Working in Small Diameter Shafts and Test Pits for Civil Engineering Purposes – Geotechnical Division of SAICE – 2003.

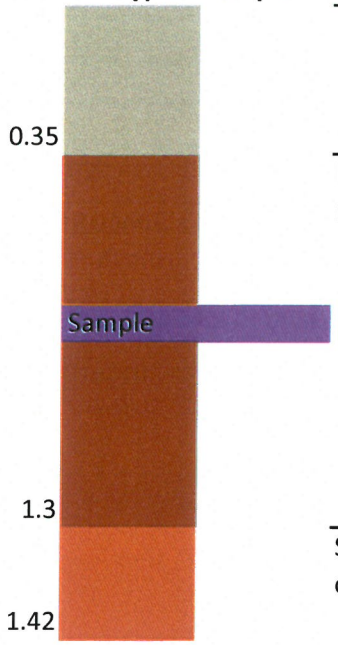
SAICE's Guidelines for Urban Engineering Geological Investigations.

Code of Practice – Foundations and Superstructures for Single Storey Residential Buildings of Mansonry Construction – The Joint Structural Division of SAICE and IStructE, First edition 1995.

APPENDIX: 1 SITE LAYOUTS

APPENDIX: 2 SOIL PROFILES

YINHLA ENVIRONMENTAL		**Project:**	Syabuswa
Profiled:	C. Bilankulu	**Client:**	Golden-Goal
Machine:	N/a	**X-Coord:**	
Contractor:	N/a	**Y-Coord:**	
Diameter:	Trench	**Date Drilled:**	20/6/2014
Orientation:	Vertical	**Date Profiled:**	20/6/2014
Hole No:	TP2		



Descriptions
Moist, brown, silty sand, abundant roots,. HILL WASH
Moist, reddish brown, dense to medium dense, intact medium sand.
Slightly moist, yellowish brown, medium dense, intact, coarse sand. RESIDUAL

EOH: 1.42m
No seepage
Sample @ 0.7m

YINHLA ENVIRONMENTAL		**Project:**	Siyabuswa
Profiled:	c. Bilankulu	**Client:**	Golden-Goal
Machine:	N/a	**X-Coord:**	
Contractor:	N/a	**Y-Coord:**	
Diameter:	Trench	**Date Drilled:**	20/6/2014
Orientation:	Vertical	**Date Profiled:**	20/6/2014
Hole No:	TP1		

Depth	Soil type	Sample	Descriptions
			Moist, brown, silty sand, abundant roots,. HILL WASH
0.3			
			Moist, reddish brown, dense to medium dense, intact medium sand.
1.1			
		Sample	Slightly moist, yellowish brown, medium dense, intact, coarse sand. RESIDUAL
1.3			

EOH: 1.3m
No seepage
Sample @ 1.1m

APPENDIX: 3 LABORATORY TEST RESULTS

LETABA LAB (Pty) Ltd

CIVIL ENGINEERING MATERIALS LABORATORY

P.O. Box: 795
Faunapark
0787

123 Rivier Street
Ladine
Polokwane
0699

Tel. No: 015 293 2524 Fax. No: 015 293 2534 e-mail : neville@letabalab.co.za

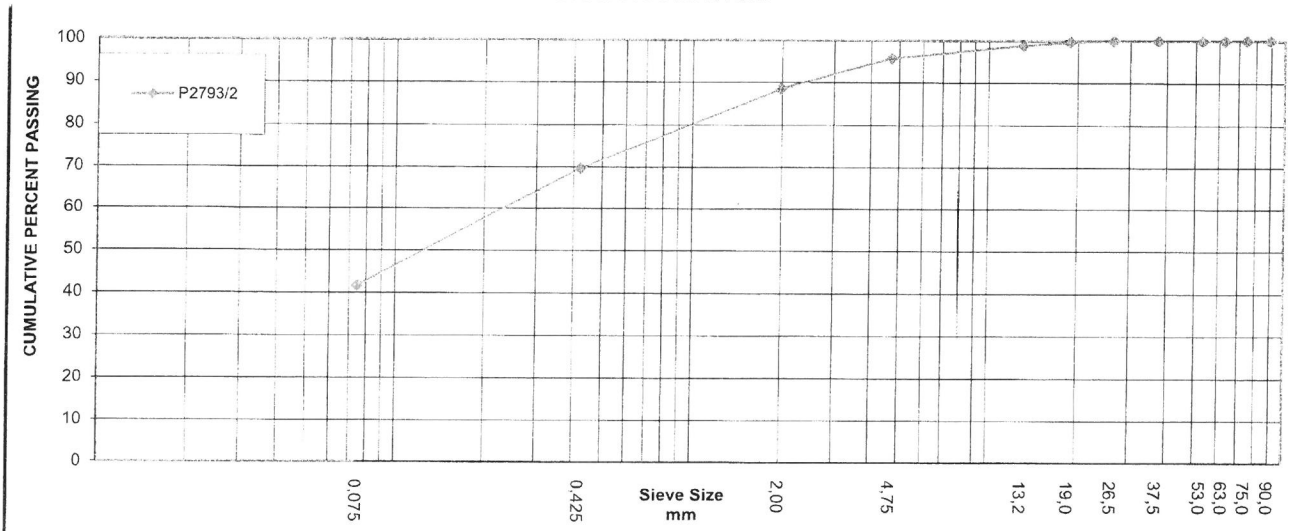
GRAVEL, SOIL AND SAND TEST REPORT

TMH 1:1986 Method A1-A5,A7, A8 & A9*

Client :	**Yinhla Engineers & Environmental**	Doc No: P2793/2(i)	Date Sampled : **26-Jun-14**
Address:	P.O Box 2729 Thohoyandou		
Contract :	**Construction of New Housing Development - Siyabuswa MP**		Date Tested : **03-Jul-14**
Description :	**Sample nr C2 & C1 material delivered to lab sampled by client**		

Depth (m)	Sample No	Description * (Unified Soil Classification)	Sieve Analysis Cumulative percentage passing 53,0	37,5	26,5	19,0	13,2	4,75	2,00	0,425	0,075	Grading Modulus	Atterberg Limits (%) Liquid Limit	Plasticity Index	Linear Shrinkage	Classification * Unified Soil	COLTO : 1998	US. Highway	Group Index
-	P2793/2	R Brown Clayey sand	100	100	100	100	99	96	88	70	42	1,00	25	5	4,0	SC	G9	A-4	1

GRADING ANALYSIS



GENERAL *

Effective size (mm):	**<0.075**
Uniformity co-eff. :	**234**
Curvature co-eff. :	**0,4**
Oversize Index :	**0**
Shrinkage Product :	**279**
Grading co-eff. :	**11,0**

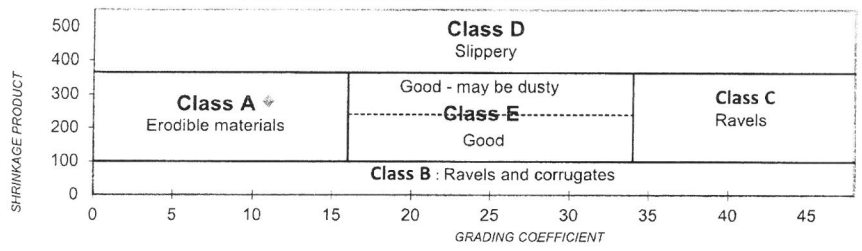
CBR RESULTS (%) :

@ 100% comp. :	**13**
@ 98% comp. :	**12**
@ 97% comp. :	**12**
@ 95% comp. :	**11**
@ 93% comp. :	**9**
@ 90% comp. :	**6**

Soil Mortar Analysis

Coarse Sand (<2.0>0.425mm) :	**18,8%**
Fine Sand (<0.425>0.075mm) :	**28,2%**
Material <0.075mm :	**41,5%**

PERFORMANCE AS GRAVEL WEARING COURSE *



REMARKS

Please note that test results are only relevant to the sample tested, which were delivered to the lab, and were uncontaminated and fit for testing. Any results may only be reproduced in their entirety with the written consent of Letaba Lab (Pty) Ltd, and any opinions and interpretations expressed fall outside Letaba Lab's Quality Document.

Date Issued: 2014-07-07 *Technical signatory (Name) :* R. Lieberberg *Signature:*

