

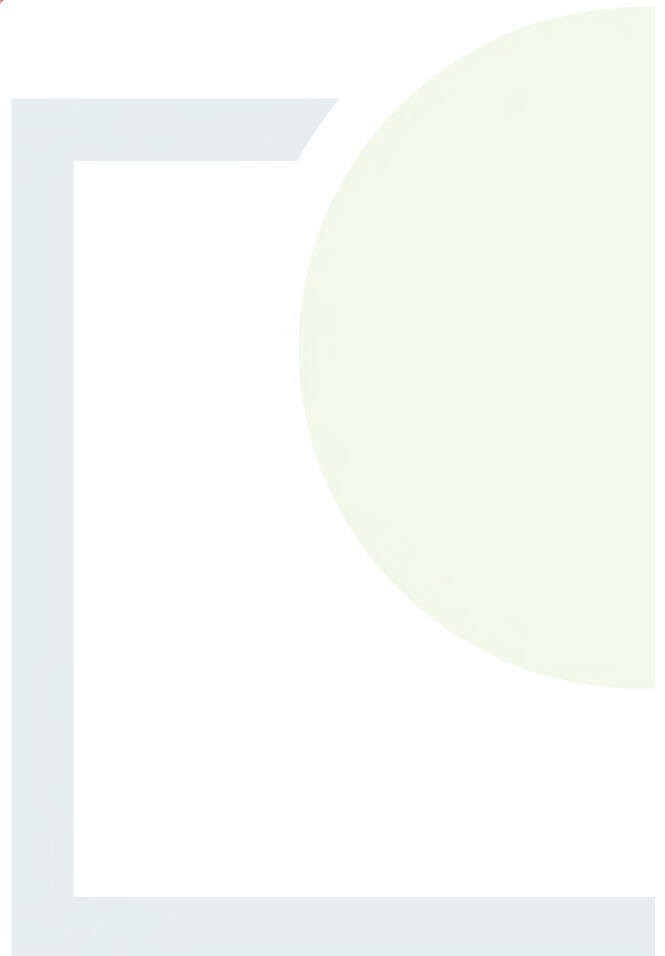


CONSULTANTS IN ENGINEERING,  
ENVIRONMENTAL SCIENCE & PLANNING

# APPENDIX 2

Geotechnical Report

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**CAUSEWAY**  
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**GEOTECH**

## Historical Landfills in Mid Kerry - Castleisland

Client: Kerry County Council

Client's Representative: Feehily Timoney

Report No.: 18-1102b

Date: September 2019

Status: Final for Issue

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## APPENDICES

Appendix A	Site and exploratory hole location plans
Appendix B	Borehole logs
Appendix C	Trial pit logs
Appendix D	Trial pit photographs
Appendix E	Geotechnical laboratory test results
Appendix F	Environmental laboratory test results

## Document Control Sheet

<b>Report No.:</b>		18-1102b			
<b>Project Title:</b>		Historical Landfills in Mid Kerry - Castleisland			
<b>Client:</b>		Kerry County Council			
<b>Client's Representative:</b>		Fehily Timoney			
<b>Revision:</b>	A00	<b>Status:</b>	Final for Issue	<b>Issue Date:</b>	23 September 2019
<b>Prepared by:</b>		<b>Reviewed by:</b>		<b>Approved by:</b>	
 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 Mid Kerry - Castleisland

### 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 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 a site located 1km north east of Castleisland, Co. Kerry. The site is accessed off College Road and is bordered to the west by Clonough housing estate and to the north, east and south by agricultural lands.



## 4 SITE OPERATIONS

### 4.1 Summary of site works

Site operations, which were conducted between 31<sup>st</sup> May and 19<sup>th</sup> 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 was 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

Five trial pits (TP01-TP05) were excavated using a JCB 3CX excavator fitted with a 600mm wide bucket, to a maximum depth of 2.50m.

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 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 comprise Glacial Till with bedrock at subcrop level in the north of the site. These deposits are underlain by limestones of the Cracoean Reef Member.

### 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 at all locations with a thickness range of 100 -300mm.
- **Made Ground (fill):** reworked sandy gravelly clay fill with varying amounts of glass bottles, plastic bags, metal fragments, brick and clothes encountered in TP01, TP02 and TP04 to a depth of 2.00m. Not the full extent of landfill material present was not determined in the trial pits.
- **Glacial Till:** sandy gravelly clay/silt, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.
- **Bedrock (Limestone):** Rockhead was encountered at a depth of 0.30m in BH01 and 8.80m in BH02.

### 6.3 Groundwater

Groundwater was not noted during drilling at any of the locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any groundwater strikes and the possibility of encountering groundwater at other depths should not be ruled out.

It should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

Groundwater was not noted 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.

