

 Jones & Wagener Engineering & Environmental Consultants 59 Bevan Road PO Box 1434 Rivonia 2128 South Africa tel: 00 27 11 519 0200 www.jaws.co.za email: post@jaws.co.za		NOTE
African Exploration Mining and Finance Corporation SOC Ltd. Vlakfontein Colliery Pollution Control Dams Geotechnical Investigation Report	JOB No.	E717-00
	DATE	14/11/2014

**FINDINGS OF THE GEOTECHNICAL INVESTIGATION CONDUCTED AT
VLACKFONTEIN MINE FOR THE PLANNED PHASE 2 POLLUTION CONTROL
DAMS AND WATER FILLING POINT**

1. INTRODUCTION

African Exploration Mining and Finance Corporation (SOC) Ltd (AEMFC) Vlakfontein Colliery is in the process of obtaining environmental authorisations to mine further portions of their northern coal reserves. Jones & Wagener (J&W) was appointed to carry out preliminary designs of two pollution control dams and a water filling point to sufficient detail to include in the environmental applications.

The site is located just north of the N12 freeway at the Ogies-Balmoral off-ramp and approximately 30 km South-west of Emalahleni and 8.7 km North of ESKOM's Kendal power station in the Mpumalanga province (refer to Figure 1).

J&W carried out a geotechnical investigation on 4 October 2014 at the locations of the proposed dams and water filling point to assess the ground condition and the suitability of the in-situ material for the construction of the planned infrastructure. Test pits were excavated and profiled during which samples were retrieved and taken for laboratory testing.

This note summarises the procedure followed in carrying out the geotechnical investigation as well as the findings from the investigation.

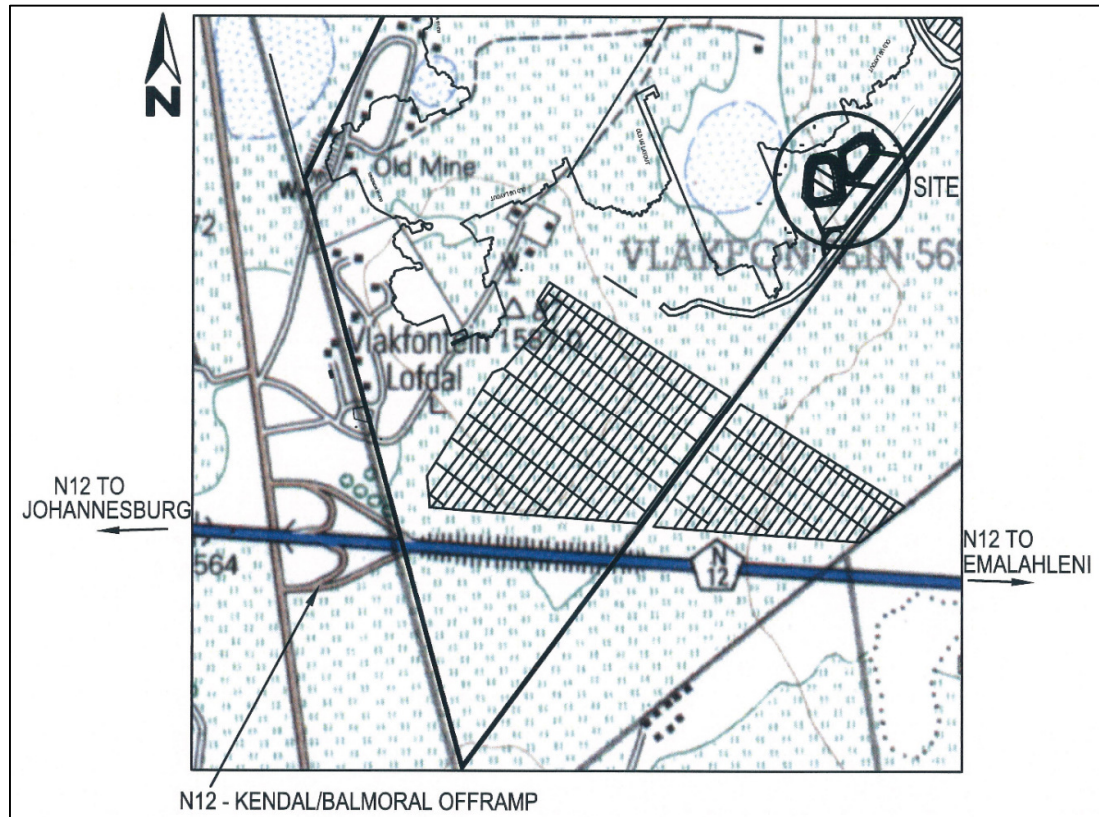


Figure 1 Site Location on 2628BB 1 in 50 000 Topographical Map

2. METHODOLOGY

2.1 Fieldwork

A total of 9 test pits were excavated and profiled on the 2nd October 2014 by Mr. Rudi Aschenborn and Ntsako Malepfana using a CAT428B tractor-loader-backhoe (TLB). Test pit positions can be seen on Drawing E717-00-001 attached as Annexure A in relation to the proposed infrastructure while the test pit profiles are attached as Annexure B.

The test pitting was conducted according to the following procedure:

- Most test pit positions were pre-selected during the desk top study and set out on site using a hand held GPS. Variations and additions to the locations were made as required from observations on site.
- Each soil horizon was observed and measured with a standard 30 m long metric measuring type.
- Excavation of the test pits was terminated on:
 - Refusal of plant on hard pan ferricrete.
 - Slow excavation on very stiff/very dense soils.
 - Maximum reach of TLB at 3.2 to 3.6 m.



- All test pits were profiled by a geotechnical engineer in accordance with standard procedures¹².
- After completion of the profiling, the holes were closed by starting with the spoils last excavated and finishing with the topsoil.

2.2 Laboratory Testing

Soil samples were retrieved from the test pits and sent for laboratory testing to assess the properties and suitability of the material for dam embankment construction. The Laboratory test results are attached as Annexure C. The following tests were carried out:

- Classification – (Grading analyses, Atterberg limits and SG)
- Moisture-Density relationship (MDD&OMC)
- California Bearing Ratio (CBR)
- Permeability tests (Falling head at 95 % and 98 % proctor compaction)

3. SITE STRATIGRAPHY

The Site is located within the Vryheid Formation of the Eccia Group of the Karoo Supergroup. The Vryheid formation is characterised by sandstones and sub-ordinate gravels and mudstones as well as coal seams³. The Vryheid formations is also characterised by dolerite and Felsite intrusions.

3.1 Typical soil profile

The test pit profiles are attached as Annexure B. The following typical soil horizons were observed:

- *Hillwash/Topsoil*: All areas investigated are generally covered by up to 400 mm topsoil comprising of dry or slightly moist, pale brown, loose, porous, fine sand, HILLWASH with roots, ploughed maze fields.
- *Aeolian*: The above horizon is underlain by moist, yellow, loose, porous, fine sand. AEOLIAN of between 400 and 700 mm thickness. In the lower lying test pits VF04 to VF09 a further Aeolian layer was observed comprising of moist or very moist, loose and medium dense, porous, ferruginised and cemented, or even containing definite ferricrete nodules, silty sand.
- *Residual soils*: The above is generally underlain by moist, dense, sands, clays and silts, highly reworked RESIDUAL SANDSTONE from a depth of ± 1.8 m to the end of the test pit. In test pits VF04, VF05 and VF08 the profiles were wet towards the bottom.

No bedrock was encountered in any of the test pits. Test pits generally stopped due to the TLB reaching its maximum depth at between 3.2 and 3.6 m. In test pit VF07 the TLB refused at 2.4 m on hard pan ferricrete.

¹ Site Investigation Code of Practice, 1st Edition, South African Institution of Civil Engineering - Geotechnical Division, January, 2010.

² Brink A.B.A. and Bruin R.M.H. (eds) (1990) **Guidelines for Soil and Rock Logging in South Africa**, 2nd Impression 2002. Proc. Geoterminology Workshop. SAIEG - AEG - SAICE 1990

³ Brink A.B.A., 1983, Buildings Publications, Pretoria.

3.2 Laboratory Results

Samples taken during the fieldwork were sent for laboratory testing to confirm their properties. The test results are attached as Annexure C and can be summarised in the following tables.

Table 1 Summary of the indicator laboratory test results

Sample no.	Depth (m)	Description	Grading (% fraction)				MC (%)	GM	SG	Atterberg Limits (%)				Classification	
			Gravel	Sand	Silt	Clay				LL	PI (<0.06 mm)	LS	Overall PI	AASHTO	% Swell
VF1/1	2.2	Silty sand		65	21	14	18	0.72	2.6	30	13	5.5	12	A-6[1]	0.5
VF2/1	1.6	Silty sand	2	63	18	17	15.1	0.69	2.63	26	9	4	8	A-4[0]	0.5
VF2/2	2.2	Silty sand	12	57	17	14	15.7	0.96	2.69	27	10	4	8	A-4[0]	0.2
VF3/1	0.9	Sand		88	9	3	1.5	0.89	2.62	-	-	-	-	A-2-4[0]	-
VF3/2	2.2	Silty sand	1	79	13	7	9	0.86	2.63	-	-	-	-	A-2-4[0]	-
VF4/1	1.7	Silty sand	16	56	14	14	14.5	1.07	2.61	22	8	4.5	6	A-2-4[0]	0.1
VF7/1	1.8	Silty sand	10	68	14	8	11.3	1.04	2.59	19	9	2.5	7	A-2-4[0]	0.1
VF8/1	1.4	Clayey sand	4	54	14	28	20.7	0.68	2.63	32	17	8	15	A-6[4]	0.4
VF9/1	1.8	Silty sand	1	77	19	9	11	0.83	2.58	-	-	-	-	A-2-4[0]	-

Table 2 Summary of moisture-density, CBR and road indicator laboratory test results

Sample no.	Depth (m)	Description	OMC (%)	MDD (kg/m ³)	CBR (Mod AASHTO) TMH1						TRH14 Classification
					100%	98%	97%	95%	93%	90%	
VF4/1-1	1.7	Silty sand	9.8	2026	41.8	39.1	37.8	34.9	24.8	14.8	G7
VF7/1-1	1.8	Silty sand	8.6	2075	22.9	20.1	18.8	17.1	16	14.4	G7
VF8/1-1	1.4	Clayey sand	12.7	1878	17.5	15.2	14.2	12.3	10.4	8.2	G9
VF4/1-2	1.7	Silty sand	11	1957	-	-	-	-	-	-	-
VF7/1-2	1.8	Silty sand	5.8	2047	-	-	-	-	-	-	-
VF8/1-2	1.4	Clayey sand	14.8	1806	-	-	-	-	-	-	-

Table 3 Summary of the Falling head permeability laboratory test results

Sample no.	Depth (m)	Description	Proctor compaction (%)	Coefficient of Permeability
VF4/1-1	1.7	Silty sand	95	3.90E-07
VF7/1-1	1.8	Silty sand	98	2.10E-07
VF8/1-1	1.4	Clayey sand	98	8.40E-09



4. **GEOTECHNICAL CONSIDERATIONS**

The following geotechnical aspects should be considered during the design:

- Groundwater / Seepage
- Excavatability
- Slope Stability

4.1 **Groundwater and Seepage**

Seepage occurred in the lower lying test pits VF04, VF05, VF07, VF08 and VF09, typically within the reworked residual materials at a depth of 2.2 m onwards, above a less permeable horizon.

During construction, the lower horizons where seepage was observed and that have a wet moisture content will probably not be suitable for use as fill in embankments and terraces and will have to be spoiled. Working in and on the material with machines will be problematic or even impossible and mitigation will be necessary.

The design of the dams will have to include subsoil drains under the liner of the dams in order to remove seepage water from below. This is required to prevent floating of the liner. Wet conditions of the deeper horizons need to be taken cognisance when designing the embankments to ensure stability.

4.2 **Excavatability**

No refusal was obtained, except for VF07 which is located towards the north of the site. Most test pits were excavated to a maximum reach of the TLB at a depth of between 3.2 and 3.5 m.

It can therefore be concluded that it is likely that no rock will be encountered and as a result no blasting will be required up to a depth of 3.5 m.

4.3 **Slope Stability**

Side slope instability occurred in one test pit, VF04 below 2.3 m and is likely associated due to the wet soil profile and high pore pressures. It can be expected that long term excavations into the wet horizons will have instable slopes. Excavations should therefore be battered to 1:2 slopes.