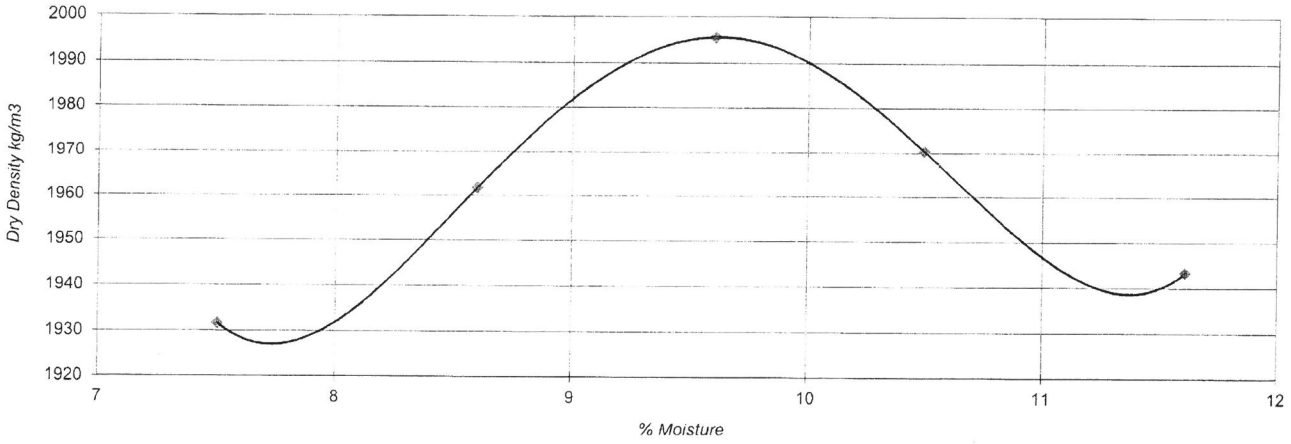
LETABA LAB

CBR and Modified A.A.S.H.T.O Density test report

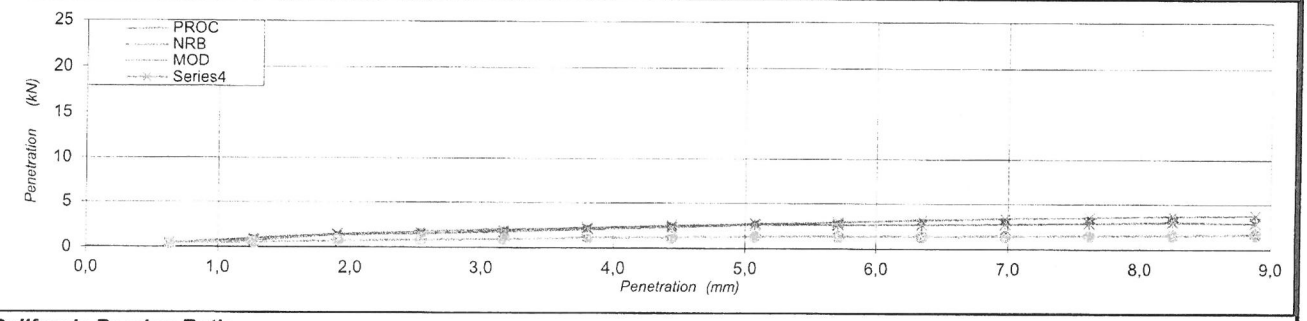
TMH 1:1986 Method A7, A8 & A9*

Client:	**Yinhla Engineers & Environmental**	Date tested:	**03-Jul-14**
Contract :	**Construction of New Housing Development - Siyabuswa MP**	Doc no:	P2793/2(II)
Description:	**Sample nr C2 & C1 material delivered to lab sampled by client**	Sample no:	**P2793/2**

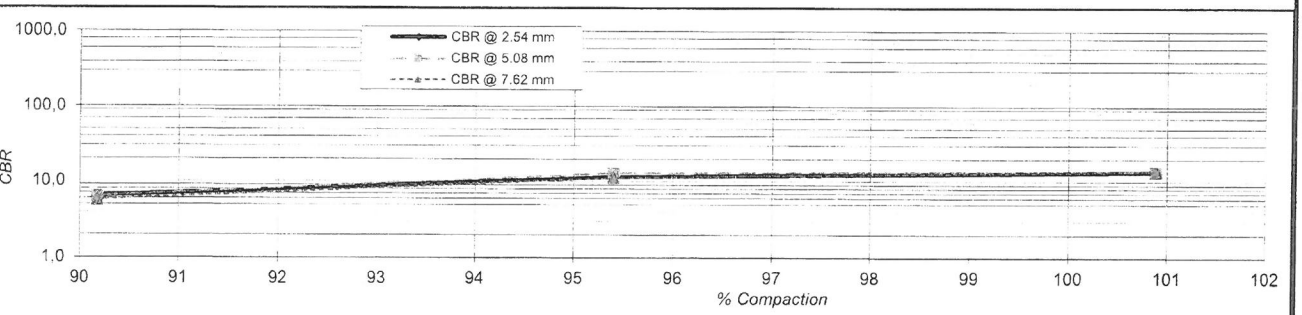
Maximum dry density =	**1995**	**kg/m³**
Optimum moisture content =	**9,6**	**%**



California Bearing Ratio (readings)



California Bearing Ratio



% Compaction	100	98	97	95	93	90
CBR of 13.344 kN	13	12	12	11	9	6

Briquette Info	Mod	N.R.B.	Proc.
Dry Density (kg/m³)	2013	1903	1799
Compaction Moisture (%)	9,5	9,5	9,5
Compaction (%)	100,9%	95,4%	90,2%
% Swell	0,08	0,15	0,22

Date Issued: 2014-07-07 Technical signatory (Name) : R. Liebenberg Signature:

LETABA LAB (Pty) Ltd

CIVIL ENGINEERING MATERIALS LABORATORY

P.O. Box: 795
Fauna park
0787

123 Rivier Street
Ladine
Polokwane
0699

Tel. No: 015 293 2524 Fax. No: 015 293 2534 e-mail : neville@letabalab.co.za

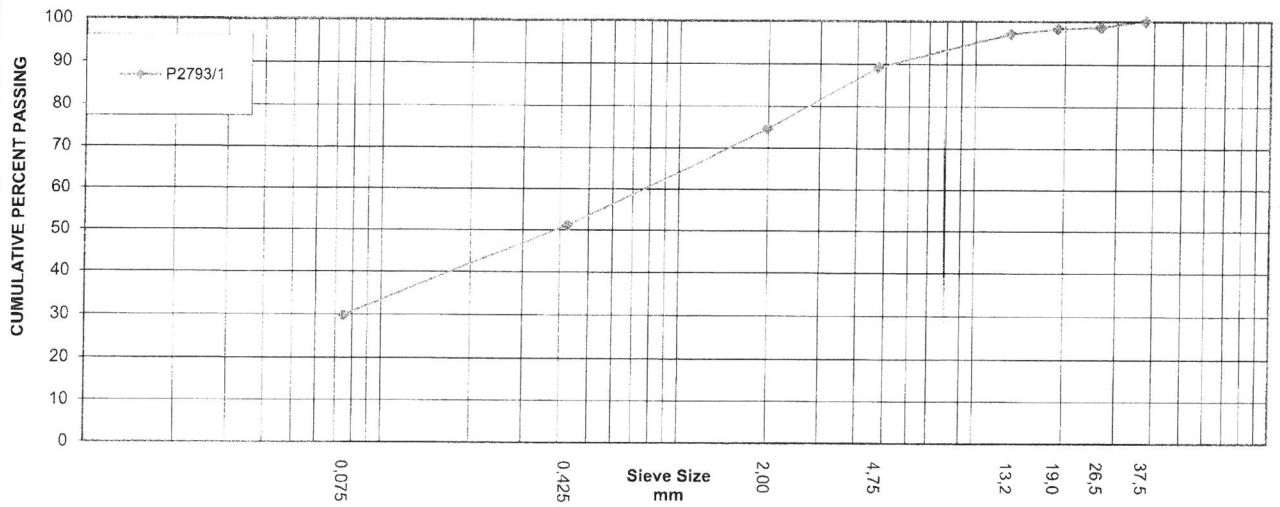
GRAVEL, SOIL AND SAND TEST REPORT

TMH 1 1986 Method A1-A5,A7, A8 & A9*

Client :	**Yinhla Engineers & Environmental**	Doc No: P2793/1(i)	Date Sampled : **26-Jun-14**
Address:	P.O Box 2729 Thohoyandou		
Contract :	**Construction of New Housing Development - Siyabuswa MP**		Date Tested : **03-Jul-14**
Description :	**Sample nr G1 & G2 material delivered to lab sampled by client**		

Depth (m)	Sample No	Description * (Unified Soil Classification)	Sieve Analysis Cumulative percentage passing 53,0	37,5	26,5	19,0	13,2	4,75	2,00	0,425	0,075	Grading Modulus	Atterberg Limits (%) Liquid Limit	Plasticity Index	Linear Shrinkage	Classification * Unified Soil	COLTO : 1998	US. Highway	Group Index
	P2793/1	Brown Silty/Clayey sand		100	99	98	97	89	75	51	30	1,44	24	7	3,4	SM-SC	G8	A-2-4	0

GRADING ANALYSIS



GENERAL *

Effective size (mm):	**<0.075**
Uniformity co-eff. :	**766**
Curvature co-eff. :	**7,4**
Oversize Index :	**0**
Shrinkage Product :	**174**
Grading co-eff. :	**21,5**

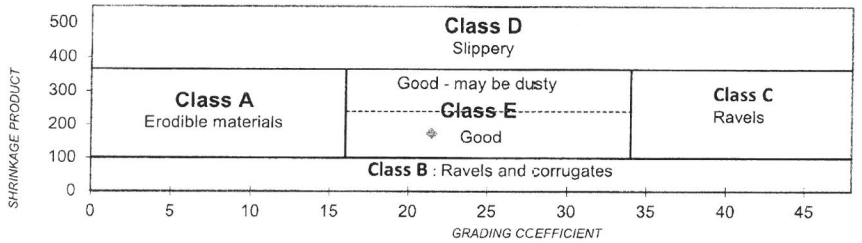
CBR RESULTS (%) :

@ 100% comp. :	**15**
@ 98% comp. :	**14**
@ 97% comp. :	**13**
@ 95% comp. :	**13**
@ 93% comp. :	**12**
@ 90% comp. :	**10**

Soil Mortar Analysis

Coarse Sand (<2.0>0.425mm) :	**23,5%**
Fine Sand (<0.425>0.075mm) :	**21,1%**
Material <0.075mm :	**29,9%**

PERFORMANCE AS GRAVEL WEARING COURSE *



REMARKS

Please note that test results are only relevant to the sample tested, which were delivered to the lab, and were uncontaminated and fit for testing. Any results may only be reproduced in their entirety with the written consent of Letaba Lab (Pty) Ltd. and any opinions and interpretations expressed fall outside Letaba Lab's Quality Document.

