

Limerick WWTP Upgrade and Regional Bioresource Centre

Appendix 14.1 - SI Factual Report Limerick WwTP

June 2026



Formerly JB Barry Partners who became part of Egis in 2023



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

Report No: 2099-21A

19th January 2022

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

Uisce Eireann

J.B. Barry & Partners Ltd



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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 Bunlicky Waste Water Treatment Plant (WWTP) as part of the Limerick WWTP Upgrade Projects contract.

The investigation was required to obtain geotechnical information at the Bunlicky 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 18th May and 6th July 2021.

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

2 SITE AND GEOLOGY

2.1 The Site

Bunlicky Waste Water Treatment Plant (WWTP) is situated approximately 875m south-east of the N18 Limerick Tunnel and 400m northerly adjacent to R510 Dock Road, 3.5km south-west of Limerick city, Co. Limerick. The site lies approximately 250m south of the River Shannon.

Site investigation works were undertaken within the existing WWTP facility, mainly in an untended vegetated area westerly adjacent to the existing main treatment tanks.

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.

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 – Bunlicky WWTP – Site Investigation – Site Investigation Layout Plan 2099-21A-SI-L1 Rev 01*’ 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	5 Nr.	4.80m (TP-05BL)	Trial Holes carried out using a Doosan DX140 tracked excavator.
Percussive Boreholes	6 Nr.	12.00m (BH06BL)	Percussive boreholes sunk using a Dando 2000 percussive drilling rig.
Rotary Cored Boreholes	5 Nr.	19.20m (RC02BL)	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)	47 Nr.	11.00m (BH06BL)	SPTs carried out using a Dando 2000 percussive rig.
Hand Penetrometer Test	20 Nr.	4.00m	Undertaken using a hand-held pocket penetrometer.

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/RC01BL	E: 554468.82 N: 655775.78 Z: 1.10	4.00 – 10.80	0.00 – 4.00	10.80
BH/RC03BL	E: 554551.20 N: 655693.00 Z: 2.10	3.60 – 15.60	0.00 – 3.60	15.60

LOCATION	MONITORING DATE	WATER LEVEL (M) B.G.L.	WATER LEVEL (M) AOD
BH/RC01BL	09-09-2021	5.10	- 4.00
BH/RC03BL	09-09-2021	6.90	- 4.80

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>2099-21A-SI-L1 Rev 01</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 C.

TYPE	QUANTITY	REMARKS
Natural Moisture Content	36 Nr.	BS 1377- Part 2 (1990) : Section 2
Atterberg Limits	22 Nr.	BS 1377- Part 2 (1990) : Section 2
Particle Size Distribution (PSD)	20 Nr.	BS 1377- Part 2 (1990) : Sections 3 & 9
PSD Sedimentation	16 Nr.	BS 1377- Part 2 (1990) : Sections 3 & 9
Total Sulphate as SO ₄ BRE	7 Nr.	BS 1377- Part 2 (1990)
pH	7 Nr.	BS 1377- Part 2 (1990)
Organic Matter	11 Nr.	BS 1377- Part 2 (1990)
Oedometer 1D Consolidation	3 Nr.	BS 1377- Part 2 (1990) : Sections 7 & 8
Unconsolidated Undrained Triaxial	2 Nr.	BS 1377- Part 2 (1990) : Sections 7 & 8
Point Load	10 Nr.	ASTM D5731-08
Uniaxial Compressive Strength (UCS)	8 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