Note Compiled by,



Ntsako Malepfana
For Jones & Wagener



Rudi Aschenborn **PrEng**

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Document template: corNote_14r0_TT.dotx

Annexure A – Test pits location

Annexure B – Test pits profiles

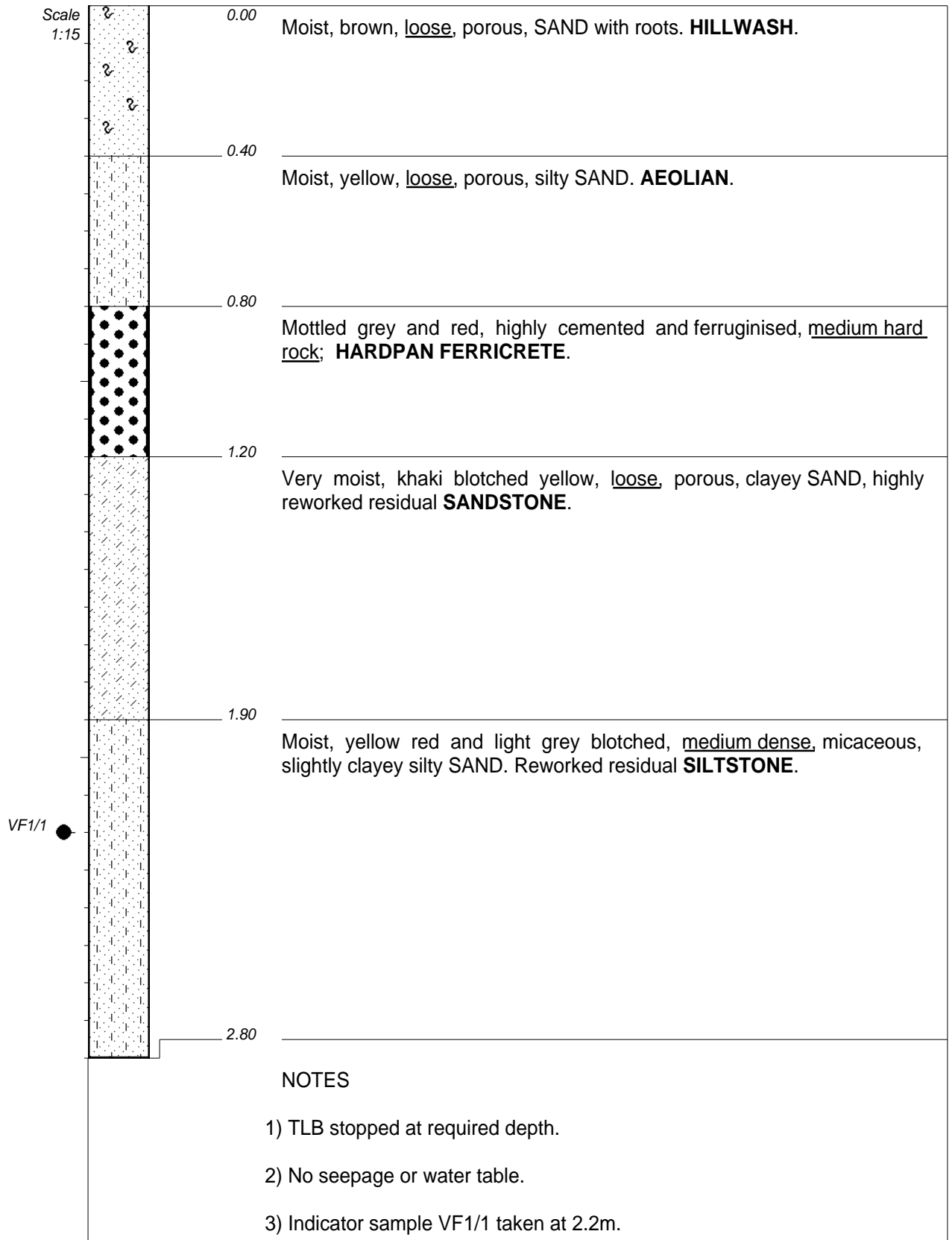


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AEMFC
POLLUTION CONTROL DAM
GEOTECHNICAL INVESTIGATION

HOLE No: VF01
Sheet 1 of 1

JOB NUMBER: E717



CONTRACTOR : CONCOR
MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFILED BY : RA/NM

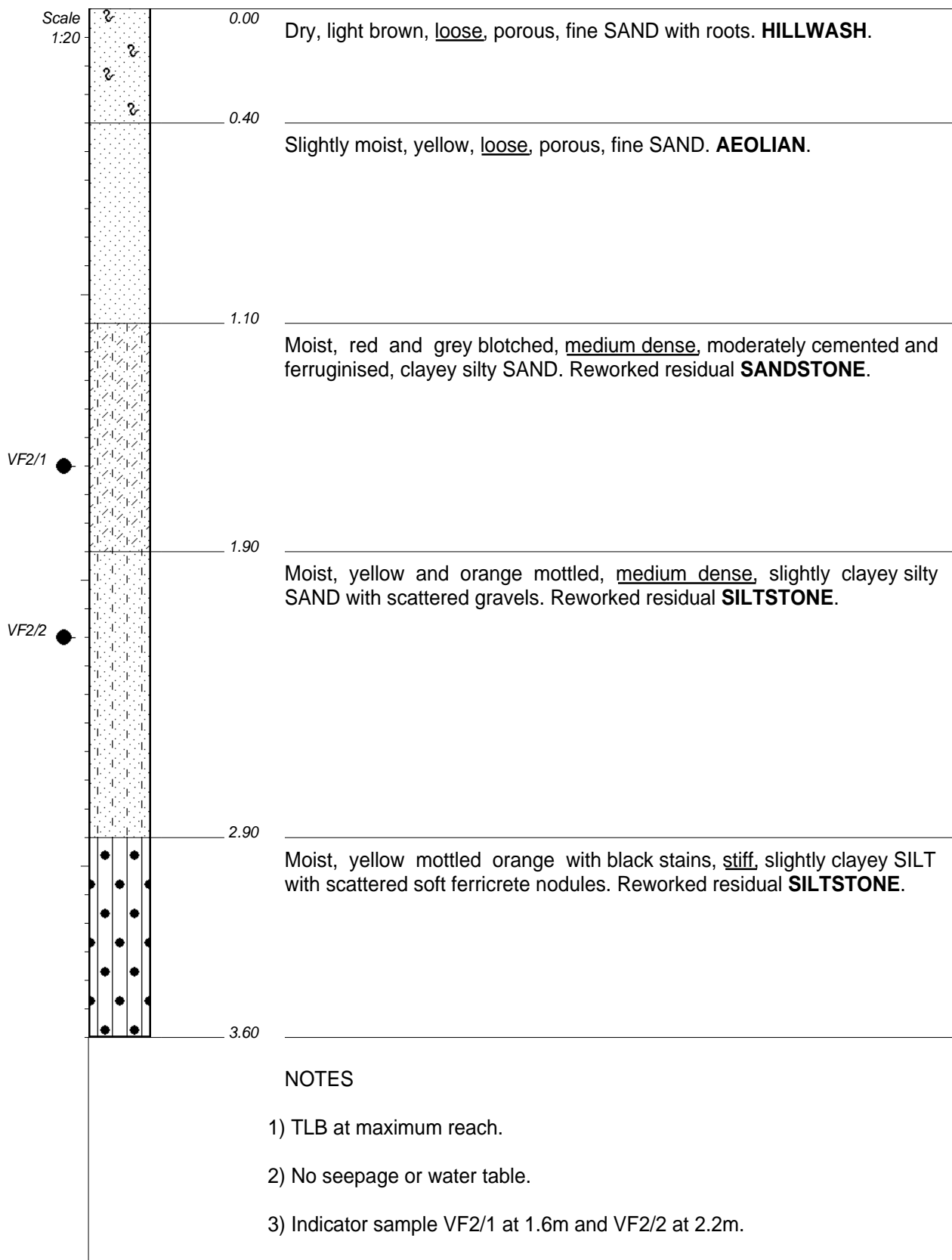
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X-COORD : 2 877 709
Y-COORD : 2 063

HOLE No: VF01



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DRILLED BY : ISAAC
PROFILED BY : NM/RA

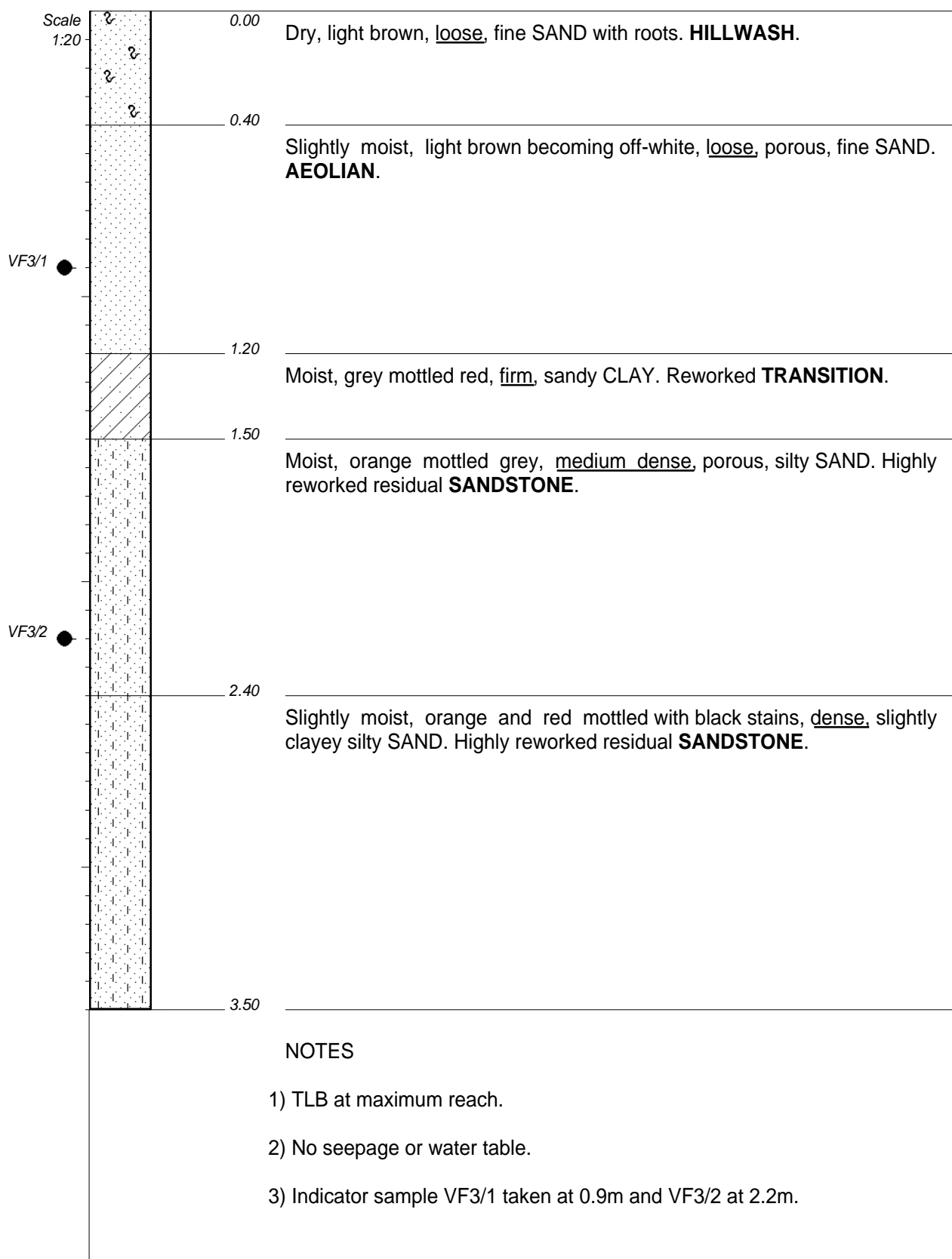
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 574
Y-COORD : 2 106

HOLE No: VF 02



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PROFIED BY : RA/NM

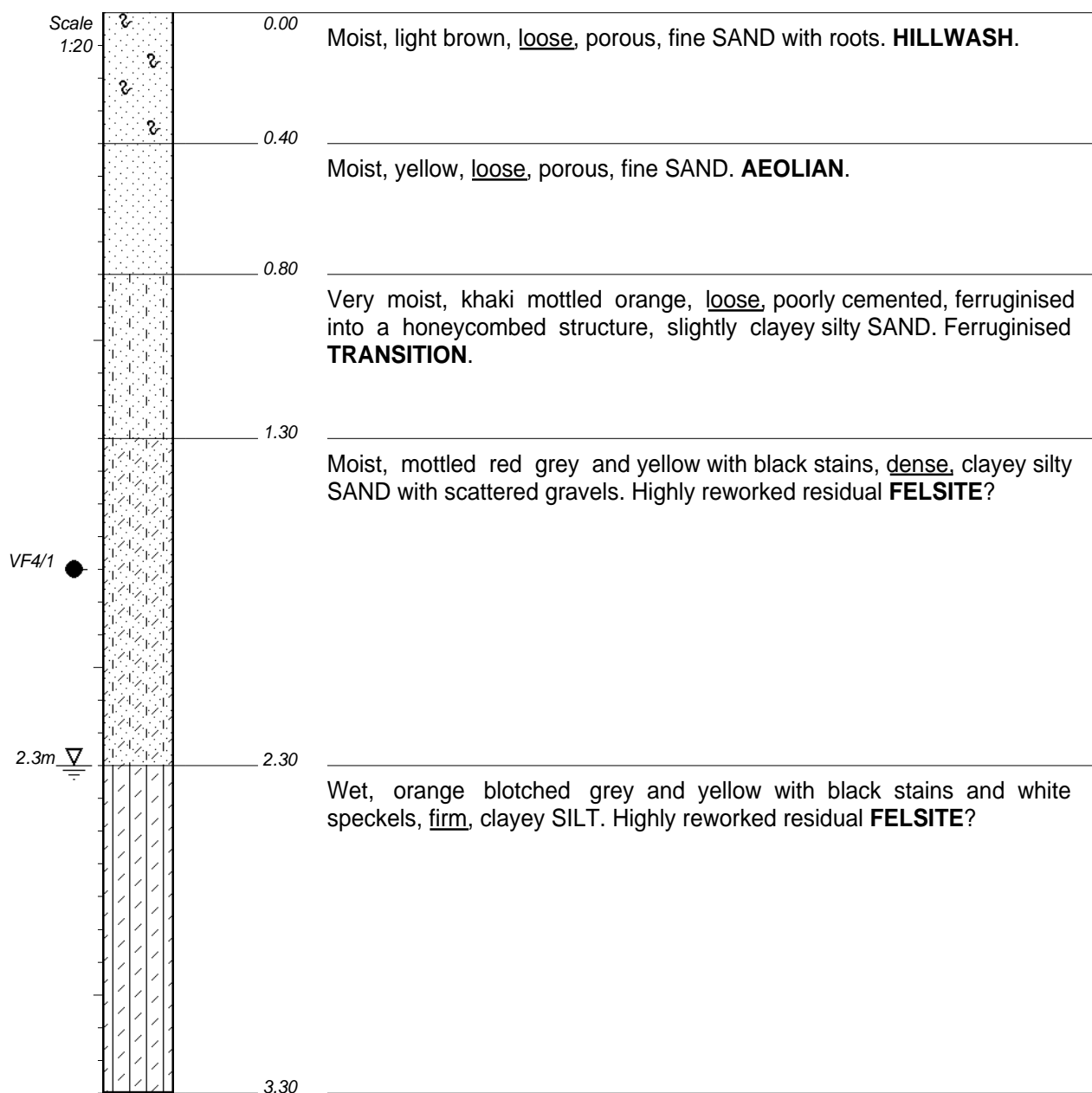
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 465
Y-COORD : 2 097

HOLE No: VF 03



NOTES

- 1) TLB at maximum reach.
- 2) Slow seepage below 2.3m.
- 3) Some sidewall collapse below 2.3m.
- 4) Bulk sample VF4/1 taken at 1.7m.

