FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 3

CGL Site Investigation Report

Historical Landfills in South and West Kerry - Dingle

Client:	Kerry County Council
Client's Representative:	Feehily Timoney
Report No.:	18-1123b
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.:		18-1123b			
Project Title:		Historical Landfills in South and West Kerry - Dingle			
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 South and West Kerry - Dingle

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, in-situ and 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 off the R559 north west of Dingle, Co.Kerry. the site is bounded by the R559 to the north and east, by agricultural lands to the south and north and by a local stream to the west.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 4th and 18th June 2019, comprised:

- one borehole by rotary drilling methods;
- one standpipe installation; and
- five 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

One borehole (BH01) was put to its completion by rotary drilling techniques only. The borehole was completed using a Hanjin 8D tracked rotary drilling rig.

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

Appendix B presents the borehole logs.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in BH01.

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–TP05) were excavated using a 8t tracked excavator fitted with a 600mm wide bucket, to a maximum depth 3.50m.

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 encountered during the excavation of any of the 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 of 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 comprise Glacial Till. These deposits are underlain by sandstone of the Coumeenoole Sandstone Formation and sandstones and conglomerates of the Slea Head 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 100 – 250mm.
- **Made Ground (fill):** reworked sandy gravelly clay/silt fill with varying amounts of plastic bags, glass bottles, bricks, clothes, shoes, plastic bottles encountered at all locations to a maximum depth of 5.00m in BH02.
- **Alluvium:** BH01 and BH02 encountered silt, sands and gravels to a maximum depth of 10.00m in BH02.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during drilling and trial pit excavation as water strikes as shown in Table 1 below.

Table 1 Groundwater strikes encountered during the ground investigation

GI Ref.	Water level (mbgl)	Comments
BH01	4.40	Rose to 4.00m after 10 mins
TP02	3.50	Seepage
TP03	2.40	Seepage
TP04	1.20	Seepage

It should be noted that the casing used in supporting the borehole walls during drilling may have sealed out additional groundwater strikes and the possibility of encountering groundwater at other depths should not be ruled out.

Groundwater was not noted during excavation of any of the other 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.

CAUSEWAY GEOTECH

APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

CAUSEWAY GEOTECH

Project No.:	18-1123b	**Client:**	Kerry County Council
Project Name:	Historical Landfills in South and West Kerry - Dingle	**Client's Representative:**	Fehily Timoney

Legend Key

Title:
Site Location Plan

Last Revised:	**Scale:**
23/09/2019	1:10000

CAUSEWAY GEOTECH

Project No.:	18-1123b	**Client:**	Kerry County Council
Project Name:	Historical Landfills in South and West Kerry - Dingle	**Client's Representative:**	Fehily Timoney

Legend Key

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

Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
23/09/2019	1:2500

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

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

Project No.: 18-1123b

Project Name: Historical Landfills in South and West Kerry - Dingle

Borehole No.: BH01

Coordinates: 42557.06 E, 102023.18 N

Client: Kerry County Council

Sheet 1 of 1

Client's Representative: Fehily Timoney

Scale: 1:50

Driller: KW

Ground Level: 10.13 mOD

Dates: 18/09/2019 - 18/06/2019

Logger: PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(0.50)		MADE GROUND: Hardcore fill. (Driller's description)
					9.63	0.50		MADE GROUND: Brown CLAY fill. (Driller's description)
						(2.30)		
					7.33	2.80		Grey silty fine SAND. (Driller's description)
						(1.60)		
				Water strike at 4.40m	5.73	4.40		SAND and GRAVEL. (Driller's description)
						(2.60)		
					3.13	7.00		End of Borehole at 7.00m

Water | Backfill

Remarks

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.40	4.40	10	4.00

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	10.00

Project No.: 18-1123b

Project Name: Historical Landfills in South and West Kerry - Dingle

Borehole No.: BH02

Coordinates: 42586.43 E, 101775.83 N

Client: Kerry County Council

Sheet 1 of 1

Client's Representative: Fehily Timoney

Scale: 1:50

Driller: KW

Ground Level: 10.71 mOD

Dates: 18/09/2019 - 18/06/2019

Logger: PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
						(2.00)		MADE GROUND: Brown CLAY. (Driller's description)
					8.71	2.00		WASTE. (Driller's description)
						(3.00)		
					5.71	5.00		Very sandy GRAVEL. (Driller's description)
						(2.80)		
					2.91	7.80		Brown sandy gravelly CLAY. (Driller's description)
						(0.90)		
				Water strike at 8.70	2.01	8.70		Brown sandy GRAVEL. (Driller's description)
						(1.30)		
					0.71	10.00		End of Borehole at 10.00m