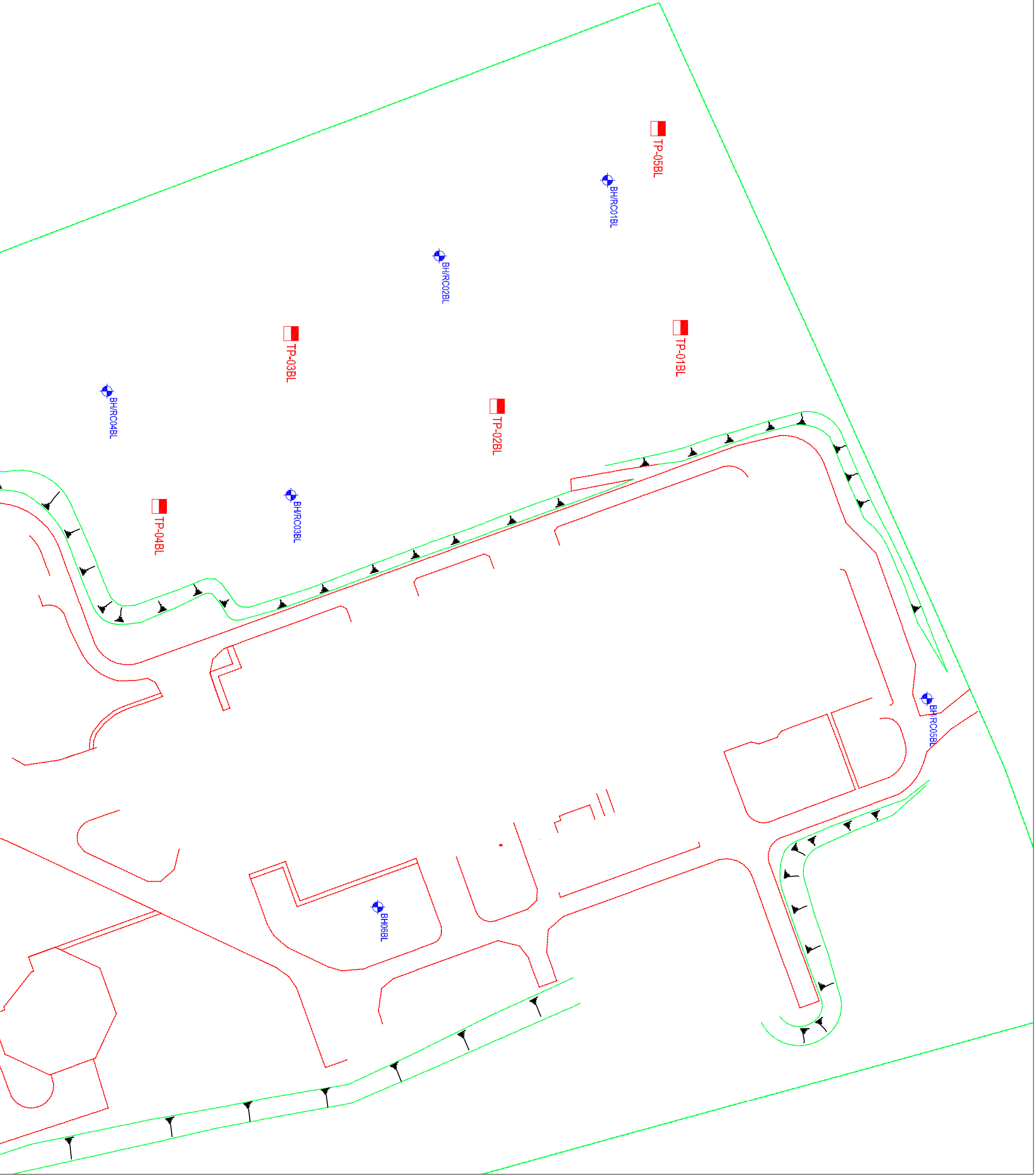
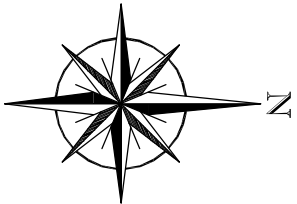
ASTM C215-08: Standard Test Method for Fundamental Transverse, Longitudinal, and Torsional Frequencies of Concrete Specimens

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

APPENDIX A DRAWINGS

LIMERICK WWTP UPGRADE PROJECTS – BUNLICKY WWTP
SITE INVESTIGATION
SITE INVESTIGATION LAYOUT PLAN
2099-21A-SI-L1 Rev 01

1 x A3



Investigation Drawing Key:

■ TP-01BL TRIAL HOLE LOCATION

● BH/RC01BL BOREHOLE / ROTARY CORE LOCATION

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

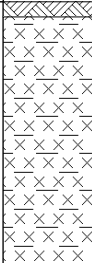
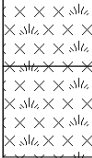
APPENDIX B

EXPLORATORY HOLE RECORDS

TRIAL HOLES	5 x A4
PERCUSSIVE BOREHOLES	8 x A4
ROTARY CORED BOREHOLES	10 x A4

Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 09/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554507.40 N655794.90	
Project No. : 2099-21		Crew Name:		Equipment: Doosan DX140	
Location Number TP-01BL	Location Type TP	Level 1.15m AoD	Logged By AT	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					
		0.05			0.05	1.10		TOPSOIL. Soft, yellowish brownish grey, slightly sandy SILT / CLAY with occasional cobbles.	1
		0.50	B						
		0.90			0.90	0.25		Very soft to soft, grey, organic SILT.	2
		1.00 1.00	B PP	100.00					
		1.80			1.80	-0.65		Very soft to soft, greyish brown, peaty SILT with rootlets.	3
		2.00 2.00	B PP	100.00					
		2.80			2.80	-1.65		Very soft to soft, grey, organic SILT.	4
		3.00 3.00	B PP	50.00					
		4.20			4.20	-3.05		Very soft to soft, greyish brown, organic SILT.	5
		4.00 4.00	B PP	50.00					
		4.50	B		4.50	-3.35		End of Borehole at 4.500m	

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
6.20	3.95	Excavation stable.					