CONTRACTOR : CONCOR
MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFIED BY : NM / RA

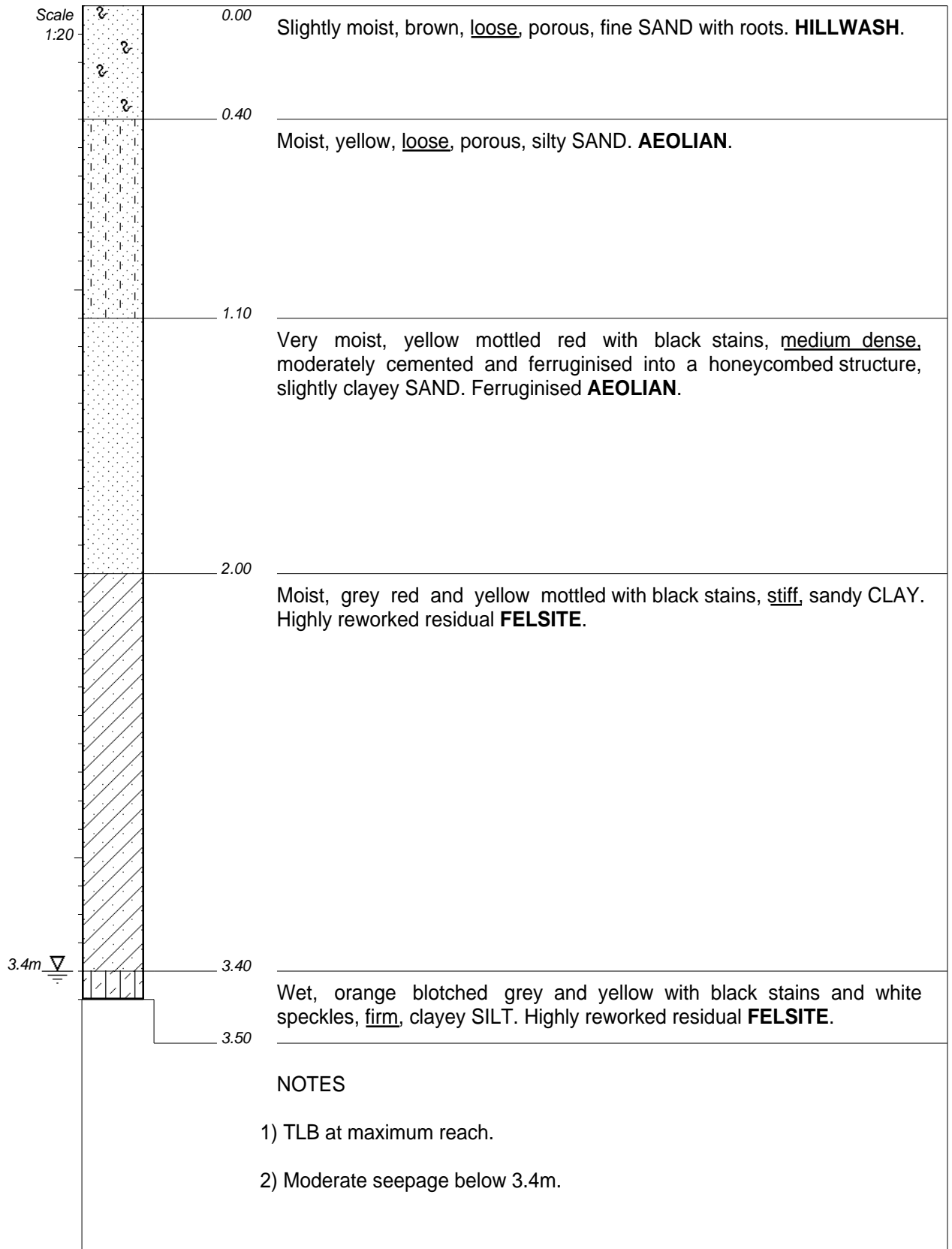
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 556
Y-COORD : 2 035

HOLE No: VF 04



CONTRACTOR : CONCOR
MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFIED BY : RA / NM

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DATE : 02/10/2014

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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 525
Y-COORD : 1 987

HOLE No: VF 05

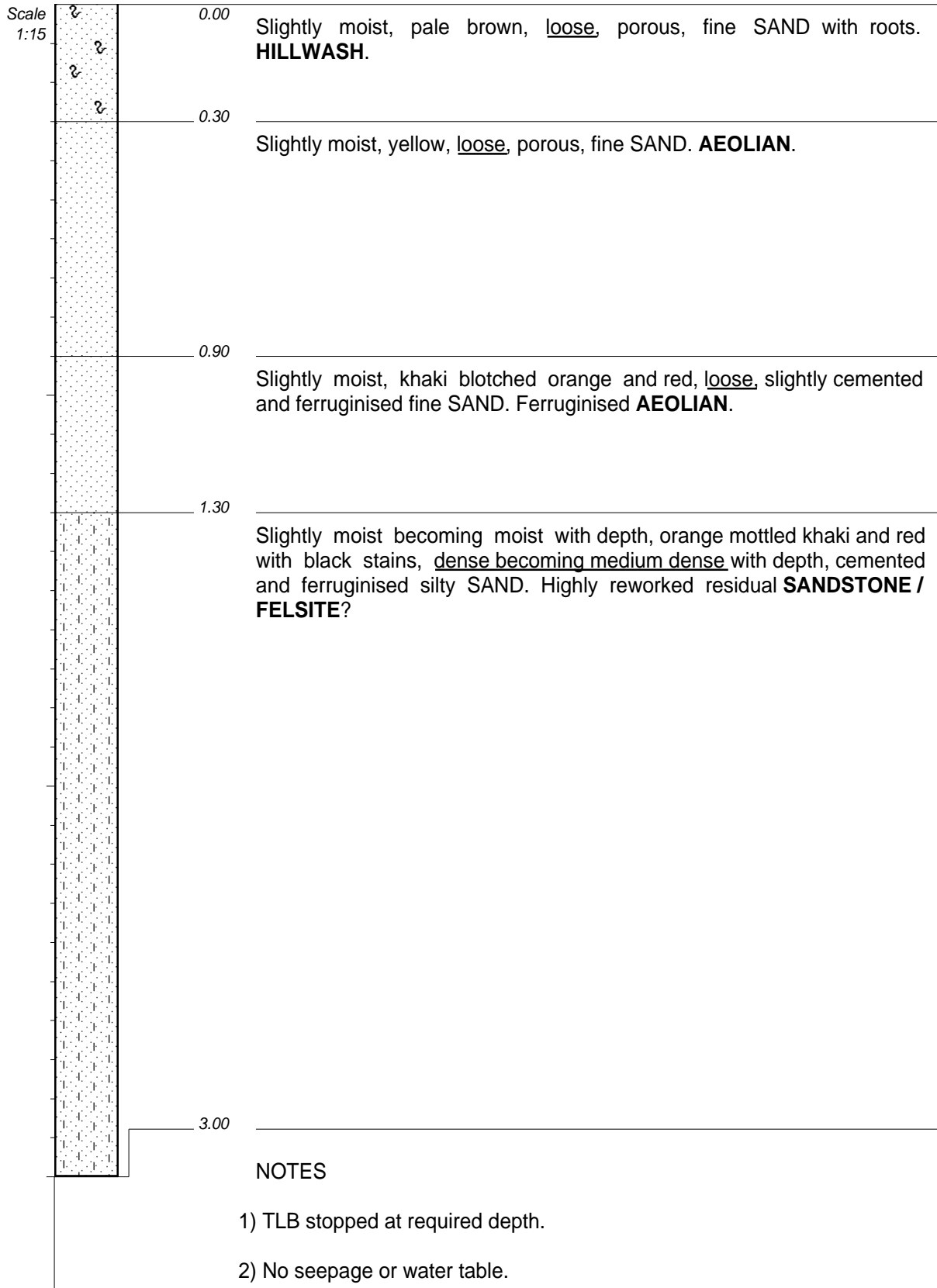


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POLLUTION CONTROL DAM
GEOTECHNICAL INVESTIGATION

HOLE No: VF 06
Sheet 1 of 1

JOB NUMBER: E717



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MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFIED BY : NM / RA

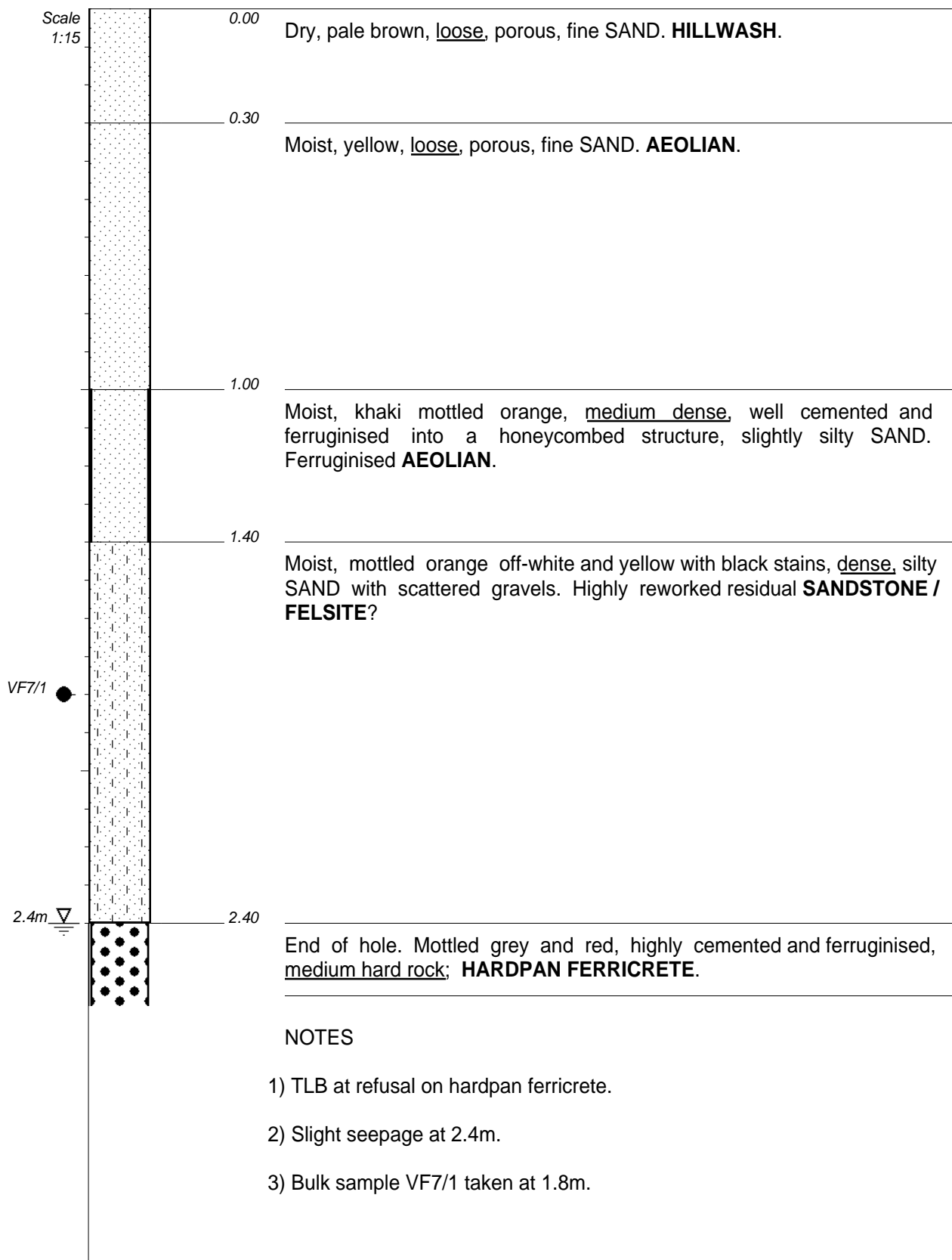
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 459
Y-COORD : 2 051

HOLE No: VF 06



CONTRACTOR : CONCOR
MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFILED BY :

