FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 2

Causeway Geotechnical Reports

Historical Landfills in North Kerry - Ardfert

Client:	Kerry County Council
Client's Representative:	Feehily Timoney
Report No.:	18-1068d
Date:	September 2019
Status:	Final for Issue

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Approved: ISO 9001 • ISO 14001 • OHSAS 18001

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APPENDICES

Document Control Sheet

Report No.:		18-1068d			
Project Title:		Historical Landfills in North Kerry - Ardfert			
Client:		Kerry County Council			
Client's Representative:		Fehily Timoney			
Revision:	A00	**Status:**	Final for Issue	**Issue Date:**	23 September 2019
Prepared by:		**Reviewed by:**		**Approved by:**	
Sean Ross BSc MSc		Colm Hurley BSc FGS		Darren O'Mahony BSc MSc MIEI EurGeol PGeo	

The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Liner sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
▽	Water strike: initial depth of strike
▼	Water strike: depth water rose to
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum).

Historical Landfills in North Kerry - Ardfert

1 AUTHORITY

On the instructions of Fehily Timoney Consulting Engineers, ("the Client's Representative"), acting on the behalf of Kerry County Council ("the Client"), a ground investigation was undertaken at the above location to allow the geotechnical and environmental assessment of the historical landfill present on site. The information will input into the Tier 2 and 3 reports being compiled by the Client's Representative.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, trial pits, soil sampling, environmental sampling, laboratory testing, and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted on the site 100m north of Ardfert Town Centre in Ardfert, Co. Kerry. The site is located adjacent to Ardfert Cathedral of St. Brendan and is bordered to the north by agricultural fields and to the west by a local access road.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 29th May and 21st June 2019, comprised:

- two boreholes by rotary drilling methods;
- one standpipe installation; and
- four machine dug trial pits.

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

Two boreholes (BH01-BH02) were put to their completion by rotary drilling techniques only. The boreholes were completed using a Hanjin 8D tracked rotary drilling rig.

Symmetrix-cased full hole rotary percussive drilling techniques were employed to advance the boreholes to scheduled depths.

Appendix B presents the borehole logs.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in BH01 and BH02.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 Trial Pits

Four trial pits (TP01–TP04) were excavated using a 3t tracked excavator fitted with a 600mm wide bucket, to a maximum depth of 4.00m.

Environmental samples were taken at various depths of in each trial pit.

Disturbed (bulk bag) samples were taken at standard depth intervals and at change of strata.

Groundwater was not noted during excavation of any of the trial pits. The stability of the trial pit walls was noted on completion.

Appendix C presents the trial pit logs with photographs of the pits and arising provided in Appendix D.

4.5 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish National Grid) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **permeability testing:** permeability by triaxial compression

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix E.

5.2 Environmental laboratory testing of soils

Environmental testing, as specified by the Client's Representative was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out according to Engineer's Ireland Suite E which comprises a single stage waste acceptance criteria (WAC) test.

Results of environmental laboratory testing are presented in Appendix F.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprises alluvium and glacial till with bedrock at subcrop level across the site. These deposits are underlain by limestones of the Cloonagh Limestone Formation.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** encountered across the site with a thickness range of 200 – 500mm.
- **Made Ground (fill):** reworked sandy gravelly clay fill with various amounts of plastic bags, plastic bottles, clothes, shoes and glass bottles to a maximum depth of 4.50m in BH01.
- **Bedrock (Limestone):** Rockhead was encountered at depths of 1.10m in BH01 and 4.50m in BH02.

6.3 Groundwater

Groundwater was not encountered during drilling of any of the boreholes nor during excavation of any of the trial pits.

7 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description

BS EN ISO 22282-2: 2012: Geotechnical investigation and testing. Geohydraulic testing – Part 2: Water permeability tests in a borehole using open systems.

APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

Project No.:	18-1068d	**Client:**	Kerry County Council
Project Name:	Historical Landfills in North Kerry - Ardfert	**Client's Representative:**	Fehily Timoney

Legend Key

Title:
Site Location Plan

Last Revised:	**Scale:**
16/08/2019	1:10000

CAUSEWAY GEOTECH

Project No.:	18-1068d	**Client:**	Kerry County Council
Project Name:	Historical Landfills in North Kerry - Ardfert	**Client's Representative:**	Fehily Timoney

