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Geotechnical Report
Level One Inspection and Testing
Version 2

Summerhill Stage 1
Cranbourne

Prepared for:

Streetworks Pty Ltd
4 Len Thomas Place
Narre Warren South 3805

Project No 9457

20th April 2017.

Prepared by:

TERRA FIRMA LABORATORIES
Geotechnical Inspection and Testing Authority

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Geotechnical Report Level One Inspection and Testing
Summerhill Stage 1

1. Introduction

Terra Firma Laboratories was engaged by Streetworks Pty Ltd as the geotechnical inspection and testing authority to provide Level 1 supervision and testing works on the earthworks component for Summerhill Stage 1. This work was conducted over the period of 27/02/2017 to 04/04/2017.

This report presents that the allotment earthworks was carried out in accordance with *AS3798-2007 Guidelines for Earthworks for Commercial and Residential Development* and in compliance with the compaction control specifications established by the contractor.

2. Scope of Works

2.1. Areas of work

The areas of work included lots 101, 107, 108, 110, 112, 113, 114, 115, 116, 117, 119, 125, 126, 127, 128, 129, 132, 133, 134, 135 and 136. The site will be a residential estate.

The area on which fill was placed is shown on site plan (Appendix 1) based on drawings prepared by GPR Consulting and provided by Streetworks Pty Ltd.

The supervision work by *Terra Firma Laboratories* involved both inspection of sub grade preparation work and full time inspection and testing of fill placement.

2.2. Specification

The placement of fill on the areas of work was to be carried out in accordance with *AS3798-2007 Guidelines for Earthworks for Commercial and Residential Development,* as directed by *CONTRACTOR NAME*. At all times during placement of fill materials Terra Firma Laboratories maintained a Geotechnical Technician on site to perform the supervision and testing as required by AS3798-2007.

A technical specification for compaction control requirements was provided by Streetworks Pty Ltd and established that:

As referenced from AS3798-2007 (Section 5.2) establishes a specification requirement for a minimum density ratio of not less than 95% noting that soils containing more than 20% of particles coarser than 37.5mm cannot be tested for relative compaction using the procedures of AS1289.

Field density testing shall be undertaken at a frequency of not less than 3 tests per visit.

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Test Rolling is required for all layers of structural fill and materials within 150mm of permanent subgrade level so as to withstand test rolling without visible deformation or springing. Corrective action is required where unstable areas exceed 20% of the area being considered by test rolling.

3. Inspection and Testing

3.1. Sub-Grade Preparation

Subgrade preparation involved stripping the site down of topsoil and organic matter to a depth of approximately 200mm below existing levels detailed on the site plans. The sub-grade area was then proof-rolled to determine soft or otherwise unsuitable zones and such zones rectified as necessary. The sub-grade was watered and scarified prior to fill placement to aid layer bonding.

3.2. Fill materials

The materials used as fill were locally sourced and observed to generally consist of Silty Clay, sourced from stockpiled materials on site. No particles greater than 150mm were observed. The fill was nominated as clean fill by the contractor.

3.3. Fill Construction

The contractor had the following plant available on-site during the construction period for use in the fill placement:

- *Dozer*
- *Water Cart*
- *Compactor*
- *Excavator*
- *Tanker Truck*
- *Pad Foot Roller*
- *Dump Truck*
- *Smooth Drum Roller*
- *Tandem Truck*

All fill was placed in layers of thicknesses not exceeding 300mm. *The work area was typically a 2 or 3 lot area on any one particular day*. At the completion of a placed layer, compaction testing was performed to confirm appropriate compaction had been achieved and supported the observations made.

It was observed that finished levels were in accordance with levels marked on site by survey. These levels are shown on site plans attached in Appendix 1.

The final 300mm of fill placed across the site was placed as a topsoil layer/ growing medium and should be considered as non-structural, as it was placed in an uncontrolled manner, as allowed by specifications.

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4. Compaction Control Testing

Testing comprised of a total of 22 in-situ density tests, with a summary of results included in Appendix 2. Test Reports are referenced in Appendix 3.

It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed. Each lot does not necessarily require a compaction test to comply. The compaction control testing indicated that the engineered fill on all lots complied with the technical specification.