Water | Backfill

Remarks

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
8.70	8.70		

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
10.00	200

Chiselling Details

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

APPENDIX C

TRIAL PIT LOGS

CAUSEWAY GEOTECH

Project No.: 18-1123b	**Project Name:** Historical Landfills in South and West Kerry - Dingle		**Trial Pit No.:** TP01
Co-ordinates: 42505.68 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	101952.10 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 12.63 mOD	**Date:** 04/06/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.20	B2		12.38	(0.25) 0.25		TOPSOIL: Firm brown slightly sandy sightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
1.75	ES1			(2.75)		MADE GROUND: Firm greyish brown slightly sandy slightly gravelly silty CLAY with low cobble and low boulder content and some rubbish, including plastic bags and glass bottles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are subangular to subrounded of limestone.	
			9.63	3.00		End of trial pit at 3.00m	

Remarks
No groundwater encountered.

Terminated due to >1.50m of landfill material present.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.10

Length: 3.20

CAUSEWAY GEOTECH

Project No.: 18-1123b	**Project Name:** Historical Landfills in South and West Kerry - Dingle		**Trial Pit No.:** TP02
Co-ordinates: 42579.68 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Tril Pitting	101866.27 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 12.12 mOD	**Date:** 04/06/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			12.02	(0.10) 0.10		TOPSOIL	
0.50 0.50	B3 ES1			(0.90)		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content and plastic bags. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
			11.12	1.00		MADE GROUND: Firm black pseudo-fibrous PEAT.	
			10.82	(0.30) 1.30		MADE GROUND: Firm grey to greyish brown slightly sandy slightly gravelly silty CLAY with low cobble content and some rubbish including plastic bags, glass bottles, building blocks, and clothing. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
2.50	ES2			(2.20)			
		Water strike at 3.50m.	8.62	3.50		End of trial pit at 3.50m	▼

Remarks

Terminated due water ingress.

Water Strikes:

Struck at (m):	Remarks:
3.50	Water strike at 3.50m.

Stability: Stable

Width: 1.00

Length: 3.40

CAUSEWAY GEOTECH

Project No.: 18-1123b	**Project Name:** Historical Landfills in South and West Kerry - Dingle		**Trial Pit No.:** TP03
Co-ordinates: 42623.50 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	101811.86 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 10.01 mOD	**Date:** 04/06/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			9.91	(0.10) 0.10		TOPSOIL	
0.30	B2			(0.65)		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content and plastic bags. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
			9.26	0.75		MADE GROUND: Grey slightly sandy slightly gravelly SILT with low cobble content and rubbish including, plastic bags, shoes, and plastic bottles. Sand is fine to coarse. Gravel s subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
				(1.85)			
2.30	ES1	Water strike at 2.40m					▼
			7.41	2.60		End of trial pit at 2.60m	

Remarks

Terminated due water ingress.

Water Strikes:

Struck at (m):	Remarks:
2.40	Water strike at 2.40m

Stability: Stable

Width: 0.95

Length: 3.20

CAUSEWAY GEOTECH

Project No.: 18-1123b	**Project Name:** Historical Landfills in South and West Kerry - Dingle		**Trial Pit No.:** TP04
Co-ordinates: 42610.66 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	101898.79 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 11.32 mOD	**Date:** 04/06/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			11.22	(0.10) 0.10		TOPSOIL	
						MADE GROUND: Firm brownish grey slightly sandy slightly gravelly silty CLAY with low cobble content and sa small amount of rubbish. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
0.50	B2			(0.80)			
			10.42	0.90		MADE GROUND: Firm greyish brown to brownish grey slightly sandy slightly gravelly silty CLAY with low cobble content and rubbish including, plastic bags, glass bottles, shoes and a spoon. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone and sandstone.	
		Seepage at 1.20m					▼
				(1.80)			
			8.62	2.70		End of trial pit at 2.70m	
2.80	ES1						

Remarks

Terminated due to >1.50m of landfill material present.