Date Issued: 2014-07-07 *Technical signatory (Name) :* R Liebenberg *Signature:*

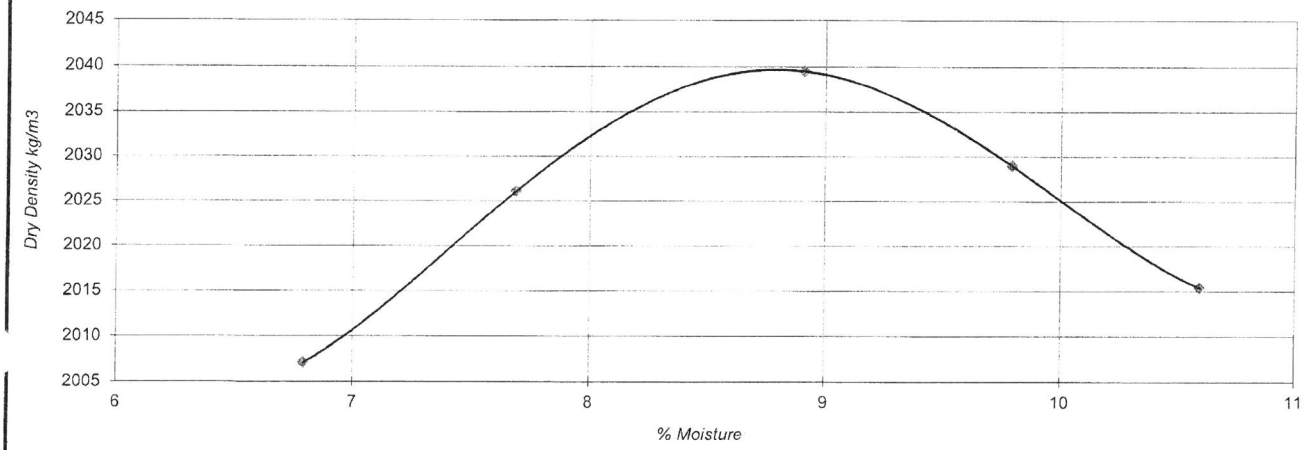
LETABA LAB

CBR and Modified A.A.S.H.T.O Density test report

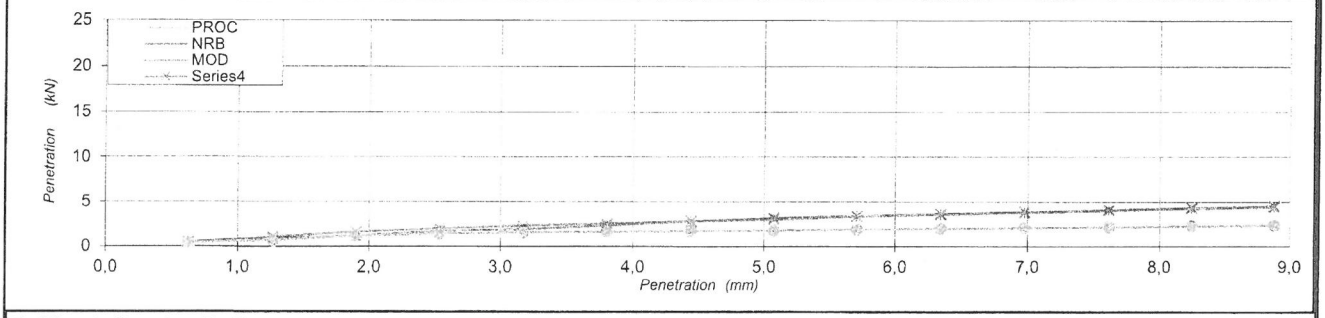
TMH 1:1986 Method A7, A8 & A9*

Client:	**Yinhla Engineers & Environmental**	Date tested:	**03-Jul-14**
Contract :	**Construction of New Housing Development - Siyabuswa MP**	Doc no:	P2793/1(II)
Description:	**Sample nr G1 & G2 material delivered to lab sampled by client**	Sample no:	**P2793/1**

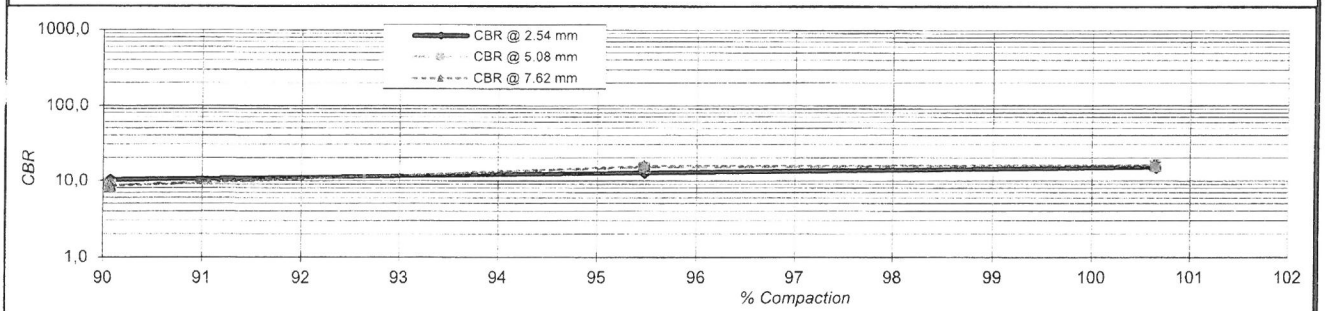
Maximum dry density =	**2040**	**kg/m³**
Optimum moisture content =	**8,8**	**%**



California Bearing Ratio (readings)



California Bearing Ratio



% Compaction	100	98	97	95	93	90
CBR of 13.344 kN	15	14	13	13	12	10

Briquette Info	Mod	N.R.B.	Proc.
Dry Density (kg/m³)	2053	1948	1837
Compaction Moisture (%)	8,9	8,9	8,9
Compaction (%)	100,6%	95,5%	90,1%
% Swell	0,06	0,14	0,19

Date Issued: 2014-07-07 *Technical signatory (Name) :* R. Lichtenberg *Signature:*

LETABA LAB (Pty) Ltd

CIVIL ENGINEERING MATERIALS LABORATORY

P.O. Box: 795
Fauna park
0787

123 Rivier Street
Ladine
Polokwane
0699

Tel. No: 015 293 2524 Fax. No: 015 293 2534 e-mail : neville@letabalab.co.za

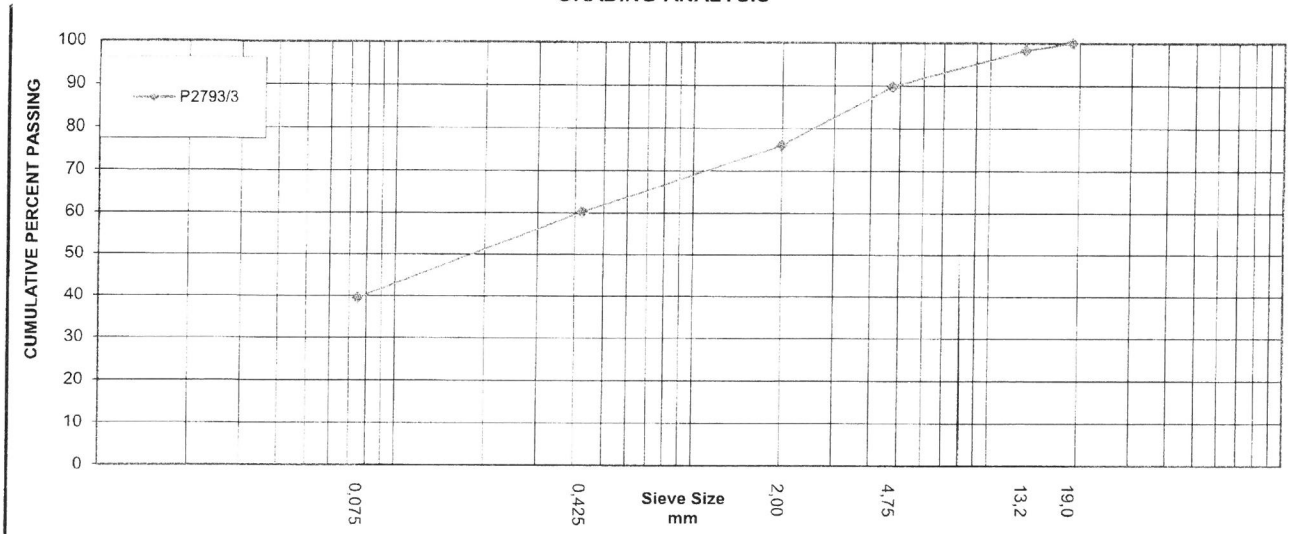
GRAVEL, SOIL AND SAND TEST REPORT

TMH 1 1986 Method A1-A5,A7, A8 & A9*

Client :	**Yinhla Engineers & Environmental**	Doc No: P2793/3(i)	Date Sampled : **26-Jun-14**
Address:	P.O Box 2729 Thohoyandou		
Contract :	**Construction of New Housing Development - Siyabuswa MP**		Date Tested : **03-Jul-14**
Description :	**Sample nr E1 & E2 material delivered to lab sampled by client**		

Depth (m)	Sample No	Description * (Unified Soil Classification)	Sieve Analysis Cumulative percentage passing 53,0	37,5	26,5	19,0	13,2	4,75	2,00	0,425	0,075	Grading Modulus	Atterberg Limits (%) Liquid Limit	Plasticity Index	Linear Shrinkage	Classification * Unified Soil	COLTO : 1998	US. Highway	Group Index
-	P2793/3	1.8-2km Clayey sand				100	95	90	76	60	39	1,24	28	8	4,0	SC	G9	A-4	1

GRADING ANALYSIS



GENERAL *

Effective size (mm):	**<0.075**
Uniformity co-eff. :	**417**
Curvature co-eff. :	**0,2**
Oversize Index :	**0**
Shrinkage Product :	**241**
Grading co-eff. :	**21,5**

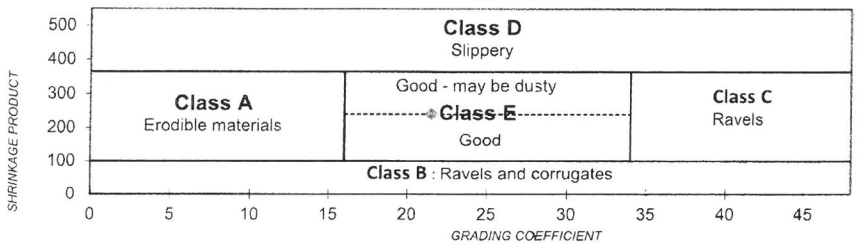
CBR RESULTS (%) :

@ 100% comp. :	**11**
@ 98% comp. :	**9**
@ 97% comp. :	**9**
@ 95% comp. :	**7**
@ 93% comp. :	**7**
@ 90% comp. :	**6**

Soil Mortar Analysis

Coarse Sand (<2.0>0.425mm) :	**15,8%**
Fine Sand (<0.425>0.075mm) :	**20,8%**
Material <0.075mm :	**39,4%**

*PERFORMANCE AS GRAVEL WEARING COURSE **



REMARKS

Please note that test results are only relevant to the sample tested, which were delivered to the lab, and were uncontaminated and fit for testing. Any results may only be reproduced in their entirety with the written consent of Letaba Lab (Pty) Ltd, and any opinions and interpretations expressed fall outside Letaba Lab's Quality Document.