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**APPENDIX A**  
**SITE AND EXPLORATORY HOLE LOCATION PLANS**

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**Project No.:** 18-1102b

**Client:** Kerry County Council

**Project Name:** Historical Landfill in Kerry - Castleisland

**Client's Representative:** Fehily Timoney

Legend Key



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**Site Location**

**Title:**  
Site Location Plan

**Last Revised:**  
16/08/2019

**Scale:**  
1:10000







**Project No.:** 18-1102b

**Client:** Kerry County Council

**Project Name:** Historical Landfill in Kerry - Castleisland

**Client's Representative:** Fehily Timoney

**Legend Key**

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



**Title:**  
Exploratory Hole Location Plan

**Last Revised:**  
16/08/2019

**Scale:**  
1:1000



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**APPENDIX B**  
**BOREHOLE LOGS**

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<b>Project No.:</b> 18-1102b	<b>Project Name:</b> Historical Landfill in Kerry - Castleisland	<b>Borehole No.:</b> BH01
<b>Coordinates:</b> 100696.43 E	<b>Client:</b> Kerry County Council	Sheet 1 of 1
<b>Method</b> Rotary Drilling	<b>Plant Used</b> Hanjin 8D	<b>Top</b> 0.00
<b>Base</b> 8.50	<b>Client's Representative:</b> Fehily Timoney	<b>Scale:</b> 1:50
<b>Ground Level:</b> 44.16 mOD	<b>Dates:</b> 19/06/2019 - 19/06/2019	<b>Driller:</b> KW
		<b>Logger:</b> PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					43.86	(0.30) 0.30		TOPSOIL (Driller's description)		
								Grey LIMESTONE. (Driller's description)		
						(8.20)				
					35.66	8.50		End of Borehole at 8.50m		

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<b>Remarks</b> No groundwater encountered.  Terminated at scheduled depth.	<b>Water Strikes</b>				<b>Chiselling Details</b>		
	Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (h:mm)
	<b>Water Added</b>		<b>Casing Details</b>				
From (m)	To (m)	To (m)	Diam (mm)				
		8.50	200				





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<b>Project No.:</b> 18-1102b	<b>Project Name:</b> Historical Landfill in Kerry - Castleisland	<b>Borehole No.:</b> BH02
<b>Coordinates:</b> 100589.12 E	<b>Client:</b> Kerry County Council	Sheet 1 of 1
<b>Method</b> Rotary Drilling	<b>Plant Used</b> Hanjin 8D	<b>Top</b> 0.00
<b>Base</b> 10.00	<b>Client's Representative:</b> Fehily Timoney	<b>Scale:</b> 1:50
<b>Ground Level:</b> 41.54 mOD	<b>Dates:</b> 19/06/2019 - 19/06/2019	<b>Driller:</b> KW
		<b>Logger:</b> PF

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					41.24	(0.30) 0.30		TOPSOIL (Driller's description)		
								Firm light brown sandy gravelly silty CLAY. (Driller's description)		
						(8.50)				
					32.74	8.80		Grey LIMESTONE. (Driller's description)		
						(1.20)				
					31.54	10.00				
End of Borehole at 10.00m										

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**Remarks**  
No groundwater encountered.  
  
Terminated at scheduled depth.

Water Strikes				Chiselling Details		
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	From (m)	To (m)	Time (hr:mm)
Water Added		Casing Details				
From (m)	To (m)	To (m)	Diam (mm)			
		10.00	200			



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**APPENDIX C**  
**TRIAL PIT LOGS**

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<b>Project No.:</b> 18-1102b	<b>Project Name:</b> Historical Landfill in Kerry - Castleisland	<b>Trial Pit No.:</b> TP01
<b>Co-ordinates:</b> 100658.15 E	<b>Client:</b> Kerry County Council	Sheet 1 of 1
<b>Method:</b> Trial Pitting	<b>Client's Representative:</b> Fehily Timoney	<b>Scale:</b> 1:25
<b>Plant:</b> JCB 3CX	<b>Ground Level:</b> 44.36 mOD	<b>Date:</b> 31/05/2019
		<b>Logger:</b> PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.15	B3		44.16	(0.20)		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 subrounded of limestone	
0.70	ES1		43.36	(0.80)		MADE GROUND: Soft greyish brown slightly sandy slightly gravelly silty CLAY with low cobble and boulder content and rubbish. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles and boulders are subangular of limestone. Rubbish includes glass bottles, glass fragments and plastic bags.	0.5
1.70	ES2		42.41	(0.95)		MADE GROUND: Soft orangish brown slightly sandy slightly gravelly silty CLAY with low cobble content and rubbish. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of limestone. Cobbles are subrounded of limestone. Rubbish includes glass bottles, glass fragments, metal parts and white plastic bags.	1.0
				1.95		End of trial pit at 1.95m	2.0

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<b>Remarks</b> No groundwater encountered.  Terminated due to >1.50m of landfill material present.	<b>Water Strikes:</b>		<b>Stability:</b> Slightly unstable
	Struck at (m):	Remarks:	<b>Width:</b> 0.85
			<b>Length:</b> 2.80