Legend Key

- Locations By Type - RO
- Locations By Type - TP

Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
16/08/2019	1:1000

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	14.50

Project No.: 18-1068d

Project Name: Historical Landfills in North Kerry - Ardfert

Borehole No.: BH01

Coordinates: 78444.64 E, 121169.49 N

Client: Kerry County Council

Sheet 1 of 2

Client's Representative: Fehily Timoney

Scale: 1:50

Driller: KW

Ground Level: 12.01 mOD

Dates: 21/06/2019

Logger: PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(1.10)		MADE GROUND: Brownish grey silty GRAVEL. (Driller's description)
					10.91	1.10		Grey LIMESTONE. (Driller's description)
						(13.40)		

Water | Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5

Remarks
No groundwater encountered.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
7.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	14.50

Project No.: 18-1068d

Project Name: Historical Landfills in North Kerry - Ardfert

Borehole No.: BH01

Coordinates: 78444.64 E, 121169.49 N

Client: Kerry County Council

Sheet 2 of 2

Client's Representative: Fehily Timoney

Scale: 1:50

Driller: KW

Ground Level: 12.01 mOD

Dates: 21/06/2019

Logger: PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								Grey LIMESTONE. (Driller's description)		
					-2.49	14.50		End of Borehole at 14.50m		

Remarks
No groundwater encountered.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
7.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Rotary Drilling	Hanjin 8D	0.00	7.00

Project No.: 18-1068d

Project Name: Historical Landfills in North Kerry - Ardfert

Borehole No.: BH02

Coordinates: 78534.31 E, 121158.17 N

Client: Kerry County Council

Sheet 1 of 1

Client's Representative: Fehily Timoney

Scale: 1:50

Driller: KW

Ground Level: 16.98 mOD

Dates: 21/06/2019

Logger: PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(1.50)		TOPSOIL. (Driller's description)
					15.48	1.50		Soft dark greyish black clayey SILT with general waste. (Driller's description)
2.50	ES1					(3.00)		
					12.48	4.50		Grey LIMESTONE. (Driller's description)
						(2.50)		
					9.98	7.00		End of Borehole at 7.00m

Water | Backfill

Remarks
No groundwater encountered.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
7.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

APPENDIX C

TRIAL PIT LOGS

CAUSEWAY GEOTECH

Project No.: 18-1068d	**Project Name:** Historical Landfills in North Kerry - Ardfert		**Trial Pit No.:** TP01
Co-ordinates: 78536.04 E 121147.85 N	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Fehily Timoney		**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 17.80 mOD	**Date:** 29/05/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.50)		TOPSOIL: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are of limestone and concrete.	
0.50	B3		17.30	0.50		MADE GROUND: Firm dark grey clayey SILT.	
1.00	B4			(0.80)			
1.00	ES1						
			16.50	1.30		MADE GROUND: Firm dark brown, dark grey slightly sandy slightly gravelly silty CLAY with low cobble and boulder content with some pieces of plastic. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are subrounded of limestone.	
				(2.70)			
4.00	ES2		13.80	4.00		End of trial pit at 4.00m	

Remarks
No groundwater encountered.

Terminated due to >1.5m of landfill material present.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.90

Length: 2.90

CAUSEWAY GEOTECH

Project No.: 18-1068d	**Project Name:** Historical Landfills in North Kerry - Ardfert		**Trial Pit No.:** TP02
Co-ordinates: 78534.47 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	121171.76 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 14.83 mOD	**Date:** 29/05/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.20)		TOPSOIL	
			14.63	0.20			
0.50	B2			(0.70)		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	
			13.93	0.90			
				(1.70)		Firm dark brown to very dark grey slightly sandy slightly gravelly silty CLAY with low cobble and boulder content, plastic bags, and bottles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles an boulders are subrounded of limestone.	
2.60	ES1		12.23	2.60		End of trial pit at 2.60m	

Remarks
No groundwater encountered.

Terminated due to >1.5m of landfill material present.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.10

Length: 2.70

CAUSEWAY GEOTECH

Project No.: 18-1068d	**Project Name:** Historical Landfills in North Kerry - Ardfert		**Trial Pit No.:** TP03
Co-ordinates: 78561.29 E 121158.49 N	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Fehily Timoney		**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 16.49 mOD	**Date:** 29/05/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.20)		TOPSOIL	
			16.28	0.20			
0.50	B1			(1.00)		MADE GROUND: Firm greyish brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are of limestone and concrete building material	
			15.28	1.20			
				(0.80)		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content and rubbish including plastic bags, bottles, cloth and shoes. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are subangular to subrounded of limestone and concrete.	
			14.48	2.00		End of trial pit at 2.00m	

Remarks
No groundwater encountered.