Date Issued: 2014-07-07 *Technical signatory (Name) :* R. Lichtenberg *Signature:*

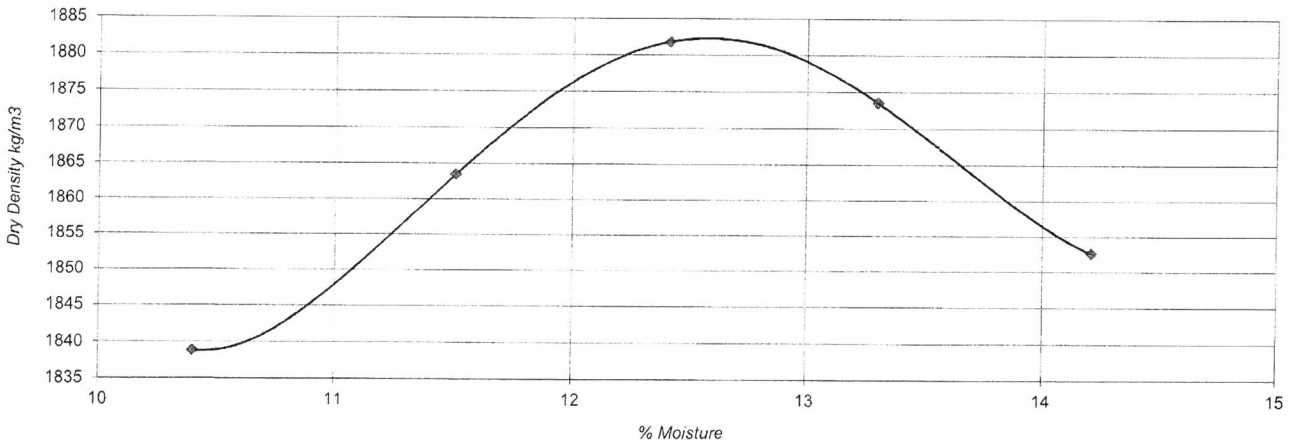
LETABA LAB

CBR and Modified A.A.S.H.T.O Density test report

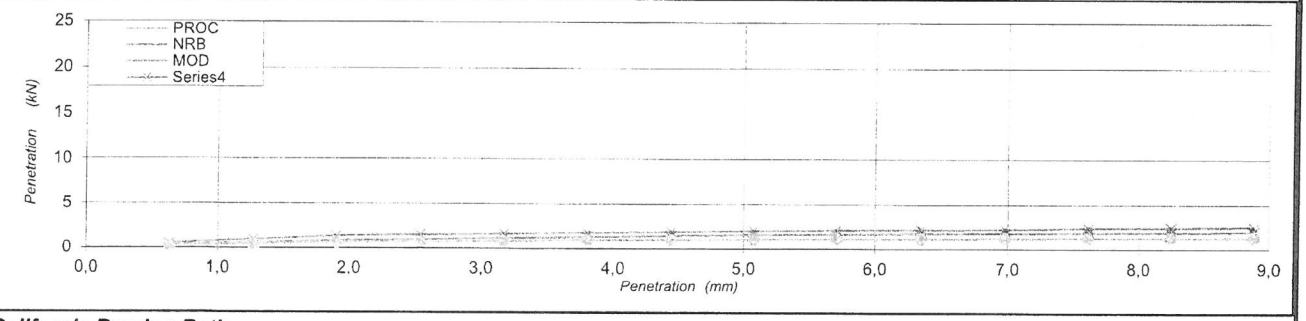
TMH 1:1986 Method A7, A8 & A9*

Client:	Yinhla Engineers & Environmental	Date tested:	03-Jul-14
Contract :	Construction of New Housing Development - Siyabuswa MP	Doc no:	P2793/3(ii)
Description:	Sample nr E1 & E2 material delivered to lab sampled by client	Sample no:	P2793/3

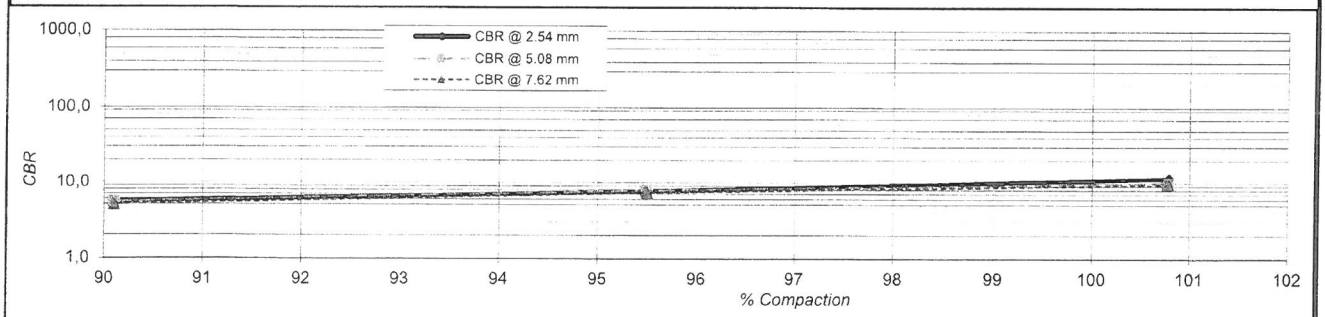
Maximum dry density =	1882	kg/m³
Optimum moisture content =	12,6	%



California Bearing Ratio (readings)



California Bearing Ratio



% Compaction	100	98	97	95	93	90
CBR of 13.344 kN	11	9	9	7	7	6

Briquette Info	Mod	N.R.B.	Proc.
Dry Density (kg/m³)	1897	1797	1696
Compaction Moisture (%)	12,4	12,4	12,4
Compaction (%)	100,8%	95,5%	90,1%
% Swell	0,07	0,13	0,21

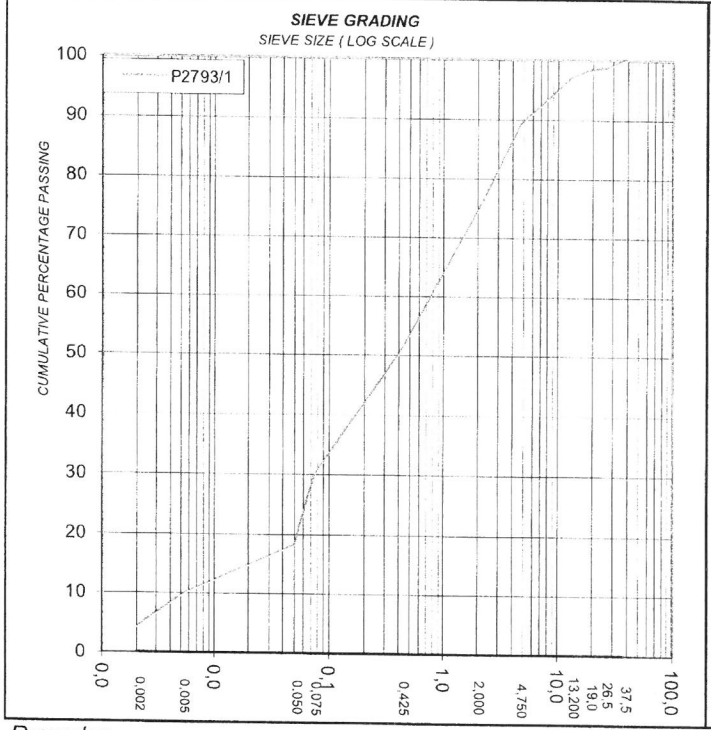
Date Issued: 2014-07-07 Technical signatory (Name) : R. Lucbenberg Signature:

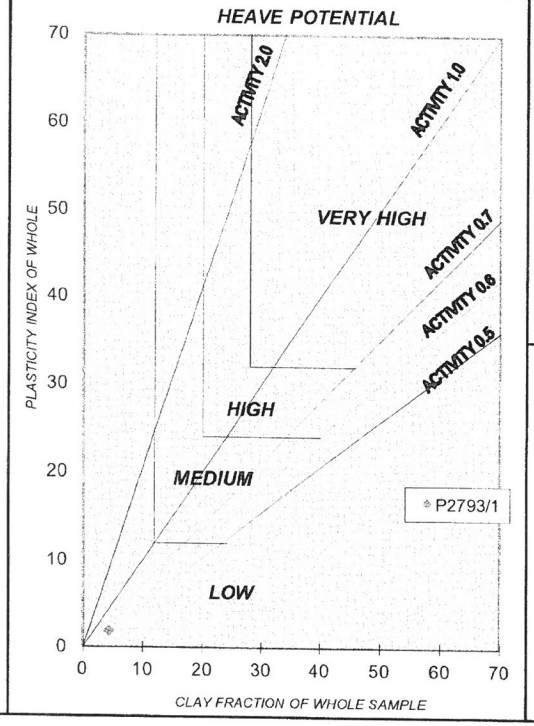
LETABA LAB

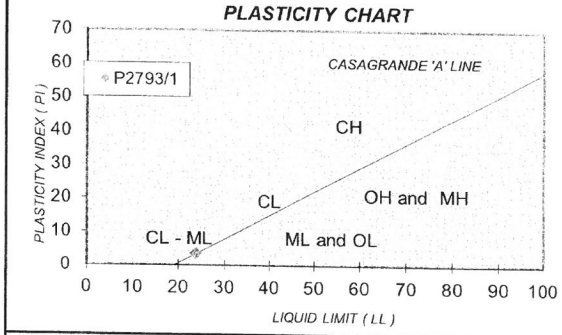
GRAVEL, SOIL AND SAND ANALYSIS

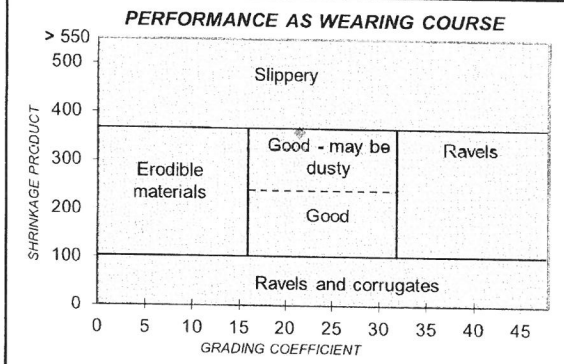
Contract :	Construction of New Housing Development - Siyabuswa MP	Client : Yinhla Engineers & Environmental	Date : 03-Jul-14
Description :	Sample nr G1 & G2 material delivered to lab		

Depth (m)	Sample No.	Description (Unified Soil Classification)	Sieve analysis Cumulative percentage passing											Soil Mortar Analysis % of mat. <2,00 mm				Effective size	Uniformity - coef.	Curvature coef.	Grading modulus	Atterberg Limits			Classifications			
			53,0 mm	37,5 mm	26,5 mm	19,0 mm	13,2 mm	4,75 mm	2,00 mm	0,425 mm	0,075 mm	0,05 mm	0,005 mm	0.002 mm	Coarse - sand <2,0 >0,425mm	Fine - sand <0,425 >0,05mm	Silt <0,05 >0,005mm	Clay <0,005 mm					Liquid Limit	Plasticity Index	Linear Shrinkage	Unified Soil	TRH 14	US.Highway	Group Index
0,00	P2793/1	Brown Silty sand		100	99	98	97	89	75	51	30	18,2	9,6	4,3	31,5	44,1	11,3	12,9	0,006	138,3	1,5	1,41	24	3	7,9	SM(d)	-	A-2-4	0
		Double Hydrometer Readings :										15,0	4,3	2,1															









Remarks:

DOUBLE HYDROMETER RESULT : 44,4 %

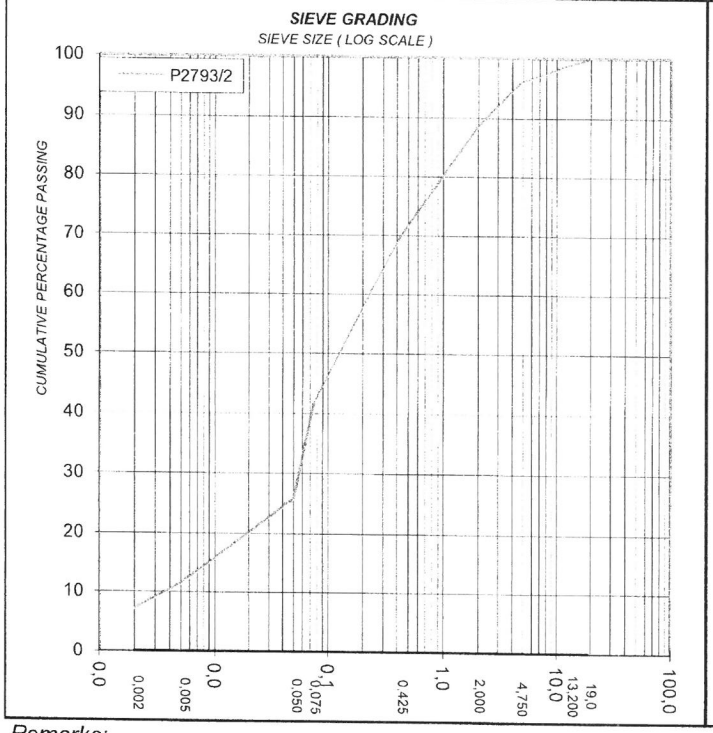
If Double Hydrometer result is above 40%, the material is considered to be dispersive.

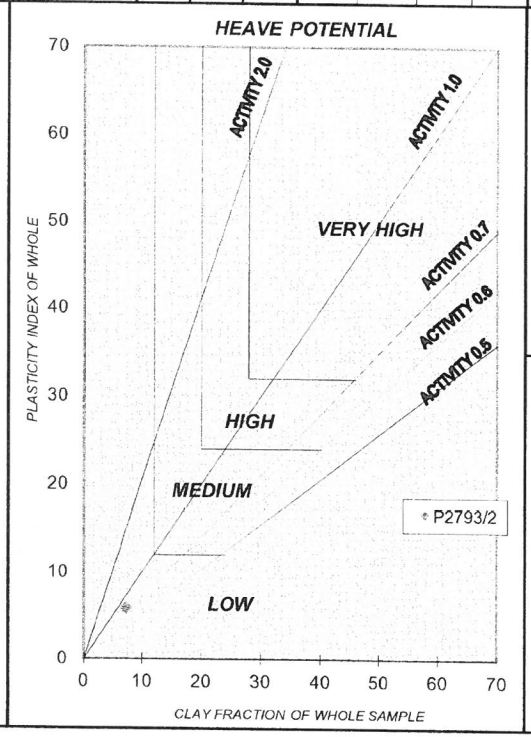
LETABA LAB

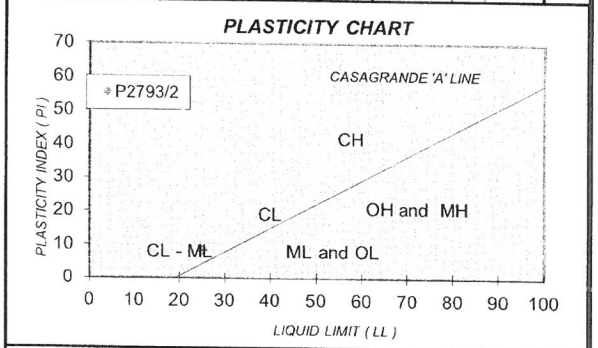
GRAVEL, SOIL AND SAND ANALYSIS

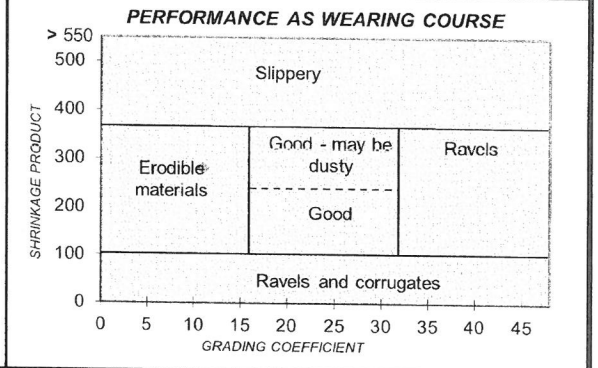
Contract :	**Construction of New Housing Development - Siyabuswa MP**	Client : **Yinhla Engineers & Environmental**	Date : **03-Jul-14**
Description :	**Sample nr C2 & C1 material delivered to lab**		

Depth (m)	Sample No.	Description (Unified Soil Classification)	Sieve analysis Cumulative percentage passing											Soil Mortar Analysis % of mat. <2,00 mm				Effective size	Uniformity - coef.	Curvature coef.	Grading modulus	Atterberg Limits			Classifications			
			53,0 mm	37,5 mm	26,5 mm	19,0 mm	13,2 mm	4,75 mm	2,00 mm	0,425 mm	0,075 mm	0,05 mm	0,005 mm	0,002 mm	Coarse - sand <2,0 >0,425mm	Fine - sand <0,425 >0,05mm	Silt <0,05 >0,005mm	Clay <0,005 mm					Liquid Limit	Plasticity Index	Linear Shrinkage	Unified Soil	TRH 14	US.Highway	Group Index
0-0,3	P2793/2	Brown clayey sand				100	99	96	86	70	42	26,8	11,5	7,2	21,2	49,6	16,2	13,0	0,061	63,8	3,6	1,00	25	8	4,0	SC	-	A-4	1
		Double Hydrometer Readings										21,5	4,3	2,9														









Remarks:

DOUBLE HYDROMETER RESULT : 37,5 %

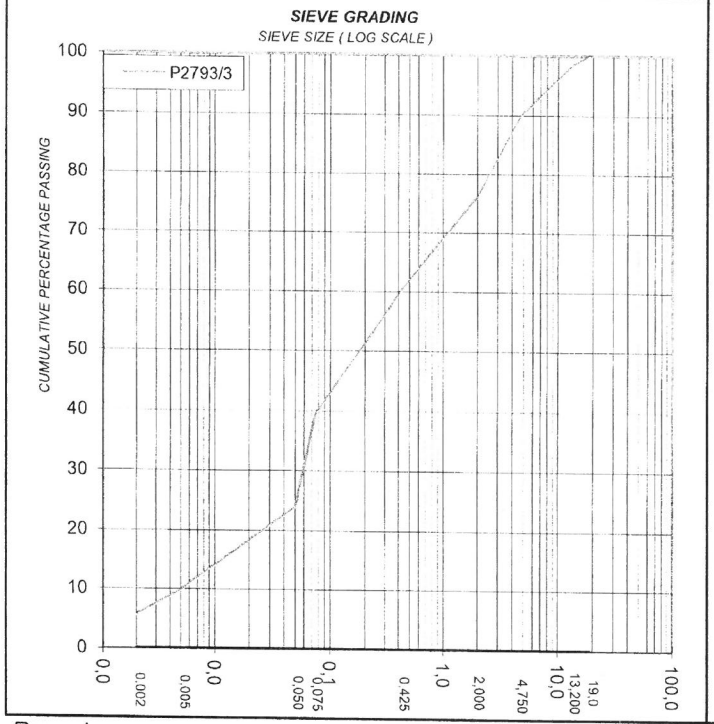
If Double Hydrometer result is above 40%, the material is considered to be dispersive.