5. Uncontrolled Works

Terra Firma Laboratories cannot verify any works completed by others after the final date specified in the introduction. Uncontrolled works may include, but not limited to trenching for services, cut and fill works for slab preparation or subsequent removal of vegetation and back fill of holes.

6. Clean Fill

Terra Firma Laboratories cannot guarantee that the material used as a filling medium is free from chemical or other contamination.

7. Statement of Compliance

Inspections and testing of the fill areas at this site indicate that both sub grade preparation and fill placement have been conducted in accordance with the specification and that the completed fill areas of greater than 300mm, as shown on the site plan attached, and not any preceding the 27/02/2017 or work completed after the 04/04/2017, may be certified as being compliant with the specification.

For and on behalf of
Terra Firma Laboratories,

T Seymour

Tom Seymour
Lab Manager

terra firma laboratories

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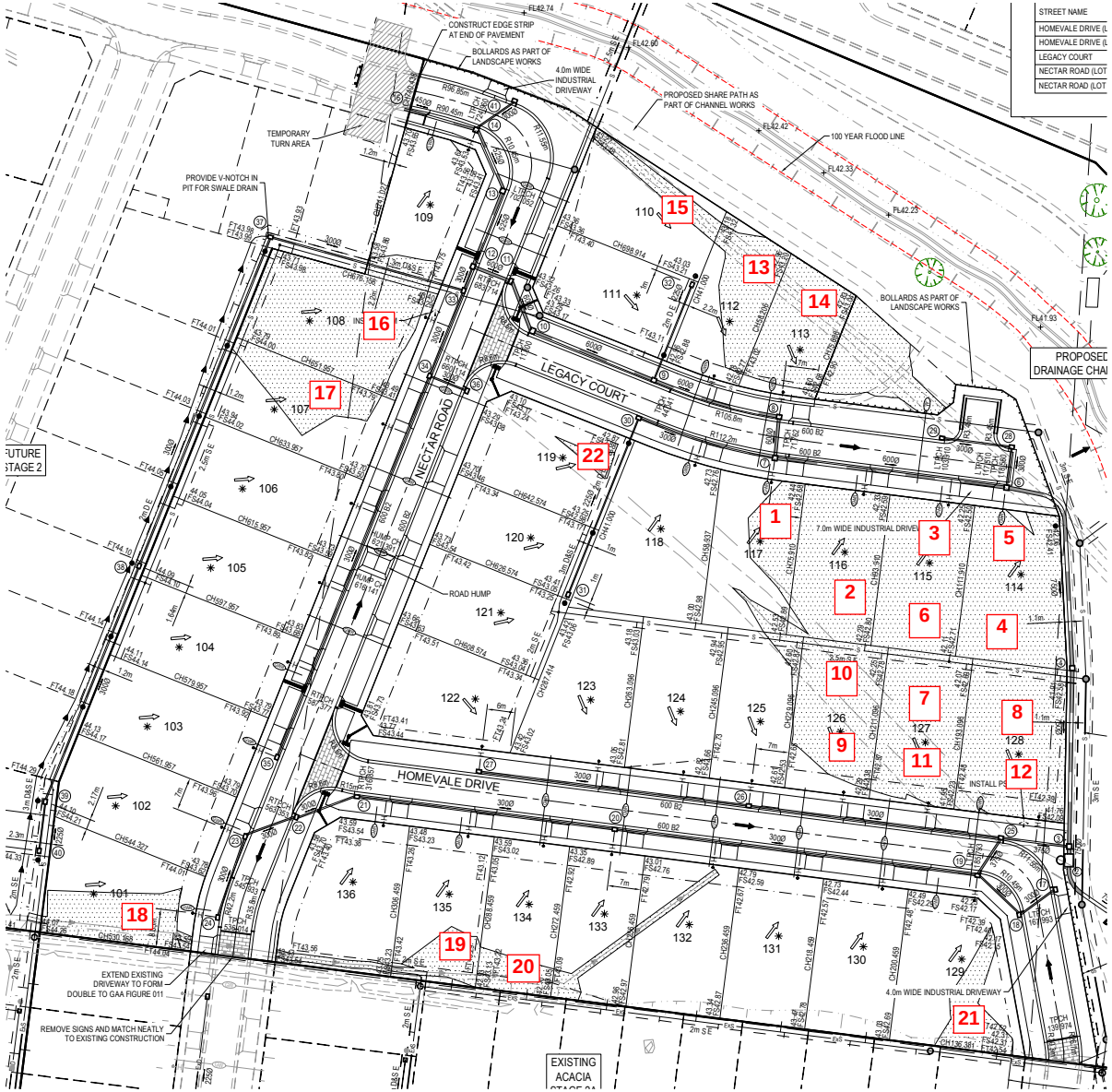
APPENDICES