Remarks Groundwater seepage at 1.00m b.g.l. PP = In-situ Pocket Penetrometer test (Results in kPa) End of Trial Hole at 4.50m b.g.l.							
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Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 10/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554527.98 N655746.95	
Project No. : 2099-21		Crew Name:		Equipment: Doosan DX140	
Location Number TP-02BL	Location Type TP	Level 1.05m AoD	Logged By AT	Scale 1:25	Page Number Sheet 1 of 1

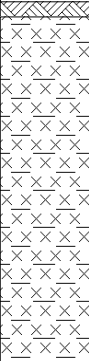
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	1.00		TOPSOIL.	1
					0.30	0.75		Soft, yellowish brown, sandy, gravelly SILT / CLAY with some cobbles.	
		0.50	B					Soft to firm, yellowish brownish grey, slightly sandy SILT / CLAY with occasional cobbles.	1
		1.00	B		0.90	0.15		Soft, yellowish brownish grey, organic SILT.	
		1.00	PP	100.00					2
					1.40	-0.35		Very soft to soft, grey, organic SILT.	
		2.00	B						3
		2.00	PP	75.00					
		3.00	B						4
		3.00	PP	75.00					
		4.00	B		4.50	-3.45			5
		4.00	PP	75.00				End of Borehole at 4.500m	

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
6.60	2.00	Excavation stable.					

Remarks Groundwater seepage at 1.80m b.g.l. PP = In-situ Pocket Penetrometer test (Results in kPa) End of Trial Hole at 4.50m b.g.l.							
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Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 10/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554508.95 N655693.05	
Project No. : 2099-21		Crew Name:		Equipment: Doosan DX140	
Location Number TP-03BL	Location Type TP	Level 1.50m AoD	Logged By AT	Scale 1:25	Page Number Sheet 1 of 1

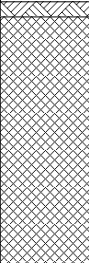
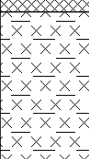
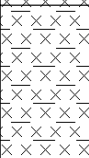
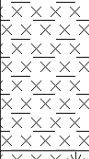
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.05			0.05	1.45		TOPSOIL. Soft, yellowish brownish grey, slightly sandy SILT / CLAY.	1
		0.50	B						
		1.00 1.00	B PP	75.00	1.20	0.30		Soft, grey, peaty, organic SILT.	2
		2.00 2.00	B PP	75.00					
		3.00 3.00	B PP	100.00					3
		4.00 4.00	B PP	75.00	3.90	-2.40		Soft, grey, organic SILT.	4
					4.60	-3.10		End of Borehole at 4.600m	5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
5.05	1.90	Excavation stable.					

Remarks Extremely weak flow of groundwater at 1.20m b.g.l. PP = In-situ Pocket Penetrometer test (Results in kPa) End of Trial Hole at 4.60m b.g.l.							
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Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 10/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554554.15 N655658.58	
Project No. : 2099-21		Crew Name:		Equipment: Doosan DX140	
Location Number TP-04BL	Location Type TP	Level 2.30m AoD	Logged By AT	Scale 1:25	Page Number Sheet 1 of 1

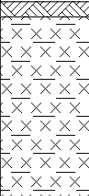
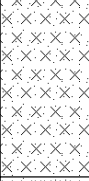
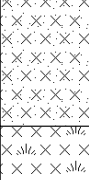
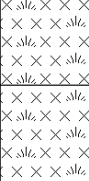
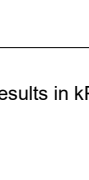
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.05			0.05	2.25		TOPSOIL. Soft to firm, yellowish brownish grey, sandy, gravelly clay with some cobbles and occasional boulders. [MADE GROUND]	1
		0.50	B						
		0.90			0.90	1.40		Soft to firm, yellowish grey, slightly sandy, slightly gravelly SILT / CLAY with some cobbles. Organic material present.	
		1.00	B						2
		1.00	PP	200.00					
		1.40			1.40	0.90		Soft to firm, brownish grey SILT / CLAY. Some organic material present.	
		2.00	B						3
		2.00	PP	250.00					
		2.40			2.40	-0.10		Soft, grey, organic SILT.	
		3.00	B						4
		3.00	PP	125.00					
		4.00	B						5
		4.00	PP	100.00					
		4.50			4.50	-2.20		End of Borehole at 4.500m	

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
5.55	2.00	Excavation stable.					