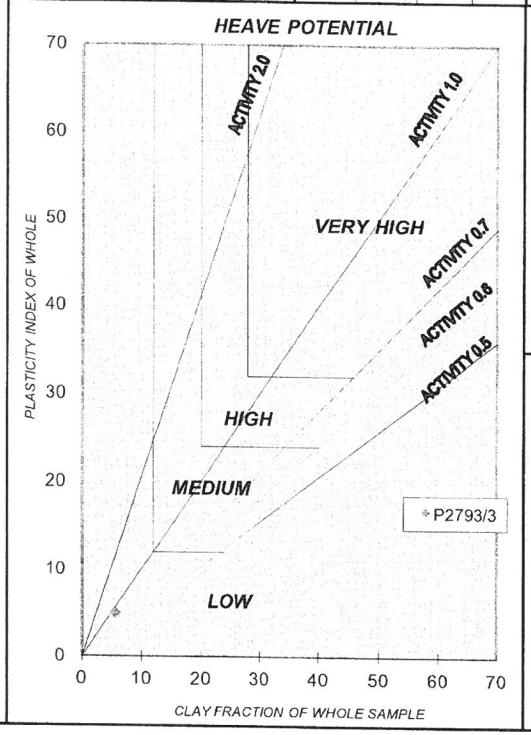
LETABA LAB

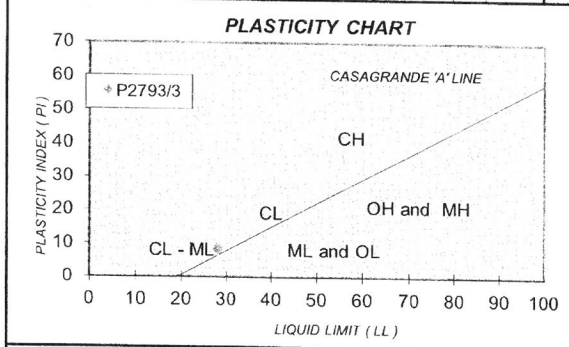
GRAVEL, SOIL AND SAND ANALYSIS

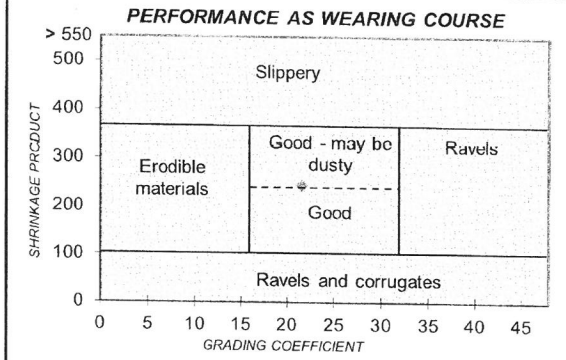
Contract :	**Construction of New Housing Development - Siyabuswa MP**	Client : **Yinhla Engineers & Environmental**	Date : **03-Jul-14**
Description :	**Sample nr E1 & E2 material delivered to lab**		

Depth (m)	Sample No.	Description (Unified Soil Classification)	Sieve analysis Cumulative percentage passing											Soil Mortar Analysis % of mat. <2,00 mm				Effective size	Uniformity - coef.	Curvature coef.	Grading modulus	Atterberg Limits			Classifications			
			53,0 mm	37,5 mm	26,5 mm	19,0 mm	13,2 mm	4,75 mm	2,00 mm	0,425 mm	0,075 mm	0,05 mm	0,005 mm	0,002 mm	Coarse - sand <2,0 >0,425mm	Fine - sand <0,425 >0,05mm	Silt <0,05 >0,005mm	Clay <0,005 mm					Liquid Limit	Plasticity Index	Linear Shrinkage	Unified Soil	TRH 14	US.Highway	Group Index
0,6	P2793/3	Brown Silty sand				100	98	90	76	60	39	42,9	9,8	5,6	20,9	47,8	18,5	13,0	0,005	611	1,6	1,5	28	8	4,0	SC		A-4	1
			Double Hydrometer Readings									21,1	4,2	2,8														









Remarks:

DOUBLE HYDROMETER RESULT : 42,9 %

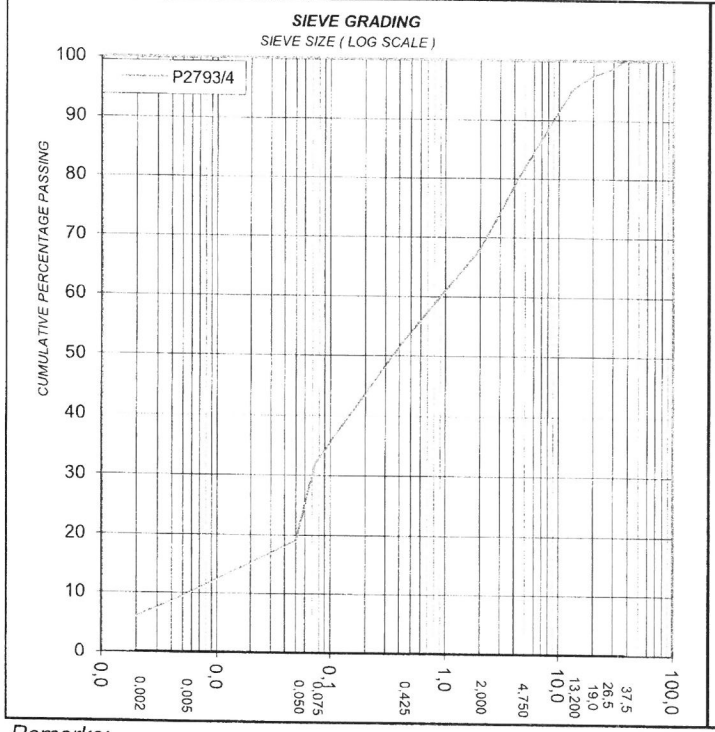
If Double Hydrometer result is above 40%, the material is considered to be dispersive.

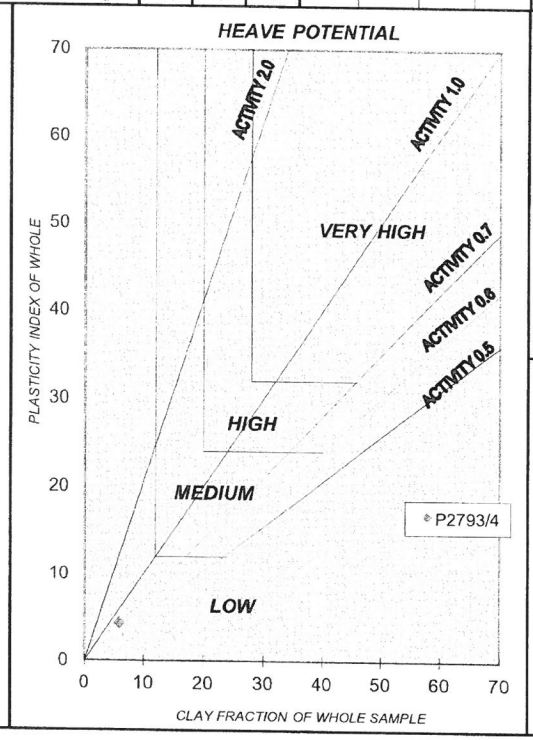
LETABA LAB

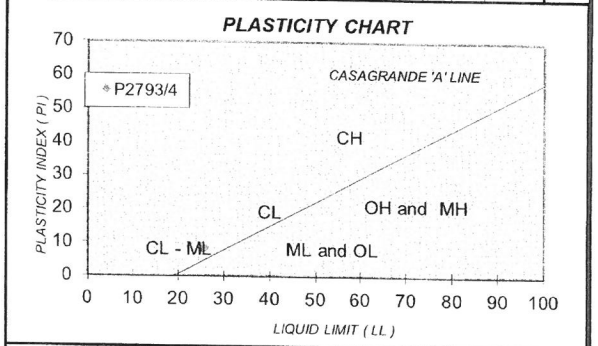
GRAVEL, SOIL AND SAND ANALYSIS

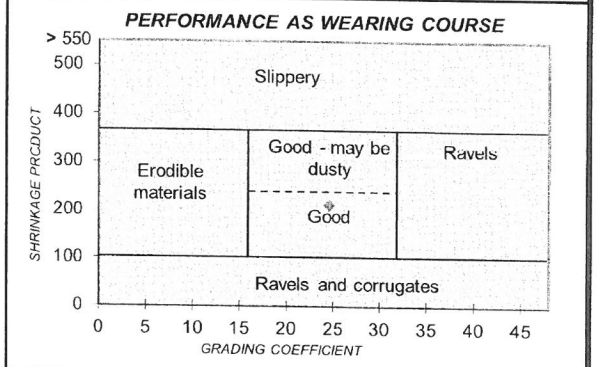
Contract :	**Construction of New Housing Development - Siyabuswa MP**	Client : **Yinhla Engineers & Environmental**	**Date : 03-Jul-14**
Description :	**Sample nr A1 & A2 material delivered to lab**		

Depth (m)	Sample No.	Description (Unified Soil Classification)	Sieve analysis Cumulative percentage passing											Soil Mortar Analysis % of mat. <2,00 mm				Effective size	Uniformity - coef.	Curvature coef.	Grading modulus	Atterberg Limits			Classifications			
			53,0 mm	37,5 mm	26,5 mm	19,0 mm	13,2 mm	4,75 mm	2,00 mm	0,425 mm	0,075 mm	0,05 mm	0,005 mm	0,002 mm	Coarse - sand <2,0 >0,425mm	Fine - sand <0,425 >0,05mm	Silt <0,05 >0,005mm	Clay <0,005 mm					Liquid Limit	Plasticity Index	Linear Shrinkage	Unified Soil	TRH 14	US Highway	Group Index
0,30	P2793/4	Brown Sandy Soil		100	98	97	95	81	68	52	32	19,0	9,3	5,9	23,0	49,1	14,0	14,0	0,065	16,9	1,9	1,48	25	8	4,0	SC	-	A-2-4	0
		Double Hydrometer Readings :										16,6	4,7	2,4														









Remarks:

DOUBLE HYDROMETER RESULT : 50 %

If Double Hydrometer result is above 40%, the material is considered to be dispersive.