Water Strikes:

Struck at (m):	Remarks:
1.20	Seepage at 1.20m

Stability: Stable

Width: 0.90

Length: 3.60

CAUSEWAY GEOTECH

Project No.: 18-1123b	**Project Name:** Historical Landfills in South and West Kerry - Dingle		**Trial Pit No.:** TP05
Co-ordinates: 42560.48 E	**Client:** Kerry County Council		Sheet 1 of 1
Method: Trial Pitting	101845.16 N	**Client's Representative:** Fehily Timoney	**Scale:** 1:25
Plant: 3T Tracked Excavator	**Ground Level:** 12.18 mOD	**Date:** 04/06/2019	**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			12.08	(0.10) 0.10		TOPSOIL	
				(0.40)		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 subangular of limestone.	
0.50	B3		11.68	0.50		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content, plastic bags and plastic pipes. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone.	
				(0.80)			
			10.88	1.30		MADE GROUND: Firm greyish brown slightly sandy slightly gravelly silty CLAY with medium cobble and low boulder content, plastic bags and plastic bottles. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are subangular to subrounded of limestone.	
2.10	ES1			(1.80)			
3.10	ES2		9.08	3.10		End of trial pit at 3.10m	

Remarks
No groundwater encountered.

Terminated due to >1.50m of landfill material present.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.30

Length: 3.50

CAUSEWAY GEOTECH

APPENDIX D

TRIAL PIT PHOTOGRAPHS

TP01 – SSE Face

TP01 – WSW Face

TP01 – NNW Face

TP01 –ENE Face

TP01 – Base

TP01 – Spoil heap

TP01 – Spoil heap

TP02 – WNW Face

TP02 – NNE Face

TP02 – ESE Face

TP02 – SSW Fac

TP02 – Base

TP02 – Spoil heap

TP02 – Spoil heap

TP03 – NW Face

TP03 – NE Face

TP03 – SE Face

TP03 – SW Face

TP03 – Base

TP03 – Spoil heap

TP04 – SW Face

TP04 – NW Face

TP04 – NE Face

TP04 – SE Face

TP04 – Base

TP04 – Spoil heap

TP04 – Spoil heap

TP05 – N Face

TP05 – E Face

TP05 – S Face

TP05 – W Face

TP05 – Base

TP05 – Spoil heap

TP05 – Spoil heap

CAUSEWAY GEOTECH

APPENDIX E

GEOTECHNICAL LABORATORY TEST RESULTS

LABORATORY REPORT

4043

Contract Number: PSL19/4110

Report Date: 13 August 2019

Client's Reference: 18-1123b

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

For the attention of: Stephen Watson

Contract Title: Dingle

Date Received: 5/7/2019
Date Commenced: 5/7/2019
Date Completed: 13/8/2019

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)
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PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990: Clause 6

Hole Number:	**TP02**	**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 sandy SILT.
Remarks
Remoulded with 4.5kg rammer

Initial Specimen Conditions		
Height	mm	101.60
Diameter	mm	100.98
Area	mm^2	8008.67
Volume	cm^3	813.68
Mass	g	1663
Dry Mass	g	1361
Bulk Density	Mg/m^3	2.04
Dry Density	Mg/m^3	1.67
Moisture Content	%	22
Voids Ratio	-	0.584
Specific Gravity	Mg/m^3	2.65
(assumed/measured)	-	assumed