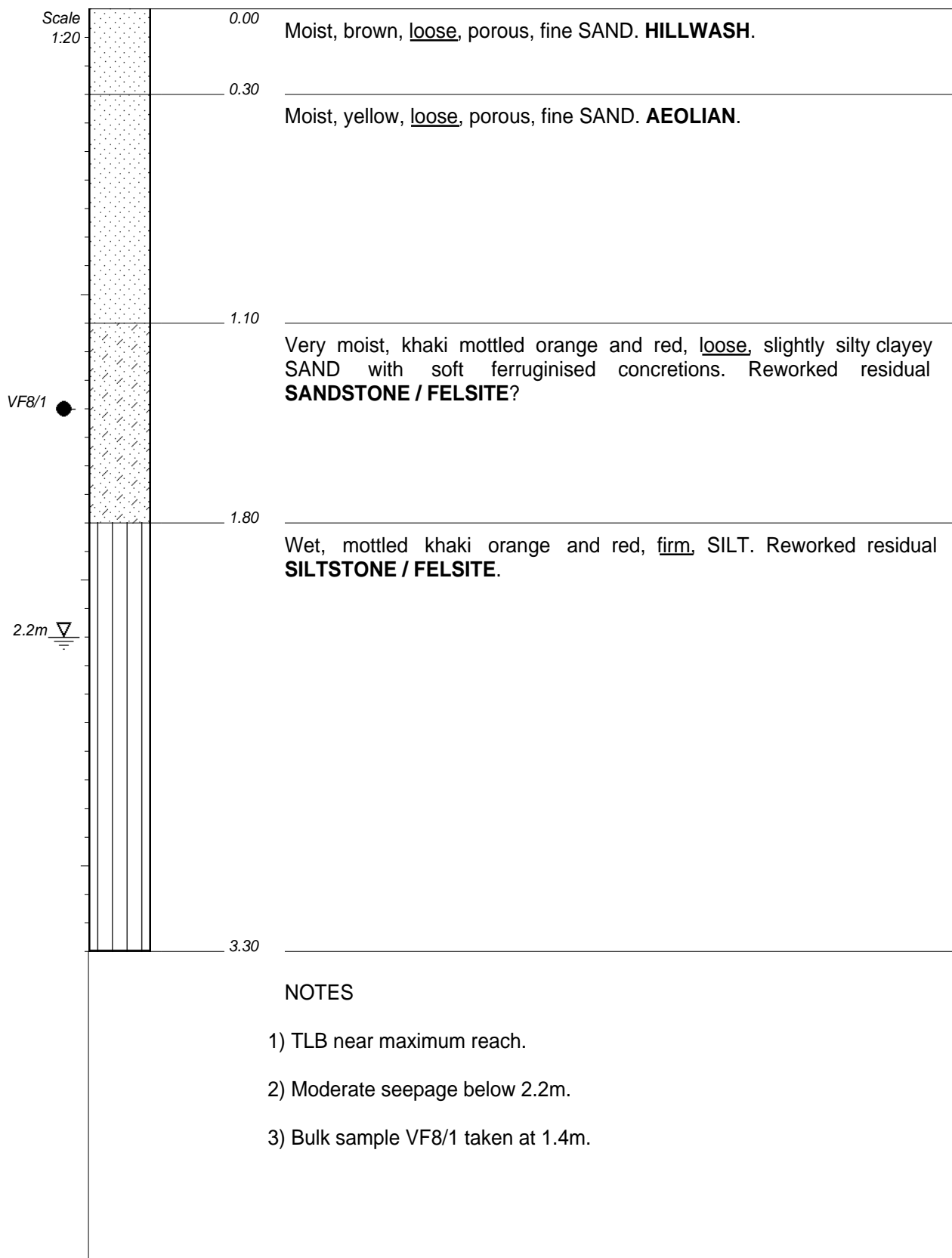
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 402
Y-COORD : 1 923

HOLE No: VF 07



CONTRACTOR : CONCOR
MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFILED BY : NM / RA

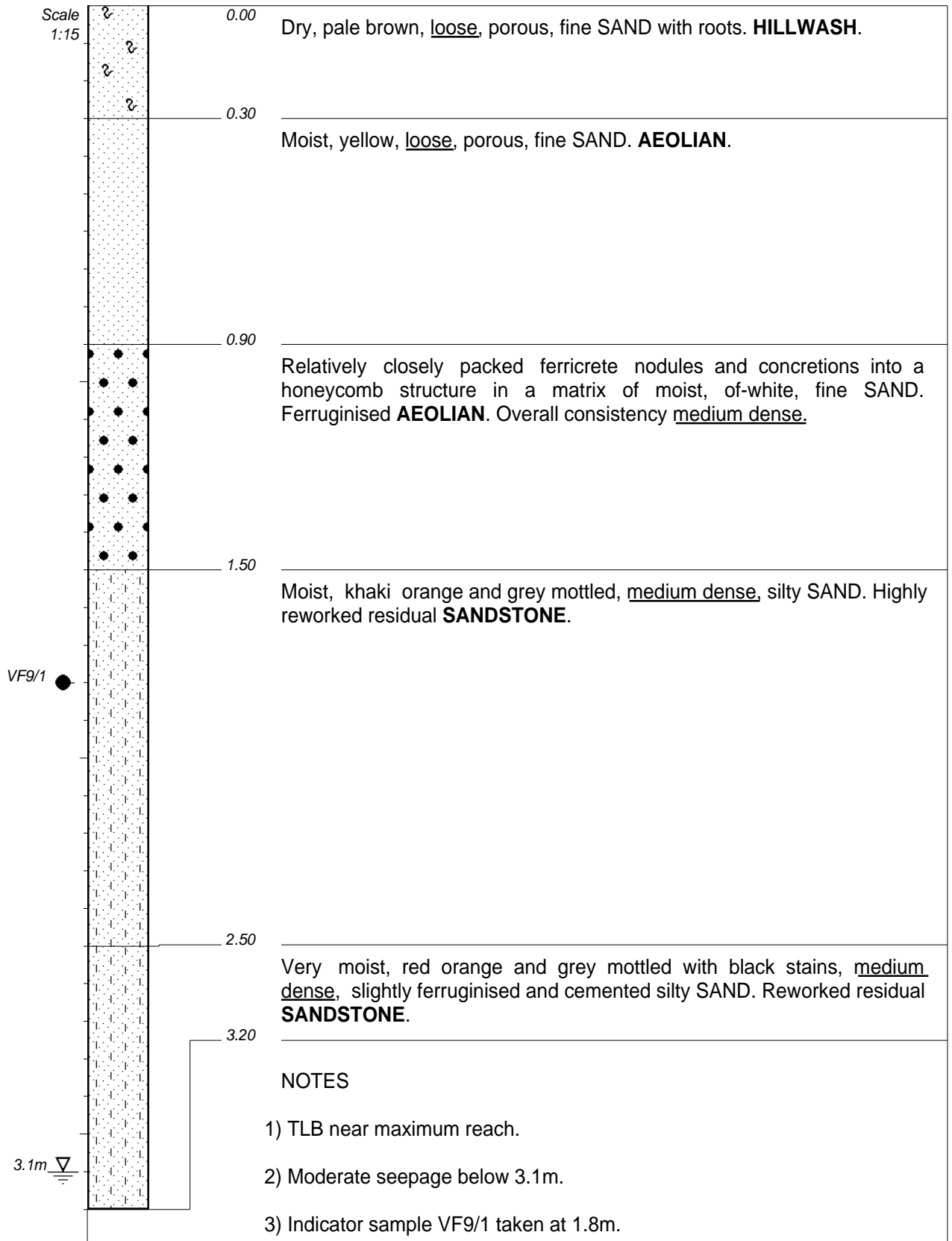
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 440
Y-COORD : 1 890

HOLE No: VF 08



CONTRACTOR : CONCOR
MACHINE : CAT 428B
DRILLED BY : ISAAC
PROFILED BY :
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DIAM : 600mm
DATE : 02/10/2014
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ELEVATION : WGS 84 LO 29
X-COORD : 2 877 431
Y-COORD : 1 989

HOLE No: VF 09

Annexure C – Laboratory results

Falling Head Permeability Test Results

Project:	VLAKFONTEIN POLLUTION CONTROL DAMS	
Project No:	2014-B-2293	Date: 21 OCTOBER 2014

Lab. Sample Reference	Field Sample Reference	Depth (m)	Moisture Contents		Dry density Kg/m ³		Coefficient of Permeability (m/s)		
			Before Test (%)	After Test (%)	Initial	As tested	Range		Average
							Minimum	Maximum	
2293-6	VF 4/1	1.7	10.6	13.9	1866	1893	3.5E-07	4.3E-07	3.9E-07
2293-7*	VF 7/1	1.8	7.6	13.0	1969	1966	1.9E-07	2.3E-07	2.1E-07
2293-8*	VF 8/1	1.4	15.1	17.1	1766	1799	6.4E-09	9.3E-09	8.4E-09

Remarks: Samples remoulded to approximately 95% Proctor.
* Samples remoulded to approximately 98% Proctor.
Saturated and tested under a load of 100kPa.
Densities reported are under a load of 100kPa.

Client : JONES AND WAGENER (PTY) LTD
Address : P O BOX 1434
 : RIVONIA
 : 2128

Client Reference :
Order No. : E717

Attention :
Facsimile : 011 519 0201
E-mail : margaret@jaws.co.za

Date Received : 07/10/2014
Date Tested : 06/10/2014 -
Date Reported : 24/10/2014

Project : Vlakfontein Pollution Control Dams
Project No. : 2014-B-2293

Page : 1 of 15

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Qty.	Test Method(s)	Authorized By	Page(s)
Relative density of soil (SG)	9.000	TMH1 A12T	J Marques	2-6
Moisture Content	9.000	SANS 3001	J Marques	2-6
Atterberg Limits < 0.425mm	9.000	TMH1 A2, A3, A4	J Marques	2-6, 13-14
Sieve Analysis 0.075mm (Mass Grading)	9.000	TMH1 A1	J Marques	2-6, 13-14
Hydrometer Analysis	9.000	ASTM D422	J Marques	2-6
MDD & OMC	6.000	TMH1 A7	J Marques	7-12
C.B.R.	3.000	THM1 A9	J Marques	13-14
Permeability: Falling Head *	3.000	KH Head	J Marques	1 File, 1 Page

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

Any information contained in this test report pertain only to the areas and/or samples tested. Documents may only be reproduced or published in their full context.

While every care is taken to ensure that all tests are carried out in accordance with recognised standards, neither Civilab (Proprietary) Limited nor its employess shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequences thereof.

All interpretations, Interpolations, Opinions and/or Classifications contained in this report falls outside our scope of accreditation.

The following parameters, where applicable, were excluded from the classification procedure: Chemical modifications, Additional fines, Fractured Faces, Soluble Salts, pH, Conductivity, Coarse Sand Ratio, Durability (COLTO: G4-G9).

The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

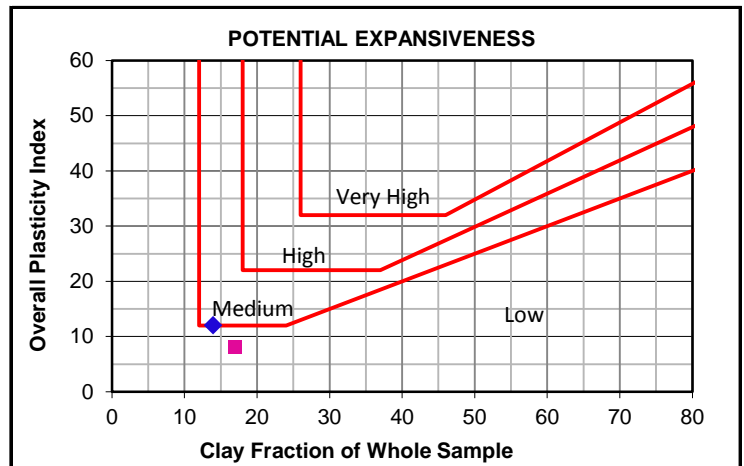
Deviations in Test Methods:

Client : JONES AND WAGENER (PTY) LTD
 Project : Vlakfontein Pollution Control Dams
 Project No : 2014-B-2293

Date Received: 07/10/2014
 Date Reported: 24/10/2014
 Page No. : 2 of 15

FOUNDATION INDICATOR

Laboratory Number	1	2
Field Number	V/F 1/1	V/F 2/1
Client Reference		
Depth (m)	2.2	1.6
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

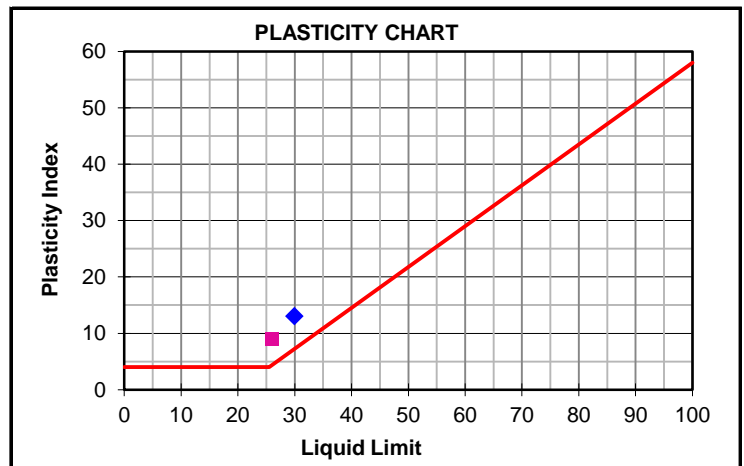


Moisture Content & Relative Density-TMH1 Metod A12T

Moisture Content (%)	18	15.1
Relative Density (S.G.)	2.6	2.633



Sieve Analysis (Wet Preparation) - TMH1 Method A1(a)

Percentage Passing	75.0 mm	100	100
	63.0 mm	100	100
	53.0 mm	100	100
	37.5 mm	100	100
	26.5 mm	100	100
	19.0 mm	100	100
	13.2 mm	100	100
	4.75 mm	100	99
	2.00 mm	100	98
	0.425 mm	91	94
0.075 mm	37	39	
Grading Modulus		0.72	0.69