LETABA LAB (Pty) Ltd

CIVIL ENGINEERING MATERIALS LABORATORY

P.O. Box: 795
Faunapark
0787

123 Rivier Street
Ladine
Polokwane
0699

Tel. No: 015 293 2524 Fax. No: 015 293 2534 e-mail : neville@letabalab.co.za

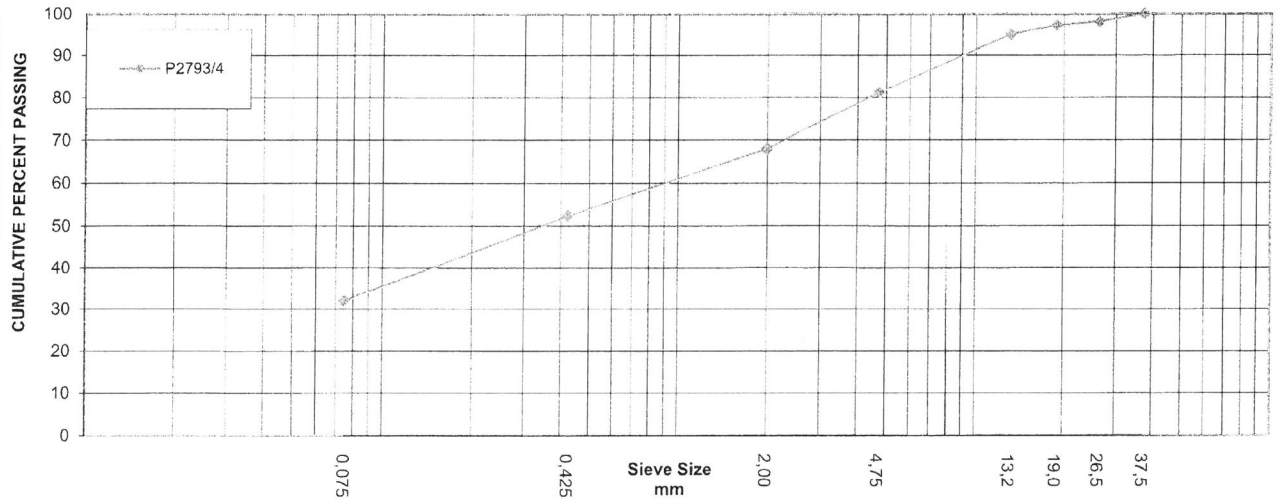
GRAVEL, SOIL AND SAND TEST REPORT

TMH 1:1986 Method A1-A5,A7, A8 & A9*

Client :	**Yinhla Engineers & Environmental**	Doc No: P2793/4(i)	Date Sampled : **26-Jun-14**
Address:	P.O Box 2729 Thohoyandou		
Contract :	**Construction of New Housing Development - Siyabuswa MP**		Date Tested : **03-Jul-14**
Description :	**Sample nr A1 & A2 material delivered to lab sampled by client**		

Depth (m)	Sample No	Description * (Unified Soil Classification)	Sieve Analysis Cumulative percentage passing 53,0	37,5	26,5	19,0	13,2	4,75	2,00	0,425	0,075	Grading Modulus	Atterberg Limits (%) Liquid Limit	Plasticity Index	Linear Shrinkage	Classification * Unified Soil	COLTO : 1998	US. Highway	Group Index
-	P2793/4	Brown Clayey sand		100	98	97	95	81	68	52	32	1,48	25	8	4,0	SC	G8	A-2-4	0

GRADING ANALYSIS



GENERAL *

Effective size (mm):	**<0.075**
Uniformity co-eff. :	**911**
Curvature co-eff. :	**0,1**
Oversize Index :	**0**
Shrinkage Product :	**209**
Grading co-eff. :	**24,5**

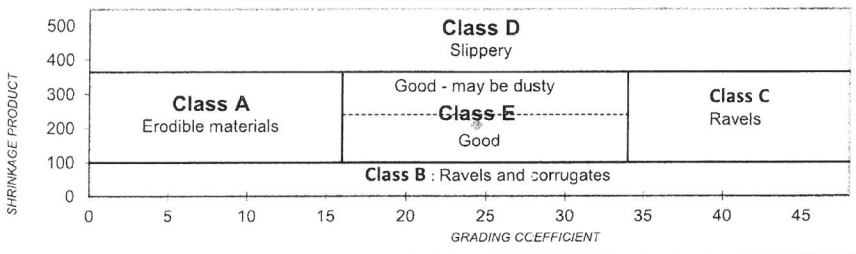
CBR RESULTS (%) :

@ 100% comp. :	**16**
@ 98% comp. :	**14**
@ 97% comp. :	**13**
@ 95% comp. :	**11**
@ 93% comp. :	**10**
@ 90% comp. :	**8**

Soil Mortar Analysis

Coarse Sand (<2.0>0.425mm) :	**15,6%**
Fine Sand (<0.425>0.075mm) :	**20,3%**
Material <0.075mm :	**32,0%**

PERFORMANCE AS GRAVEL WEARING COURSE *



REMARKS

Please note that test results are only relevant to the sample tested, which were delivered to the lab, and were uncontaminated and fit for testing. Any results may only be reproduced in their entirety with the written consent of Letaba Lab (Pty) Ltd, and any opinions and interpretations expressed fall outside Letaba Lab's Quality Document.

Date Issued: 2014-07-07 *Technical signatory (Name) :* R. Lichtenberg *Signature:*

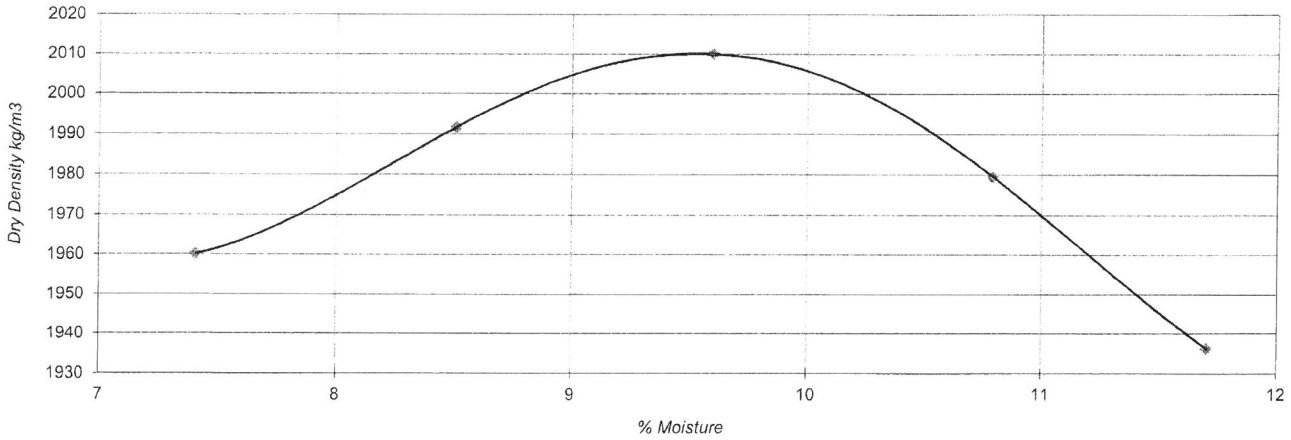
LETABA LAB

CBR and Modified A.A.S.H.T.O Density test report

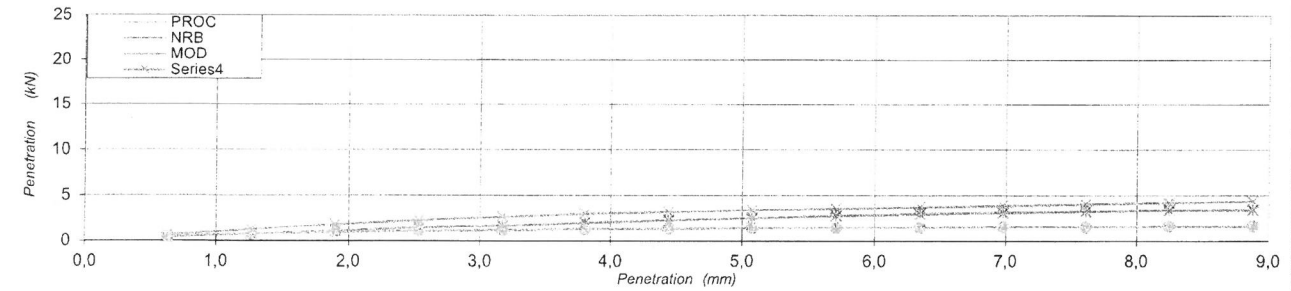
TMH 1:1986 Method A7, A8 & A9*

Client:	**Yinhla Engineers & Environmental**	Date tested:	**03-Jul-14**
Contract :	**Construction of New Housing Development - Siyabuswa MP**	Doc no:	P2793/4(ii)
Description:	**Sample nr A1 & A2 material delivered to lab sampled by client**	Sample no:	**P2793/4**