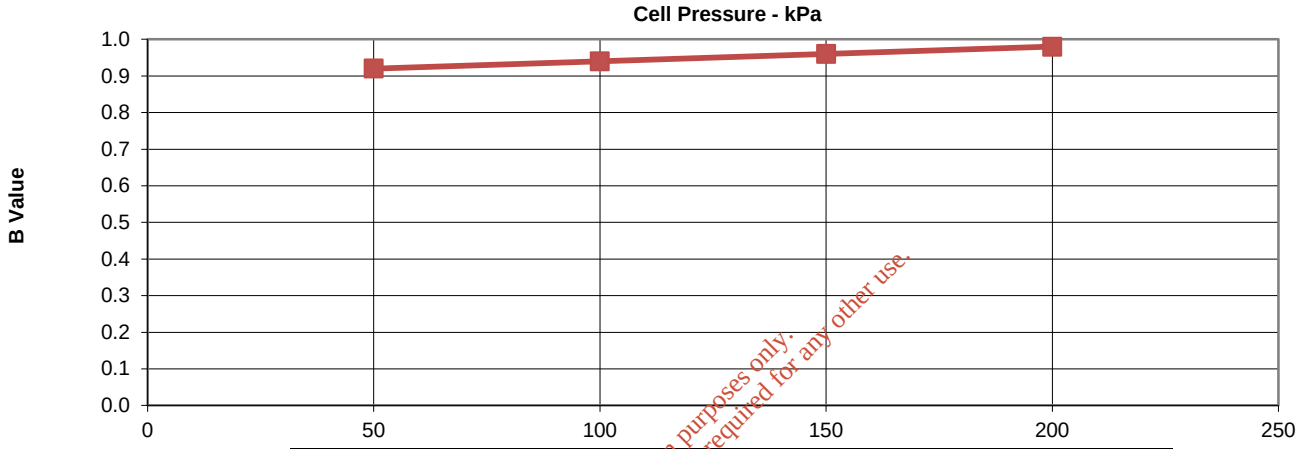
Final Specimen Conditions		
Moisture Content	%	20
Bulk Density	Mg/m^3	2.01
Dry Density	Mg/m^3	1.67

Test Setup		
Date Started		03/08/2019
Date Finished		12/08/2019
Top Drain Used		Y
Base Drain Used		Y
Method of Saturation		By back pressure
Direction Of Flow		Vertically Downwards
Saturation Time	Days	1
Consolidation Time	Days	1
Permeability Time	Days	1

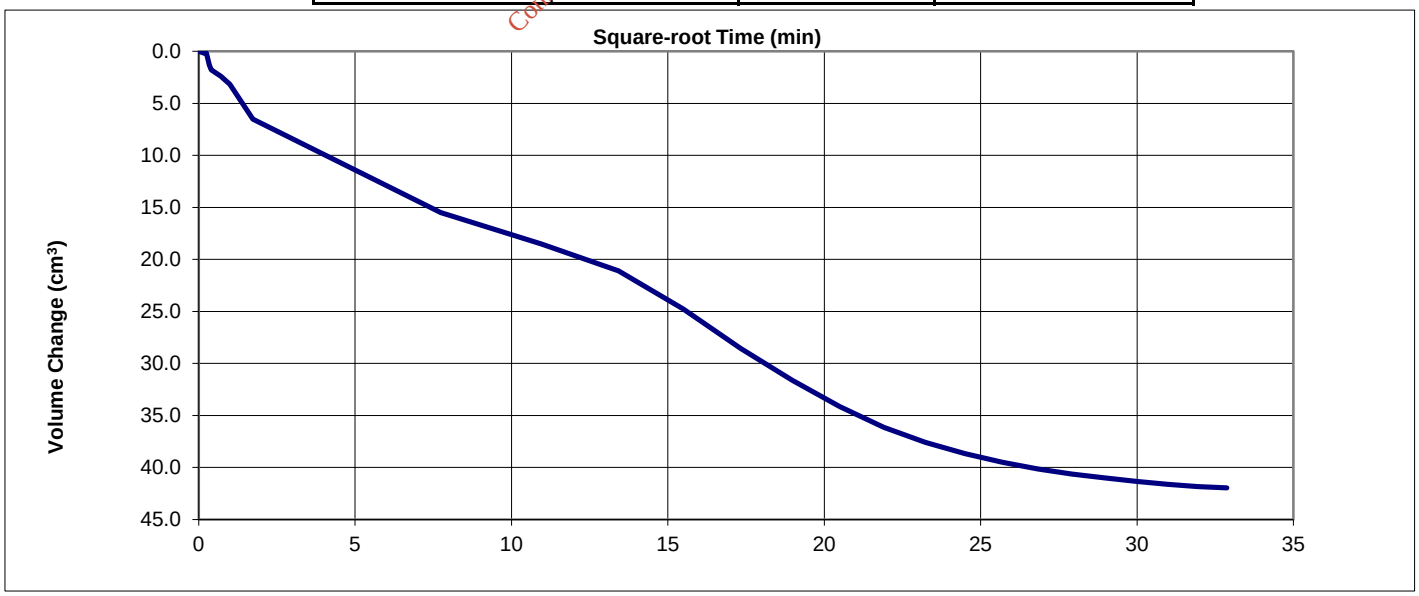
PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP02
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	200
Final B Value	-	0.98