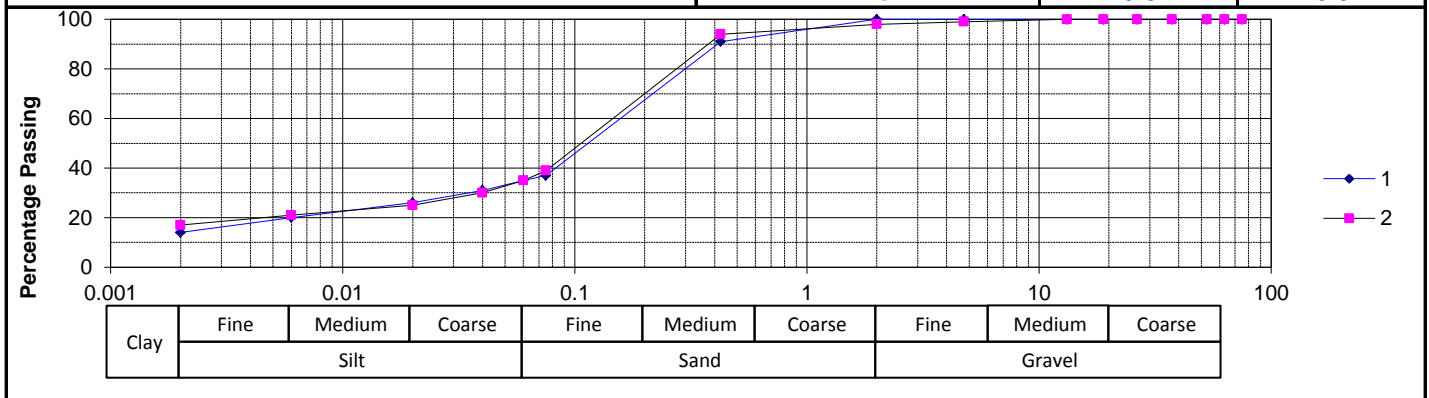
Hydrometer Analysis - ASTM Method D422

Percentage Passing	0.060 mm	35	35
	0.040 mm	31	30
	0.020 mm	26	25
	0.006 mm	20	21
	0.002 mm	14	17
Gravel	%		2
Sand	%	65	63
Silt	%	21	18
Clay	%	14	17

Laboratory Number		1		2	
Atterberg Limits - TMH1 Method A2, A3 & A4					
Liquid Limit	%	30		26	
Plasticity Index	%	13		9	
Linear Shrinkage	%	5.5		4.0	
Overall PI	%	12		8	

Classifications

HRB	A-6(1)	A-4(0)
Unified	SC	SC
Weston Swell @ 1 kPa	0.5	0.5

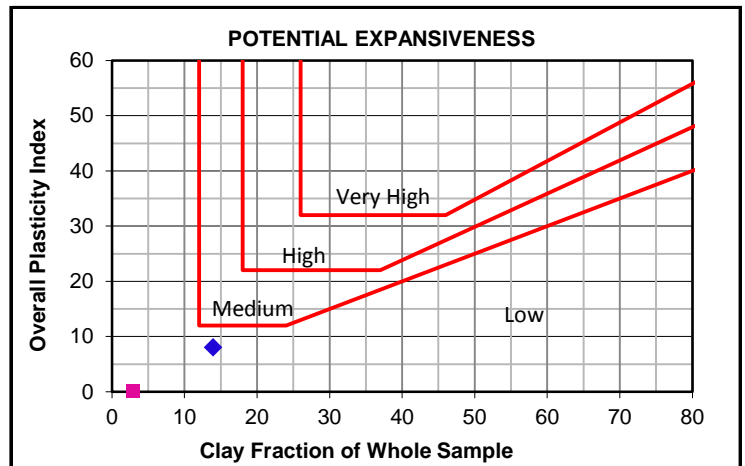


Client : JONES AND WAGENER (PTY) LTD
 Project : Vlakfontein Pollution Control Dams
 Project No : 2014-B-2293

Date Received: 07/10/2014
 Date Reported: 24/10/2014
 Page No. : 3 of 15

FOUNDATION INDICATOR

Laboratory Number	3	4
Field Number	V/F 2/1	V/F 3/1
Client Reference		
Depth (m)	2.2	0.9
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

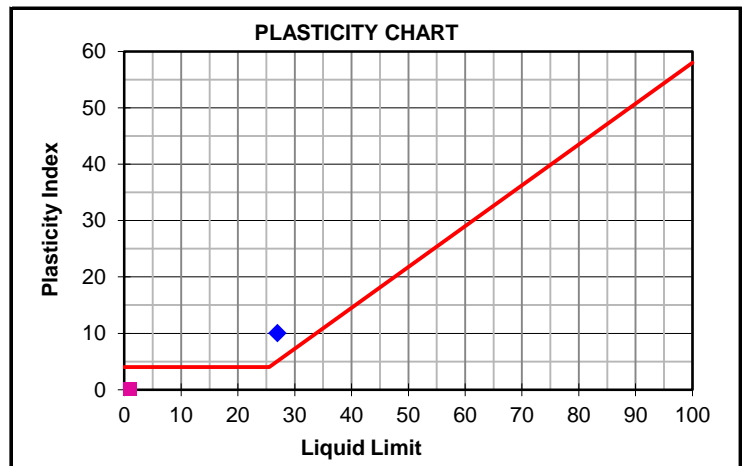


Moisture Content & Relative Density-TMH1 Metod A12T

Moisture Content (%)	15.7	1.5
Relative Density (S.G.)	2.687	2.617

Sieve Analysis (Wet Preparation) - TMH1 Method A1(a)

Percentage Passing	75.0 mm	100	100
	63.0 mm	100	100
	53.0 mm	100	100
	37.5 mm	100	100
	26.5 mm	100	100
	19.0 mm	100	100
	13.2 mm	100	100
	4.75 mm	94	100
	2.00 mm	88	100
	0.425 mm	80	95
0.075 mm	36	16	
Grading Modulus		0.96	0.89



Hydrometer Analysis - ASTM Method D422

Percentage Passing	0.060 mm	31	12
	0.040 mm	26	8
	0.020 mm	23	6
	0.006 mm	19	4
	0.002 mm	14	3
Gravel	%	12	
Sand	%	57	88
Silt	%	17	9
Clay	%	14	3

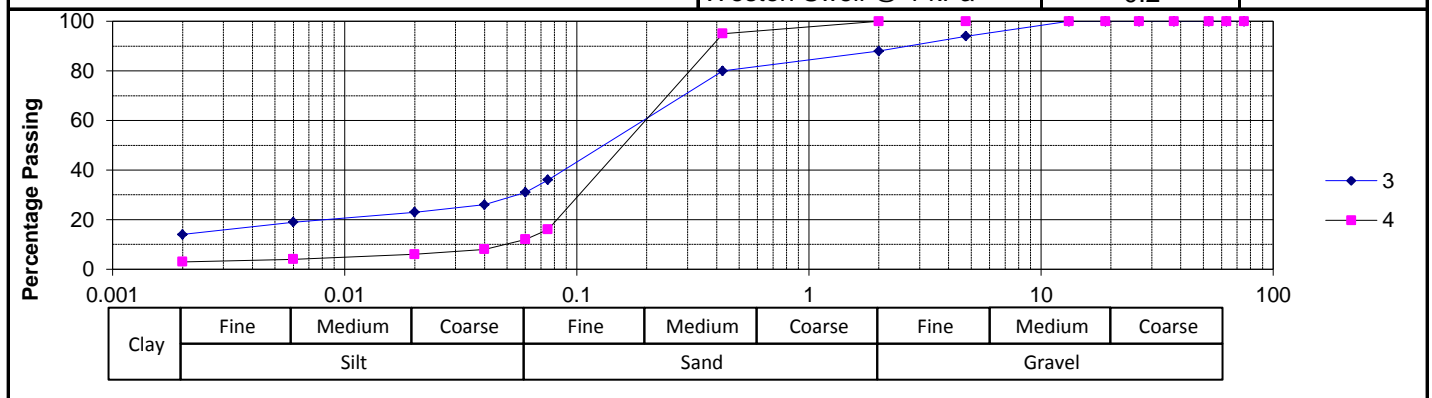
Laboratory Number	3	4
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Atterberg Limits - TMH1 Method A2, A3 & A4

Liquid Limit	%	27	
Plasticity Index	%	10	NP
Linear Shrinkage	%	4.0	
Overall PI	%	8	

Classifications

HRB	A-4(0)	A-2-4(0)
Unified	SC	SM
Weston Swell @ 1 kPa	0.2	

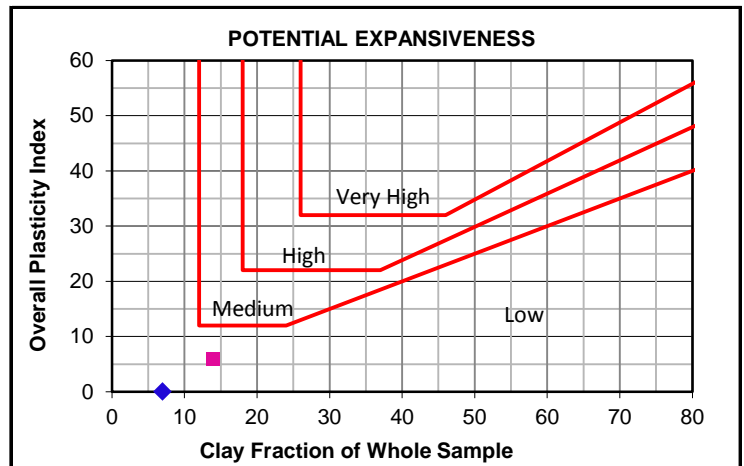


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FOUNDATION INDICATOR

Laboratory Number	5	6
Field Number	V/F 3/2	VF 4/1
Client Reference		
Depth (m)	2.2	1.7
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

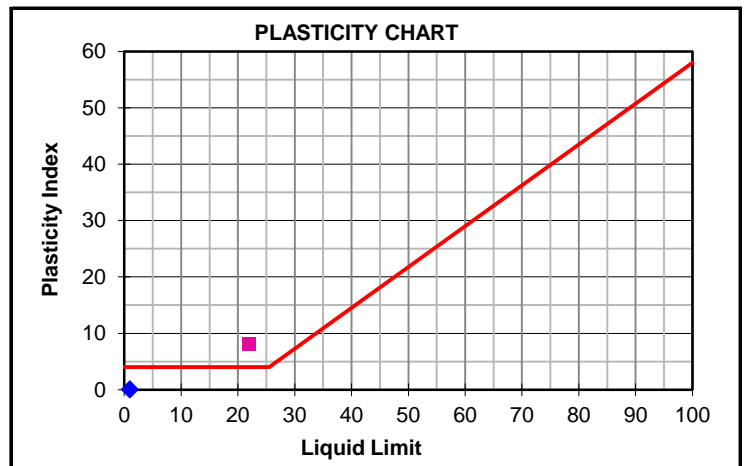


Moisture Content & Relative Density-TMH1 Metod A12T

Moisture Content (%)	9	14.5
Relative Density (S.G.)	2.628	2.607

Sieve Analysis (Wet Preparation) - TMH1 Method A1(a)

Percentage Passing	75.0 mm	100	100
	63.0 mm	100	100
	53.0 mm	100	100
	37.5 mm	100	100
	26.5 mm	100	100
	19.0 mm	100	100
	13.2 mm	100	100
	4.75 mm	100	90
	2.00 mm	99	84
	0.425 mm	91	77
0.075 mm	24	32	
Grading Modulus		0.86	1.07



Hydrometer Analysis - ASTM Method D422

Percentage Passing	0.060 mm	20	28
	0.040 mm	16	24
	0.020 mm	15	21
	0.006 mm	11	17
	0.002 mm	7	14
Gravel	%	1	16
Sand	%	79	56
Silt	%	13	14
Clay	%	7	14

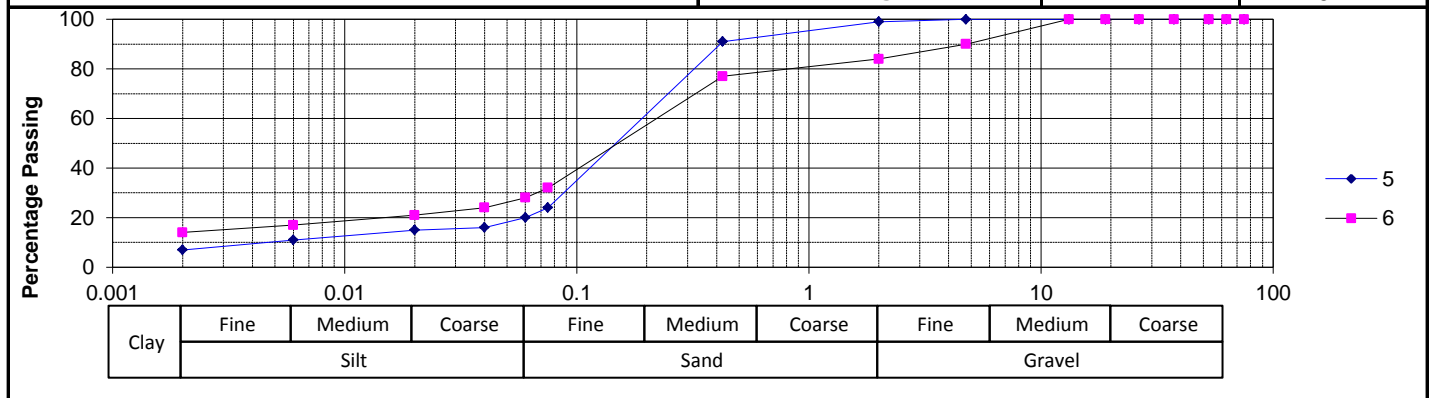
Laboratory Number	5	6
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Atterberg Limits - TMH1 Method A2, A3 & A4

Liquid Limit	%		22
Plasticity Index	%	NP	8
Linear Shrinkage	%		4.5
Overall PI	%		6