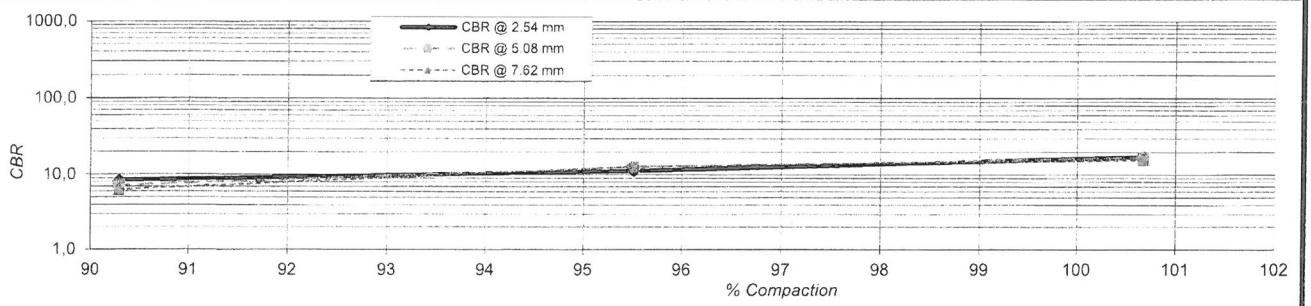
Maximum dry density =	**2010**	**kg/m³**
Optimum moisture content =	**9,6**	**%**



California Bearing Ratio (readings)



California Bearing Ratio



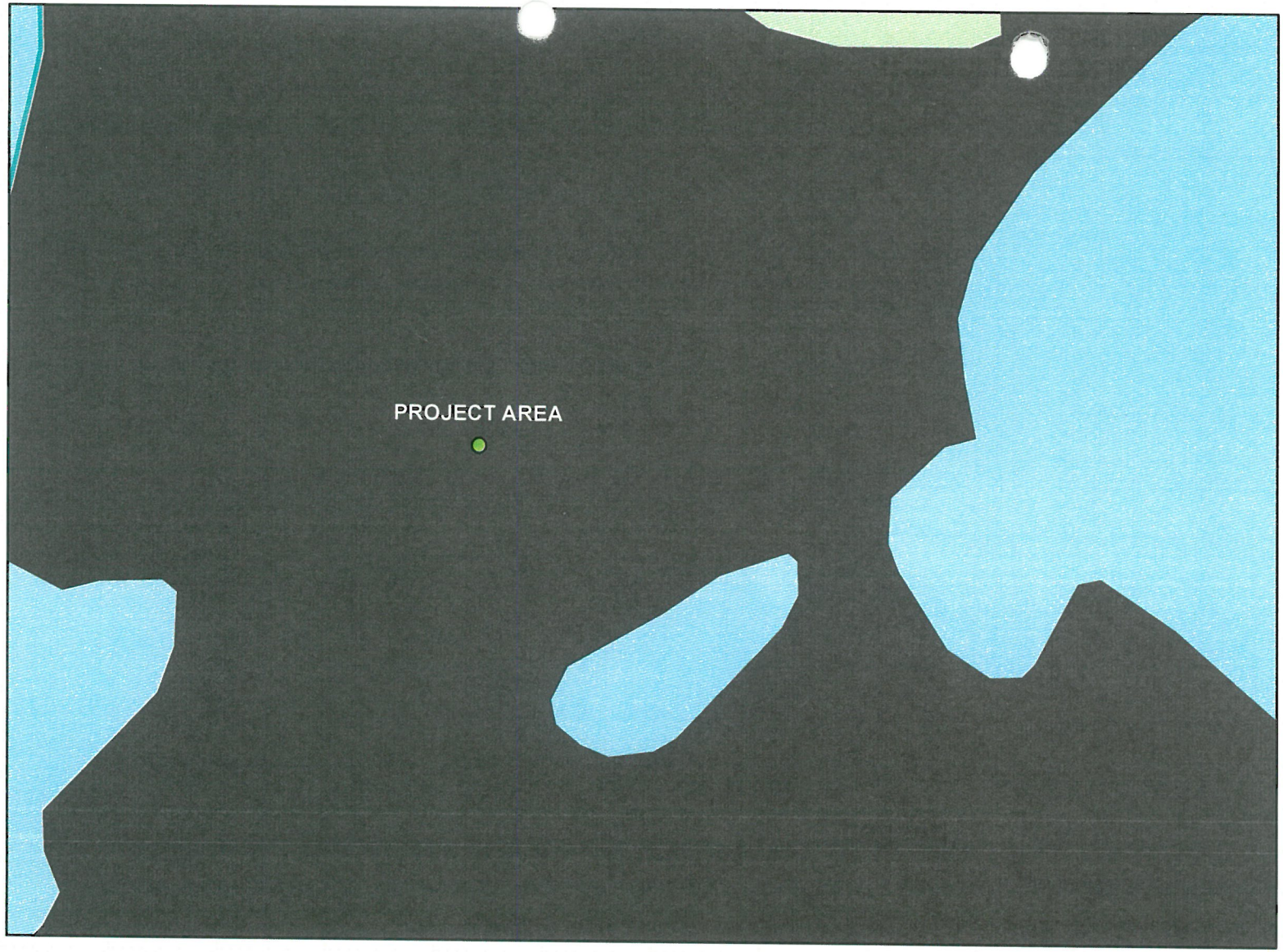
% Compaction	100	98	97	95	93	90
CBR of 13.344 kN	16	14	13	11	10	8

Briquette Info	Mod	N.R.B.	Proc.
Dry Density (kg/m³)	2024	1920	1815
Compaction Moisture (%)	9,7	9,7	9,7
Compaction (%)	100,7%	95,5%	90,3%
% Swell	0,06	0,13	0,15

Date Issued: 2014-07-07 *Technical signatory (Name) :* R. Lichtenberg *Signature:*

APPENDIX: 4 GEOTECHNICAL CLASSIFICATION

YINHLA ENVIRONMENTAL
CONSULTING ENGINEERS



Legend

- Ecca_Grp,_karoo_Spgrp
- Lebowa_Granite_Sui,Bushveld_Cplx

THE MAP SHOWING GEOLOGY AROUND THE PROJECT AREA

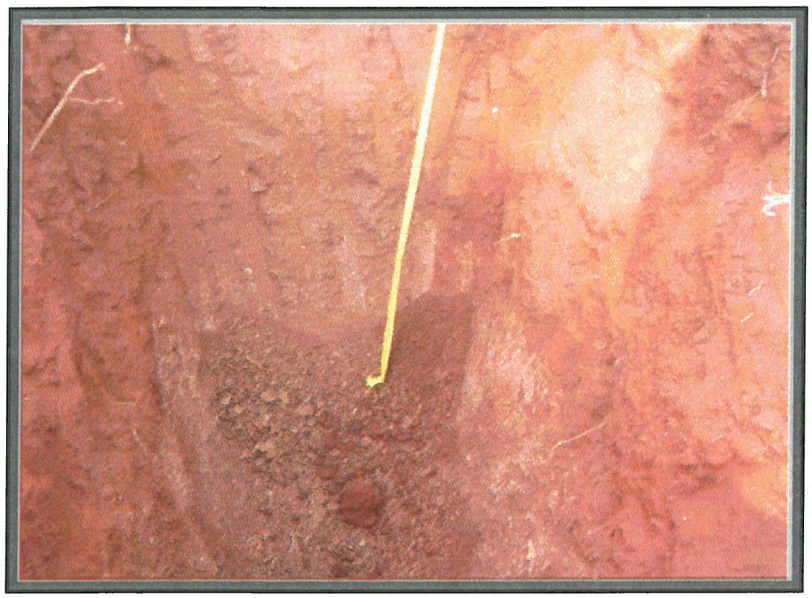
2.5 1.25 0 2.5 Kilometers

N

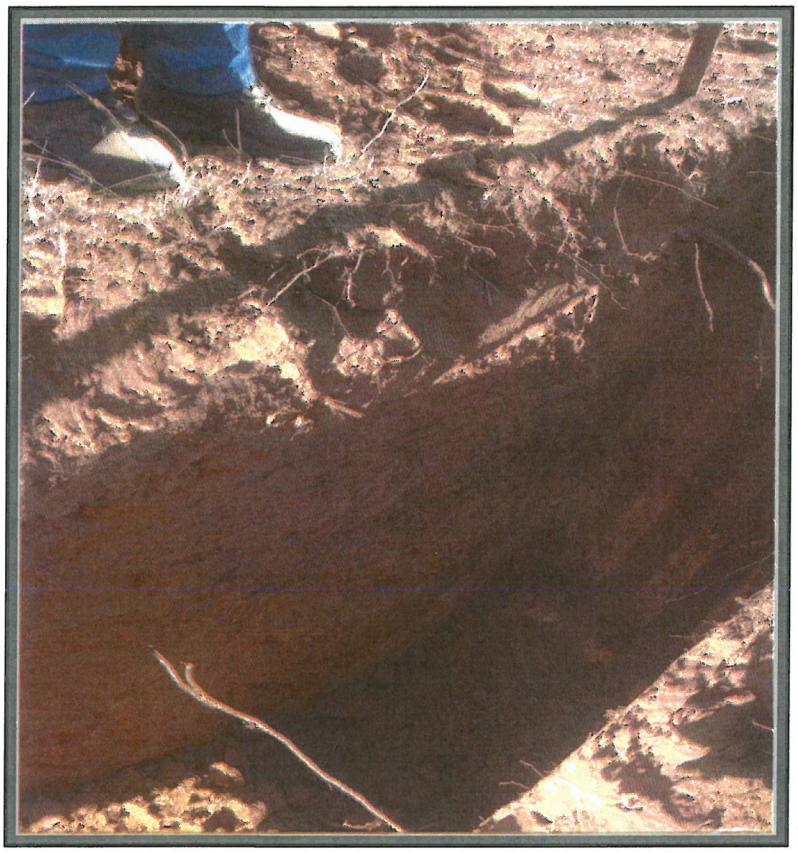
APPENDIX: 5 SITE PHOTOGRAPHS

Test Pit 01

Test Pit 02



Test pit 03



Test pit 04