Terminated on obstruction.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.90

Length: 3.00

CAUSEWAY GEOTECH

Project No.: 18-1068d	**Project Name:** Historical Landfills in North Kerry - Ardfert		**Trial Pit No.:** TP04
Co-ordinates: 78502.63 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	121158.17 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 15.13 mOD	**Date:** 29/05/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.20)		TOPSOIL	
			14.93	0.20		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subrounded of limestone.	
				(0.50)			
0.70	B3		14.43	0.70		MADE GROUND: Firm light brown CLAY.	
				(0.25)			
			14.18	0.95		MADE GROUND: Thick layer of refuse sacks.	
			14.08	(0.10) 1.05		MADE GROUND: Firm dark greyish brown sandy gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	
1.10	B4						
1.10	ES1						
				(0.45)			
1.50	B5		13.63	1.50		MADE GROUND: Firm brown sandy gravelly silty CLAY with low cobble content, rubbish including plastic, plastic bags and glass bottles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subrounded of various lithologies	
				(1.00)			
2.50	B6		12.63	2.50		End of trial pit at 2.50m	
2.50	ES2						

Remarks
No groundwater encountered.

Terminated due to >1.5m of landfill material present.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.90

Length: 2.80

CAUSEWAY GEOTECH

APPENDIX D

TRIAL PIT PHOTOGRAPHS

TP01 – N Face

TP01 – E Face

TP01 – S Face

TP01 – W Face

TP01 – Base

TP01 – Spoil heap

TP01 – Spoil heap

TP02 – SSE Face

TP02 – WSW Face

TP02 – NNW Face

TP02 – ENE Face

TP02 – Base

TP02 – Spoil heap

TP02 – Spoil heap

TP03 – W Face

TP03 – N Face

TP03 – E Face

TP03 – S Face

TP03 – Base

TP03 – Spoil heap

TP03 – Spoil heap

TP04 – NE Face

TP04 – SE Face

TP04 – SW Face

TP04 – NW Face

TP04 – Base

TP04 – Spoil heap

TP04 – Spoil heap

CAUSEWAY GEOTECH

APPENDIX E

GEOTECHNICAL LABORATORY TEST RESULTS

LABORATORY REPORT

4043

Contract Number: PSL19/3894

Report Date: 15 August 2019

Client's Reference: 18-1068d

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Ardfert

Date Received: 26/6/2019
Date Commenced: 26/6/2019
Date Completed: 15/8/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

S Royle (Laboratory Manager)
S Eyre (Senior Technician)
L Knight (Senior Technician)

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PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990: Clause 6

Hole Number:	**TP03**	**Top Depth (m) :**	**0.50**
Sample Number:	**1**	**Base Depth (m) :**	
Sample Type:	**B**	**Lift Number:**	
Date		**Grid Reference:**	

Description of Specimen
Brown slightly gravelly slightly sandy CLAY
Remarks
Remoulded with 4.5kg rammer

Initial Specimen Conditions		
Height	mm	102.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	817.21
Mass	g	1563
Dry Mass	g	1240
Bulk Density	Mg/m^3	1.91
Dry Density	Mg/m^3	1.52
Moisture Content	%	26
Voids Ratio	-	0.747
Specific Gravity	Mg/m^3	2.65
(assumed/measured)	-	assumed

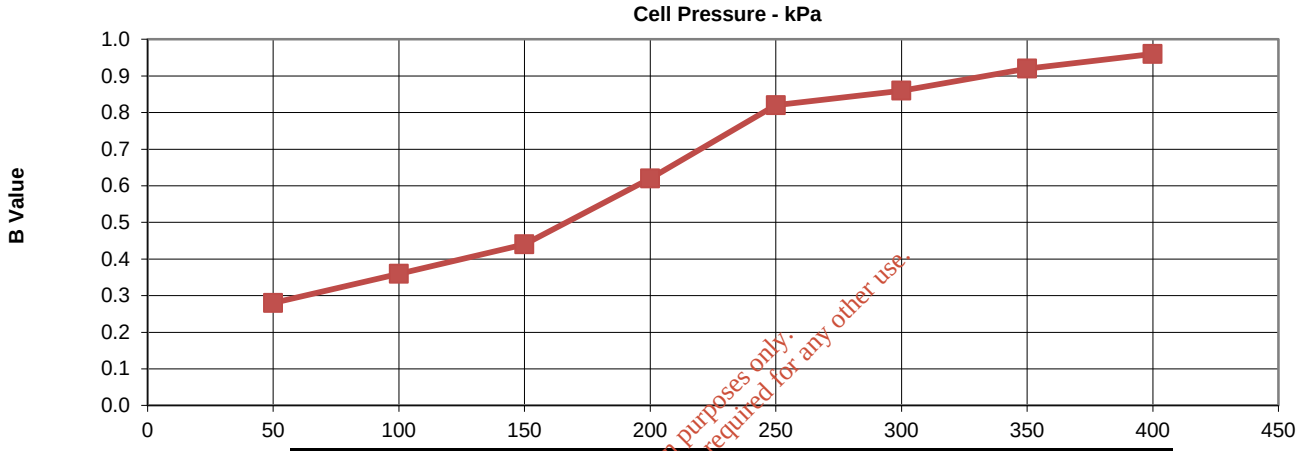
Final Specimen Conditions		
Moisture Content	%	27
Bulk Density	Mg/m^3	1.93
Dry Density	Mg/m^3	1.52