Remarks No groundwater observed. PP = In-situ Pocket Penetrometer test (Results in kPa) End of Trial Hole at 4.50m b.g.l.							
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Trial Pit Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 09/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554455.36 N655789.02	
Project No. : 2099-21		Crew Name:		Equipment: Doosan DX140	
Location Number TP-05BL	Location Type TP	Level 1.35m AoD	Logged By AT	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					
					0.05	1.30		TOPSOIL. Soft, yellowish brownish grey, slightly sandy SILT / CLAY with occasional cobbles.	1
					0.70	0.65		Very soft to soft, brownish grey, slightly sandy SILT with occasional cobbles.	
		1.00 1.00	B PP	100.00				Organic material, occasional tree fragments and rootlets present.	
					1.30	0.05		Very soft to soft, brownish grey, slightly sandy SILT with occasional cobbles.	2
					1.80	-0.45		Very soft to soft, greyish brown, peaty SILT with many rootlets.	
		2.00 2.00	B PP	75.00					
					3.00	-1.65		Soft, grey, organic SILT.	3
		3.00 3.00	B PP	50.00					
					3.50	-2.15		Very soft to soft, grey SILT.	
		4.00 4.00	B PP	50.00					4
					4.80	-3.45		End of Borehole at 4.800m	5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
5.35	3.20	Excavation stable.					

Remarks Groundwater seepage at 1.00m b.g.l. PP = In-situ Pocket Penetrometer test (Results in kPa) End of Trial Hole at 4.80m b.g.l.							
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Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 10/06/2021 - 11/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554468.82 N655775.78	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH01BL	Hole Type CP	Level 1.10m 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					
					0.30	0.80	---	Soft, brown CLAY.	
							XXXXXX	Soft, brownish grey SILT.	
		1.00	B		0.90	0.20		Very soft, dark brown, slightly silty PEAT.	1
		1.20	SPT	N=1 (0,0/1,0,0,0)					
		2.00	B						2
		2.00	SPT	N=1 (0,0/0,1,0,0)					
		3.00	B		3.00	-1.90		Very soft, light grey, organic SILT.	3
		3.00	SPT	N=0 (0,1/0,0,0,0)					
		3.50	U						
		4.00	B						4
		4.00	SPT	N=1 (0,0/0,1,0,0)					
		5.00	B		5.00	-3.90		Very soft, dark brownish grey, peaty SILT.	5
		5.00	SPT	N=1 (0,1/0,0,0,1)					
		6.00	B		6.00	-4.90		Firm, light pinkish grey, gravelly SILT.	6
		6.00	U						
		6.50	SPT	N=10 (1,2/2,2,2,4)	6.60	-5.50		Medium dense, light grey GRAVEL with many angular cobbles and occasional boulders.	7
		7.00	B		7.30	-6.20		End of Borehole at 7.300m	8
		7.00	SPT	50 (13,16/50 for 10mm)					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	7.30	200	7.30	7.30	01:00		0.00	7.30	90	0

Remarks Groundwater encountered at 7.10m b.g.l. (5.00m after 20 mins) End of Borehole at 7.30m b.g.l. - unable to advance casing / tooling further.										
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Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 09/06/2021 - 10/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554488.64 N655731.80	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH02BL	Hole Type CP	Level 1.40m 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					
					0.30	1.10	---	Soft, brown CLAY.	
		1.00	B				XXXXXX	Soft to firm, light grey SILT.	1
		1.20	SPT	N=5 (0,1/0,2,2,1)			XXXXXX		
							XXXXXX		
							XXXXXX		
							XXXXXX		
		2.00	B		2.00	-0.60	XXXXXX	Very soft, light grey, organic SILT.	2
		2.00	SPT	N=0 (0,0/0,0,0,0)			XXXXXX		
							XXXXXX		
							XXXXXX		
							XXXXXX		
		3.00	B				XXXXXX		3
		3.00	SPT	N=1 (0,1/0,0,0,1)			XXXXXX		
							XXXXXX		
							XXXXXX		
		3.50	U				XXXXXX		
		4.00	B				XXXXXX		4
		4.00	SPT	N=1 (1,0/0,0,1,0)			XXXXXX		
							XXXXXX		
							XXXXXX		
							XXXXXX		
		5.00	B		5.00	-3.60	XXXXXX	Very soft, brownish grey, peaty SILT.	5
		5.00	SPT	N=1 (0,0/0,1,0,0)			XXXXXX		
							XXXXXX		
							XXXXXX		
							XXXXXX		
		6.00	U				XXXXXX		6
							XXXXXX		
							XXXXXX		
							XXXXXX		
							XXXXXX		
		6.50	B		6.30	-4.90	XXXXXX	Firm, pinkish grey SILT.	
		6.50	SPT	N=35 (4,6/8,8,10,9)			XXXXXX		
					6.80	-5.40	XXXXXX	Dense, light pinkish grey, silty GRAVEL.	7
					7.20	-5.80	XXXXXX	Dense, light grey, silty GRAVEL with many angular cobbles.	
		7.50	B				XXXXXX		
		8.00	SPT	N=50 (6,10/50 for 225mm)			XXXXXX	End of Borehole at 8.300m	8
					8.30	-6.90	XXXXXX		
									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
8.30	200	8.30	200	8.20	8.30	01:00		0.00	8.30	90	0