Classifications

HRB	A-2-4(0)	A-2-4(0)
Unified	SM	SC
Weston Swell @ 1 kPa		0.1

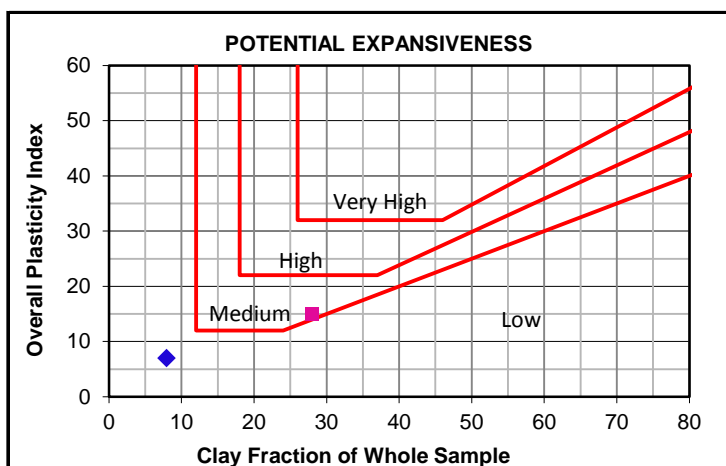


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FOUNDATION INDICATOR

Laboratory Number	7	8
Field Number	VF 7/1	VF 8/1
Client Reference		
Depth (m)	1.8	1.4
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

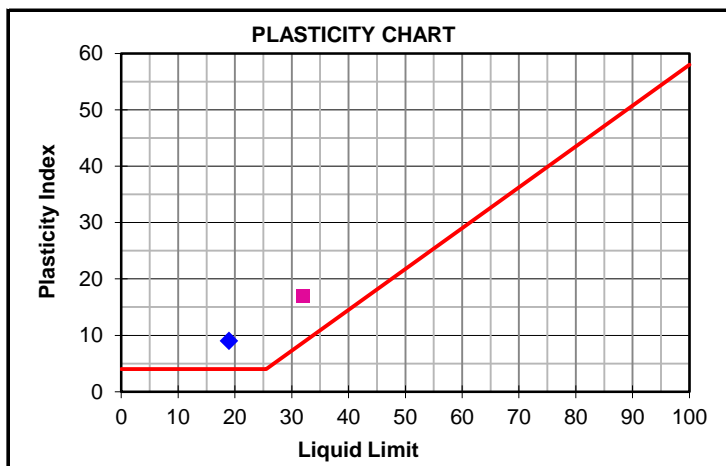


Moisture Content & Relative Density-TMH1 Metod A12T

Moisture Content (%)	11.3	20.7
Relative Density (S.G.)	2.594	2.63

Sieve Analysis (Wet Preparation) - TMH1 Method A1(a)

Sieve Analysis (ASTM D 1557) - Actual vs. Nominal (%)			
Percentage Passing	75.0 mm	100	100
	63.0 mm	100	100
	53.0 mm	100	100
	37.5 mm	100	100
	26.5 mm	100	100
	19.0 mm	100	100
	13.2 mm	100	100
	4.75 mm	93	98
	2.00 mm	90	96
	0.425 mm	81	90
	0.075 mm	25	46
Grading Modulus		1.04	0.68



Hydrometer Analysis - ASTM Method D422

Percentage Passing	0.060 mm	22	42
	0.040 mm	19	37
	0.020 mm	16	34
	0.006 mm	12	31
	0.002 mm	8	28
Gravel	%	10	4
Sand	%	68	54
Silt	%	14	14
Clay	%	8	28

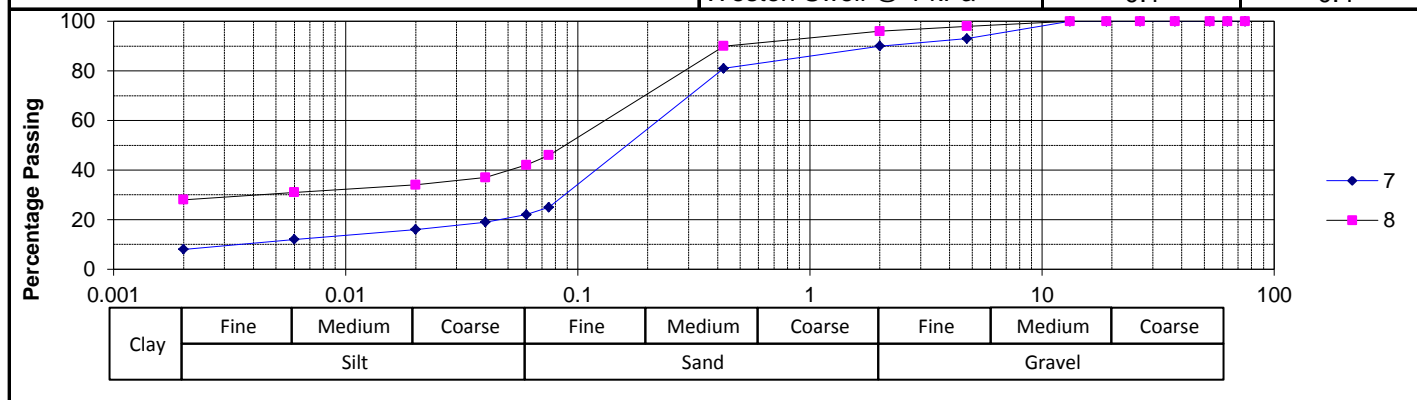
Laboratory Number	7	8
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Atterberg Limits - TMH1 Method A2, A3 & A4

Liquid Limit	%	19	32
Plasticity Index	%	9	17
Linear Shrinkage	%	2.5	8.0
Overall PI	%	7	15

Classifications

HRB	A-2-4(0)	A-6(4)
Unified	SC	SC
Weston Swell @ 1 kPa	0.1	0.4

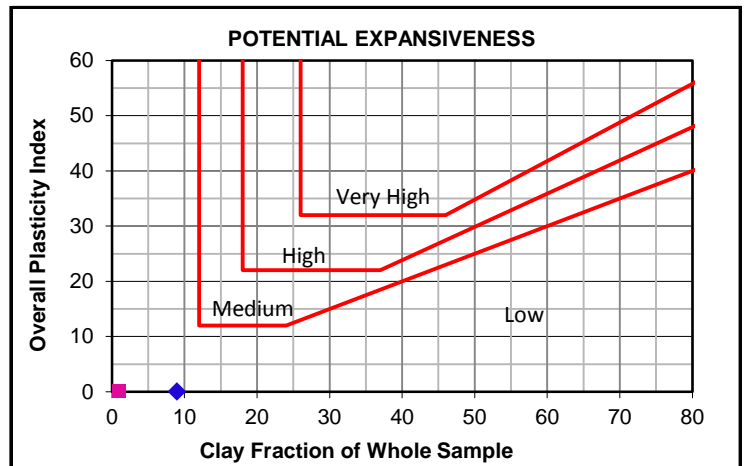


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FOUNDATION INDICATOR

Laboratory Number	9	
Field Number	V/F 9/1	
Client Reference		
Depth (m)	1.8	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

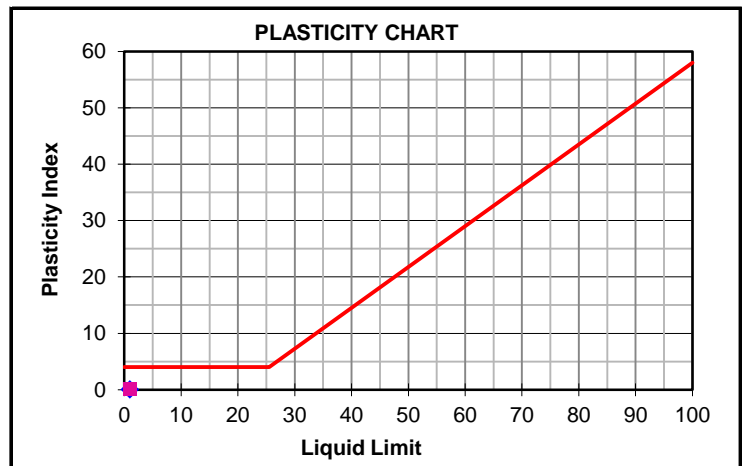


Moisture Content & Relative Density-TMH1 Metod A12T

Moisture Content (%)	11	
Relative Density (S.G.)	2.578	

Sieve Analysis (Wet Preparation) - TMH1 Method A1(a)

Percentage Passing	75.0 mm	100	
	63.0 mm	100	
	53.0 mm	100	
	37.5 mm	100	
	26.5 mm	100	
	19.0 mm	100	
	13.2 mm	100	
	4.75 mm	99	
	2.00 mm	99	
	0.425 mm	90	
0.075 mm	28		
Grading Modulus		0.83	



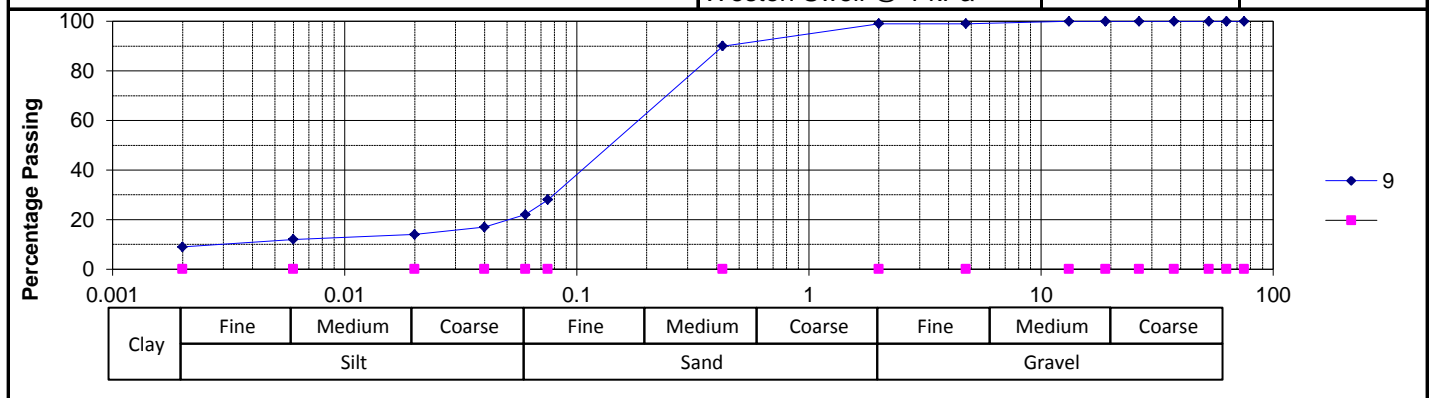
Hydrometer Analysis - ASTM Method D422

Percentage Passing	0.060 mm	22	
	0.040 mm	17	
	0.020 mm	14	
	0.006 mm	12	
	0.002 mm	9	
Gravel	%	1	
Sand	%	77	
Silt	%	13	
Clay	%	9	

Laboratory Number	9	
Atterberg Limits - TMH1 Method A2, A3 & A4		
Liquid Limit	%	
Plasticity Index	%	NP
Linear Shrinkage	%	
Overall PI	%	

Classifications

HRB	A-2-4(0)	
Unified	SM	
Weston Swell @ 1 kPa		



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MOISTURE DENSITY RELATIONSHIP

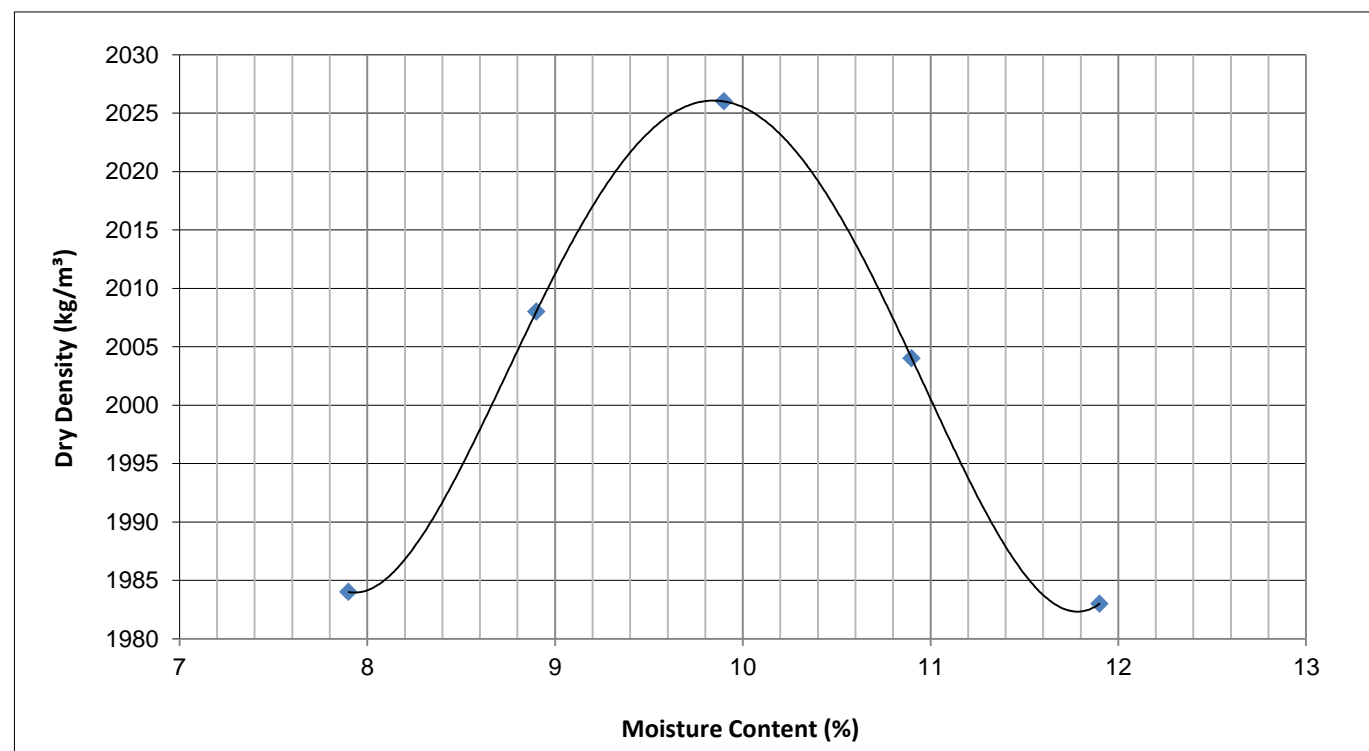
Laboratory Number	6	
Field Number	VF 4/1	
Client Reference		
Depth (m)	1.7	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - TMH1 Method A7