Test Setup		
Date Started		01/08/2019
Date Finished		14/08/2019
Top Drain Used		Y
Base Drain Used		Y
Method of Saturation		By back pressure
Direction Of Flow		Vertically Downwards
Saturation Time	Days	2
Consolidation Time	Days	7
Permeability Time	Days	2

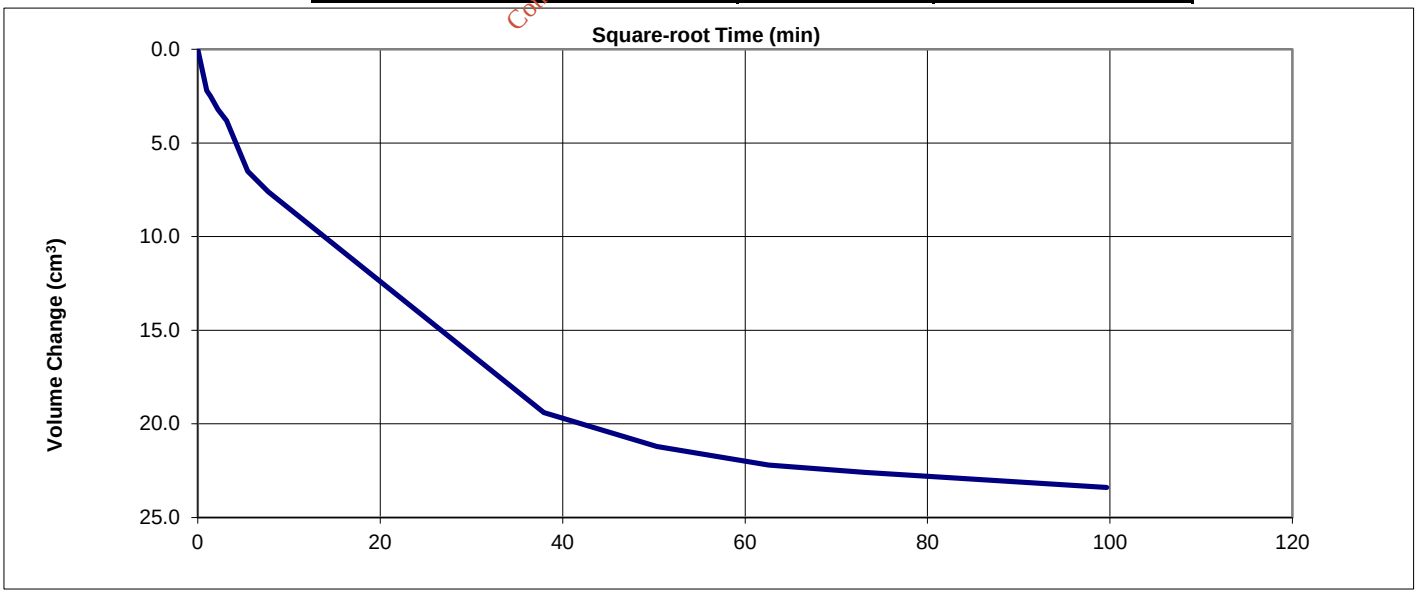
PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP03
Sample Depth	m	0.50
Sample No,		1
Grid Reference		
Lift Number		
Saturation		
Cell Pressure Incr.	kPa	50
Back Pressure Incr.	kPa	50
Differential Pressure	kPa	10
Final Cell Pressure	kPa	400
Final B Value	-	0.96