Remarks Groundwater encountered at 5.30m b.g.l. (5.00m after 20 mins) End of Borehole at 8.30m b.g.l. - unable to advance casing / tooling further.										
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Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 08/06/2021 - 09/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554551.20 N655693.00	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH03BL	Hole Type CP	Level 2.10m 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	1.90		TOPSOIL.	1		
		0.50	B	N=4 (0,1/1,1,1,1)	0.80	1.30		Soft to firm, dark brown, slightly sandy CLAY with occasional cobbles.			
		1.00	B		1.20	1.30		Soft to firm, dark pinkish grey, silty CLAY with occasional cobbles.			
		1.60	0.50			Very soft, light grey, slightly organic SILT.	2				
		2.00	B	N=1 (0,1/0,1,0,0)	2.40	-0.30			Very soft, light grey SILT.	3	
		2.00	SPT		3.00	B	N=1 (0,0/0,0,1,0)	3.50	U		4
		3.00	SPT	3.70	-1.60			Very soft, light grey, organic SILT.	5		
		4.00	B	N=1 (0,1/0,0,1,0)	4.00	SPT	5.00	B		6	
		4.00	SPT		5.00	SPT	6.00	B	7		
		6.00	B	N=5 (0,0/1,1,1,2)	6.50	SPT	6.80	-4.70			Firm, dark greyish brown, peaty SILT.
		6.00	U		7.10	B	7.30	-5.20		Firm, pinkish grey SILT.	9
		6.50	SPT	8.00	SPT	N=32 (5,5/5,9,9,9)	8.40	-6.30		Dense, light grey, slightly sandy GRAVEL with many angular cobbles.	
		7.10	B	8.10	B		8.70	-6.60		End of Borehole at 8.700m	

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
8.70	200	8.70	200	8.60	8.70	01:00		0.00	8.70	90	0

Remarks

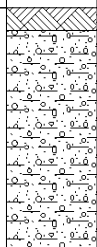
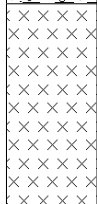
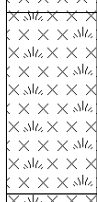
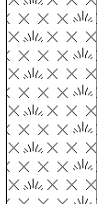
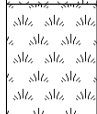
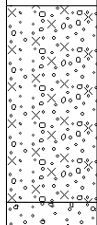
Groundwater encountered at 7.20m b.g.l. (7.00m after 20 mins)

End of Borehole at 8.70m b.g.l. - unable to advance casing / tooling further.



Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 03/06/2021 - 04/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554569.00 N655663.10	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH04BL	Hole Type CP	Level 2.25m 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					
					0.15	2.10		TOPSOIL. Firm, dark brown, slightly sandy CLAY with some cobbles.	1
		1.00	B						
		1.20	SPT	N=6 (1,0/0,2,2,2)					
					1.60	0.65		Firm, grey SILT.	2
		2.00	B						
		2.00	SPT	N=6 (1,2/2,1,2,1)					
					3.00	-0.75		Soft, light grey, slightly organic SILT.	3
		3.00	SPT	N=5 (1,0/1,2,1,1)					
		3.50	U						
					4.20	-1.95		Very soft, light grey, organic SILT.	4
		4.00	B						
		4.00	SPT	N=1 (0,0/0,1,0,0)					
		5.00	B						
		5.00	SPT	N=1 (0,1/0,0,1,0)					
		6.00	U						
		6.50	SPT	N=1 (1,0/0,0,1,0)					
					6.80	-4.55		Very soft, dark brown PEAT.	7
		7.00	B						
					7.60	-5.35		Firm, pinkish grey SILT.	
		8.00	B		8.00	-5.75		Medium dense to dense, grey, silty GRAVEL with many angular cobbles.	8
		8.00	SPT	N=26 (2,4/4,5,8,9)					
		9.00	B						
					9.30	-7.05			
		9.50	SPT	50 (6,16/50 for 190mm)	9.50	-7.25		Dense, grey GRAVEL with many angular cobbles and occasional boulders. End of Borehole at 9.500m	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
9.50	200	9.50	200	9.50	9.50	01:00		0.00	9.50	90	0

