

## Appendix 13B: SI Factual Report

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*explore the possibilities*



**Limerick WWTP Upgrade Projects**  
**Castletroy Waste Water Treatment Plant (WWTP)**  
**Site Investigation – Factual Report**

Report No: 2099-21C DRAFT

1<sup>st</sup> February 2022

*This document has been prepared by Whiteford Geoservices Ltd  
on behalf of*

*Uisce Eireann*

*J.B. Barry & Partners Ltd*



**Whiteford Geoservices Ltd**, 2 Main Street, Straid, Co. Antrim, BT39 9NE

Tel: 0044 (0) 28 93349351 Fax: 0044 (0) 28 93349352

[www.whitefordgeoservices.com](http://www.whitefordgeoservices.com)

## CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
<b>2</b>	<b>SITE AND GEOLOGY</b>	<b>1</b>
	2.1 The Site	
	2.2 Published Geology	
<b>3</b>	<b>FIELDWORK</b>	<b>2</b>
	3.1 General	
	3.2 Exploratory Holes	
	3.3 In-situ Testing	
	3.4 Instrumentation and Monitoring	
	3.5 Topographical Survey	
<b>4</b>	<b>LABORATORY TESTING</b>	<b>4</b>
	4.1 Geotechnical Testing	
	<b>REFERENCES</b>	<b>5</b>
	<b>APPENDICES</b>	
	A DRAWINGS	
	B EXPLORATORY HOLE RECORDS	
	C IN-SITU TESTING RESULTS	
	D LABORATORY TESTING RESULTS	
	E PHOTOGRAPHS	

## 1 INTRODUCTION

During May 2021 Whiteford Geoservices Ltd was commissioned by Uisce Eireann (Irish Water) and J.B. Barry & Partners Ltd (Consulting Engineers) to undertake site investigation works at Castletroy Waste Water Treatment Plant (WWTP) as part of the Limerick WWTP Upgrade Projects contract.

The investigation was required to obtain geotechnical information at the Castletroy WWTP site; primarily to establish the existing ground conditions at the proposed location of new tanks and other associated infrastructure.

The investigation was performed in accordance with the relevant standards (see References) and the fieldwork was carried out between July and December 2021.

This report presents the factual records of the site investigations undertaken.

## 2 SITE AND GEOLOGY

### 2.1 The Site

Castletroy WWTP is situated north-westerly adjacent to University of Limerick campus, approximately 3km east of Limerick city, Co. Limerick. The site lies to the south of the River Shannon.

Site investigation works were undertaken within the existing waste water treatment facility.

### 2.2 Published Geology

The published geological maps indicate that Visean Limestone is the predominant solid geology in the local region.

Superficial geology consisting predominantly of estuarine silts and clays were anticipated to be present, with underlying granular soils (gravel) also likely to be encountered.

Due to the nature of the investigation site a layer of made ground / fill, of unknown thickness, was anticipated to be present.



### 3 FIELDWORK

#### 3.1 General

The fieldwork was carried out in general accordance with BS 5930:2015+A1:2020, BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006) and other related standards.

Refer to Appendix A for the drawing ‘*Limerick WWTP Upgrade Projects – Castletroy WWTP – Site Investigation – Site Investigation Layout Plan 2099-21C-SI-L1 Rev 02*’ indicating the positions of all site investigations undertaken by Whiteford Geoservices Ltd. Site investigations were surveyed to Irish Transverse Mercator (ITM) and Malin Head (Ordnance Datum).

#### 3.2 Exploratory Holes

The exploratory holes are detailed within the following table.

METHOD	QUANTITY	MAXIMUM DEPTH (m)	EQUIPMENT
Trial Holes	3 Nr.	4.20m (TP-01)	Trial Holes carried out using a Kobelco 135SR LC tracked excavator.
Window Sample	1 Nr.	3.00m (WS-03)	Window sampled hole undertaken using a Nordmeyer Geotool rig.
Percussive Boreholes	3 Nr.	9.00m (BH01 / BH02)	Percussive boreholes sunk using a Dando 2000 percussive drilling rig.
Rotary Cored Boreholes	2 Nr.	25.10m (RC01)	Rotary boreholes carried out using a Beretta T44 Rotary Coring rig.

The engineering logs contained within Appendix B provide descriptions of the strata encountered, together with observations made during excavation, coring and drilling works.

### 3.3 In-situ Testing

The in-situ testing works carried out are detailed within the following table.

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Standard Penetration Test (SPT)	21 Nr.	9.00m (BH01)	SPTs carried out using a Dando 2000 percussive rig.
Medium Dynamic Probing (DPM)	2 Nr.	5.80m (DP-03)	Medium Dynamic Probing undertaken using a Nordmeyer Geotool dynamic probing rig.

### 3.4 Instrumentation and Monitoring

The following table details the monitoring instrumentation installed within the exploratory holes upon completion.

LOCATION	ITM COORDINATES (EASTING / NORTHING / ELEVATION)	MONITORING SECTION (M) B.G.L.	TOP SEAL (M) B.G.L.	END DEPTH (M) B.G.L.
BH/RC01	E: 560719.30 N: 658474.02 Z: 7.05	9.00 – 25.10	0.00 – 9.00	25.10
BH03	E: 560734.00 N: 658428.00 Z: 7.00	4.50 – 7.30	0.00 – 4.50	7.30

LOCATION	MONITORING DATE	WATER LEVEL (M) B.G.L.	WATER LEVEL (M) AOD
BH/RC01	04-01-2022	4.30	2.75
BH03	04-01-2022	5.00	2.00

### 3.5 Topographical Survey

The topographical survey of each individual site investigation location was undertaken post-completion of all associated works and is detailed in the following table.

EQUIPMENT	LOCATION	COORDINATE SYSTEM
Leica RTK / GNSS DGPS System	Refer to Appendix A <i>2099-21C-SI-L1 Rev 02</i>	Irish Transverse Mercator (ITM) / Malin Head (Ordnance Datum)

## 4 LABORATORY TESTING

### 4.1 Geotechnical Testing

The testing was scheduled by J.B. Barry & Partners Ltd and carried out in accordance with BS 1377 (1990) and ISRM (2007) by Whiteford Geoservices Ltd.

The testing is summarised in the table below and the results are presented within Appendix D.

TYPE	QUANTITY	REMARKS
Natural Moisture Content	23 Nr.	BS 1377- Part 2 (1990) : Section 2
Atterberg Limits	8 Nr.	BS 1377- Part 2 (1990) : Section 2
Particle Size Distribution (PSD)	15 Nr.	BS 1377- Part 2 (1990) : Sections 3 & 9
PSD Sedimentation	6 Nr.	BS 1377- Part 2 (1990) : Sections 3 & 9
Dry Density / Moisture Content Relationship (2.5kg)	1 Nr.	BS 1377- Part 2 (1990) : Section 4
Total Sulphate as SO <sub>4</sub> BRE	3 Nr.	BS 1377- Part 2 (1990)
pH	3 Nr.	BS 1377- Part 2 (1990)
Oedometer 1D Consolidation	2 Nr.	BS 1377- Part 2 (1990) : Sections 7 & 8
Unconsolidated Undrained Triaxial	1 Nr.	BS 1377- Part 2 (1990) : Sections 7 & 8
Point Load	5 Nr.	ASTM D5731-08
Uniaxial Compressive Strength (UCS)	4 Nr.	ASTM D5731-08

## REFERENCES

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

BS 5930:2015+A1:2020 : Code of practice for site investigations (Amendment 2). 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: 2002 : Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.

BS EN ISO 14689-1: 2003 : Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description. British Standards Institution.

BS EN ISO 22475-1: 2006 : Geotechnical investigation and testing – Sampling methods and groundwater measurements - Part 1 Technical principles for execution. British Standards Institution.

BS EN ISO 22476-2: 2005 : Geotechnical investigation and testing - Field testing - Part 2 Dynamic probing. British Standards Institution.

BS EN ISO 22476-3: 2005 : Geotechnical investigation and testing - Field testing - Part 3 Standard penetration test. British Standards Institution.

ISRM: 2007: The Complete ISRM Suggested Methods for Rock Characterisation, Testing and Monitoring (1974-2006). Commission on Testing Methods, International Society for Rock Mechanics (Editors Ulusay R & Hudson JA).

ASTM D5731-08: Standard test method for determination of the point load strength index of rock and application to rock strength

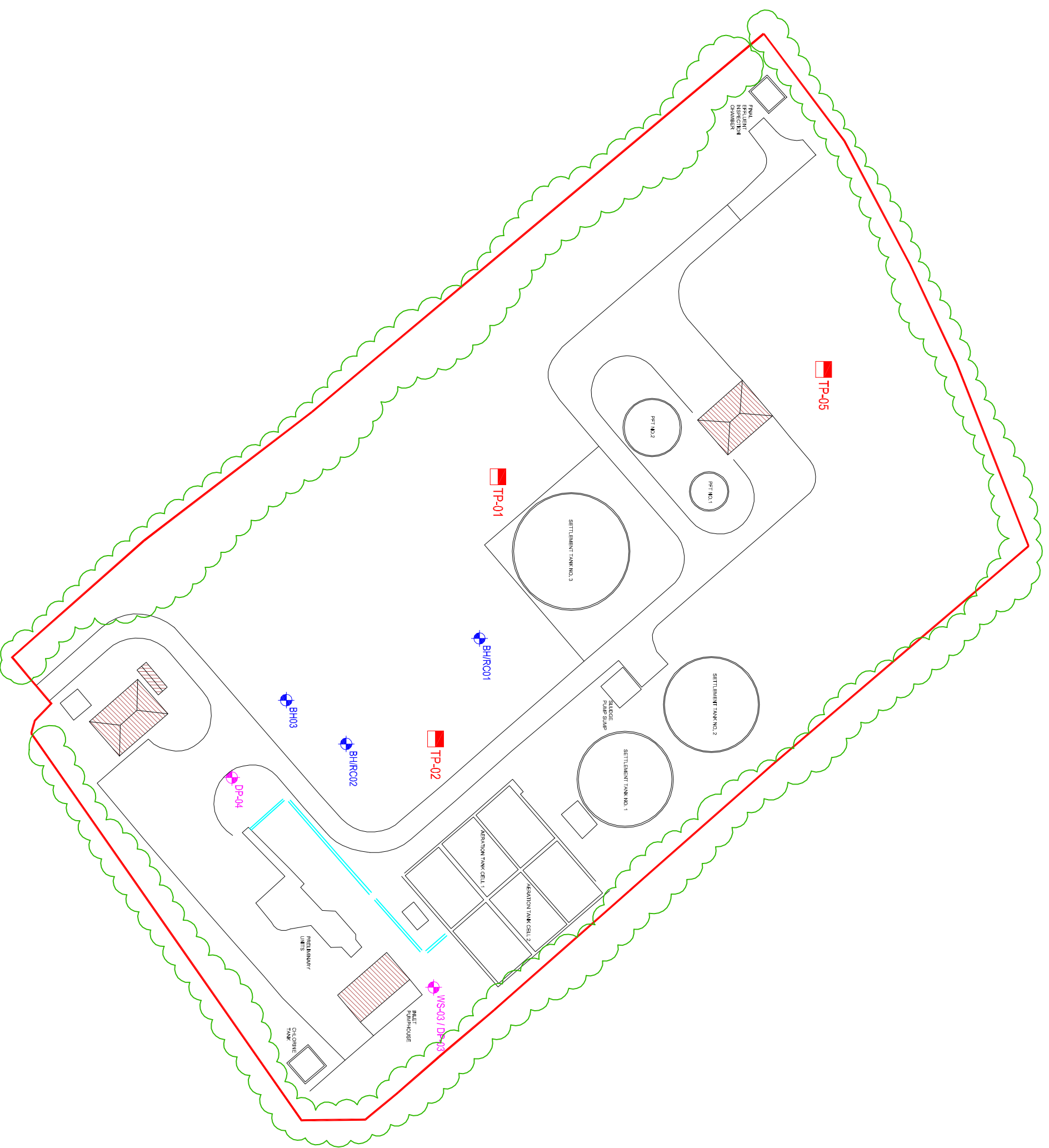
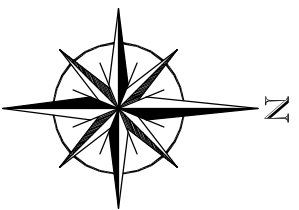
ASTM C215-08: Standard Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens

PAS 128: 2014 Specification for underground utility detection, verification and location.

**APPENDIX A**  
**DRAWINGS**

LIMERICK WWTP UPGRADE PROJECTS – CASTLETROY WWTP  
SITE INVESTIGATION  
SITE INVESTIGATION LAYOUT PLAN  
*2099-21C-SI-L1 Rev 02*

1 x A3



Investigation Drawing Key:

- TP-01 TRIAL HOLE LOCATION
- BHRC01 BOREHOLE / ROTARY CORE LOCATION
- WS/DP-03 WINDOW SAMPLE / DYNAMIC PROBE


<b>Client</b> UISCE EIREANN			
<b>Project</b> LIMERICK WWTP UPGRADE PROJECTS - CASTLEFROY WWTP			
<b>Stage</b> SITE INVESTIGATION			
<b>Title</b> SITE INVESTIGATION LAYOUT PLAN			
<b>Scales</b> 1 : 1,000 @ A3			
<b>Surveyed</b> RC / AT	<b>Drawn</b> RC	<b>Checked</b> WGS	<b>Date</b> Dec 2021
<b>WHITEFORD GEOSERVICES LTD</b> STRAID HOUSE, 2 MAIN STREET STRAID, BALLYCLARE CO. ANTRIM BT39 9NE UNITED KINGDOM +44 (0)28 9334 9351			

**APPENDIX B**  
**EXPLORATORY HOLE RECORDS**

TRIAL HOLES	3 x A4
WINDOW SAMPLED HOLE	1 x A4
PERCUSSIVE BOREHOLES	3 x A4
ROTARY CORED BOREHOLES	6 x A4

# Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann	Date: 04/01/2022
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd	Co-ords: E560680.85 N658478.42
Project No. : 2099-21		Crew Name:	Equipment: Kobelco 135SR LC
Location Number TP-01	Location Type TP	Level 7.00m AoD	Logged By RC
		Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
Well	Water Strikes				0.30	6.70		TOPSOIL.
								Firm, brown, slightly sandy, very gravelly clay with many sub-angular to sub-rounded cobbles and boulders. [MADE GROUND]  Occasional concrete, plastic, timber, tar fragments and steel re-bar present.
		3.00	B		2.60	4.40		Soft to firm, dark brownish grey, slightly sandy, slightly gravelly SILT / CLAY with occasional sub-angular to sub-rounded cobbles.
		4.00	B		4.20	2.80		End of Borehole at 4.200m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
4.00	1.80	Minor excavation instability.					

**Remarks**  
 No groundwater observed.  
 End of Trial Hole at 4.20m b.g.l.





# Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann	Date: 04/01/2022
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd	Co-ords: E560743.22 N658463.54
Project No. : 2099-21		Crew Name:	Equipment: Kobelco 135SR LC
Location Number TP-02	Location Type TP	Level 6.85m AoD	Logged By RC
		Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
[Pattern]		2.50	B		0.25	6.60	[Pattern]	TOPSOIL.
					1.75	5.10	[Pattern]	Firm, brown, slightly sandy, very gravelly clay with many sub-angular to sub-rounded cobbles and boulders. [MADE GROUND]  Occasional concrete, plastic, timber fragments and steel re-bar present.
					3.00	3.85	[Pattern]	Soft, dark grey, slightly sandy, slightly gravelly SILT / CLAY with occasional sub-angular to sub-rounded cobbles.
								End of Borehole at 3.000m

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
3.50	1.80	Excavation instability throughout.					

**Remarks**  
 No groundwater observed.  
 End of Trial Hole at 3.00m b.g.l. due to excavation instability.



# Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann	Date: 04/01/2022
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd	Co-ords: E560655.25 N658555.95
Project No. : 2099-21		Crew Name:	Equipment: Kobelco 135SR LC
Location Number TP-05	Location Type TP	Level 6.00m AoD	Logged By RC
		Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		3.00	B		0.25	5.75		TOPSOIL.	1
					1.50	4.50		Firm, brown, slightly sandy, very gravelly clay with many sub-angular to sub-rounded cobbles and boulders. [MADE GROUND]	2
					3.80	2.20		Soft, dark grey, slightly sandy, slightly gravelly SILT / CLAY with occasional cobbles.	3
							End of Borehole at 3.800m	4	
								5	

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
4.00	1.80	Excavation instability.					

**Remarks**  
 No groundwater observed.  
 End of Trial Hole at 3.80m b.g.l.



# Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 12/10/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560802.40 N658463.10	
Project No. : 2099-21		Crew Name: WGS		Drilling Equipment: PR30	
Borehole Number WS-03	Hole Type WS	Level 6.85m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Pattern]					0.25	6.60	[Pattern]	TOPSOIL.	1
					1.60	5.25	[Pattern]	Firm, brown, slightly sandy, gravelly clay with many angular to tabular cobbles and some boulders. [MADE GROUND]	2
					3.00	3.85	[Pattern]	Soft, greyish brown SILT/ CLAY.	3
							End of Borehole at 3.000m		4
									5
									6
									7
									8
									9
									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
								0.00	3.00	90	0

**Remarks**  
 No groundwater observed.  
 End of Window Sampled hole at 3.00m b.g.l.



# Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 21/09/2021 - 22/09/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560719.30 N658474.02	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH01	Hole Type CP	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40	6.65		TOPSOIL.	
		1.00	B					Firm, brown, slightly sandy, gravelly clay with occasional cobbles and boulders. [MADE GROUND]	1
		2.00 2.00	B SPT	N=7 (1,2/1,2,2,2)					2
		2.50 - 3.00	U		2.50	4.55		Soft, greyish brown, silty CLAY.	
		3.00 3.00	B SPT	N=4 (1,0/1,1,1,1)					3
		3.50 - 4.00	U						
		4.00 4.00	B SPT	N=5 (1,0/1,1,1,2)	3.80 4.00	3.25 3.05		Soft, grey SILT. Very soft, blackish brown PEAT.	4
		5.00 5.00	B SPT	N=1 (1,0/0,0,0,1)	5.00	2.05		Loose, grey, silty GRAVEL with occasional cobbles and boulders.	5
		6.00 6.00	B SPT	N=2 (0,0/1,0,0,1)					6
		7.00 7.00	B SPT	N=10 (1,2/2,3,3,2)					7
		8.00 8.00	B SPT	N=50 (5,7/50 for 235mm)	7.70	-0.65		Medium dense, grey, silty GRAVEL with many cobbles and boulders.	8
		9.00 9.00	B SPT	0 (50 for 40mm/0 for 0mm)	9.00	-1.95		End of Borehole at 9.000m	9
									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
9.00	200			9.00	9.00	01:00		0.00	9.00	90	0

Remarks  
 Groundwater encountered at 5.00m b.g.l. - (3.70m b.g.l. after 20 minutes).  
 End of Borehole at 9.00m b.g.l. - unable to advance casing / tooling further.



# Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 24/09/2021 - 27/09/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560744.42 N658442.28	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH02	Hole Type CP	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20	6.85		TOPSOIL.	
		1.00 1.20	B SPT	N=24 (2,9/9,11,3,1)				Firm to stiff, brown, slightly sandy, gravelly clay with many cobbles and some boulders. [MADE GROUND]	1
		2.00 2.00 - 2.50	B U		1.70	5.35		Very soft to soft, greyish brown, silty CLAY.	2
		3.00 3.00	B SPT	N=3 (0,0/1,1,0,1)				Very soft, blackish brown PEAT.	3
		4.00 4.00	B SPT	N=2 (1,1/1,0,0,1)	3.30	3.75		Very soft to soft, grey, slightly sandy CLAY / SILT.	4
		5.00 5.00	B SPT	N=27 (5,9/9,7,4,7)	3.90	3.15		Medium dense, grey, silty GRAVEL with some cobbles and boulders.	5
		6.00 6.00	B SPT	N=48 (11,7/13,14,11,10)	5.00	2.05		Dense to very dense, brownish grey, silty, clayey, slightly sandy GRAVEL with many cobbles and boulders.	6
		7.00 7.00	B SPT	50 (25,22/50 for 70mm)	6.00	1.05			7
		8.00 8.00	B SPT	0 (50 for 60mm/0 for 0mm)					8
					9.00	-1.95		End of Borehole at 9.000m	9
								10	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
9.00	200			9.00	9.00	01:00		0.00	9.00	90	0

**Remarks**  
 Groundwater encountered at 4.30m b.g.l. - (3.90m b.g.l. after 20 minutes).  
 End of Borehole at 9.00m b.g.l. - unable to advance casing / tooling further.



# Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 22/09/2021 - 23/09/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560734.00 N658428.00	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH03	Hole Type CP	Level 7.00m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40	6.60		TOPSOIL.	
		1.00 1.20	B SPT	N=8 (1,2/1,2,2,3)	1.70	5.30		Firm, brown, gravelly clay with many cobbles and some boulders. [MADE GROUND]	1
		2.00 2.00 - 2.50	B U		3.00	4.00		Soft, greyish brown, silty CLAY.	2
		2.50	SPT	N=4 (1,0/0,2,1,1)	3.50	3.20		Very soft, blackish brown PEAT.	3
		3.00	B		4.00	3.20		Very soft to soft, grey, sandy SILT.	4
		3.50	SPT	N=2 (1,0/0,1,1,0)	4.50	2.50		Medium dense, grey, silty GRAVEL with some cobbles and occasional boulders.	5
		4.00 4.00	B SPT	N=1 (0,0/1,0,0,0)	5.30				6
		6.00 6.00	B SPT	N=23 (3,4/4,3,9,7)	7.00				7
		7.00 7.00	B SPT	50 (11,29/50 for 215mm)	7.30	-0.30			8
								End of Borehole at 7.300m	9
								10	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
7.30	200			4.50 7.30	5.30 7.30	01:00 01:00		0.00	7.30	90	0

**Remarks**  
 Groundwater encountered at 6.80m b.g.l. (6.00m b.g.l. after 20 minutes).  
 End of Borehole at 7.30m b.g.l. - unable to advance casing / tooling further. Standpipe Installation - 60mm Plain Pipe 0.00m - 4.50m / 60mm Slotted Pipe 4.50m - 7.30m b.g.l.



# Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 08/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560719.30 N658474.02	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC01	Hole Type CP+RC	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 3

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
								0.40	6.65		TOPSOIL.	
								2.50	4.55		Firm, brown, slightly sandy, gravelly clay with occasional cobbles and boulders. [MADE GROUND]	1
								3.80	3.25		Soft, greyish brown, silty CLAY.	2
								4.00	3.05		Soft, grey SILT.	3
								5.00	2.05		Very soft, blackish brown PEAT.	4
								7.70	-0.65		Loose, grey, silty GRAVEL with occasional cobbles and boulders.	5
								9.00	-1.95		Medium dense, grey, silty GRAVEL with many cobbles and boulders.	6
											Dense to very dense, grey, silty GRAVEL with many cobbles and boulders.	7
												8
												9
												10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
								0.00	25.10	90	0						

Remarks  
 Standpipe Installation: 0.00m - 9.00m b.g.l. (50mm Plain) / 9.00m - 25.10m b.g.l. (50mm Slotted)  
 End of Rotary Cored Borehole at 25.10m b.g.l.



# Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 08/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560719.30 N658474.02	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC01	Hole Type CP+RC	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 3

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
		10.40 - 11.50	6	95	66	63		10.40	-3.35		Dense to very dense, grey, silty GRAVEL with many cobbles and boulders.	11
		11.50 - 13.00	7	95	60	52					Medium strong, grey, fine grained, crystalline, distinctly weathered to partially weathered, closely fractured LIMESTONE.	12
		13.00 - 14.50		60	30	16						13
		14.50 - 16.00	4	100	81	73		14.50	-7.45		Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium fractured LIMESTONE.	14
		16.00 - 17.50	4	100	88	80						15
		17.50 - 19.00	3	95	88	84						16
		19.00 - 20.50	4	100	84	80						17
												18
												19
												20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
								0.00	25.10	90	0						

Remarks  
 Standpipe Installation: 0.00m - 9.00m b.g.l. (50mm Plain) / 9.00m - 25.10m b.g.l. (50mm Slotted)  
 End of Rotary Cored Borehole at 25.10m b.g.l.





# Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 08/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560719.30 N658474.02	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC01	Hole Type CP+RC	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 3 of 3

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
		20.50 - 22.00	4	95	81	75					Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium fractured LIMESTONE.	21
		22.00 - 23.50	5	90	78	70						22
		23.50 - 25.10	1	100	96	96						23
								25.10	-18.05		End of Borehole at 25.100m	24
												25
												26
												27
												28
												29
												30

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
								0.00	25.10	90	0						

Remarks  
 Standpipe Installation: 0.00m - 9.00m b.g.l. (50mm Plain) / 9.00m - 25.10m b.g.l. (50mm Slotted)  
 End of Rotary Cored Borehole at 25.10m b.g.l.



# Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 09/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560744.42 N658442.28	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC02	Hole Type CP+RC	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 3

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
								0.20	6.85		TOPSOIL. Firm to stiff, brown, slightly sandy, gravelly clay with many cobbles and some boulders. [MADE GROUND]	1
								1.70	5.35		Very soft to soft, greyish brown, silty CLAY.	2
								3.30	3.75		Very soft, blackish brown PEAT.	3
								3.90	3.15		Very soft to soft, grey, slightly sandy CLAY / SILT.	4
								5.00	2.05		Medium dense, grey, silty GRAVEL with some cobbles and boulders.	5
								6.00	1.05		Dense to very dense, brownish grey, silty, clayey, slightly sandy GRAVEL with many cobbles and boulders.	6
								9.00	-1.95		Very stiff to hard, brownish grey, slightly sandy, very gravelly CLAY with many cobbles and boulders.	7
												8
												9
												10

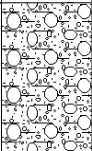









Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
								0.00	20.60	90	0						

Remarks  
 No Standpipe Installation.  
 End of Rotary Cored Borehole at 20.60m b.g.l.



# Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 09/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560744.42 N658442.28	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC02	Hole Type CP+RC	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 3

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
		11.50 - 13.10	7	85	50	46		11.00	-3.95		Very stiff to hard, brownish grey, slightly sandy, very gravelly CLAY with many cobbles and boulders.	11
		13.10 - 14.40	6	100	73	52		11.50	-4.45		Weak, grey, fine grained, crystalline, destructured to distinctly weathered LIMESTONE.	12
		14.40 - 16.10	3	100	95	90		14.40	-7.35		Medium strong, dark grey, fine grained, crystalline, distinctly weathered to partially weathered, closely fractured LIMESTONE.	13
		16.10 - 17.60	4	100	90	68						14
		17.60 - 19.10	4	100	92	77						15
		19.10 - 20.60	2	100	95	90		19.10	-12.05		Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium fractured LIMESTONE.	16
												17
												18
												19
												20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
								0.00	20.60	90	0						

Remarks  
 No Standpipe Installation.  
 End of Rotary Cored Borehole at 20.60m b.g.l.



# Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 09/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E560744.42 N658442.28	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC02	Hole Type CP+RC	Level 7.05m AoD	Logged By RC	Scale 1:50	Page Number Sheet 3 of 3

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
								20.60	-13.55		Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium to widely fractured LIMESTONE.	
											End of Borehole at 20.600m	21
												22
												23
												24
												25
												26
												27
												28
												29
												30

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
								0.00	20.60	90	0						

Remarks  
 No Standpipe Installation.  
 End of Rotary Cored Borehole at 20.60m b.g.l.



**APPENDIX C**  
**IN-SITU TESTING RESULTS**

MEDIUM DYNAMIC PROBING (DPM)

3 x A4

Project Name: Limerick WWTP Upgrade Projects  
 - Site Investigation

 Project No.  
 2099-21

Co-ords: 560802.40 - 658463.10

 Hole Type  
 DP

Location: Limerick, Co. Limerick

Level: 6.85

 Scale  
 1:25

Client: Uisce Eireann

Dates: 12/10/2021

Logged By

Depth (m)	Blows/100mm				Torque (Nm)
	0-10	10-20	20-30	30-40	
1					
2					
3	1 1 2 1 1 1 0 0 0				
4	1 1 2 2 2 2 5 10 11 13 12				

 Remarks:  
 Dynamic Probing commenced at base of Window  
 Sampled hole WS-03.

Fall Height 500

Cone Base Diameter

Hammer Wt 30

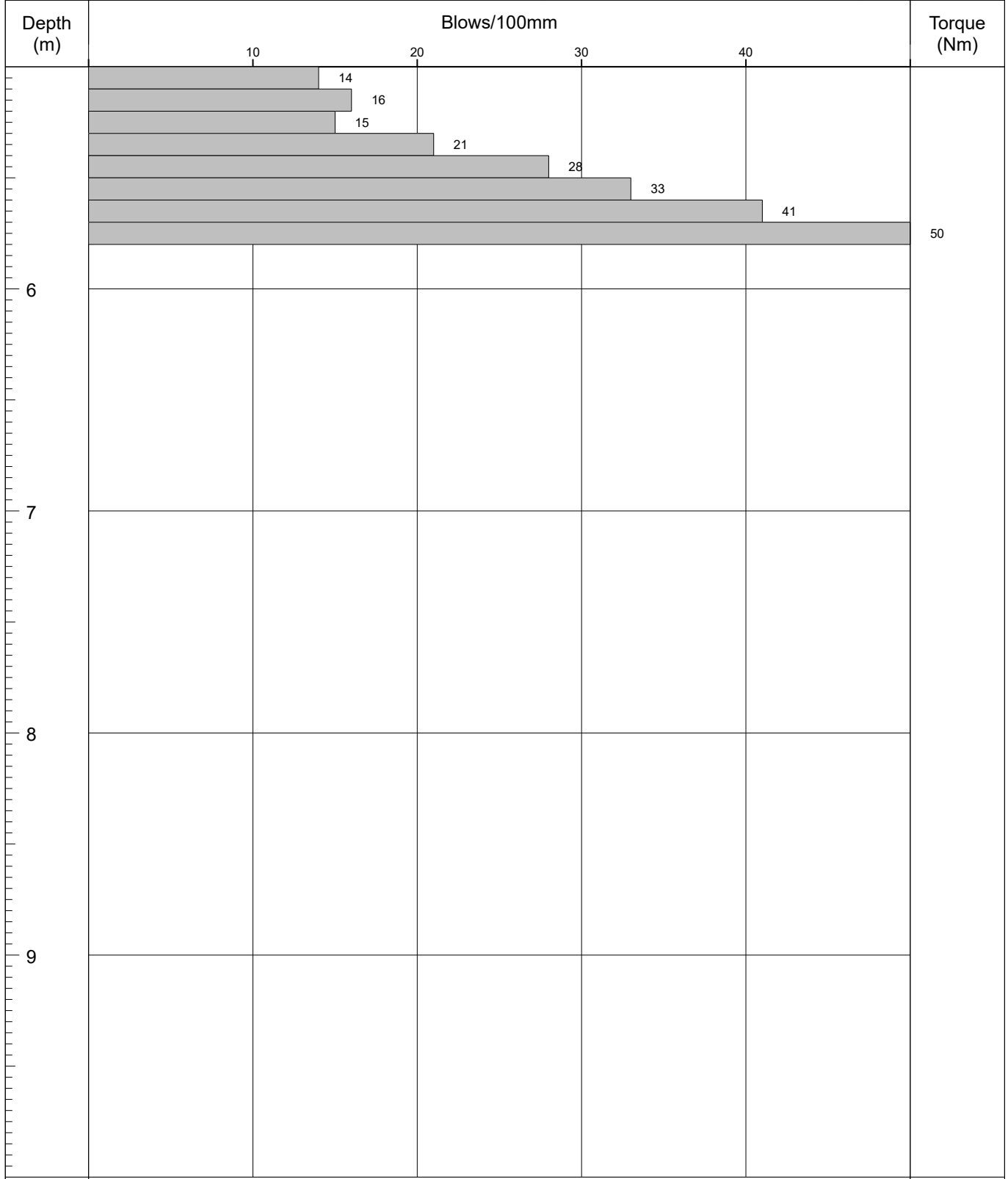
Final Depth 5.80

Probe Type DPM



End of Dynamic Probing at 5.80m b.g.l. - Refusal encountered on probable boulder.

Project Name: Limerick WWTP Upgrade Projects - Site Investigation	Project No. 2099-21	Co-ords: 560802.40 - 658463.10	Hole Type DP
Location: Limerick, Co. Limerick		Level: 6.85	Scale 1:25
Client: Uisce Eireann		Dates: 12/10/2021	Logged By



Remarks: Dynamic Probing commenced at base of Window Sampled hole WS-03.	Fall Height	500	Cone Base Diameter	
	Hammer Wt	30	Final Depth	5.80
	Probe Type	DPM		



End of Dynamic Probing at 5.80m b.g.l. - Refusal encountered on probable boulder.

Project Name: Limerick WWTP Upgrade Projects  
 - Site Investigation

 Project No.  
 2099-21

Co-ords: 560752.45 - 658415.06

 Hole Type  
 DP

Location: Limerick, Co. Limerick

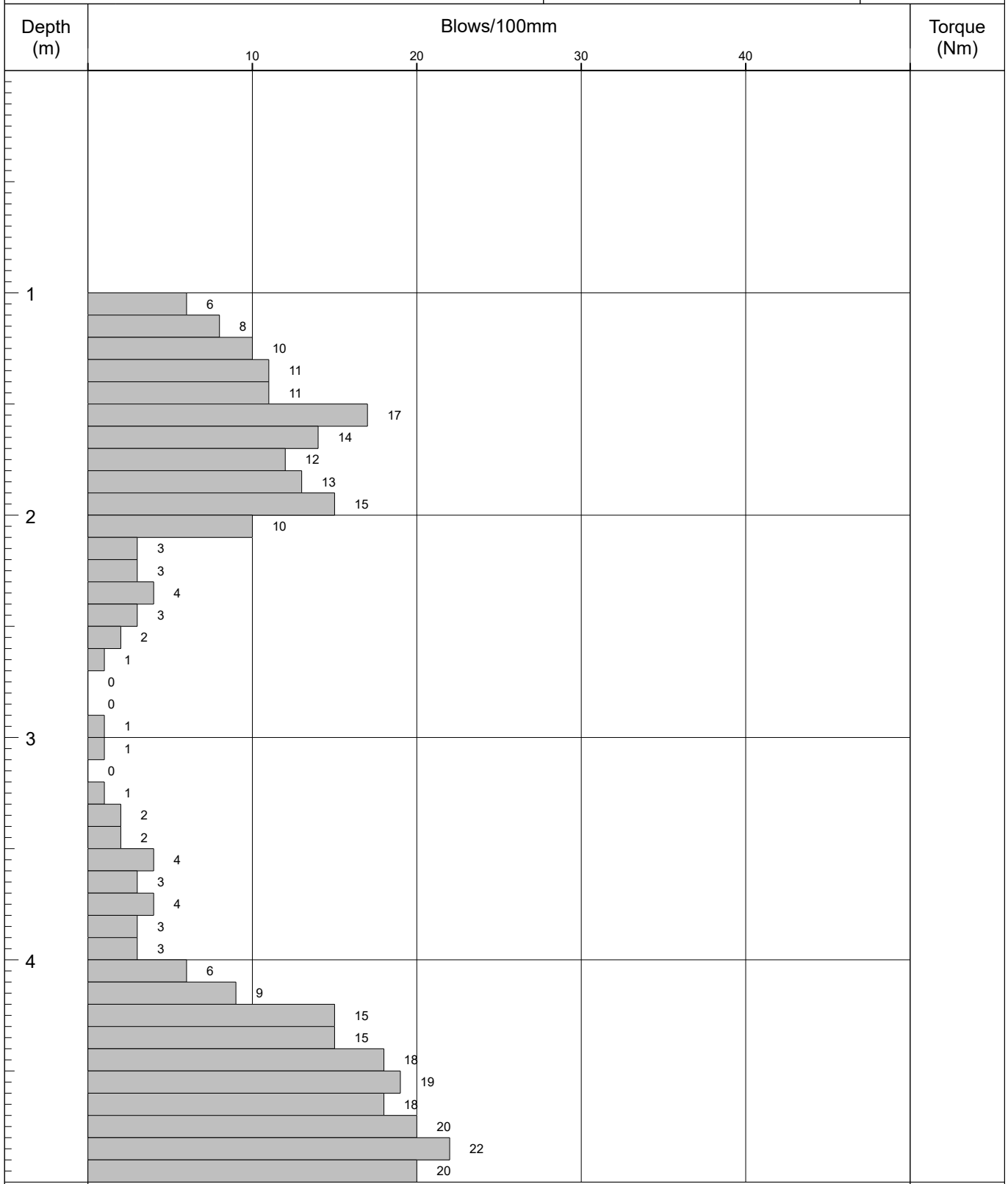
Level: 6.45

 Scale  
 1:25

Client: Uisce Eireann

Dates: 12/10/2021

Logged By


 Remarks:  
 Dynamic Probing commenced at base of hand  
 excavated inspection pit.