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<b>Project No.:</b> 18-1102b	<b>Project Name:</b> Historical Landfill in Kerry - Castleisland	<b>Trial Pit No.:</b> TP02
<b>Co-ordinates:</b> 100665.54 E	<b>Client:</b> Kerry County Council	Sheet 1 of 1
<b>Method:</b> Trial Pitting	<b>Client's Representative:</b> Fehily Timoney	<b>Scale:</b> 1:25
<b>Plant:</b> JCB 3CX	<b>Ground Level:</b> 45.22 mOD	<b>Date:</b> 31/05/2019
		<b>Logger:</b> PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.20	B3		45.07	(0.15) 0.15		TOPSOIL	
			44.82	(0.25) 0.40		MADE GROUND: Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	
0.90	ES1			(0.70)		MADE GROUND: Dark brown and orangish brown slightly sandy slightly gravelly silty CLAY with low to medium cobble content and rubbish from 0.40m - 0.70m. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular of limestone increasing with depth. Rubbish includes plastic bags, glass fragments and plastic bottles	
1.10	ES2		44.12	1.10		End of trial pit at 1.10m	

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<b>Remarks</b> No groundwater encountered.  Terminated on possible bedrock.	<b>Water Strikes:</b>		<b>Stability:</b> Stable
	Struck at (m):	Remarks:	
			<b>Width:</b> 0.80 <b>Length:</b> 4.00



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<b>Project No.:</b> 18-1102b	<b>Project Name:</b> Historical Landfill in Kerry - Castleisland	<b>Trial Pit No.:</b> TP03
<b>Co-ordinates:</b> 100642.56 E	<b>Client:</b> Kerry County Council	Sheet 1 of 1
<b>Method:</b> Trial Pitting	<b>Client's Representative:</b> Fehily Timoney	<b>Scale:</b> 1:25
<b>Plant:</b> JCB 3CX	<b>Ground Level:</b> 42.15 mOD	<b>Date:</b> 31/05/2019
		<b>Logger:</b> PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.20	B4			(0.30)		TOPSOIL: Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone.	
0.40	ES1		41.85	0.30 (0.20)		Firm orangish brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles are subrounded of argillaceous limestone.	
			41.65	0.50		Firm grey and orangish brown slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles are subrounded of limestone.	
1.50	ES2			(1.60)			
2.10	ES3		40.05	2.10		End of trial pit at 2.10m	

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<b>Remarks</b> No groundwater encountered.  Terminated due to no landfill material present.	<b>Water Strikes:</b>		<b>Stability:</b> Stable
	Struck at (m):	Remarks:	
			<b>Width:</b> 0.80 <b>Length:</b> 2.80



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**Project No.:**

18-1102b

**Project Name:**

Historical Landfill in Kerry - Castleisland

**Trial Pit No.:**

TP04

**Co-ordinates:**

100661.69 E

**Client:**

Kerry County Council

Sheet 1 of 1

**Method:**

Trial Pitting

110790.85 N

**Client's Representative:**

Fehily Timoney

**Scale:** 1:25

**Plant:**

JCB 3CX

**Ground Level:**

44.62 mOD

**Date:**

31/05/2019

**Logger:** PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.20	B3		44.52	(0.10) 0.10		TOPSOIL	
				(0.30)		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	
1.00	ES1		44.22	0.40		MADE GROUND: Black and brown slightly sandy slightly gravelly silty CLAY with low cobble content and rubbish. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subangular to subrounded of various lithologies. Rubbish consists of black, white and blue plastic bags, brick, glass bottles and socks.	0.5
				(1.60)			1.0
1.90	ES2		42.62	2.00		End of trial pit at 2.00m	2.0
							2.5
							3.0
							3.5
							4.0
							4.5

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**Remarks**  
No groundwater encountered.  
  
Terminated due to >1.50m of landfill material present.

Water Strikes:		Stability: Slightly unstable
Struck at (m):	Remarks:	
		<b>Width:</b> 1.20
		<b>Length:</b> 2.90



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<b>Project No.:</b> 18-1102b	<b>Project Name:</b> Historical Landfill in Kerry - Castleisland	<b>Trial Pit No.:</b> TP05
<b>Co-ordinates:</b> 100551.85 E	<b>Client:</b> Kerry County Council	Sheet 1 of 1
<b>Method:</b> Trial Pitting	<b>Client's Representative:</b> Fehily Timoney	<b>Scale:</b> 1:25
<b>Plant:</b> JCB 3CX	<b>Ground Level:</b> 41.02 mOD	<b>Date:</b> 31/05/2019
		<b>Logger:</b> PF

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
0.20	B5				[Symbol]	Firm dark brown slightly sandy silty CLAY. Sand is fine to coarse	
0.20	ES1			(0.70)	[Symbol]		
0.50	ES2				[Symbol]		
			40.32	0.70	[Symbol]	Firm greyish brown slightly sandy gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are subrounded of limestone	
				(0.90)	[Symbol]		
1.50	ES3				[Symbol]		
			39.42	1.60	[Symbol]	Firm yellowish brown slightly sandy slightly gravelly 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	
				(0.90)	[Symbol]		
2.50	ES4				[Symbol]	End of trial pit at 2.50m	
			38.52	2.50	[Symbol]		

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<b>Remarks</b> No groundwater encountered.  Terminated due to no landfill material present.	<b>Water Strikes:</b>		<b>Stability:</b>
	Struck at (m):	Remarks:	Stable
			<b>Width:</b> 0.80
		<b>Length:</b> 2.80	