Remarks Groundwater encountered at 8.50m b.g.l. (4.40m after 20 mins) End of Borehole at 9.50m b.g.l. - unable to advance casing / tooling further.										
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Percussion Drilling Log

Project Name: Limerick WWTP Upgrade
Projects - Site Investigation

Client: Uisce Eireann

Date: 18/05/2021 - 20/05/2021

Location: Limerick, Co. Limerick

Contractor: Whiteford Geoservices Ltd

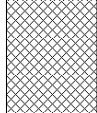
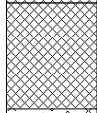
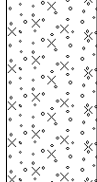
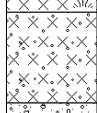
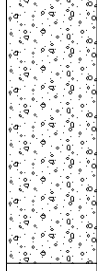
Co-ords: E554604.46 N655859.32

Project No. : 2099-21

Crew Name: GII

Drilling Equipment: Dando 2000

Borehole Number BH05BL	Hole Type CP	Level 2.30m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 2
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20	2.10		TOPSOIL.	
		0.50	B					Soft to firm, brown clay with some angular cobbles and occasional boulders. [MADE GROUND]	
		1.20	SPT	N=23 (7,4/4,5,9,5)	1.00	1.30		Stiff, grey, gravelly clay with some cobbles. [MADE GROUND]	1
		1.50	B						
		2.00	SPT	N=10 (4,6/5,2,2,1)	1.70	0.60		Loose, light blueish grey, silty GRAVEL.	2
		2.50	B						
		3.00	SPT	N=0 (0,0/0,0,0,0)	3.00	-0.70		Very soft to soft, light grey, organic peaty SILT.	3
		3.50	B						
		4.00	SPT	N=3 (2,1/1,0,1,1)					4
		4.50	B						
		5.00	SPT	N=3 (1,0/1,0,1,1)					5
		5.50	B						
		6.50	B						
		6.50	SPT	N=2 (0,1/0,0,1,1)					7
		7.50	B		7.60	-5.30		Soft, light pinkish grey, peaty, gravelly SILT.	8
		7.90	B						
		8.00	SPT	0 (50 for 10mm/0 for 0mm)	8.20	-5.90		Medium dense, light grey, silty, sandy GRAVEL with some angular cobbles and occasional boulders.	9
		8.90	B						
		9.50	SPT	N=23 (4,6/4,5,6,8)					
		9.90	B						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
10.10	200	10.10	200	8.00 10.10	8.20 10.10	01:00 01:00		0.00	10.10	90	0

Remarks

Groundwater encountered at 1.90m b.g.l. (1.70m after 20 mins) / Groundwater encountered at 8.00m b.g.l. (7.90m after 20 mins)

End of Borehole at 10.10m b.g.l. - unable to advance casing / tooling further.

Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 18/05/2021 - 20/05/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554604.46 N655859.32	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH05BL	Hole Type CP	Level 2.30m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 2

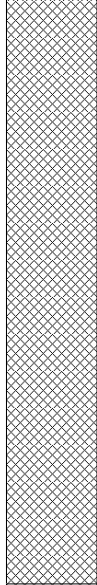
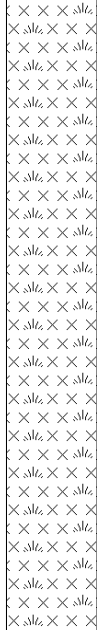
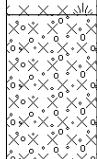
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.10 10.10	B SPT	0 (50 for 0mm/0 for 0mm)	10.10	-7.80		Medium dense, light grey, silty, sandy GRAVEL with some angular cobbles and occasional boulders. End of Borehole at 10.100m	
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

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
10.10	200	10.10	200	8.00 10.10	8.20 10.10	01:00 01:00		0.00	10.10	90	0