Fall Height 500

Cone Base Diameter

Hammer Wt 30

Final Depth 5.00

Probe Type DPM



End of Dynamic Probing at 5.00m b.g.l.



**APPENDIX D**  
**LABORATORY TESTING RESULTS**

NATURAL MOISTURE CONTENT	2 x A4
ATTERBERG LIMITS	2 x A4
PARTICLE SIZE DISTRIBUTION (PSD) / SEDIMENTATION	15 x A4
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP	1 x A4
CHEMICAL CONTENT	7 x A4
OEDOMETER 1D CONSOLIDATION	10 x A4
UNCONSOLIDATED UNDRAINED TRIAXIAL	1 x A4
POINT LOAD TESTING	1 x A4
UNIAXIAL COMPRESSIVE STRENGTH (UCS)	1 x A4

# Moisture Content Results



Location: Castletroy WWTP

Job No: 2099-21

Client: Irish Water

Sample no:	Depth (m)	Water Content (%)
BH01	1.0	13.1
BH01	2.5	19.4
BH01	3.0	34.9
BH01	4.0	162.1
BH01	5.0	11.1
BH01	8.0	5.4
BH02	2.0	32.0
BH02	2.0	21.9
BH02	4.0	20.9
BH02	5.0	13.0
BH02	7.0	3.0
BH03	1.0	22.2
BH03	2.0	25.0
BH03	2.0	24.5
BH03	3.0	66.3
BH03	4.0	22.7
BH03	5.3	10.6

Testing Carried out by Queens University Belfast

Operator	Checked	Approved
QUB / SV	SV	JMCN

# Moisture Content Results



Location: Castletroy WWTP

Job No: 2099-21

Client: Irish Water

Sample no:	Depth (m)	Water Content (%)
TP-01	3.00	16.2
TP-01	4.00	20.1
TP-02	2.50	23.2
TP-05	3.00	29.9
WS-03	2.00	69.8
WS-03	3.00	65.4

Testing Carried out by Queens University Belfast

Operator	Checked	Approved
QUB / SV	SV	JMCN

## Atterberg Limits



Location: Castletroy WWTP

Client: Irish Water

Job No: 2099-21

Hole ID	Depth (m)	<sup>425</sup> % PASS	LL (%)	PL (%)	PI (%)	Sample References	Results
BH01	1.0	32.0	29	16	13	Refer to Log	CLAY OF LOW PLASTICITY
BH01	3.0	89.0	34	17	17	Refer to Log	CLAY OF INTERMEDIATE PLASTICITY
BH01	4.0	92.0	123	48	75	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH02	2.0	98.0	42	22	20	Refer to Log	CLAY OF INTERMEDIATE PLASTICITY
BH02	4.0	54.0	26	14	12	Refer to Log	CLAY OF LOW PLASTICITY
BH03	1.0	39.0	28	15	13	Refer to Log	CLAY OF LOW PLASTICITY
<b>Operator</b>						<b>Checked</b>	<b>Approved</b>
SV						JM	JW

TESTS CARRIED OUT BY DR SIVAKUMAR VINAYAGAMOTHY OF QUEENS UNIVERSITY BELFAST

## Atterberg Limits



Location: Castletroy WWTP

Client: Irish Water

Job No: 2099-21

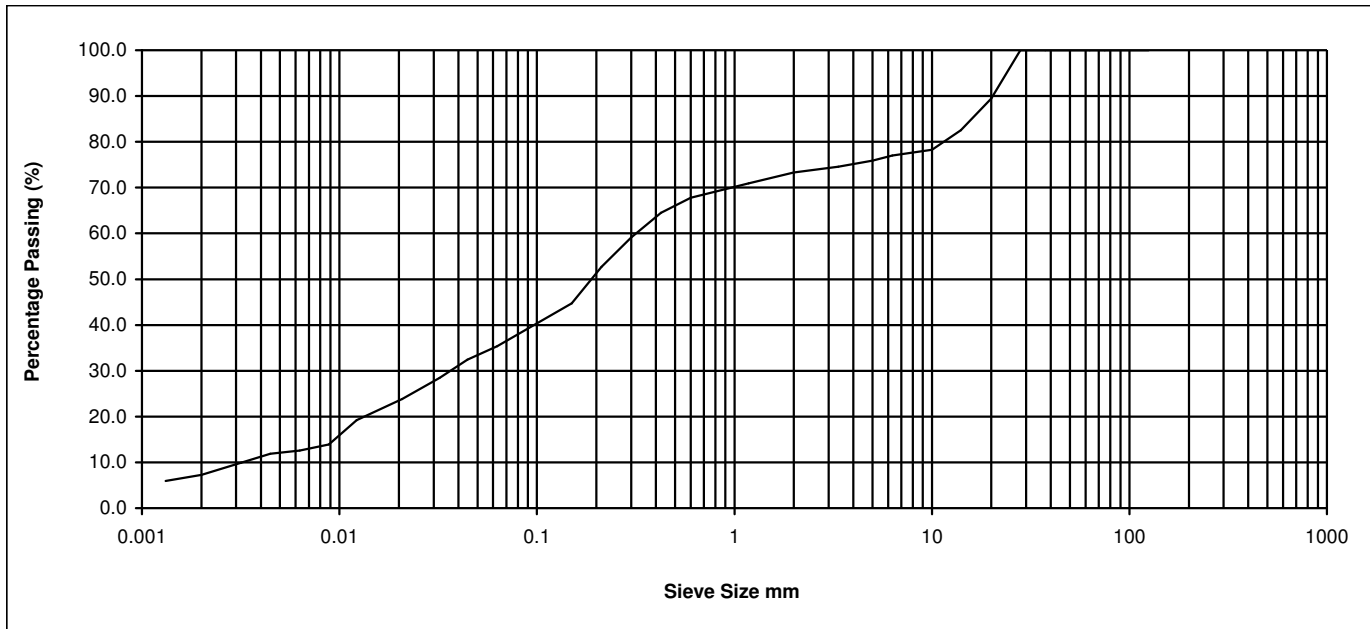
Hole ID	Depth (m)	425 % PASS	LL (%)	PL (%)	PI (%)	Sample References	Results
TP-01	3.00	84.0	30	16	14	Refer to Log	CLAY OF LOW PLASTICITY
WS-03	2.00	100.0	84	31	53	Refer to Log	CLAY OF VERY HIGH PLASTICITY
				<b>Operator</b>		<b>Checked</b>	<b>Approved</b>
				SV		JM	JW

TESTS CARRIED OUT BY DR SIVAKUMAR VINAYAGAMOTHY OF QUEENS UNIVERSITY BELFAST

**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	89.5
14.000	82.5
10.000	78.3
6.300	77.0
5.000	75.9
3.350	74.6
2.000	73.3
1.180	70.9
0.600	67.8
0.425	64.5
0.300	59.1
0.212	52.7
0.150	44.7
0.063	35.3
0.044	32.4
0.032	28.5
0.021	23.8
0.012	19.2
0.009	13.9
0.006	12.6
0.004	11.9
0.003	9.9
0.002	7.3
0.001	6.0

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**



Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
7.3			28.1			38.0			26.7	0.0	0.0

Sample Description Gravelly sandy clayey SILT

Project No. 2099-21

BH/TP No. TP-01

Sample No.

Project Castletroy

Operator SS

Checked

VS

Approved

VS

Date sample tested

31/01/2022

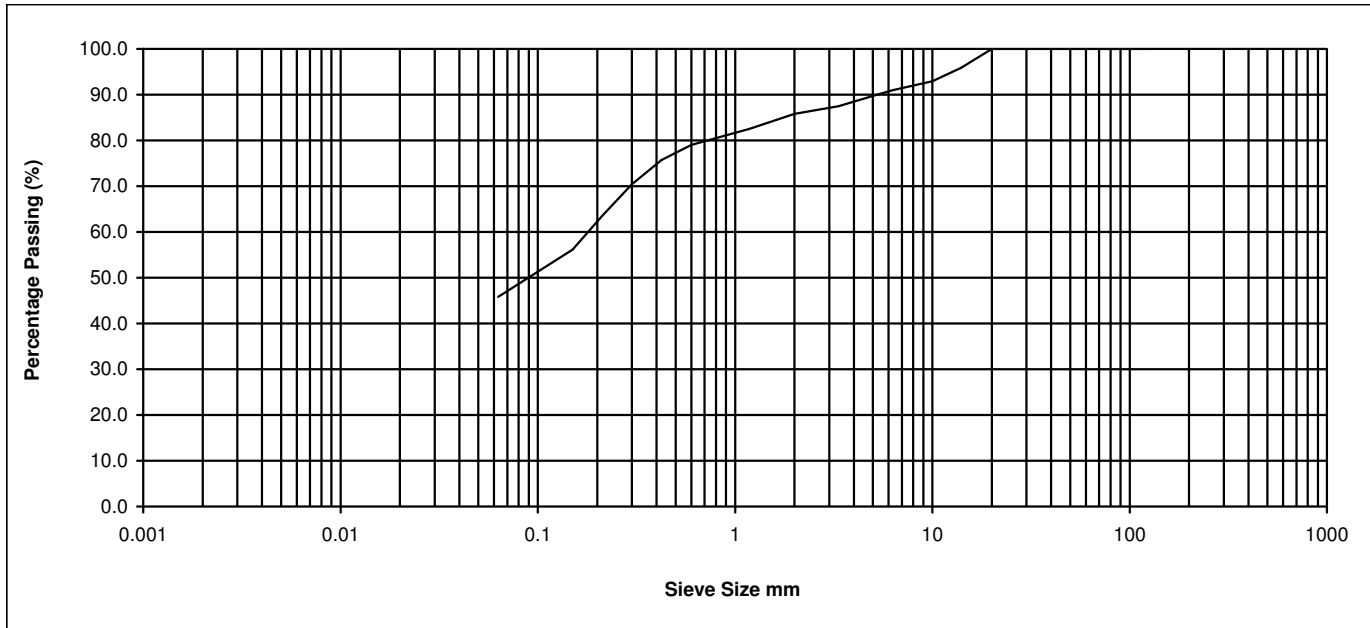
Depth

3.0m

**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	95.9
10.000	92.9
6.300	91.0
5.000	89.7
3.350	87.5
2.000	85.8
1.180	82.5
0.600	79.0
0.425	75.7
0.300	70.4
0.212	63.5
0.150	56.1
0.063	45.8

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**



Percentage Particle Size

Clay	Fine			Coarse			Cobbles	Boulder
	Fine	Medium	Coarse	Fine	Medium	Coarse		
0.0	Silt			Sand			0.0	0.0
		45.8			40.0			
						14.2		

Sample Description Gravelly sandy clayey SILT

Project No. 2099-21

BH/TP No. TP-02

Sample No.

Project Castletroy

Operator

SS

Checked

VS

Approved

VS

Date sample tested

31/01/2022

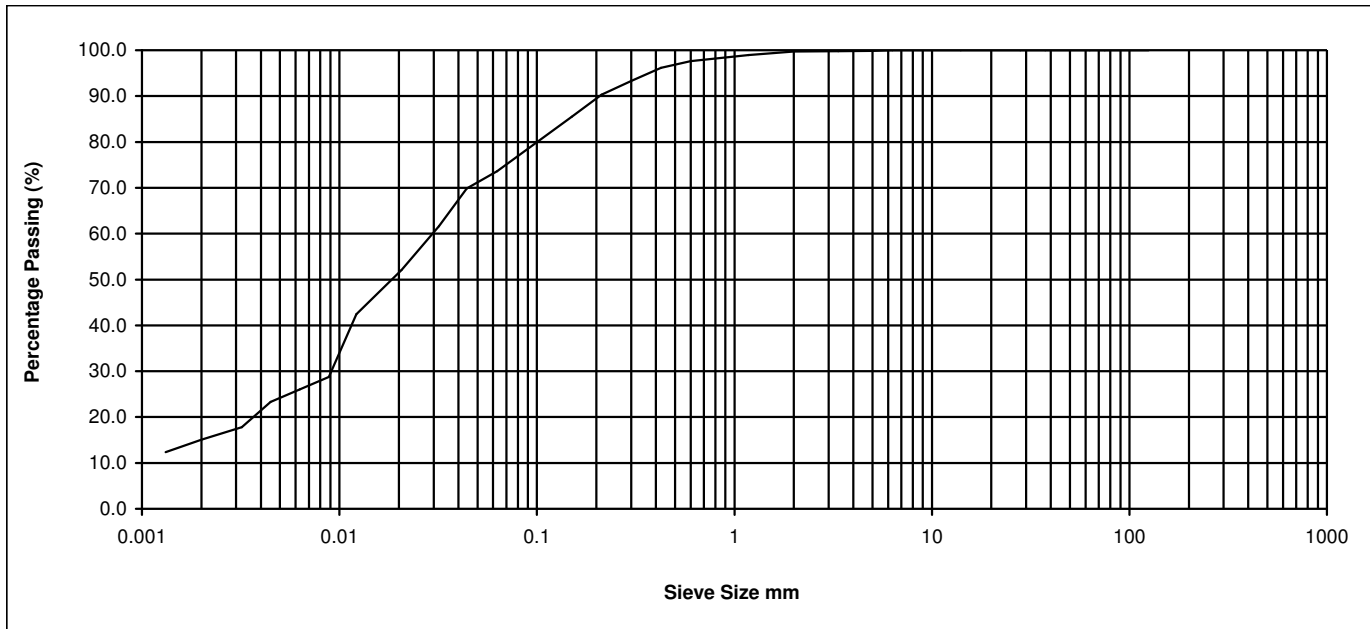
Depth

2.5m

**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	100.0
5.000	99.9
3.350	99.8
2.000	99.7
1.180	99.0
0.600	97.6
0.425	96.2
0.300	93.3
0.212	90.3
0.150	85.5
0.063	73.6
0.044	69.8
0.032	61.6
0.021	52.0
0.012	42.4
0.009	28.8
0.006	26.0
0.004	23.3
0.003	17.8
0.002	15.1
0.001	12.3

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**



Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
15.1			58.5			26.1			0.3	0.0	0.0

Sample Description Sandy clayey SILT

Project No. 2099-21

BH/TP No. TP-05

Sample No.

Project Castletroy

Operator SS

Checked

VS

Approved

VS

Date sample tested

31/01/2022

Depth

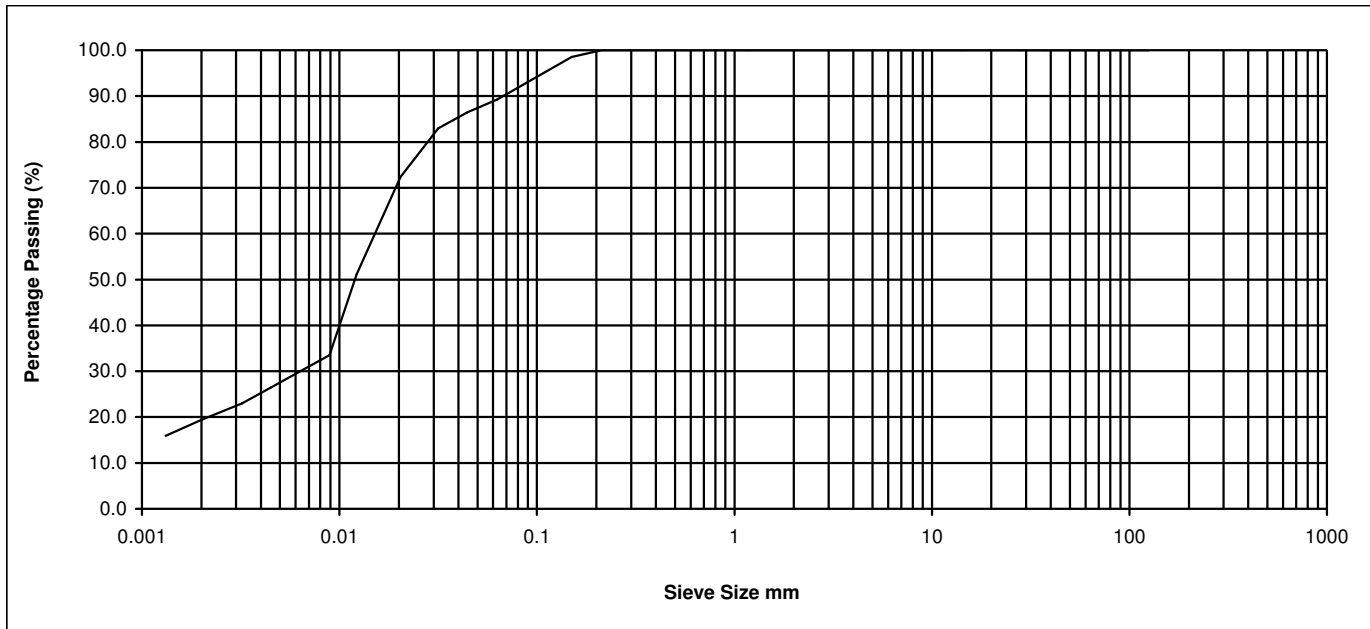
3.0m



**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	100.0
5.000	100.0
3.350	100.0
2.000	100.0
1.180	100.0
0.600	100.0
0.425	100.0
0.300	100.0
0.212	100.0
0.150	98.5
0.063	89.3
0.044	86.5
0.032	82.9
0.020	72.4
0.012	51.2
0.009	33.5
0.006	30.0
0.004	26.5
0.003	22.9
0.002	19.4
0.001	15.9