Consolidation		
Effective Pressure	kPa	100
Cell Pressure	kPa	400
Back Pressure	kPa	300
Final PWP	kPa	301
PWP dissipation	%	99



UKAS TESTING 4043

PSL Professional Soils Laboratory

Dingle

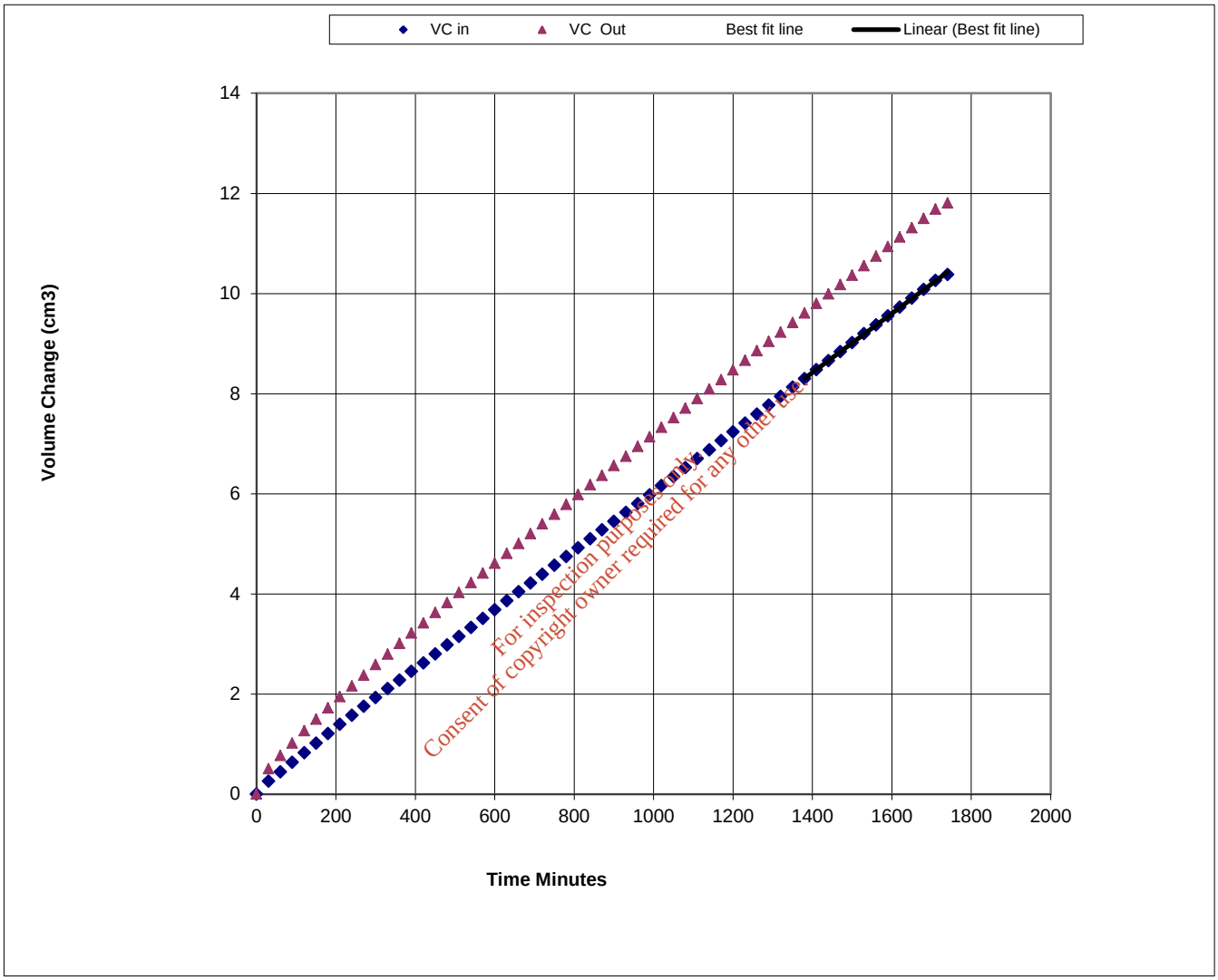
Contract No.
PSL19/4110
Client Ref
18-1123b

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP02
Sample Depth	m	0.50
Sample No.		1
Grid Reference		
Lift Number		