Appendix 1: Site Plans

Appendix 2: Test Summary

Appendix 3: Test Reports



Test Location Plan

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47 National Avenue
Pakenham VIC 3810

Client : Streetworks Pty Ltd

Project : Summerhill Stage 1

Scale
NTS

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Level One Test Summary

Client: Streetworks **Specification:** 95%
Project: Summerhill Stage 1 **Project No:** 9457

Date:	Test Number:	Layer:	Retest of:	Density:	Pass/Fail:	Lot No:	Report No:
27/02/2017	1	L1		99	PASS	117	9457-1
27/02/2017	2	L1		97.5	PASS	116	9457-1
27/02/2017	3	L1		97	PASS	115	9457-1
28/02/2017	4	L1		97.5	PASS	114	9457-2
28/02/2017	5	L2		97.5	PASS	114	9457-2
28/02/2017	6	L2		96.5	PASS	115	9457-2
4/03/2017	7	L1		96.5	PASS	127	9457-3
4/03/2017	8	L1		99	PASS	128	9457-3
4/03/2017	9	L2		101	PASS	126	9457-3
6/03/2017	10	L3		95.5	PASS	126	9457-4
6/03/2017	11	L3		95	PASS	127	9457-4
6/03/2017	12	L2		97	PASS	128	9457-4
29/03/2017	13	L1		96	PASS	112	9457-5
29/03/2017	14	L1		95	PASS	113	9457-5
29/03/2017	15	L1		95.5	PASS	110	9457-5
31/03/2017	16	L1		99	PASS	108	9457-6
31/03/2017	17	L1		99.5	PASS	107	9457-6
31/03/2017	18	L1		98	PASS	101	9457-6
4/04/2017	19	L1		95	PASS	135	9457-7
4/04/2017	20	L1		99.5	PASS	134	9457-7
4/04/2017	21	L1		104	PASS	129	9457-7
4/04/2017	22	L1		107.5	PASS	119	9457-7

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

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report No 9457-1

date of issue 07-Mar-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 1
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	CC
time	All Day
date	27-Feb-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**1**	**2**	**3**			
location Lot No		117	116	115			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1			
measurement depth	mm	275	275	275			
field wet density	t/m^3	2.01	2.00	1.98			
field dry density	t/m^3	1.68	1.68	1.71			
field moisture content	%	19.6	19.4	16.0			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.03	2.05	2.05			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		1.0	1.0	-1.0			
Moisture ratio	**%**	**106.5**	**106.5**	**94.0**			
Hilf density ratio (R_{HD})	**%**	**99.0**	**97.5**	**97.0**			

material description

Silty CLAY

NATA ACCREDITED FOR TECHNICAL COMPETENCE

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards.
Accredited for compliance with ISO/IEC 17025- Testing

LABORATORY ACCREDITATION No **15357**

Approved Signature

C Caulfield

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

47 National Avenue, Pakenham VIC 3810
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report No 9457-2
date of issue 07-Mar-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 1
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	CC
time	All Day
date	28-Feb-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**4**	**5**	**6**			
location Lot No		114	114	115			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 2	Layer 2			
measurement depth	mm	275	275	275			
field wet density	t/m^3	2.05	2.07	2.06			
field dry density	t/m^3	1.74	1.84	1.77			
field moisture content	%	17.6	12.2	16.2			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.10	2.12	2.13			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		0.5	3.0	2.5			
Moisture ratio	**%**	**103.5**	**131.5**	**120.0**			
Hilf density ratio (R_{HD})	**%**	**97.5**	**97.5**	**96.5**			

material description

Silty CLAY

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

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47 National Avenue, Pakenham VIC 3810