**Determination of Particle Size Distribution**  
BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Clay	Percentage Particle Size						Cobbles	Boulder		
	Fine	Medium	Coarse	Fine	Medium	Coarse			Fine	Medium
19.4	Silt		Sand			Gravel			0.0	0.0
		69.9		10.7		0.0				

Sample Description Silty CLAY

Project No. 2099-21

BH/TP No. WS-03

Project Castletroy

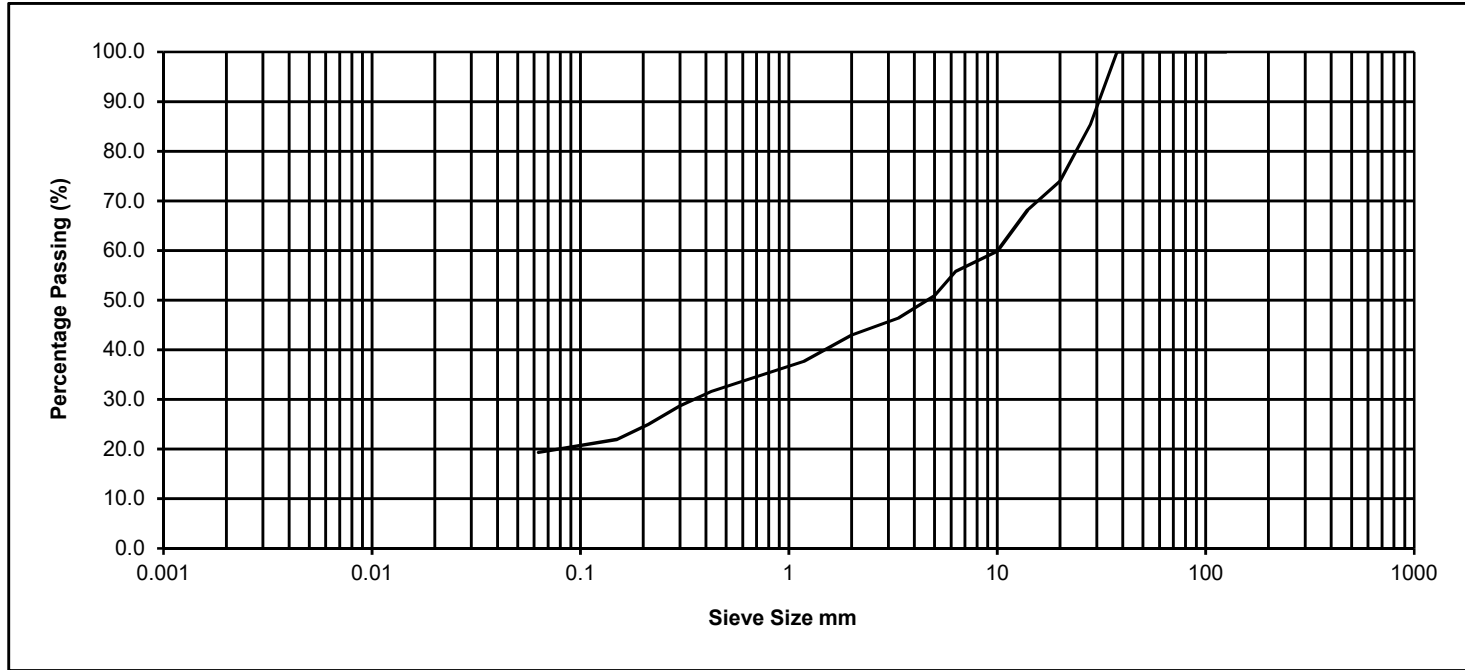
Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	31/01/2022	Depth	3.0m
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**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	85.4
20.000	74.0
14.000	68.2
10.000	59.8
6.300	55.8
5.000	50.9
3.350	46.4
2.000	43.0
1.180	37.7
0.600	33.7
0.425	31.6
0.300	28.7
0.212	25.0
0.150	22.0
0.063	19.3

**Determination of Particle Size Distribution**  
BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	19.3			23.6			57.0			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH01

Sample No.

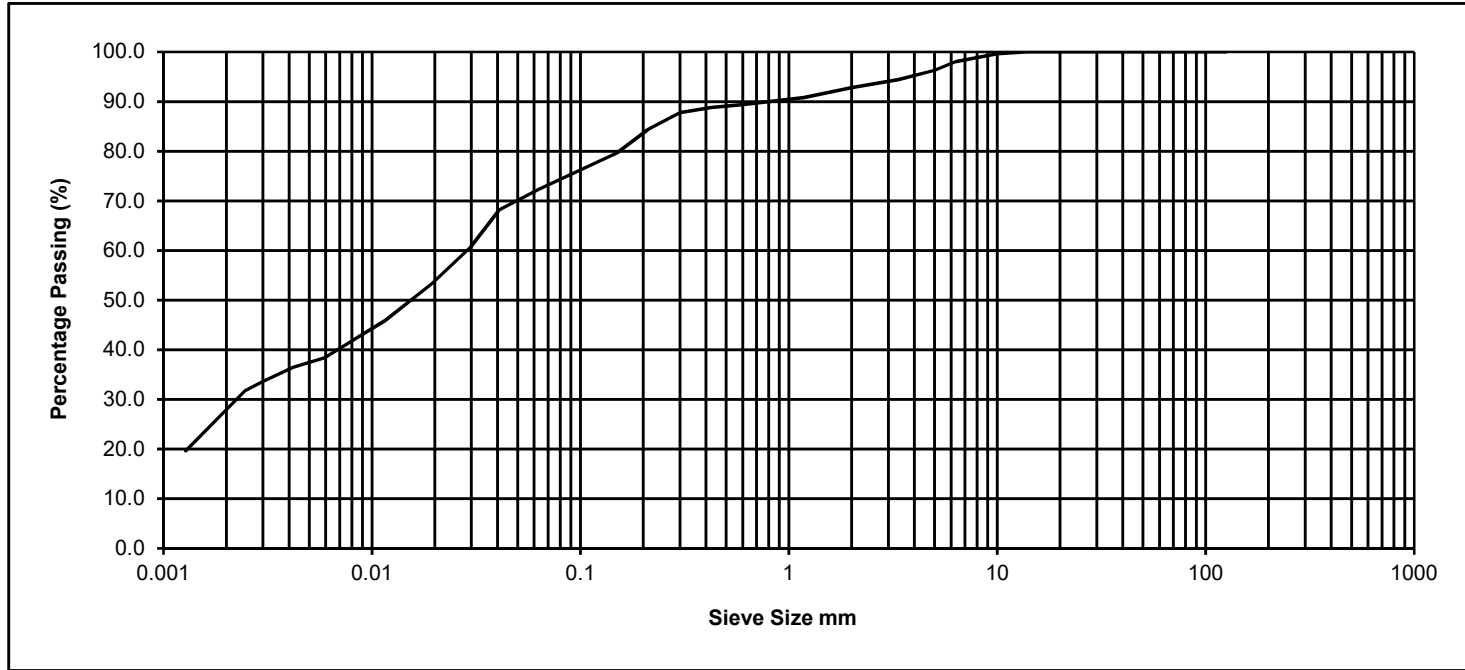
Project Castletroy

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	1.0m
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**VINI Geotechnical Testing**

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	99.6
6.300	98.1
5.000	96.3
3.350	94.4
2.000	92.8
1.180	90.8
0.600	89.4
0.425	88.8
0.300	87.8
0.212	84.4
0.150	79.7
0.063	72.3
0.041	68.2
0.030	60.7
0.019	53.3
0.011	45.8
0.008	42.0
0.006	38.3
0.004	36.4
0.003	33.6
0.002	31.8
0.001	19.6



Clay	Silt			Sand			Gravel			Cobbles	Boulder
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
31.8		40.6			20.5			7.2		0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. BH01

Project Castletroy

Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	3.0m
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**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	100.0
14.000	100.0
10.000	100.0
6.300	99.9
5.000	99.5
3.350	98.8
2.000	97.8
1.180	95.5
0.600	93.2
0.425	92.2
0.300	91.1
0.212	88.3
0.150	86.3
0.063	83.1

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**



Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	83.1			14.7			2.2			0.0	0.0

Sample Description Sandy SILT (Organic)

Project No. 2099-21

BH/TP No. BH01

Project Castletroy

Sample No.

Operator SS

Checked

VS

Approved

VS

Date sample tested

25/10/2021

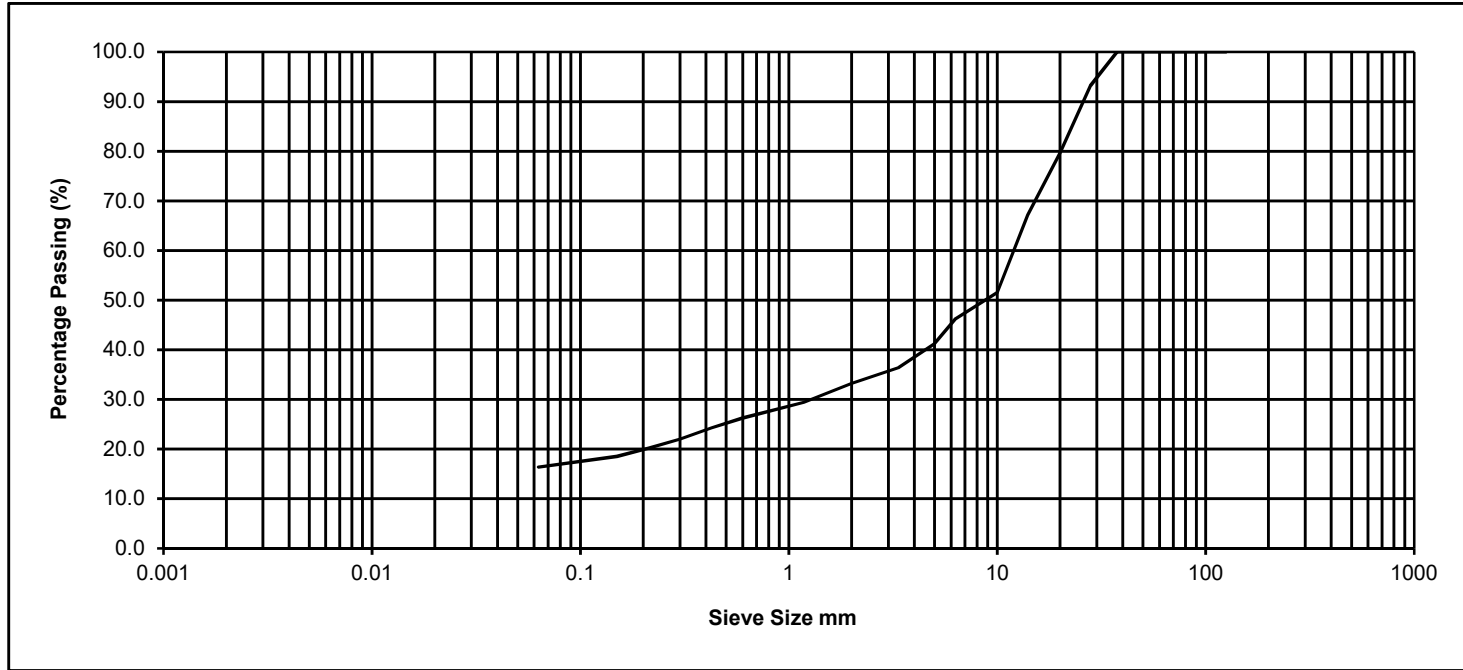
Depth

4.0m

**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	93.2
20.000	79.7
14.000	67.2
10.000	51.5
6.300	46.3
5.000	41.2
3.350	36.4
2.000	33.3
1.180	29.4
0.600	26.3
0.425	24.2
0.300	22.0
0.212	20.1
0.150	18.5
0.063	16.4

**Determination of Particle Size Distribution**  
BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	16.4			16.9			66.7			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH01

Project Castletroy

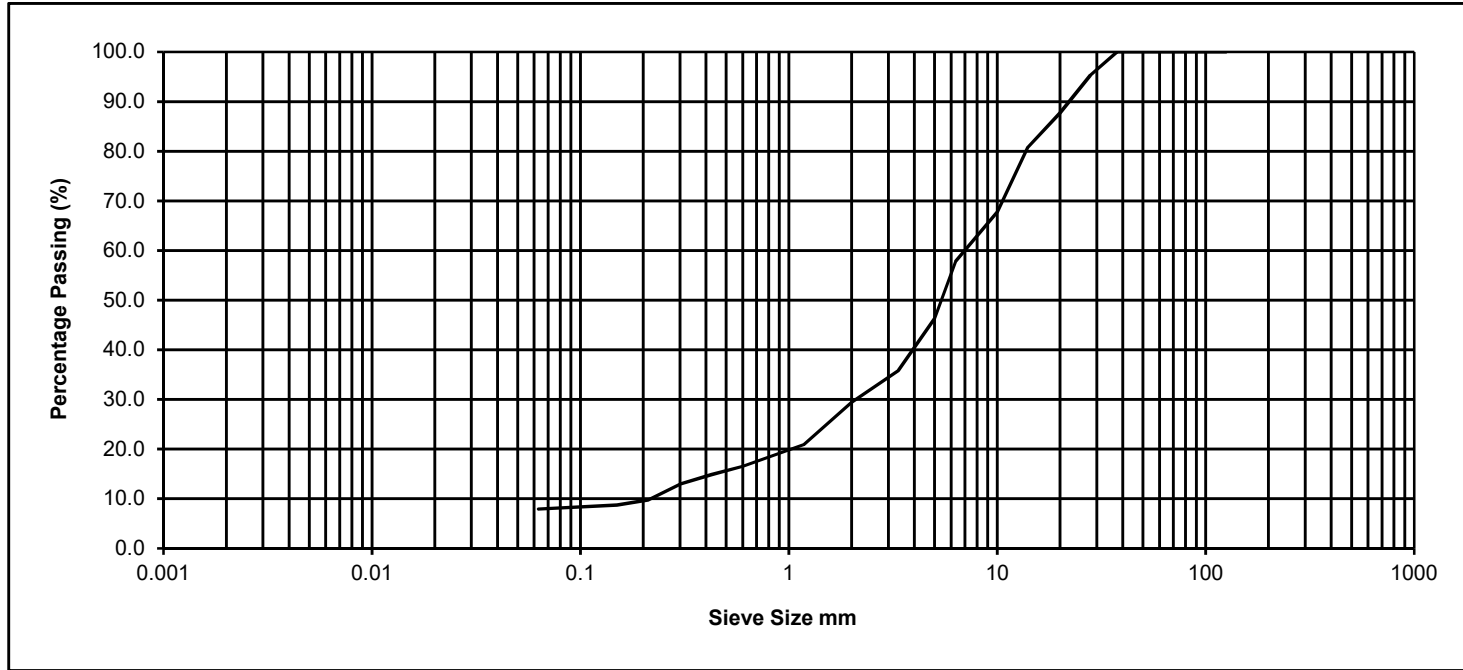
Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	5.0m
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**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	95.3
20.000	87.7
14.000	80.7
10.000	67.7
6.300	57.8
5.000	46.2
3.350	35.8
2.000	29.4
1.180	20.9
0.600	16.5
0.425	14.8
0.300	12.9
0.212	9.7
0.150	8.7
0.063	7.9

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	7.9			21.5			70.6			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH01

Sample No.

Project Castletroy

Operator SS

Checked

VS

Approved

VS

Date sample tested

25/10/2021

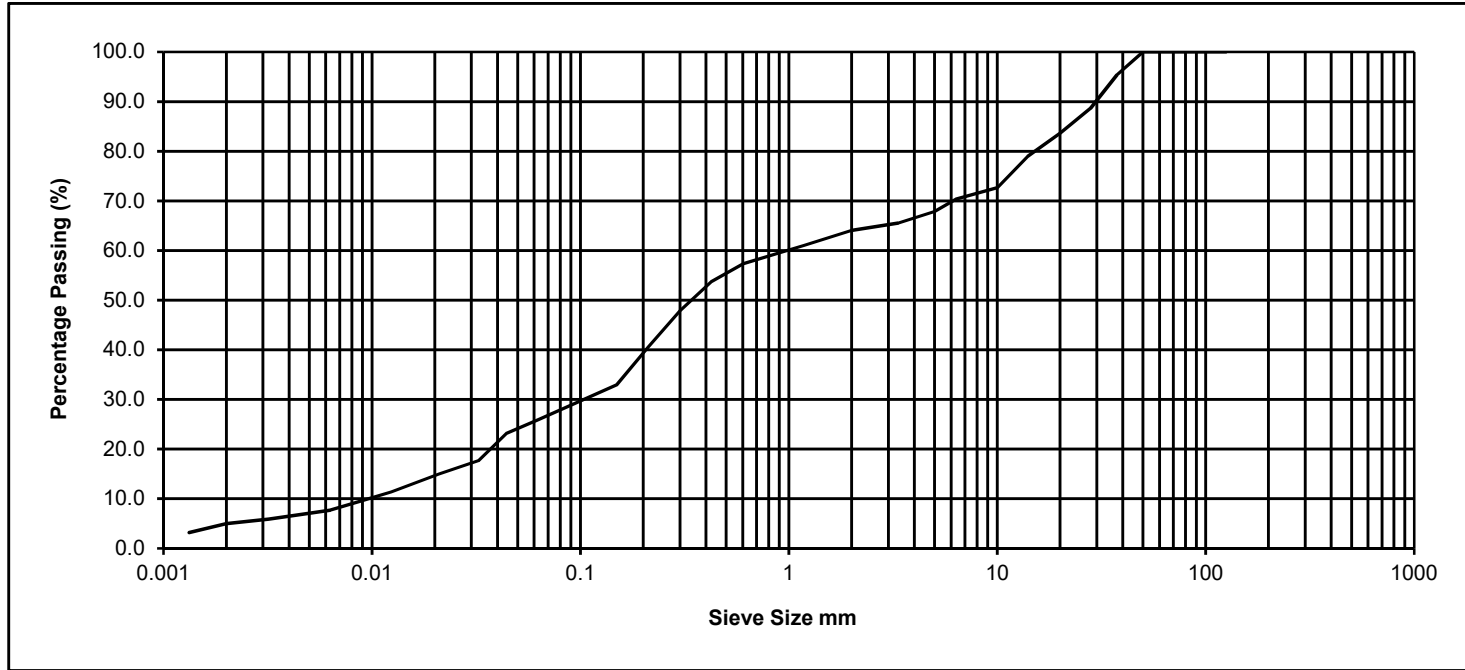
Depth

8.0m

**VINI Geotechnical Testing**

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	95.4
28.000	88.6
20.000	83.6
14.000	78.9
10.000	72.6
6.300	70.3
5.000	67.8
3.350	65.5
2.000	64.1
1.180	61.0
0.600	57.3
0.425	53.7
0.300	47.8
0.212	40.6
0.150	33.0
0.063	25.9
0.044	23.1
0.032	17.7
0.021	15.0
0.012	11.3
0.009	9.5
0.006	7.7
0.004	6.8
0.003	5.9
0.002	5.0
0.001	3.2



Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
5.0	20.9			38.1			35.9			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH02

Sample No.