Consolidation		
Effective Pressure	kPa	100
Cell Pressure	kPa	500
Back Pressure	kPa	400
Final PWP	kPa	404
PWP dissipation	%	95



UKAS TESTING 4043

PSL Professional Soils Laboratory

Ardfert

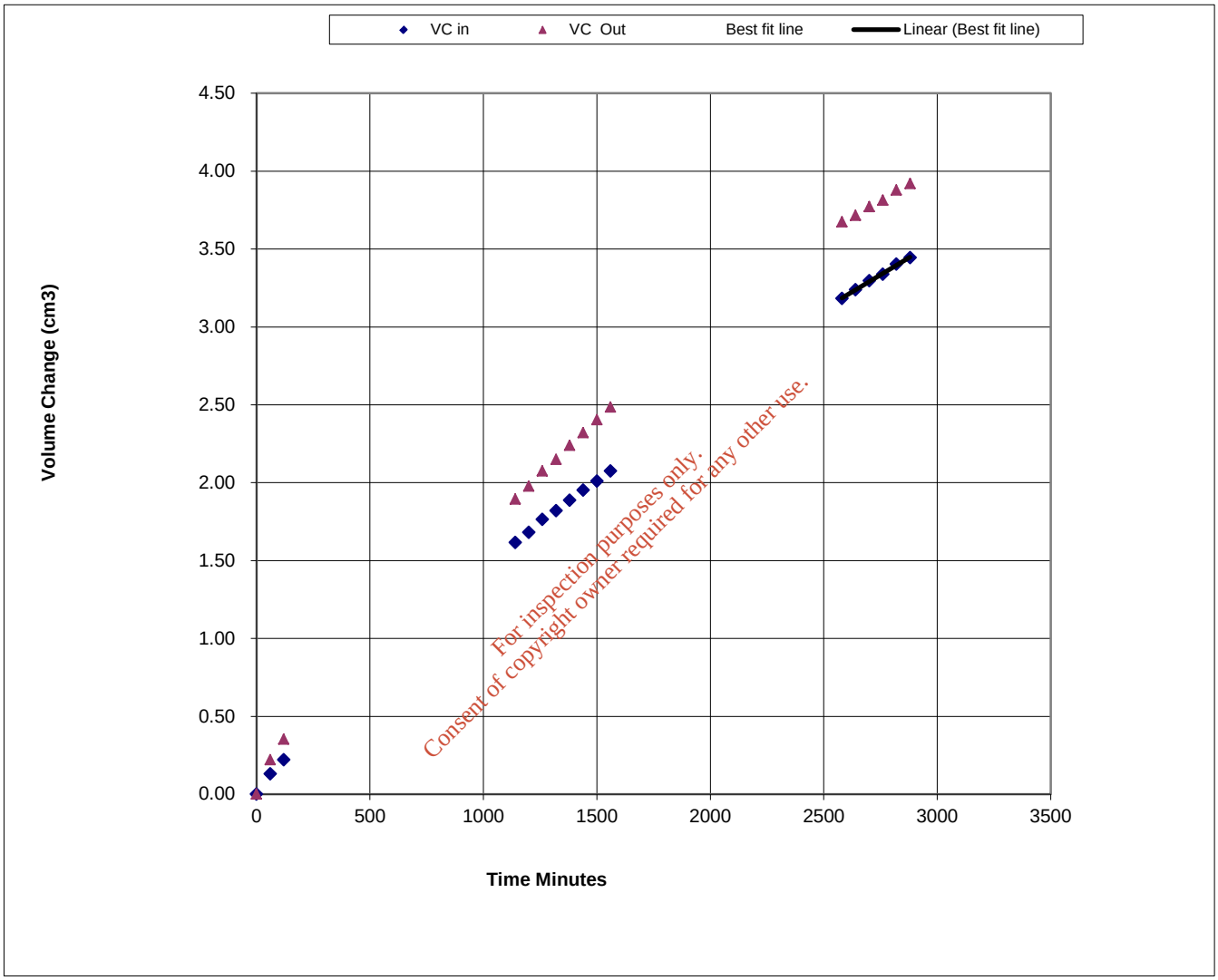
Contract No.
PSL19/3894
Client Ref
18-1068d

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP03
Sample Depth	m	0.50
Sample No.		1
Grid Reference		
Lift Number		

Permeability Stage



Permeability Stage		
Cell Pressure	kPa	500
Mean Effective Stress	kPa	100
Back Pressure Diff.	kPa	20
Mean Rate of Flow	ml/min	0.0009
Average Temperature	'C	20
Vertical Permeability Kv	m/s	9.0E-11