Permeability Stage



Permeability Stage		
Cell Pressure	kPa	400
Mean Effective Stress	kPa	100
Back Pressure Diff.	kPa	20
Mean Rate of Flow	ml/min	0.0058
Average Temperature	'C	20
Vertical Permeability Kv	m/s	6.0E-10

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990: Clause 6

Hole Number:	**TP03**	**Top Depth (m) :**	**0.30**
Sample Number:	**1**	**Base Depth (m) :**	
Sample Type:	**B**	**Lift Number:**	
Date		**Grid Reference:**	

Description of Specimen
Brown slightly gravelly very sandy SILT.
Remarks
Remoulded with 4.5kg rammer

Initial Specimen Conditions		
Height	mm	101.97
Diameter	mm	101.39
Area	mm^2	8073.84
Volume	cm^3	823.29
Mass	g	1796
Dry Mass	g	1569
Bulk Density	Mg/m^3	2.18
Dry Density	Mg/m^3	1.91
Moisture Content	%	14
Voids Ratio	-	0.390
Specific Gravity	Mg/m^3	2.65
(assumed/measured)	-	assumed

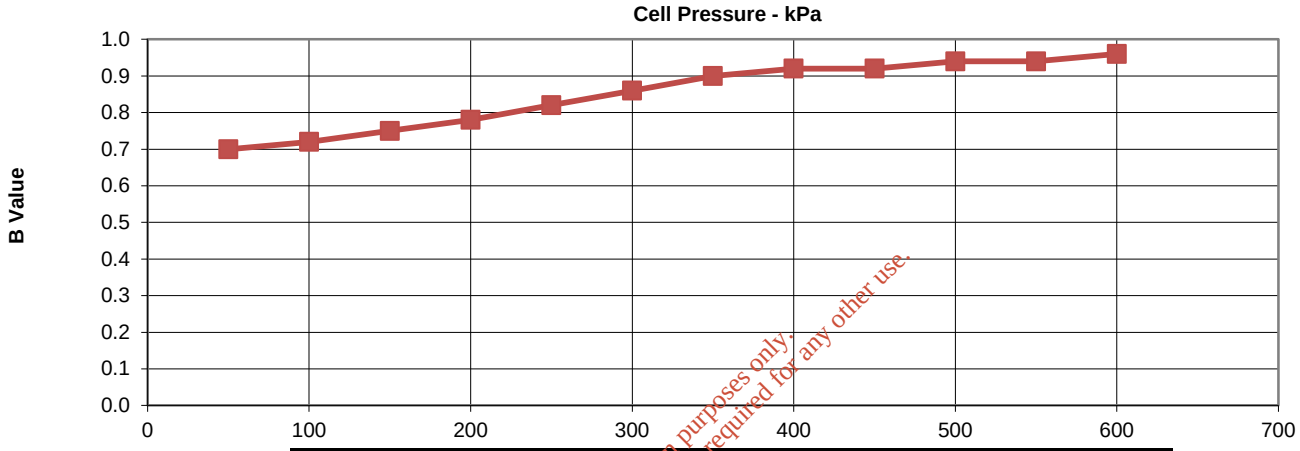
Final Specimen Conditions		
Moisture Content	%	14
Bulk Density	Mg/m^3	2.17
Dry Density	Mg/m^3	1.91

Test Setup		
Date Started		03/08/2019
Date Finished		12/08/2019
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	1
Permeability Time	Days	1