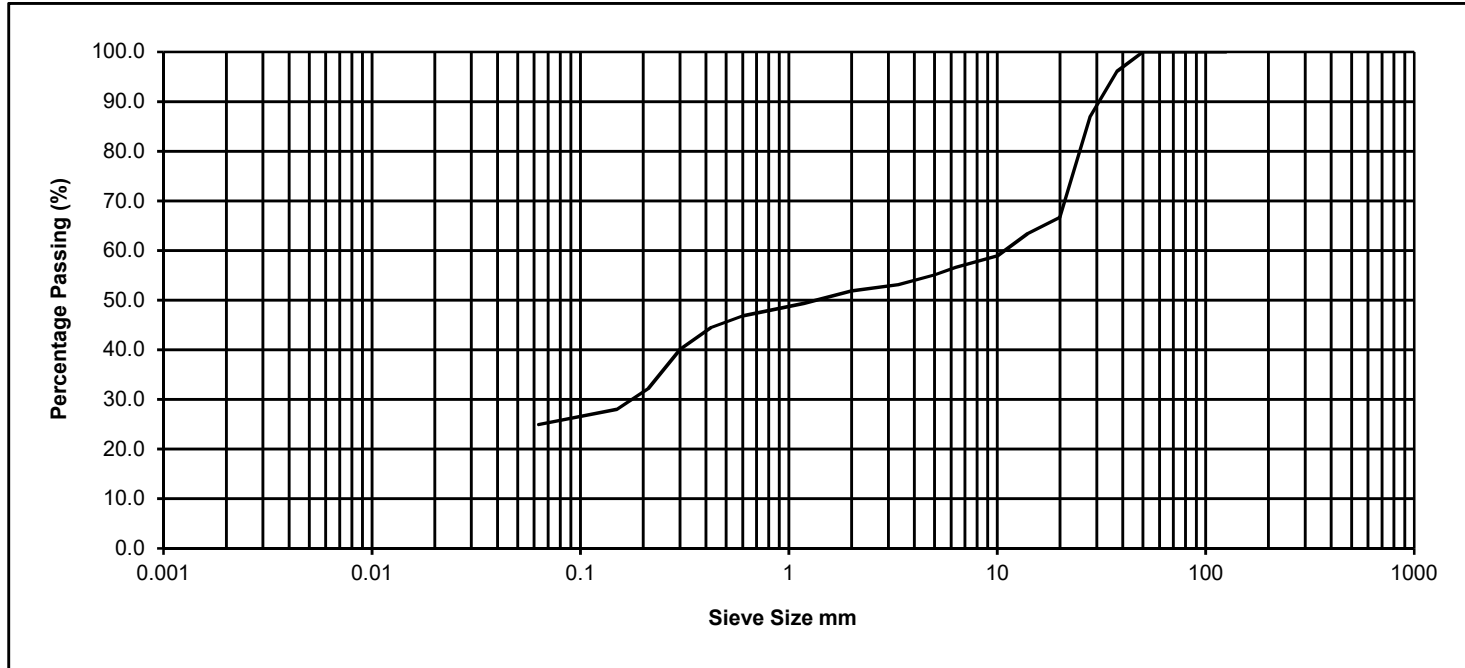
Project Castletroy

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	4.0m
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**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	96.1
28.000	87.1
20.000	66.7
14.000	63.4
10.000	58.9
6.300	56.6
5.000	55.1
3.350	53.1
2.000	51.9
1.180	49.3
0.600	46.8
0.425	44.5
0.300	40.1
0.212	32.2
0.150	28.0
0.063	24.9

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	24.9			26.9			48.1			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH02

Project Castletroy

Sample No.

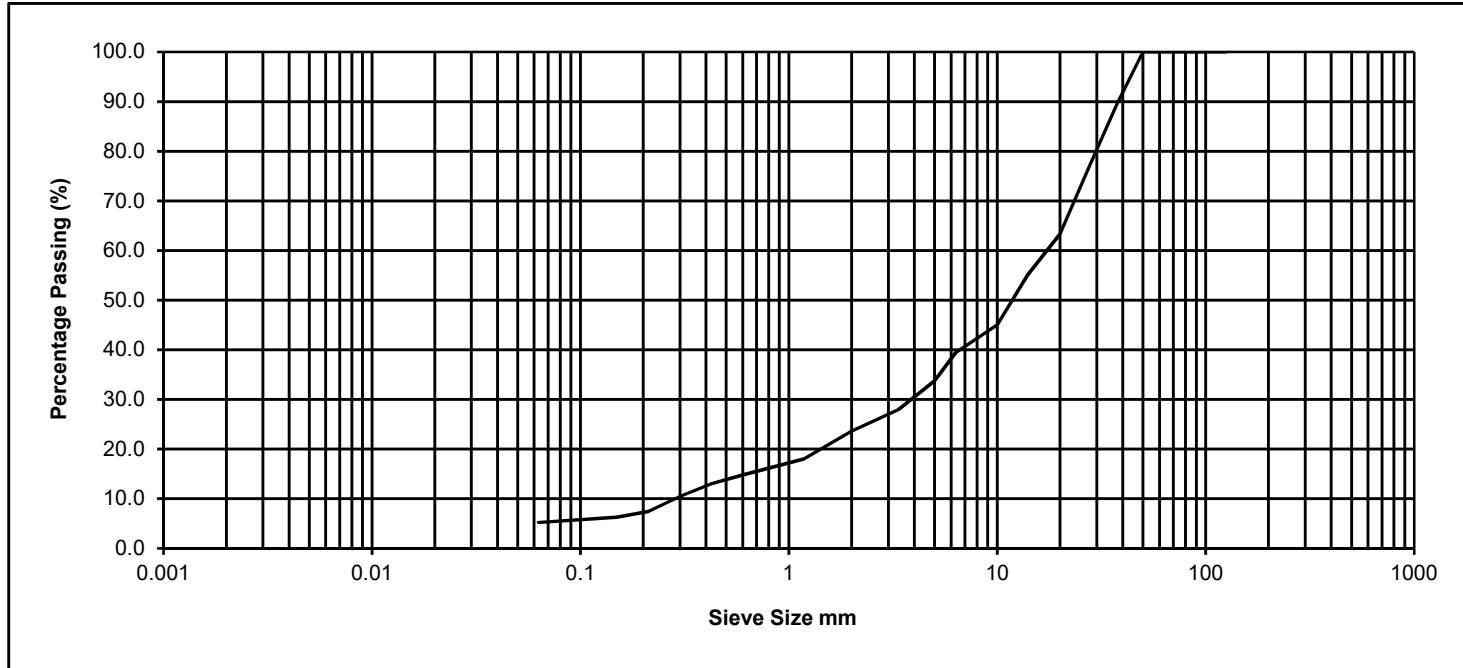
Operator SS	Checked VS	Approved VS	Date sample tested 25/10/2021	Depth 5.0m
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**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	89.5
28.000	77.5
20.000	63.3
14.000	55.1
10.000	45.0
6.300	39.4
5.000	33.7
3.350	28.0
2.000	23.6
1.180	18.0
0.600	14.8
0.425	13.0
0.300	10.5
0.212	7.5
0.150	6.3
0.063	5.2

**Determination of Particle Size Distribution**  
BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	5.2			18.4			76.4			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH02

Project Castletroy

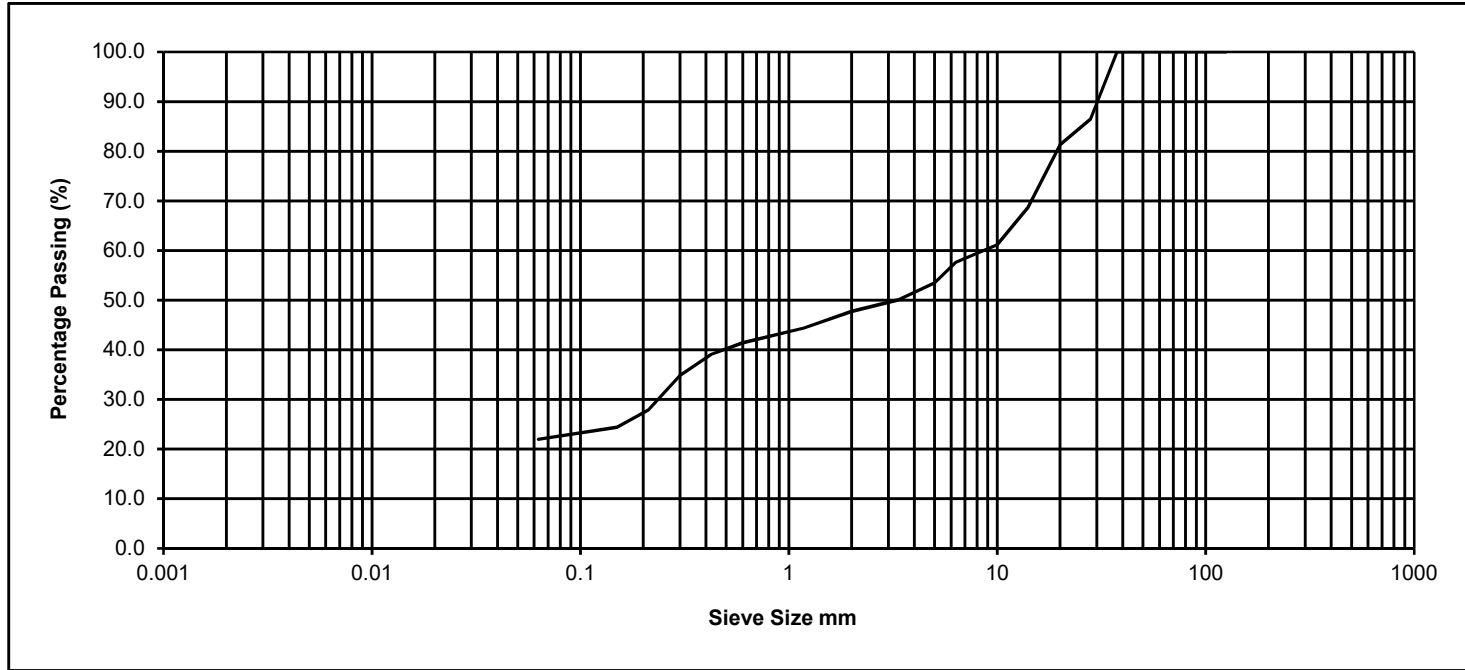
Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	7.0m
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**VINI Geotechnical Testing**

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	86.4
20.000	81.2
14.000	68.6
10.000	61.2
6.300	57.6
5.000	53.5
3.350	50.1
2.000	47.7
1.180	44.4
0.600	41.4
0.425	39.1
0.300	34.8
0.212	27.9
0.150	24.4
0.063	22.0



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	22.0			25.7			52.3			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH03

Project Castletroy

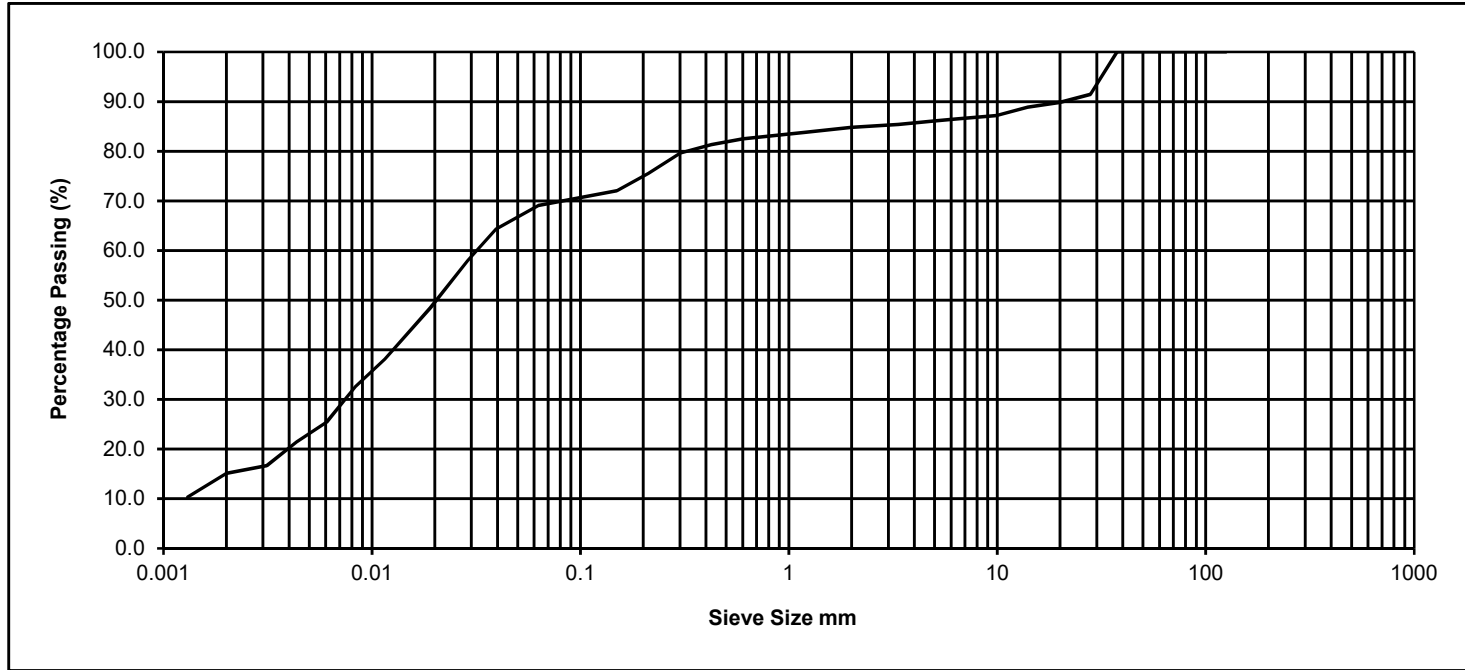
Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	1.0m
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**VINI Geotechnical Testing**

**Determination of Particle Size Distribution**  
**BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	91.4
20.000	89.9
14.000	88.9
10.000	87.2
6.300	86.5
5.000	86.1
3.350	85.4
2.000	84.8
1.180	83.8
0.600	82.5
0.425	81.3
0.300	79.6
0.212	75.5
0.150	72.1
0.063	69.1
0.039	64.3
0.029	58.0
0.019	48.4
0.012	38.1
0.008	32.6
0.006	25.4
0.004	21.4
0.003	16.7
0.002	15.1
0.001	10.3



Clay	Silt			Sand			Gravel			Cobbles	Boulder
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
15.1	54.0			15.7			15.2			0.0	0.0

Sample Description Gravelly sandy clayey SILT

Project No. 2099-21

BH/TP No. BH03

Sample No.