APPENDIX F

ENVIRONMENTAL LABORATORY TEST RESULTS

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-18923-1
Initial Date of Issue:	17-Jun-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Lucy Peaker Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen Watson Stuart Abraham
Project	18-1068d Ardfest

Quotation No.:	Q18-13245	**Date Received:**	05-Jun-2019
Order No.:		**Date Instructed:**	10-Jun-2019
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	14-Jun-2019
Date Approved:	17-Jun-2019		

Approved By:

Details: Martin Dyer, Laboratory Manager

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Single Stage WAC

Project: 18-1068d Ardfest

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-18923						
Chemtest Sample ID:	837867						
Sample Ref:							
Sample ID:							
Sample Location:	TP03						
Top Depth(m):	2.0						
Bottom Depth(m):							
Sampling Date:	29-May-2019						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	3.7	3	5	6
Loss On Ignition	2610	U	%	7.0	--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.038	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0022	< 0.050	0.5	2	25
Barium	1450	U	0.0083	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.0012	< 0.050	0.5	10	70
Copper	1450	U	0.0027	< 0.050	2	50	100
Mercury	1450	U	0.0015	0.015	0.01	0.2	2
Molybdenum	1450	U	0.0040	< 0.050	0.5	10	30
Nickel	1450	U	0.0014	< 0.050	0.4	10	40
Lead	1450	U	0.0015	0.015	0.5	10	50
Antimony	1450	U	0.0012	0.012	0.06	0.7	5
Selenium	1450	U	0.0014	0.014	0.1	0.5	7
Zinc	1450	U	0.0016	< 0.50	4	50	200
Chloride	1220	U	3.2	32	800	15000	25000
Fluoride	1220	U	0.13	1.3	10	150	500
Sulphate	1220	U	14	140	1000	20000	50000
Total Dissolved Solids	1020	N	120	1200	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	12	120	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	19

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Chemtest
The right chemistry to deliver results

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

LABORATORY REPORT

4043

Contract Number: PSL19/3894

Report Date: 15 August 2019

Client's Reference: 18-1068d

Client Name: Causeway Geotech
8 Drumahiskey Road
Ballymoney
Co.Antrim
BT53 7QL

For the attention of: Stephen Watson

Contract Title: Ardfert

Date Received: 26/6/2019
Date Commenced: 26/6/2019
Date Completed: 15/8/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

S Royle (Laboratory Manager)
S Eyre (Senior Technician)
L Knight (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990: Clause 6

Hole Number:	**TP03**	**Top Depth (m) :**	**0.50**
Sample Number:	**1**	**Base Depth (m) :**	
Sample Type:	**B**	**Lift Number:**	
Date		**Grid Reference:**	

Description of Specimen
Brown slightly gravelly slightly sandy CLAY
Remarks
Remoulded with 4.5kg rammer

Initial Specimen Conditions		
Height	mm	102.00
Diameter	mm	101.00
Area	mm^2	8011.85
Volume	cm^3	817.21
Mass	g	1563
Dry Mass	g	1240
Bulk Density	Mg/m^3	1.91
Dry Density	Mg/m^3	1.52
Moisture Content	%	26
Voids Ratio	-	0.747
Specific Gravity	Mg/m^3	2.65
(assumed/measured)	-	assumed

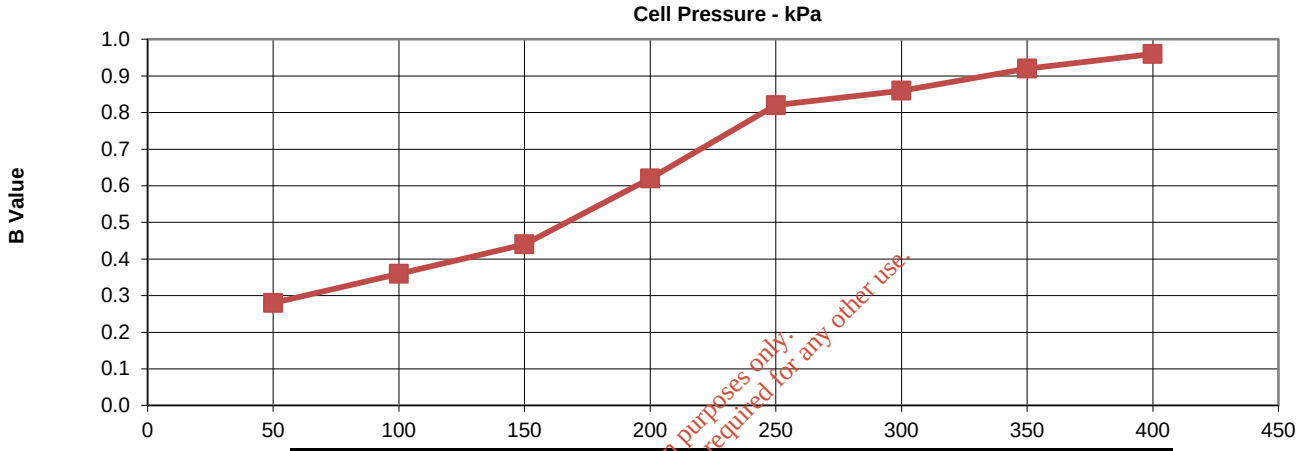
Final Specimen Conditions		
Moisture Content	%	27
Bulk Density	Mg/m^3	1.93
Dry Density	Mg/m^3	1.52