Compactive Effort:	Modified AASHTO	
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Dry Density	kg/m ³	1984	2008	2026	2004	1983	
Moisture Content	%	7.9	8.9	9.9	10.9	11.9	

Max. Dry Density	kg/m ³	2026
Optimum Moisture	%	9.8



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MOISTURE DENSITY RELATIONSHIP

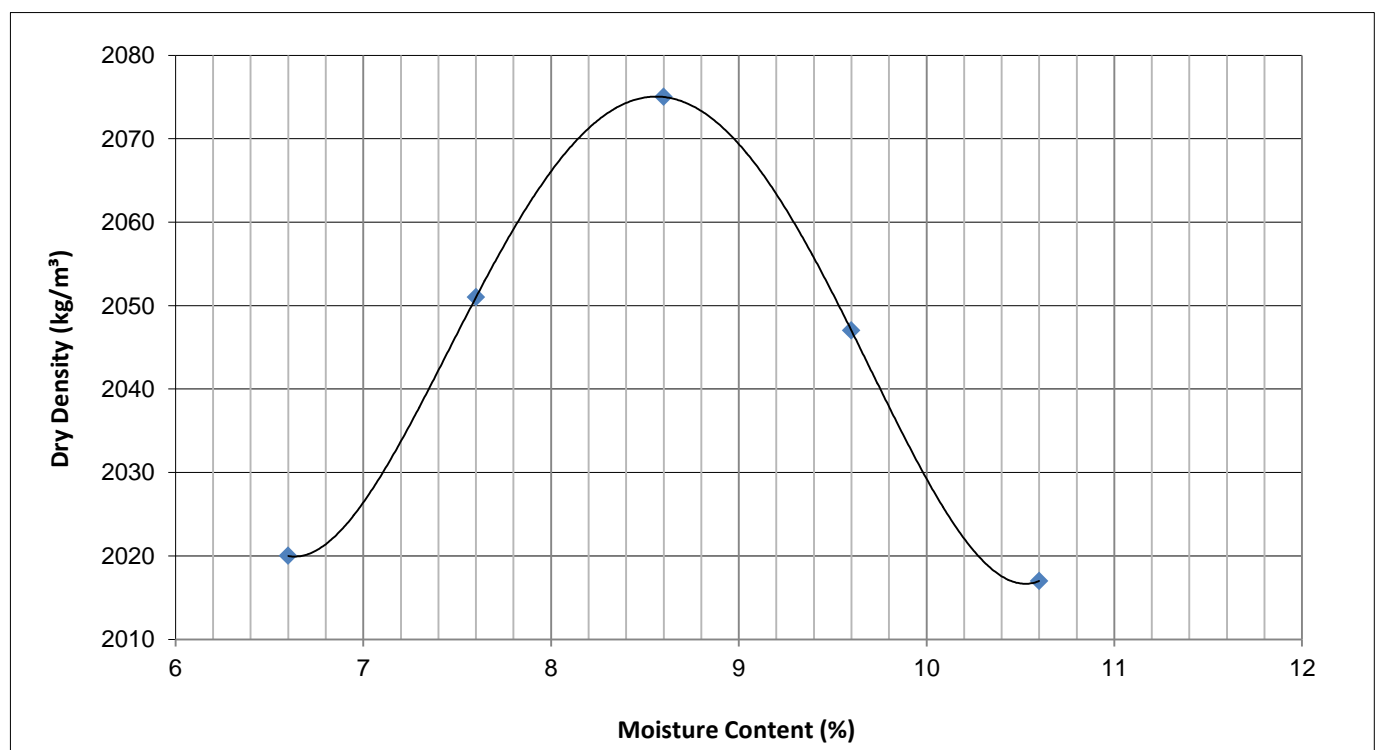
Laboratory Number	7	
Field Number	VF 7/1	
Client Reference		
Depth (m)	1.8	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - TMH1 Method A7

Compactive Effort:	Modified AASHTO
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Dry Density	kg/m ³	2020	2051	2075	2047	2017	
Moisture Content	%	6.6	7.6	8.6	9.6	10.6	

Max. Dry Density	kg/m ³	2075
Optimum Moisture	%	8.6



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MOISTURE DENSITY RELATIONSHIP

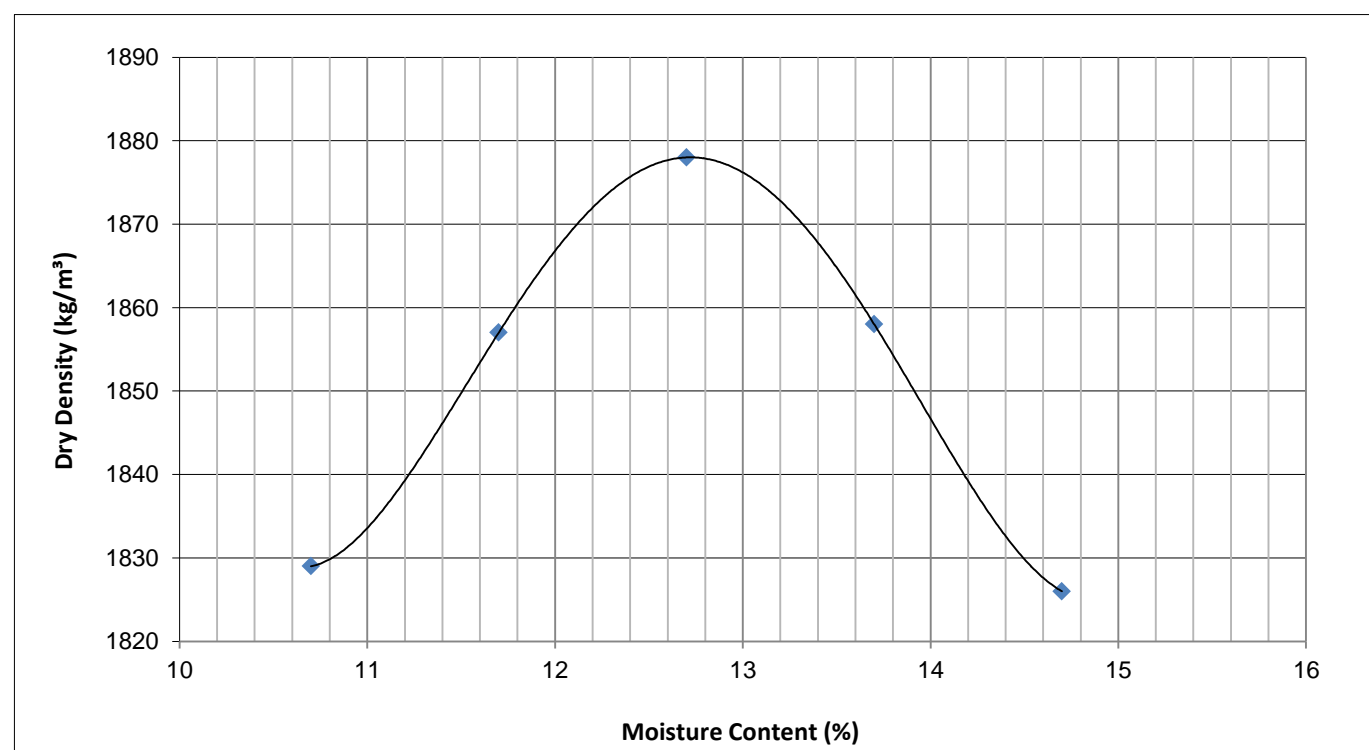
Laboratory Number	8	
Field Number	VF 8/1	
Client Reference		
Depth (m)	1.4	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - TMH1 Method A7

Compactive Effort:	Modified AASHTO	
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Dry Density	kg/m ³	1829	1857	1878	1858	1826	
Moisture Content	%	10.7	11.7	12.7	13.7	14.7	

Max. Dry Density	kg/m ³	1878
Optimum Moisture	%	12.7



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MOISTURE DENSITY RELATIONSHIP

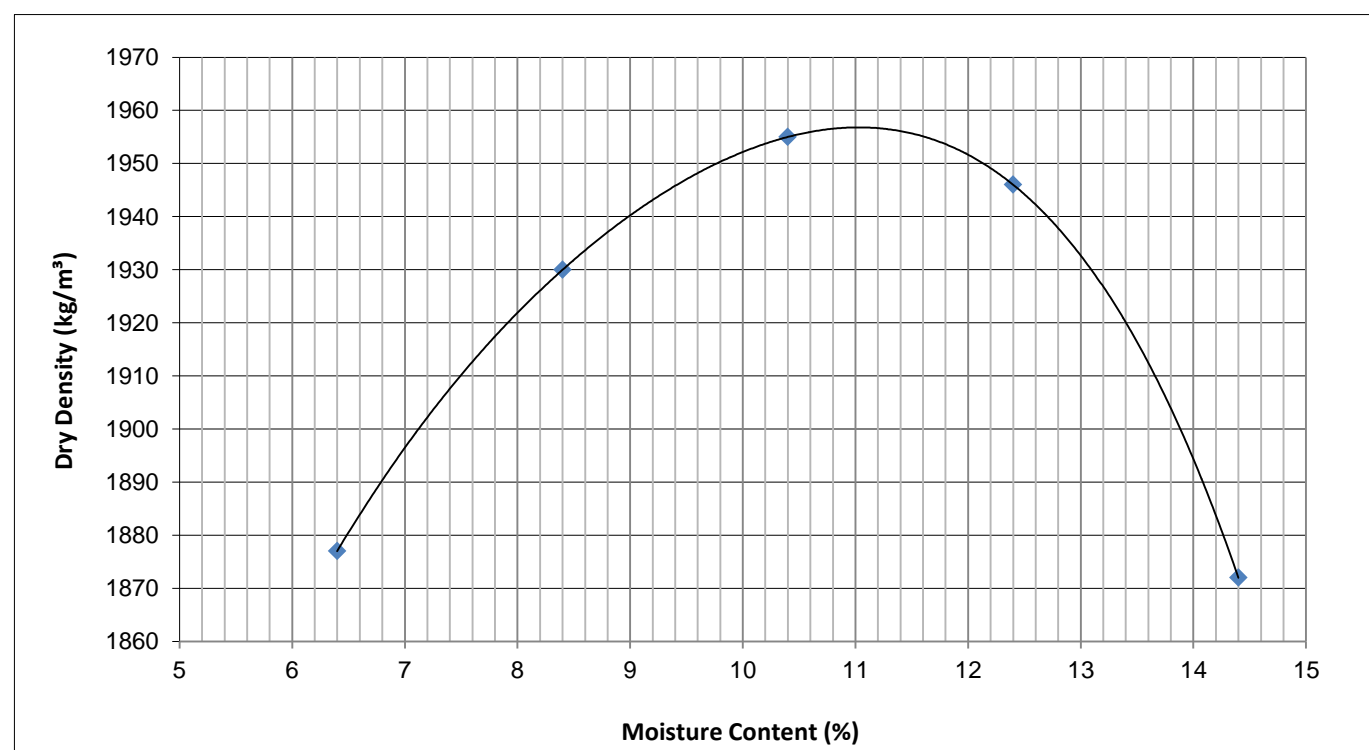
Laboratory Number	10	
Field Number	VF 4/1	
Client Reference		
Depth (m)	1.7	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - TMH1 Method A7

Compactive Effort:	Standard Proctor	
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Dry Density	kg/m ³	1877	1930	1955	1946	1872	
Moisture Content	%	6.4	8.4	10.4	12.4	14.4	

Max. Dry Density	kg/m ³	1957
Optimum Moisture	%	11



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MOISTURE DENSITY RELATIONSHIP