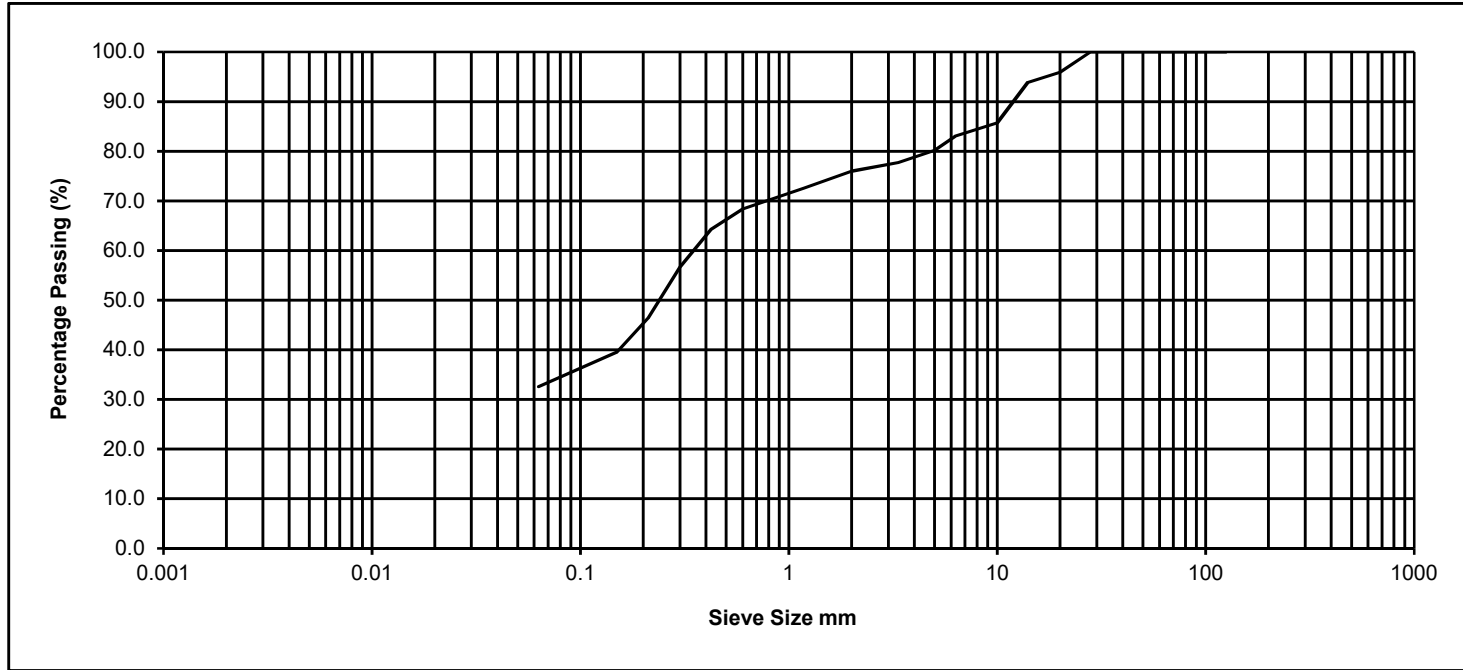
Project Castletroy

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	4.0m
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**VINI Geotechnical Testing**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	95.9
14.000	93.8
10.000	85.7
6.300	83.1
5.000	80.2
3.350	77.7
2.000	76.0
1.180	72.5
0.600	68.3
0.425	64.3
0.300	56.6
0.212	46.5
0.150	39.5
0.063	32.6

**Determination of Particle Size Distribution**  
BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	32.6			43.4			24.0			0.0	0.0

Sample Description Gravelly sandy SILT

Project No. 2099-21

BH/TP No. BH03

Project Castletroy

Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	25/10/2021	Depth	5.3m
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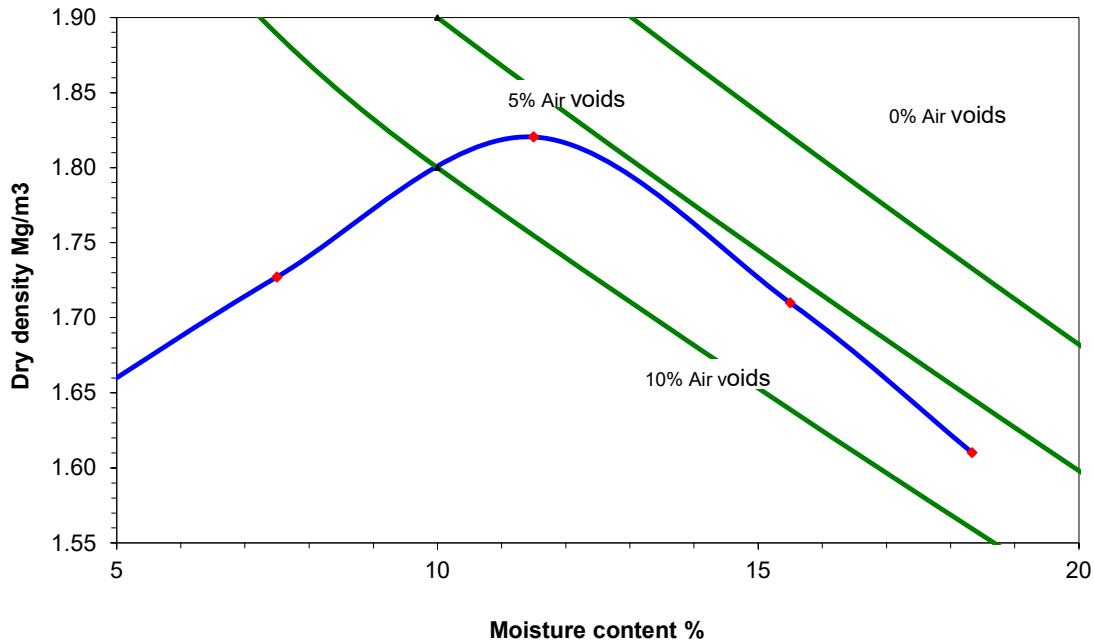
## Determination of dry density / moisture content relationship

**BS 1377: Part 4: 1990 : Clause 3.4**

Location **Castletroy**

Soil description. **Brown gravelly sandy clayey SILT**

Test No.		1	2	3	4	5
Bulk Density	Mg/m <sup>3</sup>	1.71	1.86	2.03	1.98	1.91
Moisture Content	%	4.2	7.5	11.5	15.5	18.3
Dry Density	Mg/m <sup>3</sup>	1.64	1.73	1.82	1.71	1.61



Maximum Dry Density	1.82	Mg/m <sup>3</sup>	% passing 37.5 mm sieve
Optimum Moisture content	11.5	%	% passing 20 mm sieve
Particle Density	2.50	Assumed	
Natural Moisture content	20.10	%	

		<b>Project</b>		Job No.	2099-21
		<b>Castletroy</b>		Trial pit No.	TP01
				Sample No.	Natural
Operator	SS	Checked	VS	Approved	Depth m
					4.0m

Whiteford Geoservices  
Straid House  
Straid  
Ballyclare  
BT39 9EU



**Attention :** Joy McNeill  
**Date :** 28th October, 2021  
**Your reference :** 2099-21  
**Our reference :** Test Report 21/16806 Batch 1  
**Location :** Castleroy Limerick  
**Date samples received :** 25th October, 2021  
**Status :** Final Report  
**Issue :** 1

Three samples were received for analysis on 25th October, 2021 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Authorised By:**



**Bruce Leslie**  
Project Manager

Please include all sections of this report if it is reproduced

# Element Materials Technology

**Client Name:** Whiteford Geoservices  
**Reference:** 2099-21  
**Location:** Castleroy Limerick  
**Contact:** Joy McNeill  
**EMT Job No:** 21/16806

**Report : Solid**  
  
**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2	3							
<b>Sample ID</b>	BH01	BH01	BH02							
<b>Depth</b>	1.00	4.00	2.00							
<b>COC No / misc</b>										
<b>Containers</b>	T	T	T							
<b>Sample Date</b>	<>	<>	<>							
<b>Sample Type</b>	Soil	Soil	Soil							
<b>Batch Number</b>	1	1	1							
<b>Date of Receipt</b>	25/10/2021	25/10/2021	25/10/2021							

Please see attached notes for all abbreviations and acronyms

									LOD/LOR	Units	Method No.
Sulphate as SO4 (2:1 Ext) #	0.1572	0.3496	0.0206						<0.0015	g/l	TM38/PM20
pH #	11.57	6.73	7.74						<0.01	pH units	TM73/PM11

# Element Materials Technology

# Notification of Deviating Samples

**Client Name:** Whiteford Geoservices  
**Reference:** 2099-21  
**Location:** Castleroy Limerick  
**Contact:** Joy McNeill

**Matrix : Solid**

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
21/16806	1	BH01	1.00	1	All analyses	No sampling date given
21/16806	1	BH01	4.00	2	All analyses	No sampling date given
21/16806	1	BH02	2.00	3	All analyses	No sampling date given

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.



# NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 21/16806

## SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

## WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

## DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

## SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

## DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

## BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

## NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

**REPORTS FROM THE SOUTH AFRICA LABORATORY**

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

**Measurement Uncertainty**

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

**ABBREVIATIONS and ACRONYMS USED**

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

## HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 21/16806

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

**QUB Geotechnical Testing Laboratory**

<b>Client</b>	<b>WF</b>
<b>Job Ref</b>	2099-21
<b>Date</b>	01/11/2021
<b>Borehole number</b>	BH02
<b>Sample number</b>	
<b>Depth m</b>	2.0m
<b>Soil type</b>	<b>Grey clayey SILT</b>
<b>Test</b>	<b>1 D Consolidation</b>

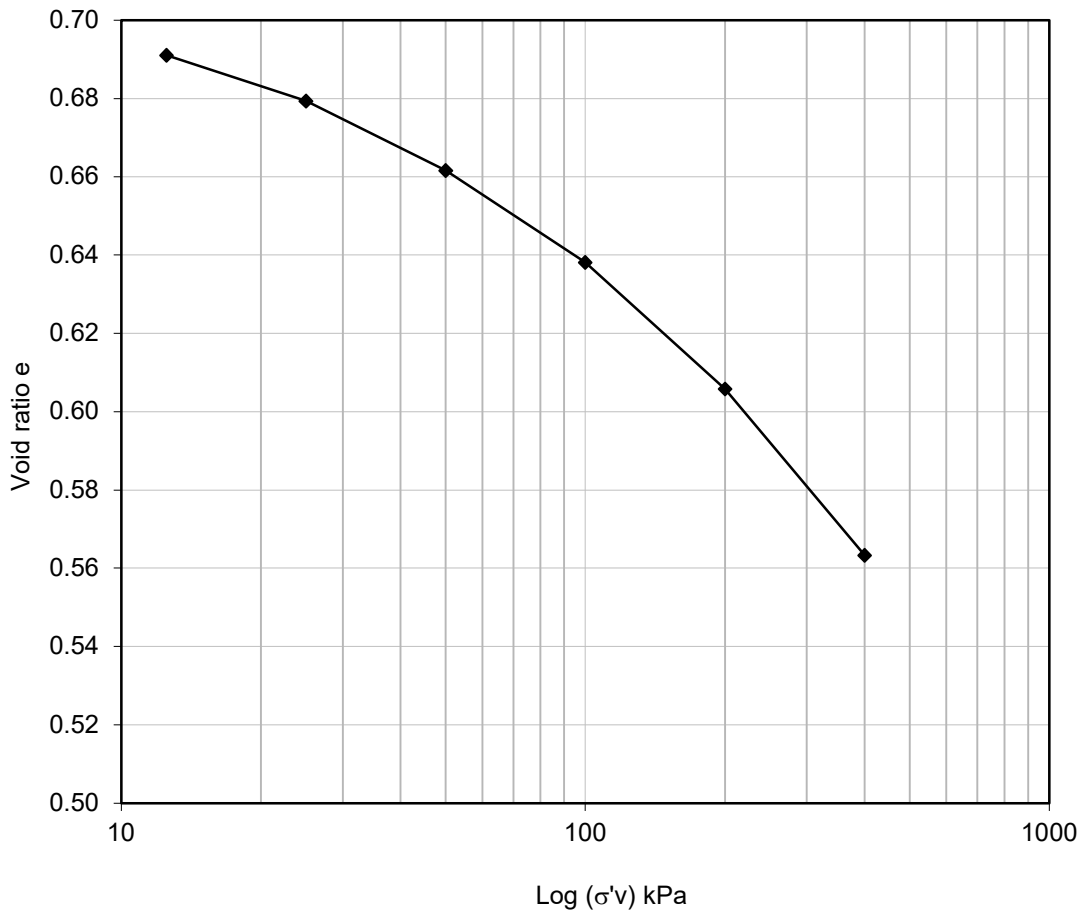
<b>Wet mass (i) g</b>	160.4
<b>Wet mass (f) g</b>	156.3
<b>Dry mass g</b>	125.4
<b>Water content (i) %</b>	27.9
<b>Water content (f) %</b>	24.6
<b>Bulk density kg/m3</b>	1976.3
<b>Dry density kg/m3</b>	1545.1

<b>Ring Diameter mm</b>	76.0
<b>Ring Height mm</b>	17.9
<b>Initial Vol m3</b>	8.1161E-05

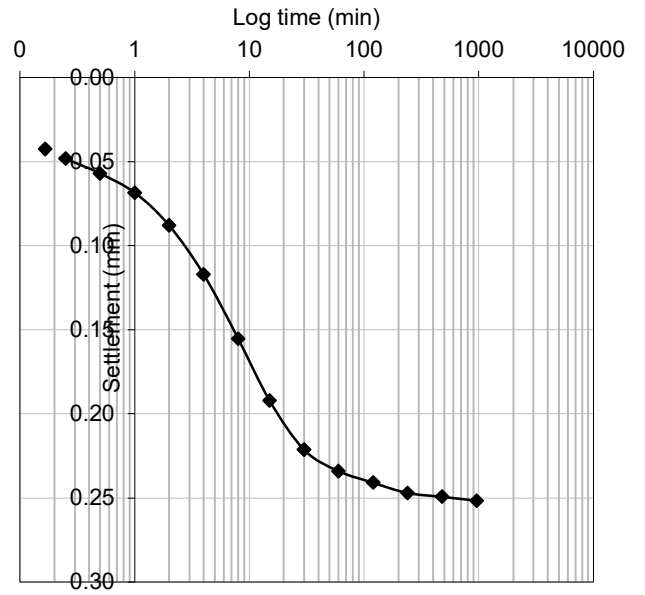
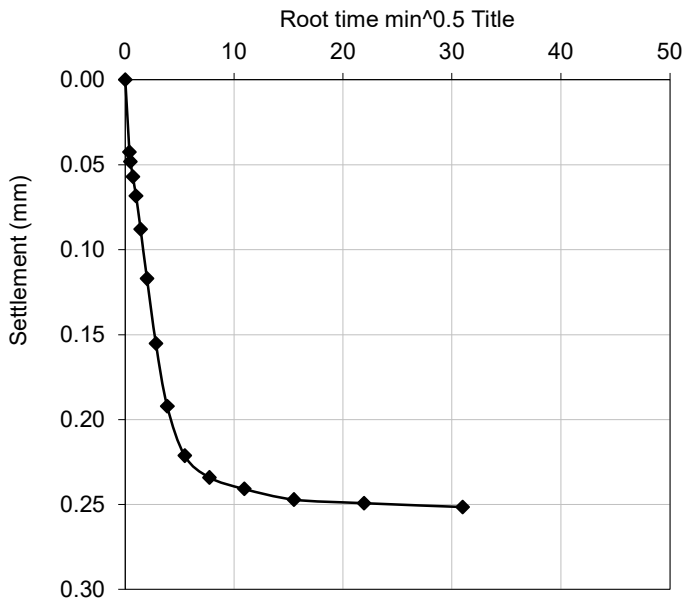
<b>Diameter mm</b>	76.0
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Initial Height mm	17.9	Specific gravity	2.65
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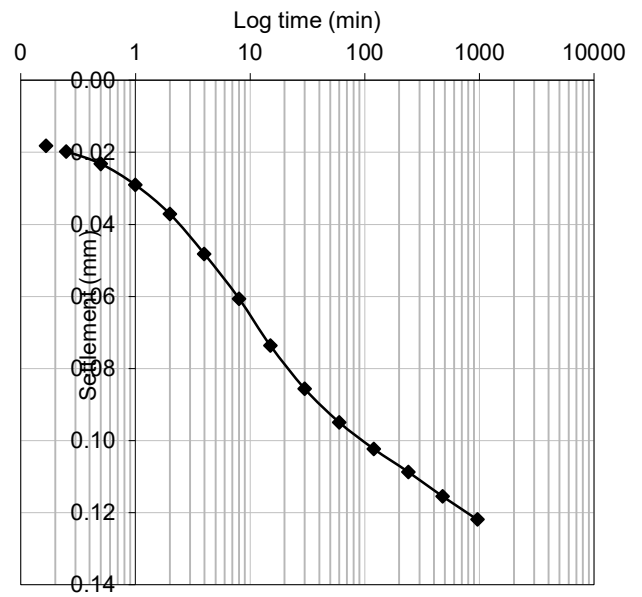
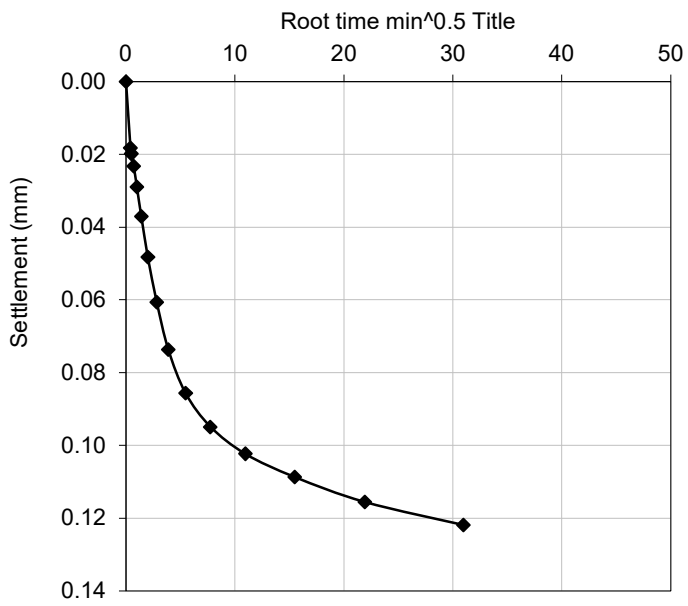
$\sigma'_v$ kPa	$\Delta H$ mm	H mm	V cm <sup>3</sup>	V <sub>v</sub> cm <sup>3</sup>	e	log( $\sigma'_v$ )	Compressibility m <sup>2</sup> /MN	C <sub>v</sub> m <sup>2</sup> /year
12.5	0.252	17.648	80.021	32.700	0.691	1.10		0.96
25	0.122	17.527	79.468	32.147	0.679	1.40	0.55	0.42
50	0.185	17.341	78.628	31.307	0.662	1.70	0.42	0.52
100	0.245	17.096	77.517	30.196	0.638	2.00	0.28	0.51
200	0.338	16.759	75.987	28.666	0.606	2.30	0.20	0.64
400	0.443	16.316	73.978	26.658	0.563	2.60	0.13	0.82