Test Setup		
Date Started		01/08/2019
Date Finished		14/08/2019
Top Drain Used		Y
Base Drain Used		Y
Method of Saturation		By back pressure
Direction Of Flow		Vertically Downwards
Saturation Time	Days	2
Consolidation Time	Days	7
Permeability Time	Days	2

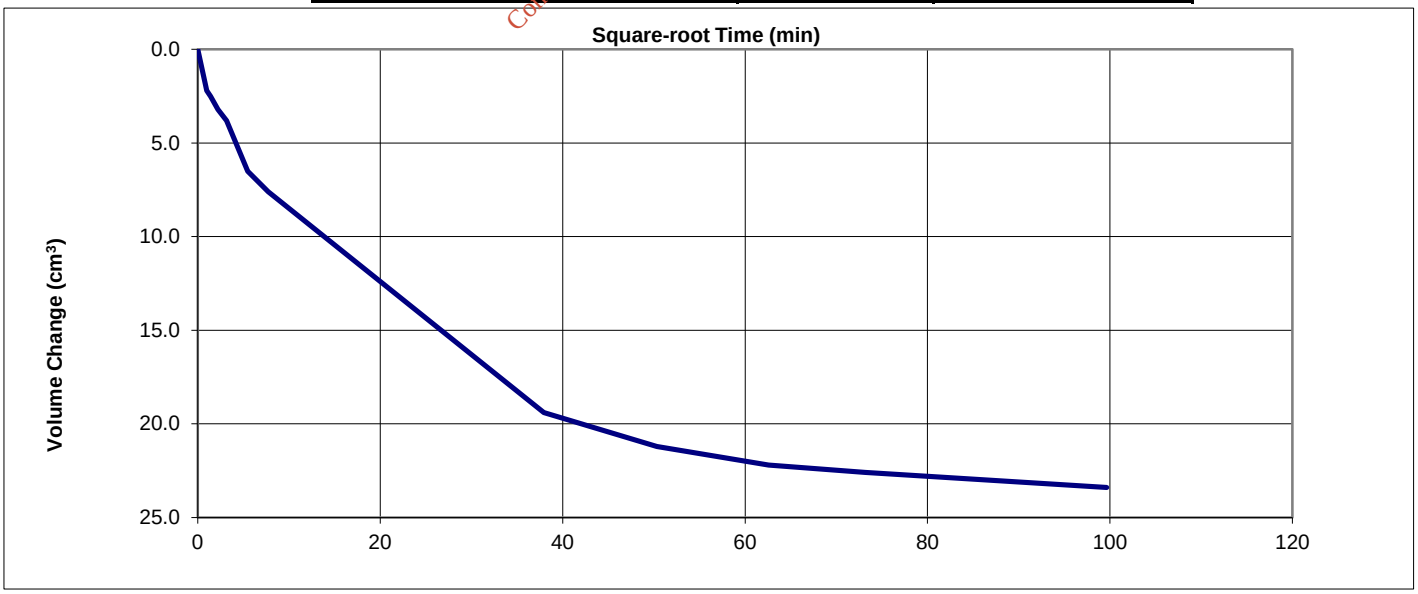
PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP03
Sample Depth	m	0.50
Sample No,		1
Grid Reference		
Lift Number		
Saturation		
Cell Pressure Incr.	kPa	50
Back Pressure Incr.	kPa	50
Differential Pressure	kPa	10
Final Cell Pressure	kPa	400
Final B Value	-	0.96



Consolidation		
Effective Pressure	kPa	100
Cell Pressure	kPa	500
Back Pressure	kPa	400
Final PWP	kPa	404
PWP dissipation	%	95