Remarks Groundwater encountered at 1.90m b.g.l. (1.70m after 20 mins) / Groundwater encountered at 8.00m b.g.l. (7.90m after 20 mins) End of Borehole at 10.10m b.g.l. - unable to advance casing / tooling further.										
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Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 21/05/2021 - 24/05/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554658.96 N655715.72	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH06BL	Hole Type CP	Level 4.34m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 2

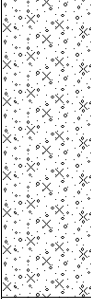
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20	4.14		TOPSOIL.	
		1.00 1.00	B SPT	0 (50 for 10mm/0 for 0mm)				Firm to stiff, light brown, gravelly clay with many cobbles and some boulders. [MADE GROUND]	1
		2.00 2.00	B SPT	N=22 (5,6/4,7,7,4)					2
		3.00 3.00	B SPT	N=50 (7,20/8,11,23,8)					3
		4.00 4.20	SPT B	N=12 (2,2/2,3,3,4)	4.10	0.24		Stiff, dark blackish grey, silty clay. [MADE GROUND]	4
					4.50	-0.16		Ceramic fragments present. Soft, light grey, organic peaty SILT.	5
		5.00 5.20	SPT B	N=6 (2,1/2,1,1,2)					6
		6.20 6.50	B SPT	N=3 (1,0/1,0,1,1)					7
		7.20	B						8
		8.00 8.20	SPT B	N=1 (1,0/0,0,1,0)					9
		9.20 9.50	B SPT	N=8 (1,2/1,1,3,3)	8.80	-4.46		Soft, light grey, peaty, gravelly SILT with some angular cobbles.	10
					9.80	-5.46		Medium dense, light grey, silty, sandy	

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
12.00	200	12.00	200	1.20 3.00	1.50 3.30	00:30 00:30		0.00	12.00	90	0

Remarks Groundwater encountered at 3.80m b.g.l. (3.70m after 20 mins) / Groundwater encountered at 10.00m b.g.l. (9.70m after 20 mins) End of Borehole at 12.00m b.g.l. - designated depth achieved.										
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Percussion Drilling Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 21/05/2021 - 24/05/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554658.96 N655715.72	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Dando 2000	
Borehole Number BH06BL	Hole Type CP	Level 4.34m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 2

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.20	B		12.00	-7.66		Medium dense, light grey, silty, sandy GRAVEL. Gravel is fine to coarse and angular.	11
		11.00	SPT	N=45 (2,2/3,14,14,14)					
		11.20	B						
								End of Borehole at 12.000m	12
									13
									14
									15
									16
									17
									18
									19
									20

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
12.00	200	12.00	200	1.20 3.00	1.50 3.30	00:30 00:30		0.00	12.00	90	0

Remarks Groundwater encountered at 3.80m b.g.l. (3.70m after 20 mins) / Groundwater encountered at 10.00m b.g.l. (9.70m after 20 mins) End of Borehole at 12.00m b.g.l. - designated depth achieved.											
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation			Client: Uisce Eireann			Date: 05/07/2021		
Location: Limerick, Co. Limerick			Contractor: Whiteford Geoservices Ltd			Co-ords: E554468.82 N655775.78		
Project No. : 2099-21			Crew Name: GII			Drilling Equipment: Beretta T44		
Borehole Number RC01BL		Hole Type CP+RC		Level 1.10m AoD		Logged By RC		Page Number Sheet 1 of 2

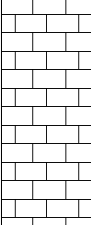
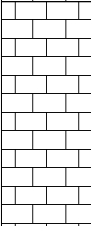
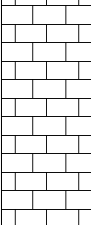
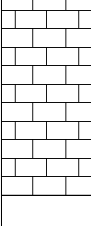
Well	Water	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.30	0.80	---	Soft, brown CLAY.	
							0.90	0.20	X X X X X	Soft, brownish grey SILT.	1
							3.00	-1.90		Very soft, dark brown, slightly silty PEAT.	2
							5.00	-3.90	X X X X X	Very soft, light grey, organic SILT.	3
							6.00	-4.90	X X X X X	Very soft, dark brownish grey, peaty SILT.	4
							6.60	-5.50	X X X X X	Firm, light pinkish grey, gravelly SILT.	5
							7.30	-6.20	●●●●●	Medium dense, light grey GRAVEL with many angular cobbles and occasional boulders.	6
							9.50	-8.40	●●●●●	Dense to very dense, grey GRAVEL with many cobbles and some boulders.	7
									■ ■ ■ ■ ■	Strong, grey, fine grained, crystalline, partially weathered, medium fractured	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	16.00	90	0						