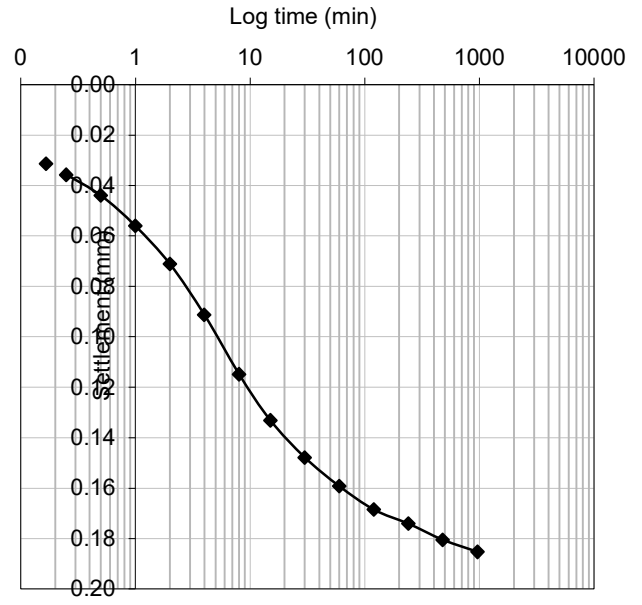
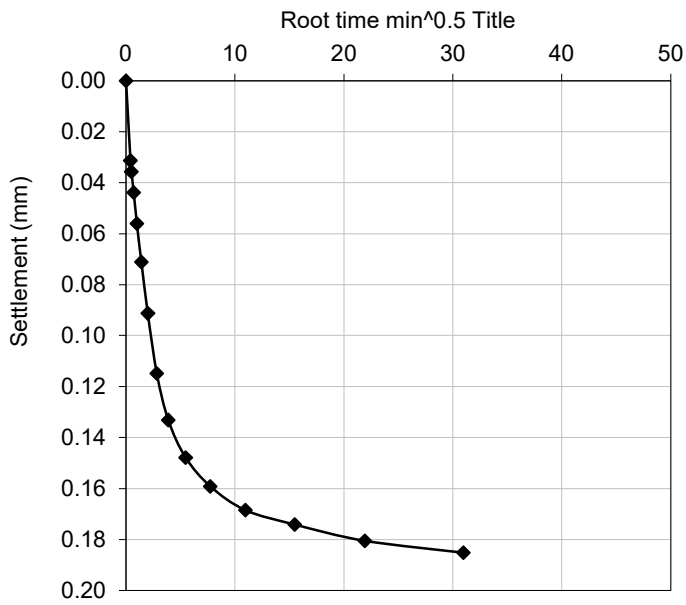
12.5kPa



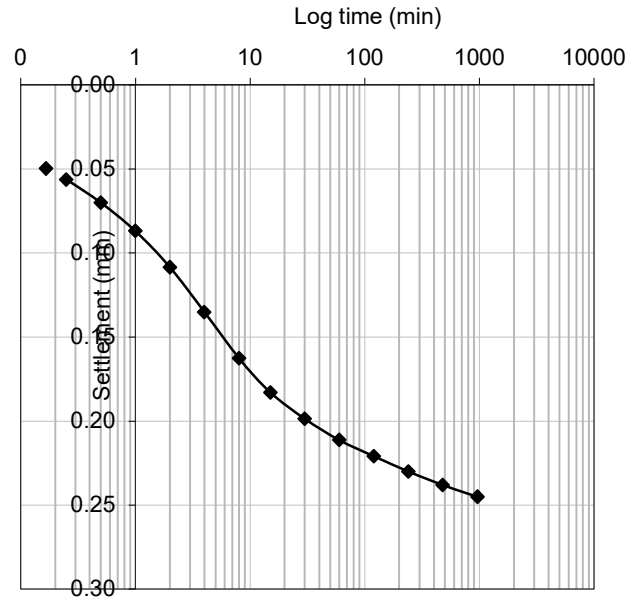
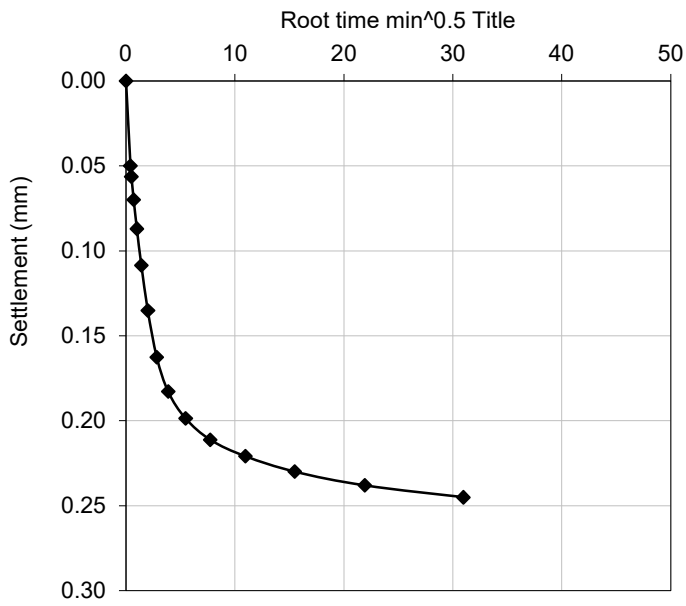
25kPa



50kPa

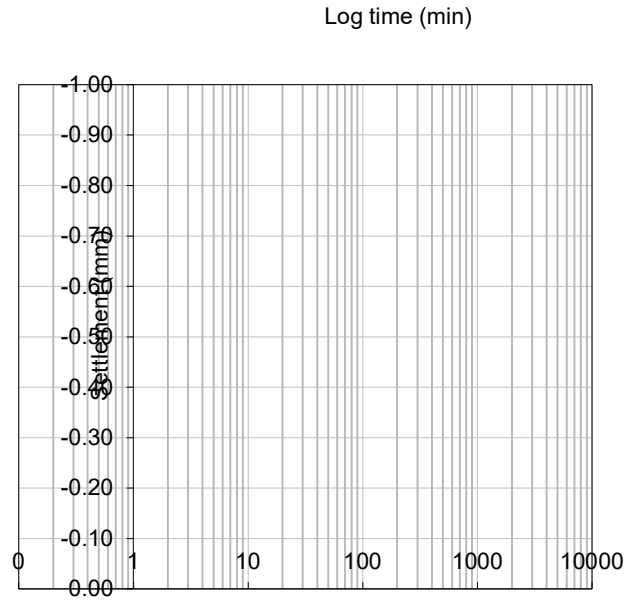
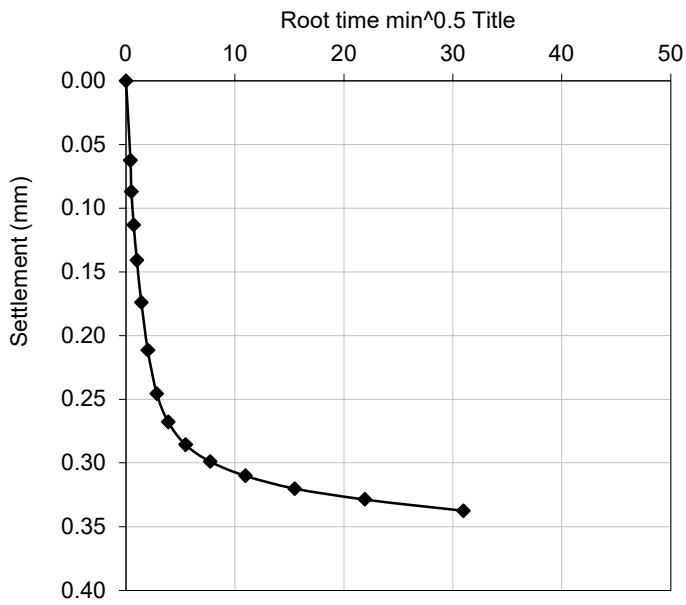


100kPa

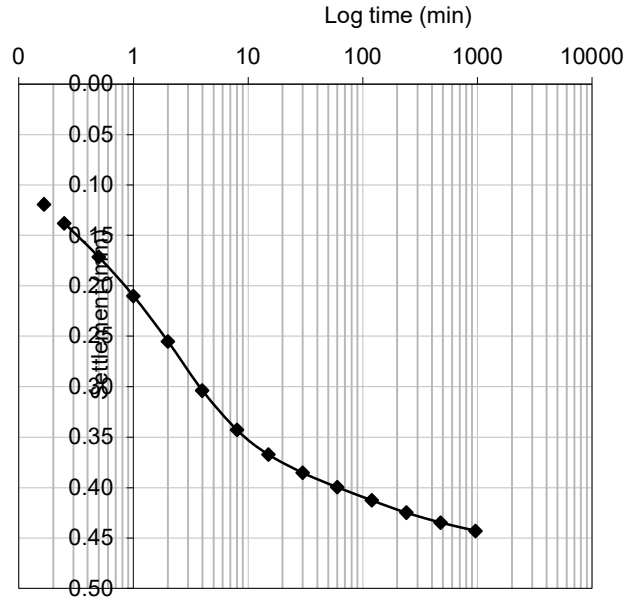
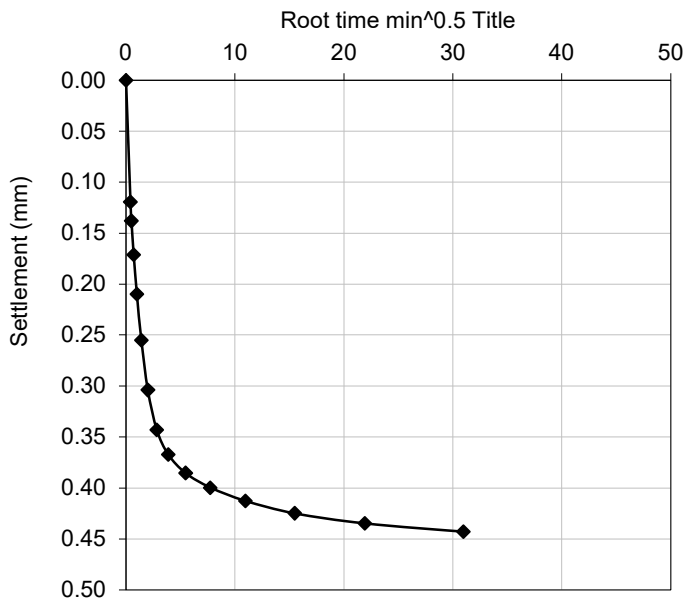


200kPa





400kPa



**QUB Geotechnical Testing Laboratory**

<b>Client</b>	<b>WF</b>
<b>Job Ref</b>	2099-21
<b>Date</b>	01/11/2021
<b>Borehole number</b>	BH03
<b>Sample number</b>	
<b>Depth m</b>	2.0m
<b>Soil type</b>	<b>Grey clayey SILT</b>
<b>Test</b>	<b>1 D Consolidation</b>

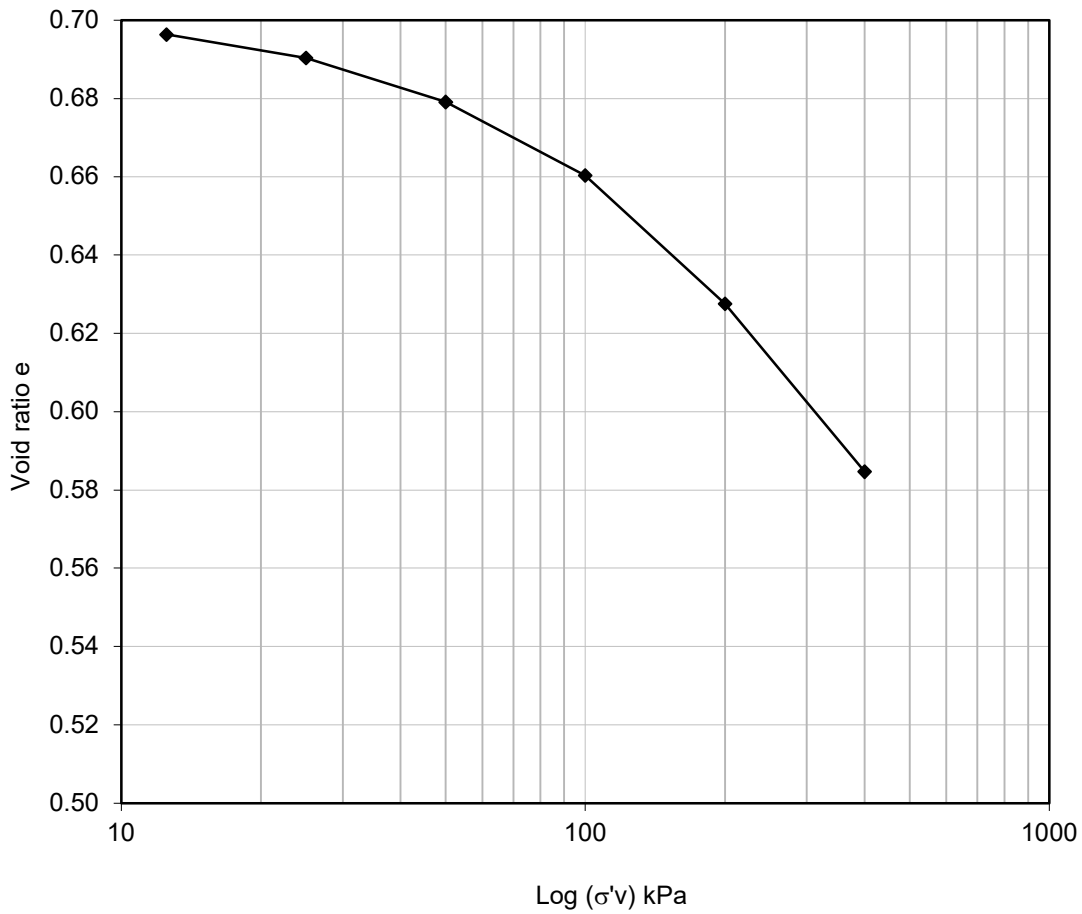
<b>Wet mass (i) g</b>	163.1
<b>Wet mass (f) g</b>	160.2
<b>Dry mass g</b>	127.5
<b>Water content (i) %</b>	27.9
<b>Water content (f) %</b>	25.6
<b>Bulk density kg/m3</b>	1993.2
<b>Dry density kg/m3</b>	1558.1

<b>Ring Diameter mm</b>	76.1
<b>Ring Height mm</b>	18.0
<b>Initial Vol m3</b>	8.183E-05

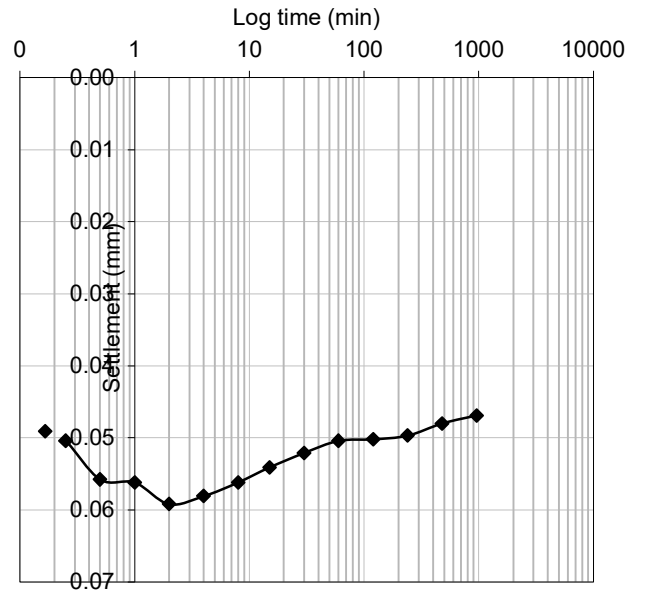
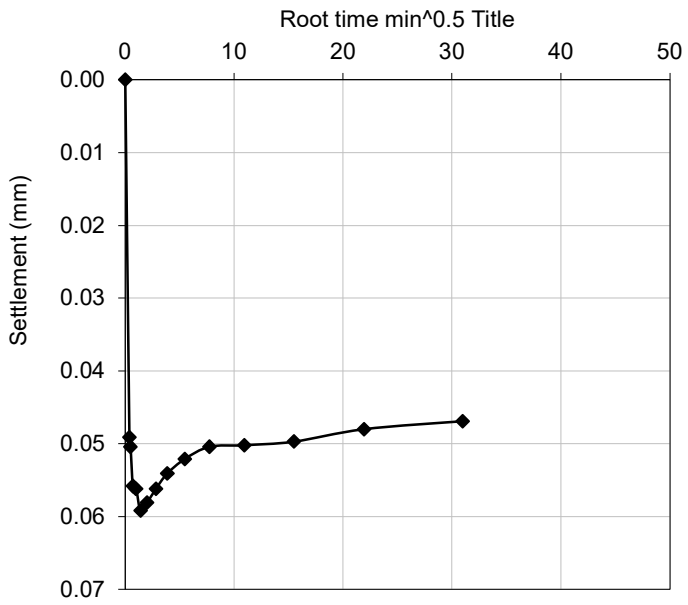
<b>Diameter mm</b>	76.1
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Initial Height mm	18.0	Specific gravity	2.65
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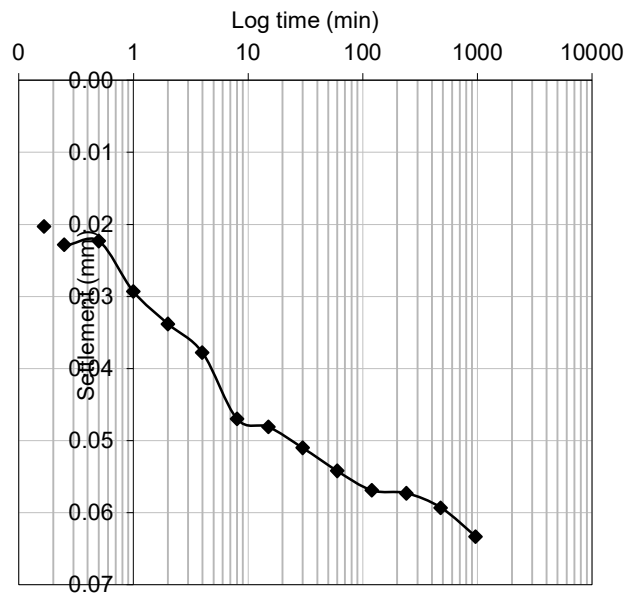
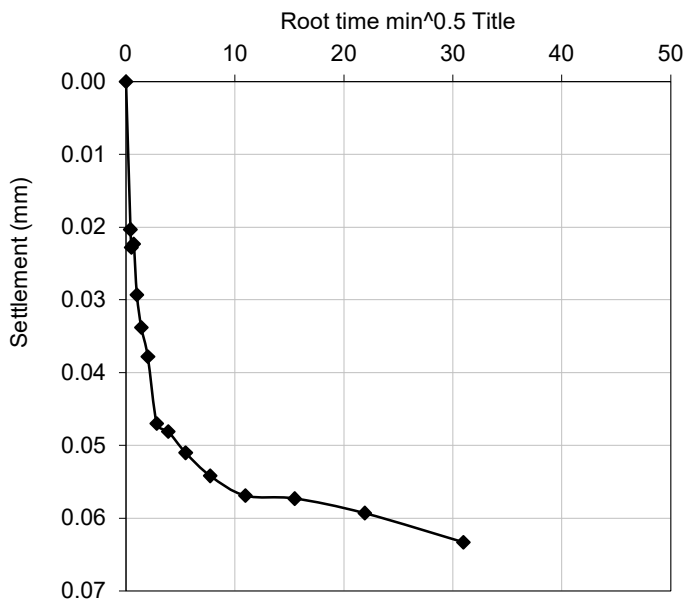
$\sigma'_v$ kPa	$\Delta H$ mm	H mm	V cm <sup>3</sup>	V <sub>v</sub> cm <sup>3</sup>	e	log( $\sigma'_v$ )	Compressibility m <sup>2</sup> /MN	C <sub>v</sub> m <sup>2</sup> /year
12.5	0.047	17.953	81.617	33.503	0.696	1.10		
25	0.063	17.890	81.329	33.216	0.690	1.40	0.28	0.73
50	0.119	17.771	80.788	32.675	0.679	1.70	0.27	0.55
100	0.198	17.573	79.887	31.774	0.660	2.00	0.22	0.70
200	0.348	17.225	78.306	30.193	0.628	2.30	0.20	0.67
400	0.453	16.772	76.245	28.132	0.585	2.60	0.13	0.64