UKAS TESTING 4043

PSL Professional Soils Laboratory

Ardfert

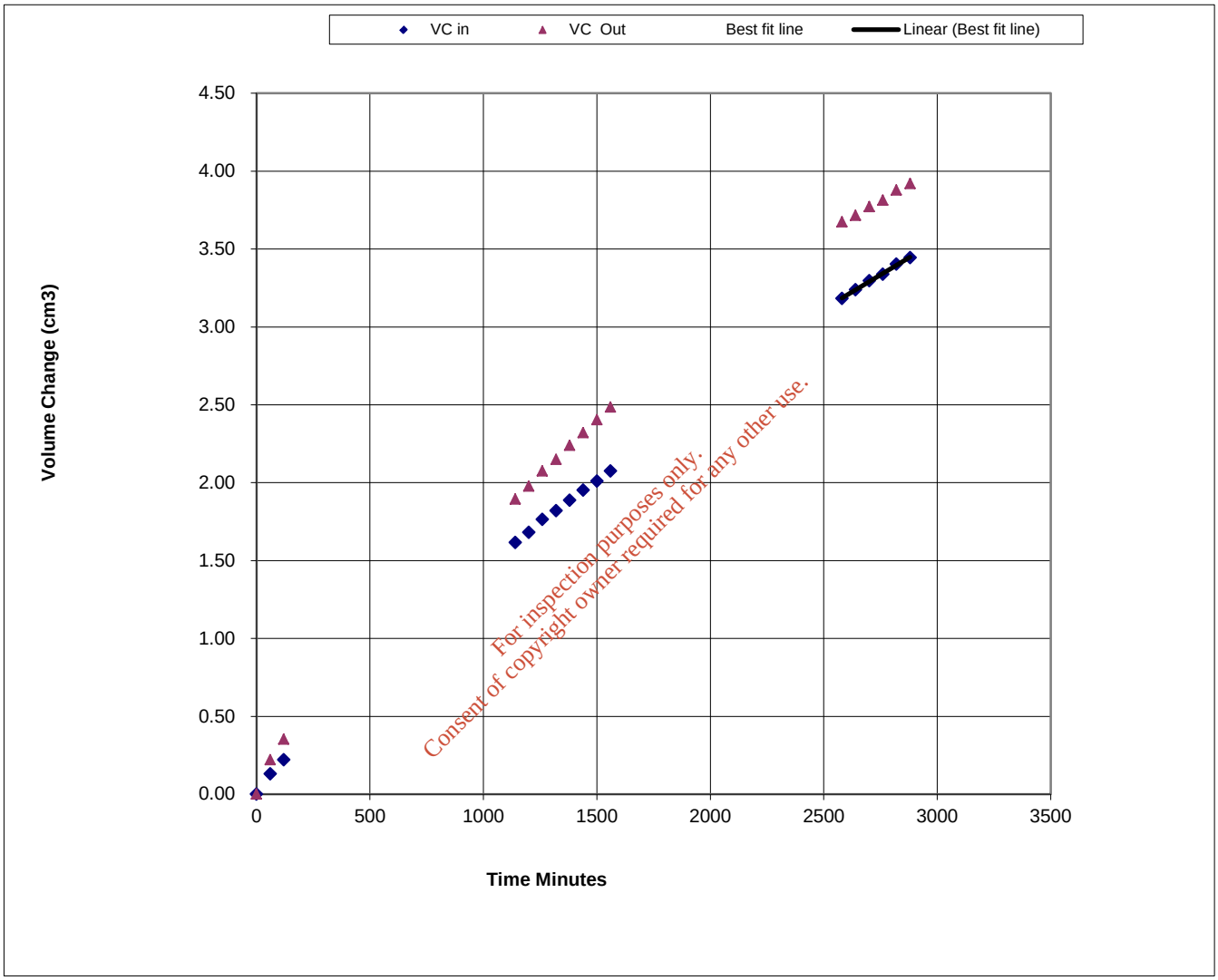
Contract No.
PSL19/3894
Client Ref
18-1068d

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP03
Sample Depth	m	0.50
Sample No.		1
Grid Reference		
Lift Number		

Permeability Stage



Permeability Stage		
Cell Pressure	kPa	500
Mean Effective Stress	kPa	100
Back Pressure Diff.	kPa	20
Mean Rate of Flow	ml/min	0.0009
Average Temperature	'C	20
Vertical Permeability Kv	m/s	9.0E-11