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report No 9457-3

date of issue 07-Mar-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 1
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	CC
time	All Day
date	04-Mar-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**7**	**8**	**9**			
location	Lot No	127	128	126			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 2			
measurement depth	mm	275	275	275			
field wet density	t/m^3	2.03	2.05	2.04			
field dry density	t/m^3	1.75	1.75	1.74			
field moisture content	%	16.1	16.9	16.9			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.10	2.07	2.02			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		1.0	-1.0	-0.5			
Moisture ratio	**%**	**107.0**	**95.5**	**96.5**			
Hilf density ratio (R_{HD})	**%**	**96.5**	**99.0**	**101.0**			

material description

Silty CLAY

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LABORATORY ACCREDITATION No **15357**

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/ersion 6 October 2016

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BY NUCLEAR GAUGE METHOD

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47 National Avenue, Pakenham VIC 3810

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report No 9457-4

date of issue 08-Mar-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 1
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	CC
time	PM
date	06-Mar-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**10**	**11**	**12**			
location Lot No		126	127	128			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 3	Layer 3	Layer 2			
measurement depth	mm	275	275	275			
field wet density	t/m^3	2.09	2.06	2.08			
field dry density	t/m^3	1.81	1.80	1.79			
field moisture content	%	15.4	14.5	16.0			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.19	2.17	2.14			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		1.5	0.5	1.5			
Moisture ratio	**%**	**111.5**	**103.5**	**108.5**			
Hilf density ratio (R_{HD})	**%**	**95.5**	**95.0**	**97.0**			

material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

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47 National Avenue, Pakenham VIC 3810

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report No 9457-5

date of issue 04-Apr-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 1
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	250

tested by	SP
time	03:53 PM
date	29-Mar-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**13**	**14**	**15**			
location Lot No		112	113	110			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1			
measurement depth	mm	225	225	225			
field wet density	t/m^3	2.04	2.01	2.02			
field dry density	t/m^3	1.72	1.67	1.68			
field moisture content	%	18.2	20.1	19.9			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.12	2.11	2.11			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		1.0	2.5	3.5			
Moisture ratio	**%**	**106.0**	**115.0**	**120.5**			
Hilf density ratio (R_{HD})	**%**	**96.0**	**95.0**	**95.5**			

material description

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/ersion 6 October 2016

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

47 National Avenue, Pakenham VIC 3810
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report No 9457-6
date of issue 04-Apr-2017

Client	Streetworks	Feature	Block Fill	tested by	TR
Client address	4 Len Thomas Place, Narre Warren, 3805			time	All Day
Project	Summerhill Stage 1	Layer thickness (mm)	300	date	31-Mar-2017
Location	Cranbourne			checked by	SB

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**16**	**17**	**18**			
location Lot No		108	107	101			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1			
measurement depth	mm	275	275	275			
field wet density	t/m^3	2.08	2.10	2.07			
field dry density	t/m^3	1.74	1.74	1.83			
field moisture content	%	19.4	20.2	13.0			
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0	19.0			
percent of oversize material	wet	0	0	0			
peak converted wet density	t/m^3	2.10	2.11	2.11			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		1.5	3.0	-1.0			
Moisture ratio	**%**	**108.0**	**117.5**	**93.5**			
Hilf density ratio (R_{HD})	**%**	**99.0**	**99.5**	**98.0**			

material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

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report No 9457-7

date of issue 06-Apr-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 1
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	200

tested by	DM
time	All Day
date	04-Apr-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**19**	**20**	**21**	**22**		
location	Lot No	135	134	129	119		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1	Layer 1		
measurement depth	mm	275	275	275	275		
field wet density	t/m^3	1.96	1.93	2.03	1.97		
field dry density	t/m^3	1.72	1.49	1.78	1.89		
field moisture content	%	14.0	29.8	13.9	4.1		
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard	standard		
oversize material retained on AS sieve	mm	19.0	19.0	19.0	19.0		
percent of oversize material	wet	0	0	0	0		
peak converted wet density	t/m^3	2.06	1.94	1.95	1.84		
adjusted peak converted wet density	t/m^3	-	-	-	-		
moisture variation from OMC (-dry,+wet)%		3.5	1.0	1.0	-2.5		
Moisture ratio	**%**	**129.5**	**103.0**	**108.0**	**67.5**		
Hilf density ratio (R_{HD})	**%**	**95.0**	**99.5**	**104.0**	**107.5**		

material description

Sandy CLAY

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