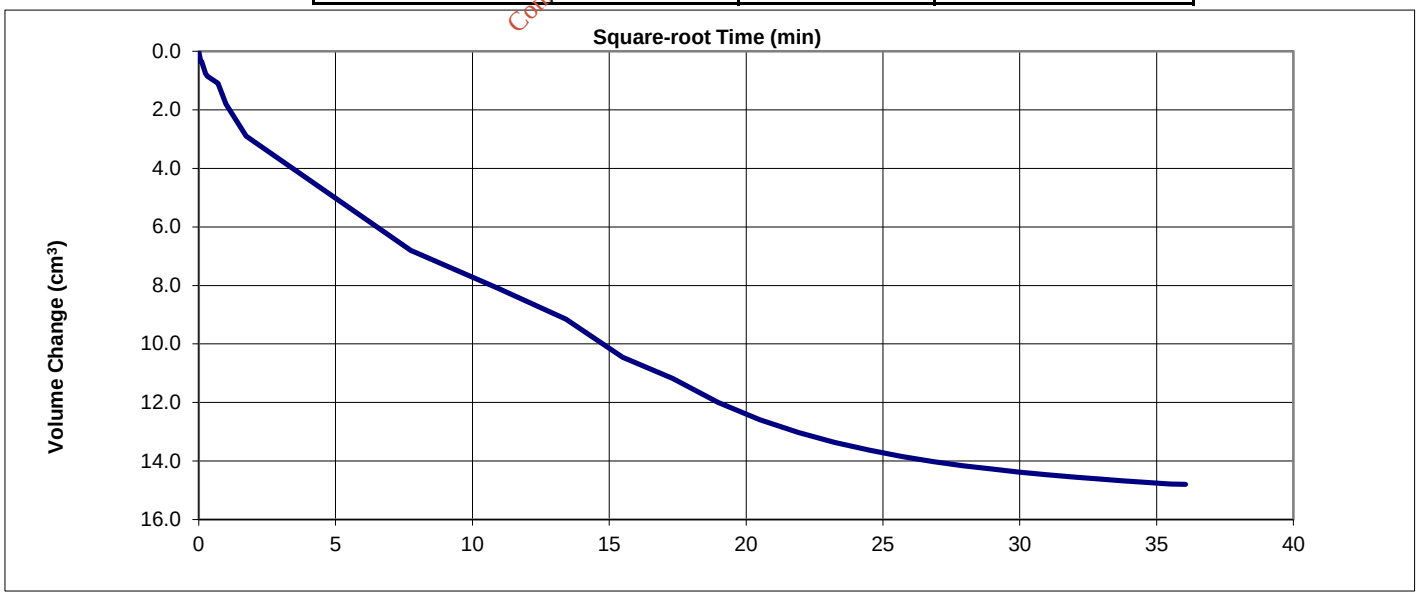
PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP03
Sample Depth	m	0.30
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	600
Final B Value	-	0.96



Consolidation		
Effective Pressure	kPa	100
Cell Pressure	kPa	650
Back Pressure	kPa	550
Final PWP	kPa	552
PWP dissipation	%	98



UKAS TESTING 4043

PSL Professional Soils Laboratory

Dingle

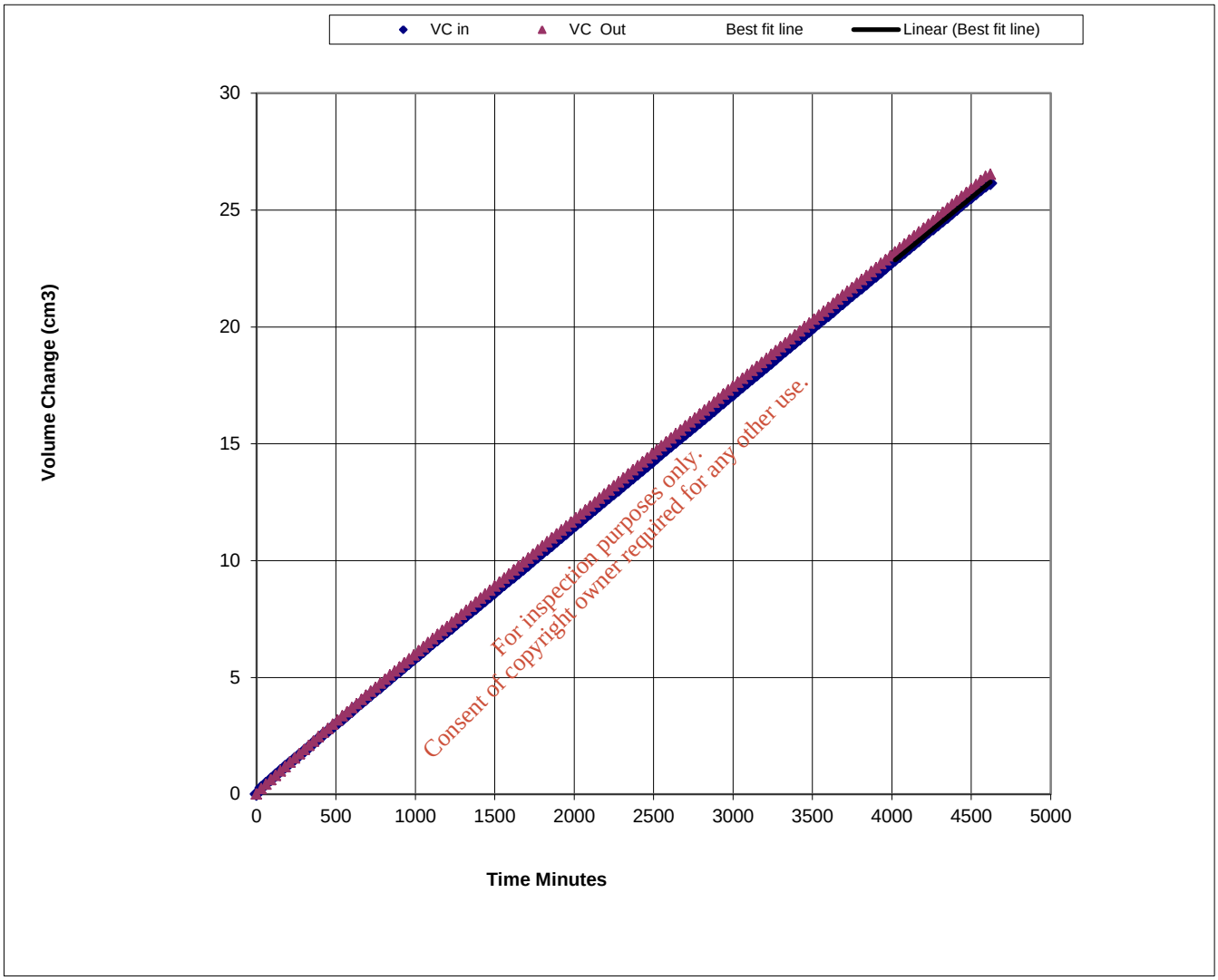
Contract No.
PSL19/4110
Client Ref
18-1123b