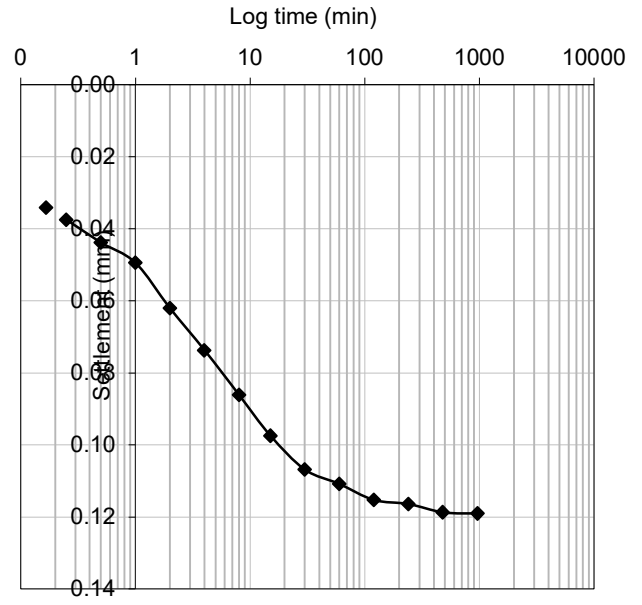
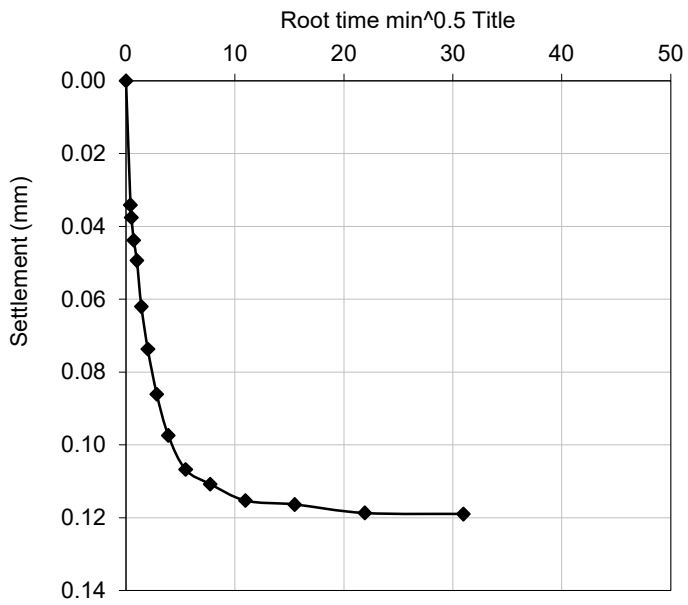
12.5



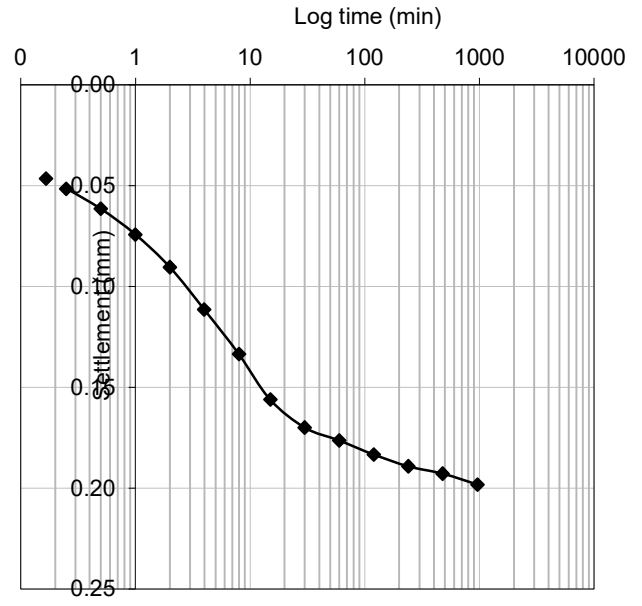
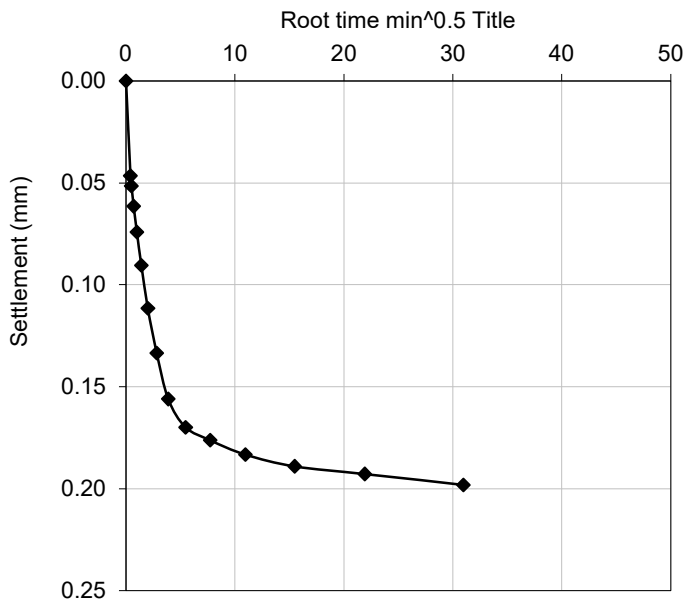
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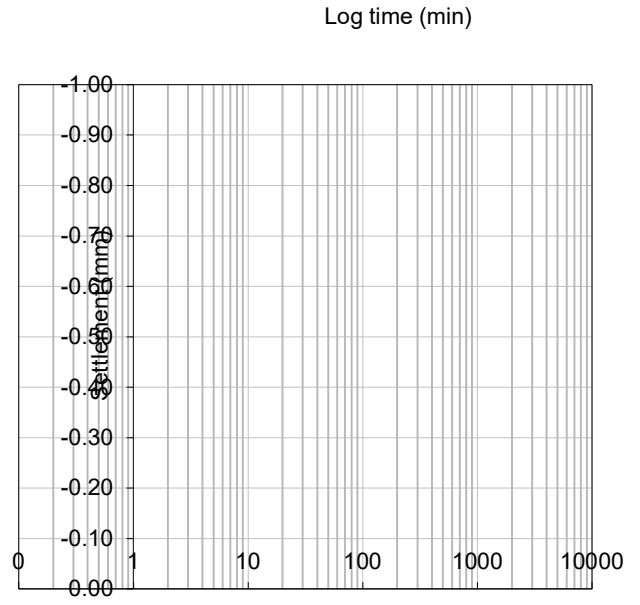
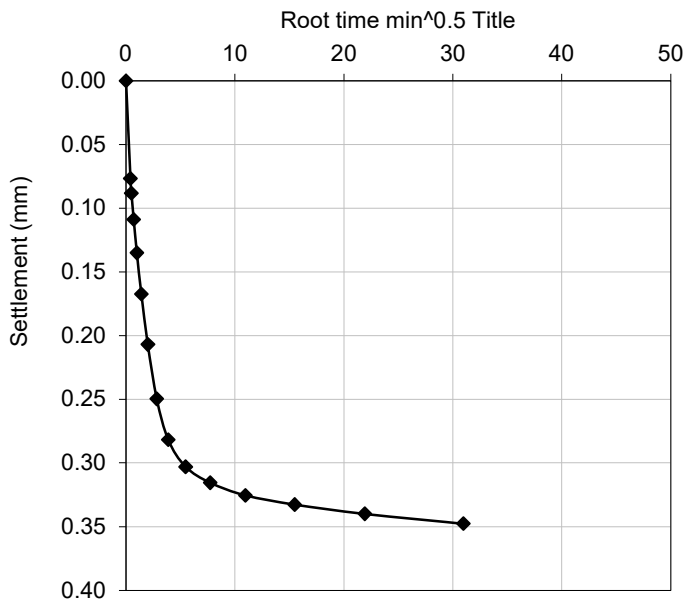
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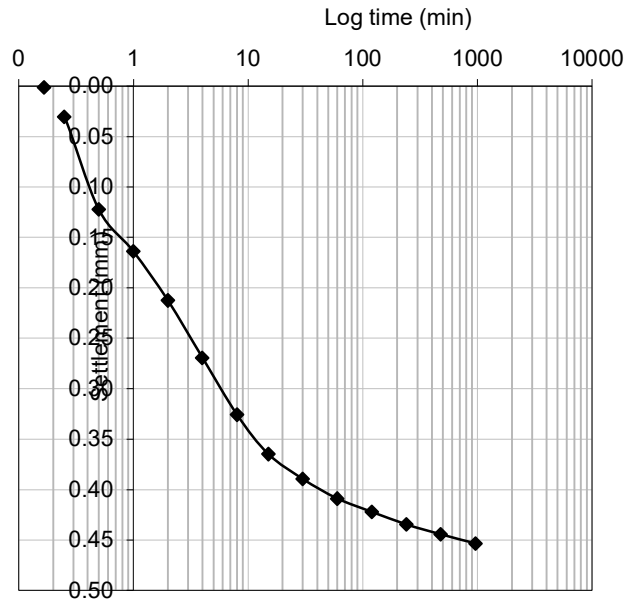
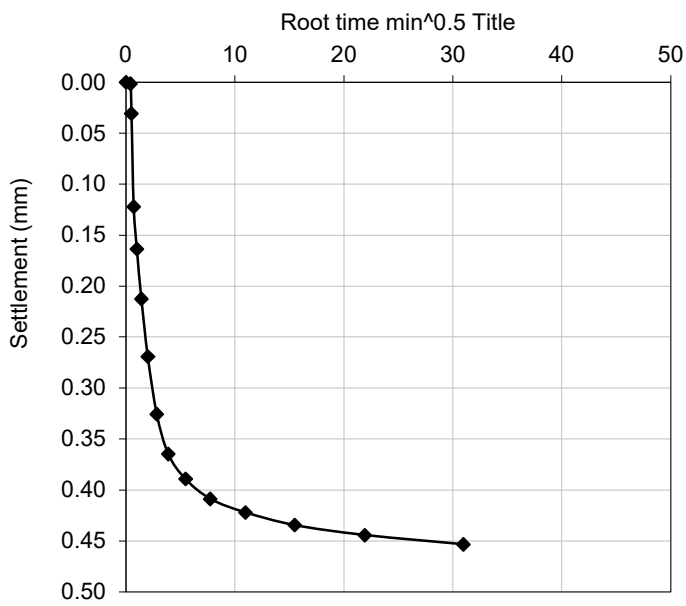
100



200



400



Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	2099-21			
Borehole/sample no.	BH01			
Depth	2.5m			
Soil type	Gravelly sandy SILT			
Sampling	Remoulded			
Stage No.		1	2	3
Diameter	mm	105		
Height	mm	200		
Initial moisture content	%	19.40		
Initial bulk density	kg/m <sup>3</sup>	1909		
Dry density	kg/m <sup>3</sup>	1599		
Cell pressure	kPa	50		
Rate of strain	%/min	1.00		
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	106		
$c_u$			51 kPa	
Mode of failure			Shear plane	
Checked and approved by V Sivakumar				

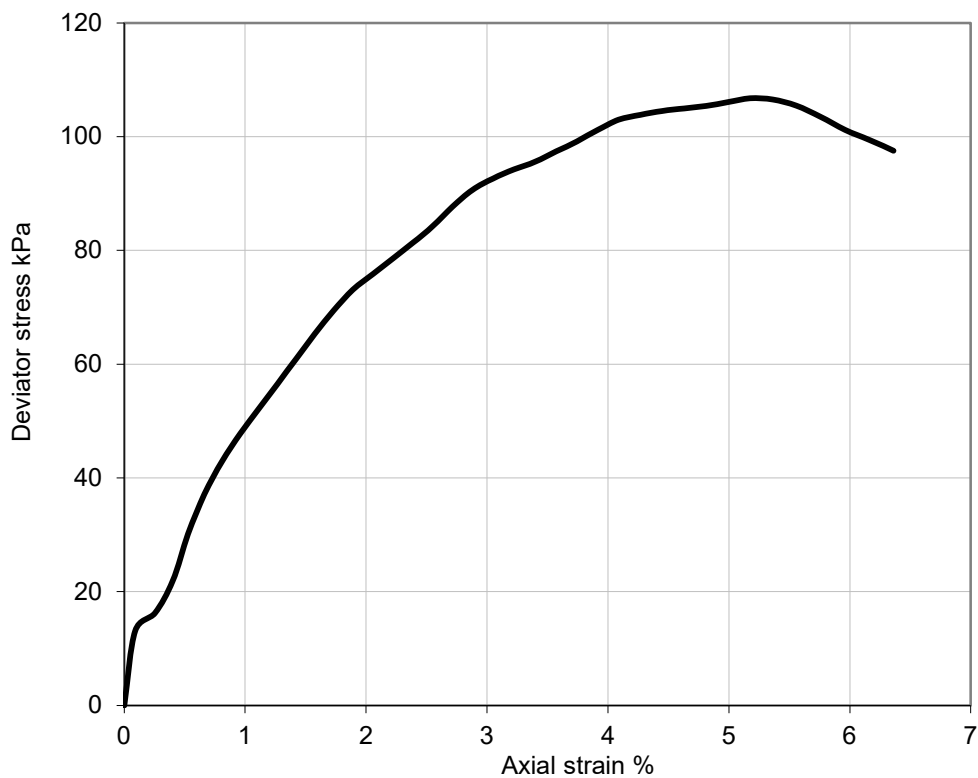


Figure 1 Deviator stress vs axial strain

## Point Load Testing



Location: Castletroy WWTP

Project No: 2099-21

Sample no:	Postion	Sample Depth	Diameter (mm)	Max Load (kN)	Point Load	Size Correction	Corrected Point Load
		(m)	"D"	"P"	Strength (Mpa) "I <sub>s</sub> "	Factor (F)	Strength (MPa) "I <sub>s(50)</sub> "
RC01	D	10.40	63	17.471	4.40	1.11	4.88
RC01	A	10.40	63	13.612	3.43	1.11	3.81
RC01	D	13.50	63	17.525	4.42	1.11	4.90
RC01	A	13.50	63	14.369	3.62	1.11	4.02
RC02	D	16.20	63	19.562	4.93	1.11	5.47
RC02	A	16.20	63	20.339	5.12	1.11	5.69
RC02	D	12.30	63	18.013	4.54	1.11	5.04
RC02	A	12.30	63	20.865	5.26	1.11	5.83
RC02	D	14.80	63	19.049	4.80	1.11	5.33
RC02	A	14.80	63	18.064	4.55	1.11	5.05
					<b>Operator</b>	<b>Checked</b>	<b>Approved</b>
					DR	JMCN	JW

AS TM D5731-08



**COMPRESSIVE STRENGTH OF ROCK CORE SPECIMENS**

Client: Whiteford Geoservices Ltd  
 Project: Castletroy

UCS1858  
 02-Nov-21

Page 1 of 1

Reports sent to: Whiteford Geoservices Ltd  
 Straid House  
 2 Main Street  
 Straid  
 Co Antrim BT39 9NE

[joy.mcneill@whitefordgeoservices.com](mailto:joy.mcneill@whitefordgeoservices.com)

Lab Core ID	R2643	R2644	R2645	R2646		
Core Markings	RC01 12.55m	RC01 14.5m	RC02 11.6m	RC02 13.2m		
Date of coring	Unknown	Unknown	Unknown	Unknown		
Date received	30-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21		
Diameter of core (Average mm)	63.4	63.4	63.3	63.3		
Length at test (mm)	158.4	175.8	177.7	173.9		
Length / Diameter Ratio	2.50	2.77	2.81	2.75		
Mass (g)	1360	1493	1520	1498		
Density (Mg/m <sup>3</sup> )	2.72	2.69	2.72	2.74		
Date of test	02-Nov-21	02-Nov-21	02-Nov-21	02-Nov-21		
Fail Load (KN)	61.3	76.2	78.6	131.6		
<b>Measured compressive strength (MPa)</b>	<b>19.4</b>	<b>24.2</b>	<b>25.0</b>	<b>41.8</b>		
Failure Type	Axial splitting	Axial splitting	Axial splitting	Axial splitting		

Comments						
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Cores tested in received moisture condition using our UKAS calibrated Class 1 Compression Testing Machine.

Signed: I Nichol  
 I Nichol BSc(Hons) MSc

**APPENDIX E  
PHOTOGRAPHS**

TRIAL HOLE PHOTOGRAPHS

6 x A4

ROCK CORE PHOTOGRAPHS

6 x A4



TP-01



TP-01





TP-01



TP-01





TP-02



TP-02





TP-02



TP-02





WS-03



WS-03





WS-03



WS-03





RC01 (Castletroy WWTP)



RC01 (Castletroy WWTP)





RC01 (Castletroy WWTP)



RC01 (Castletroy WWTP)





RC01 (Castletroy WWTP)



RC01 (Castletroy WWTP)





RC02 (Castletroy WWTP)



RC02 (Castletroy WWTP)





RC02 (Castletroy WWTP)



RC02 (Castletroy WWTP)



RC02 (Castletroy WWTP)