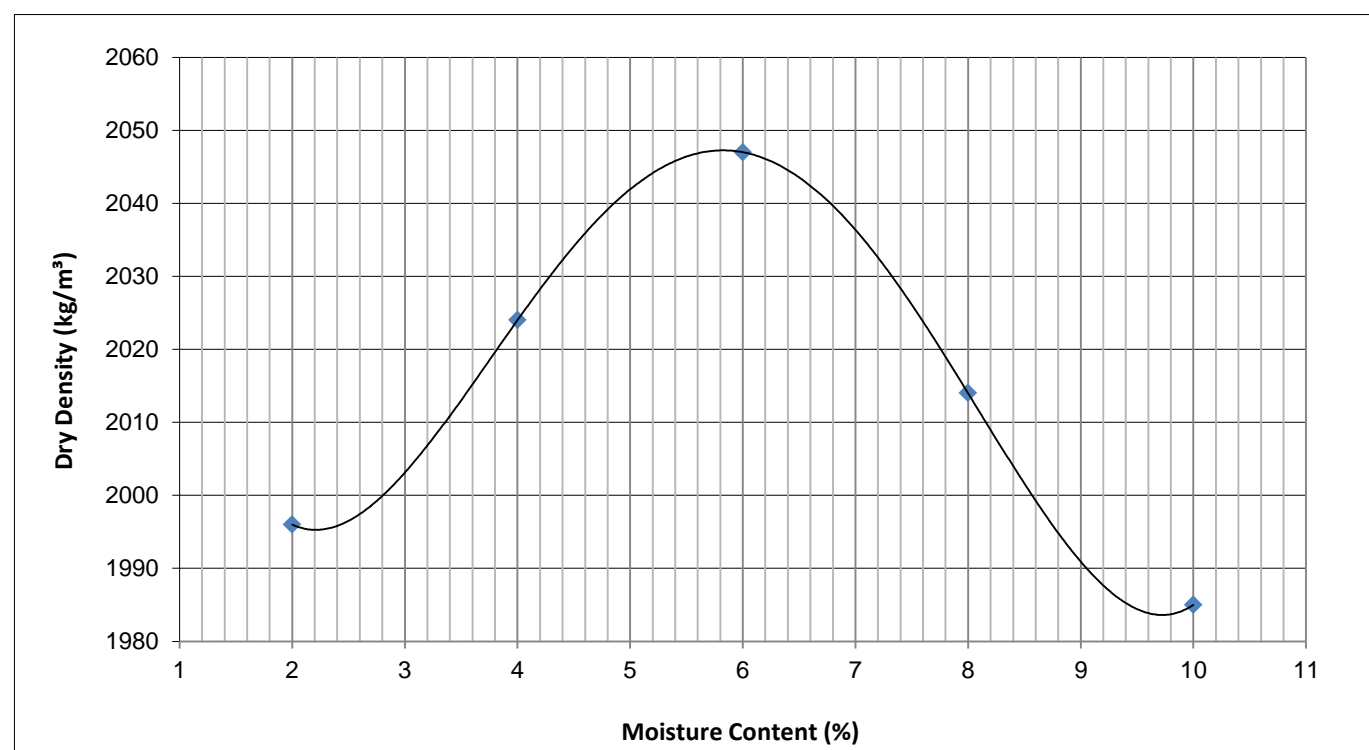
Laboratory Number	11	
Field Number	VF 7/1	
Client Reference		
Depth (m)	1.8	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - TMH1 Method A7

Compactive Effort:	Standard Proctor	
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Dry Density	kg/m ³	1996	2024	2047	2014	1985	
Moisture Content	%	2	4	6	8	10	

Max. Dry Density	kg/m ³	2047
Optimum Moisture	%	5.8



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MOISTURE DENSITY RELATIONSHIP

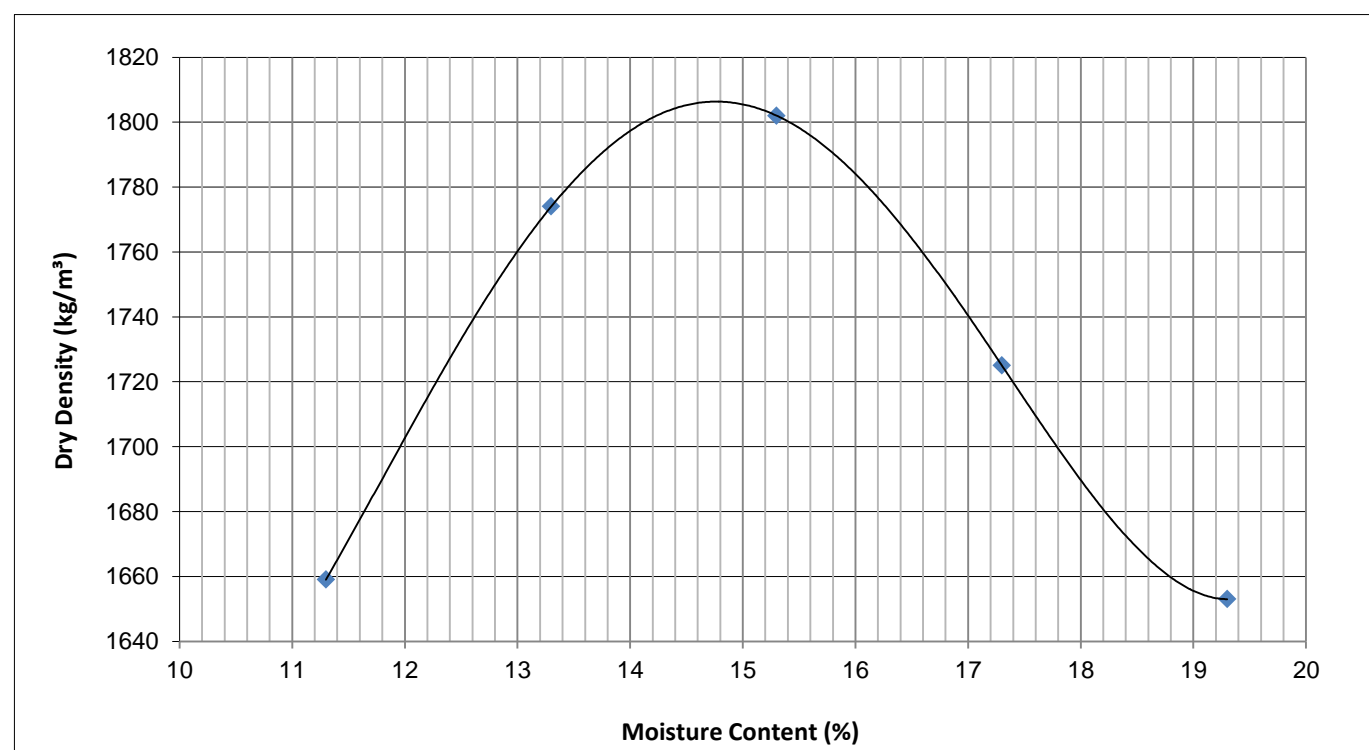
Laboratory Number	12	
Field Number	VF 8/1	
Client Reference		
Depth (m)	1.4	
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
Calcrete / Crushed		
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - TMH1 Method A7

Compactive Effort:	Standard Proctor	
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Dry Density	kg/m ³	1659	1774	1802	1725	1653	
Moisture Content	%	11.3	13.3	15.3	17.3	19.3	

Max. Dry Density	kg/m ³	1806
Optimum Moisture	%	14.8



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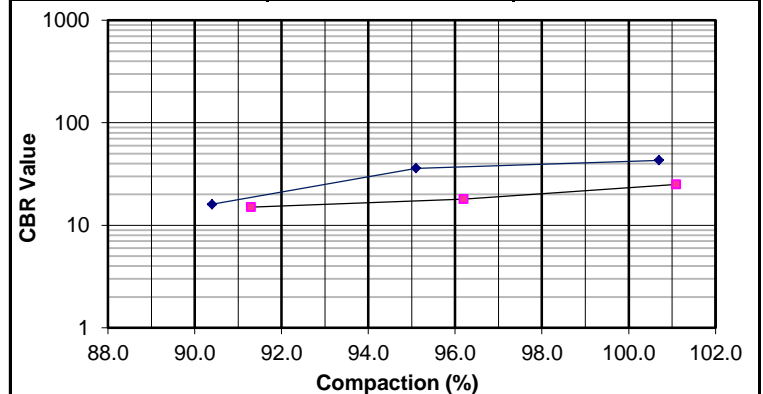
CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	6	7
Field Number	VF 4/1	VF 7/1
Client Reference		
Depth (m)	1.7	1.8
Position		
Coordinates	X	
	Y	
Description		
Additional information		
Calcrete/Crushed		
Stabilizing Agent		

Laboratory No.	6	7	
Maximum Dry Density & Optimum Moisture Content - TMH1 A7			
MDD	kg/m ³	2026	2075
OMC	%	9.8	8.6

California Bearing Ratio - TMH1 Method A8

Compaction Data							
Moisture	%	9.6			8.6		
Dry Density	kg/m ³	2041	1927	1831	2098	1996	1895
Compaction	%	100.7	95.1	90.4	101.1	96.2	91.3
Penetration Data							
CBR at	2.54 mm	43	36	16	25	18	15
	5.08 mm	48	30	14	41	22	19
	7.62 mm	49	28	12	47	25	21
Swell	%	0.1	0	0.2	0	0.2	0.1
Final Moisture (%)		11.1	13.3	14.3	10.1	10.8	12.5



Sieve Analysis (Wet preparation) - TMH1 Method A1(a)

Percentage Passing	75.0 mm	100	100
	63.0 mm	100	100
	53.0 mm	100	100
	37.5 mm	100	100
	26.5 mm	100	100
	19.0 mm	100	100
	13.2 mm	100	100
	4.75 mm	90	93
	2.00 mm	84	90
	0.425 mm	77	81
	0.075 mm	32	25
Grading Modulus		1.07	1.04

Soil Mortar Analysis

Coarse Sand	8	10
Coarse Fine Sand	21	29
Medium Fine Sand	18	22
Fine Fine Sand	14	12
Silt and Clay	38	28

Atterberg Limits - TMH1 Method A2,A3&A4

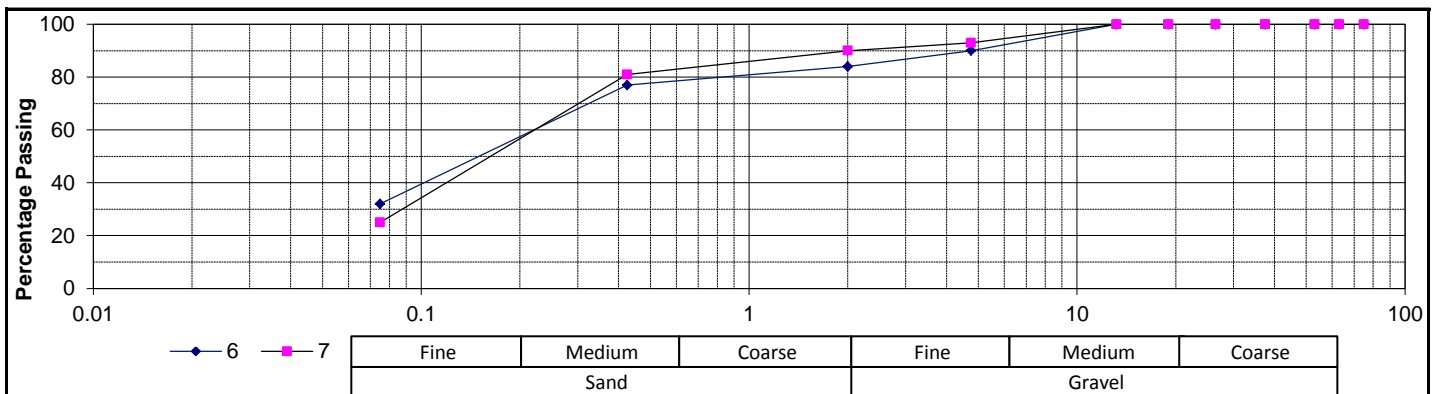
Liquid Limit (%)	22	19
Plasticity Index (%)	8	9
Linear Shrinkage (%)	4.5	2.5

Interpolated CBR Data

@ 100%	41.8	22.9
@ 98%	39.1	20.1
@ 97%	37.8	18.8
@ 95%	34.9	17.1
@ 93%	24.8	16
@ 90%	14.8	14.4

Classifications

HRB	A-2-4(0)	A-2-4(0)
COLTO	G7	G7
TRH14	G7	G7



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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.	8	
Field Number	VF 8/1	
Client Reference		
Depth (m)	1.4	
Position		
Coordinates	X	
	Y	
Description		
Additional information		
Calcrete/Crushed		
Stabilizing Agent		

Laboratory No.	8	
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Maximum Dry Density & Optimum Moisture Content - TMH1 A7

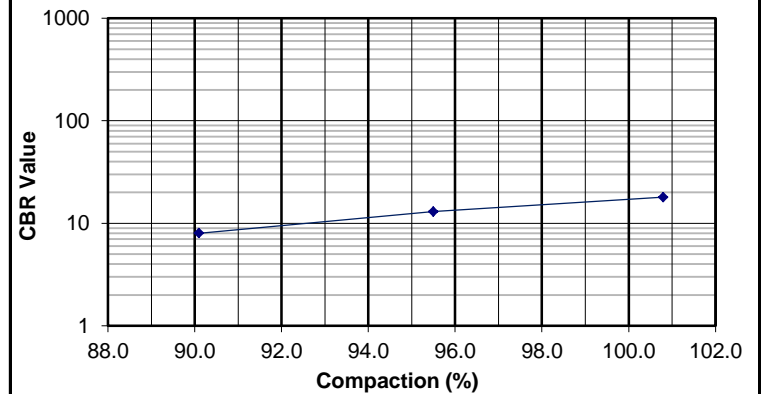
MDD	kg/m ³	1878	
OMC	%	12.7	

California Bearing Ratio - TMH1 Method A8

Compaction Data					
Moisture	%	12.7			
Dry Density	kg/m ³	1893	1794	1692	
Compaction	%	100.8	95.5	90.1	
Penetration Data					
CBR at	2.54 mm	18	13	8	
	5.08 mm	15	10	8	
	7.62 mm	14	9	6	
Swell	%	0.4	0.8	0.5	
Final Moisture (%)		14.9	17.9	18.9	

Sieve Analysis (Wet preparation) - TMH1 Method A1(a)

Percentage Passing	75.0 mm	100	
	63.0 mm	100	
	53.0 mm	100	
	37.5 mm	100	
	26.5 mm	100	
	19.0 mm	100	
	13.2 mm	100	
	4.75 mm	98	
	2.00 mm	96	
	0.425 mm	90	
	0.075 mm	46	
Grading Modulus		0.68	



Soil Mortar Analysis

Coarse Sand	6	
Coarse Fine Sand	20	
Medium Fine Sand	14	
Fine Fine Sand	12	
Silt and Clay	48	

Interpolated CBR Data

@ 100%	17.5	
@ 98%	15.2	
@ 97%	14.2	
@ 95%	12.3	
@ 93%	10.4	
@ 90%	8.2	

Atterberg Limits - TMH1 Method A2,A3&A4

Liquid Limit (%)	32	
Plasticity Index (%)	17	
Linear Shrinkage (%)	8.0	

Classifications

HRB	A-6(4)	
COLTO	None	
TRH14	G9	