PERMEABILITY IN A TRIAXIAL CELL

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details		
Hole Number		TP03
Sample Depth	m	0.30
Sample No.		1
Grid Reference		
Lift Number		

Permeability Stage



Permeability Stage		
Cell Pressure	kPa	650
Mean Effective Stress	kPa	100
Back Pressure Diff.	kPa	20
Mean Rate of Flow	ml/min	0.0055
Average Temperature	'C	20
Vertical Permeability Kv	m/s	5.6E-10

APPENDIX F

ENVIRONMENTAL LABORATORY TEST RESULTS

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.: 19-19611-1

Initial Date of Issue: 09-Jul-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
Joe Gervin
John Cameron
Lucy Newland
Matthew Gilbert
Neil Haggan
Paul Dunlop
Paul McNamara
Sean Ross
Stephen Franey
Stephen McCracken
Stephen Watson
Stuart Abraham

Project 18-1123B Dingle

Quotation No.: Q18-13245 **Date Received:** 11-Jun-2019

Order No.: **Date Instructed:** 03-Jul-2019

No. of Samples: 1

Turnaround (Wkdays): 5 **Results Due:** 09-Jul-2019

Date Approved: 09-Jul-2019

Approved By:

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

Results - Single Stage WAC

Project: 18-1123B Dingle

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-19611						
Chemtest Sample ID:	840923						
Sample Ref:							
Sample ID:							
Sample Location:	TP2						
Top Depth(m):	2.50						
Bottom Depth(m):							
Sampling Date:	04-Jun-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	%	[B] 5.5	3	5	6
Loss On Ignition	2610	U	%	3.6	--	--	10
Total BTEX	2760	U	mg/kg	[B] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[B] < 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	12	100	--	--
pH	2010	U		7.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.028	--	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	0.0013	< 0.050	0.5	2	25
Barium	1450	U	0.022	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	0.0049	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.025	0.25	0.5	10	30
Nickel	1450	U	0.0020	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0012	0.012	0.06	0.7	5
Selenium	1450	U	0.0041	0.041	0.1	0.5	7
Zinc	1450	U	0.0073	< 0.50	4	50	200
Chloride	1220	U	1.7	17	800	15000	25000
Fluoride	1220	U	0.16	1.6	10	150	500
Sulphate	1220	U	280	2800	1000	20000	50000
Total Dissolved Solids	1020	N	450	4500	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.9	59	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	18

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.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
840923			TP2	04-Jun-2019	B	Amber Glass 250ml
840923			TP2	04-Jun-2019	B	Amber Glass 60ml
840923			TP2	04-Jun-2019	B	Plastic Tub 500g

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