Remarks Standpipe Installation: 0.00m - 4.00m b.g.l. (50mm Plain) / 4.00m - 10.80m b.g.l. (50mm Slotted) End of Rotary Cored Borehole at 16.00m b.g.l.																	
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation			Client: Uisce Eireann			Date: 05/07/2021		
Location: Limerick, Co. Limerick			Contractor: Whiteford Geoservices Ltd			Co-ords: E554468.82 N655775.78		
Project No. : 2099-21			Crew Name: GII			Drilling Equipment: Beretta T44		
Borehole Number RC01BL		Hole Type CP+RC		Level 1.10m AoD		Logged By RC		Page Number Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
		9.50 - 11.60	5	95	80	72		11.60	-10.50		Strong, grey, fine grained, crystalline, partially weathered, medium fractured LIMESTONE.	11
		11.60 - 13.10	2	100	94	90					Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium to widely fractured LIMESTONE.	12
		13.10 - 14.60	4	100	90	81						13
		14.60 - 16.00	2	100	100	97						14
								16.00	-14.90		End of Borehole at 16.000m	15
												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	16.00	90	0						

Remarks Standpipe Installation: 0.00m - 4.00m b.g.l. (50mm Plain) / 4.00m - 10.80m b.g.l. (50mm Slotted) End of Rotary Cored Borehole at 16.00m b.g.l.																	
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 01/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554488.64 N655731.80	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC02BL	Hole Type CP+RC	Level 1.40m AoD	Logged By RC	Scale 1:50	Page Number Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
								0.30	1.10		Soft, brown CLAY.	1
											Soft to firm, light grey SILT.	
								2.00	-0.60		Very soft, light grey, organic SILT.	2
												3
								5.00	-3.60		Very soft, brownish grey, peaty SILT.	5
												6
6.30	-4.90		Firm, pinkish grey SILT.									
6.80	-5.40		Dense, light pinkish grey, silty GRAVEL.	7								
7.20	-5.80		Dense, light grey, silty GRAVEL with many angular cobbles.	8								
8.50	-7.10		Dense to very dense, grey, silty GRAVEL with many cobbles and some boulders.	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	19.20	90	0						

Remarks

No Standpipe Installation.

End of Rotary Cored Borehole at 19.20m b.g.l.



Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation			Client: Uisce Eireann			Date: 01/07/2021		
Location: Limerick, Co. Limerick			Contractor: Whiteford Geoservices Ltd			Co-ords: E554488.64 N655731.80		
Project No. : 2099-21			Crew Name: GII			Drilling Equipment: Beretta T44		
Borehole Number RC02BL		Hole Type CP+RC		Level 1.40m AoD		Logged By RC		Page Number Sheet 2 of 2

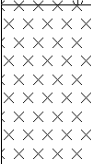
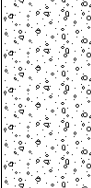
Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
											Dense to very dense, grey, silty GRAVEL with many cobbles and some boulders.	11
		11.90 - 13.10	3	92	90	83		11.90	-10.50		Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium to widely fractured LIMESTONE.	12
		13.10 - 14.60	4	100	91	81						13
		14.60 - 16.10	2	100	96	90						14
		16.10 - 17.60	2	100	98	96						15
		17.60 - 19.20	2	100	98	98						16
								19.20	-17.80			17
											End of Borehole at 19.200m	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	19.20	90	0						

Remarks No Standpipe Installation. End of Rotary Cored Borehole at 19.20m b.g.l.																	
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation			Client: Uisce Eireann			Date: 01/07/2021		
Location: Limerick, Co. Limerick			Contractor: Whiteford Geoservices Ltd			Co-ords: E554551.20 N655693.00		
Project No. : 2099-21			Crew Name: GII			Drilling Equipment: Beretta T44		
Borehole Number RC03BL		Hole Type CP+RC		Level 2.10m AoD		Logged By RC		Page Number Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.20	1.90		TOPSOIL.	
							0.80	1.30		Soft to firm, dark pinkish grey, silty CLAY with occasional cobbles.	1
							1.60	0.50		Very soft, light grey, slightly organic SILT.	2
							2.40	-0.30		Very soft, light grey SILT.	3
							3.70	-1.60		Very soft, light grey, organic SILT.	4
							6.80	-4.70		Firm, dark greyish brown, peaty SILT.	7
							7.30	-5.20		Firm, pinkish grey SILT.	8
							8.40	-6.30		Dense, light grey, slightly sandy GRAVEL with many angular cobbles.	9
							8.70	-6.60		Dense to very dense, grey, sandy GRAVEL with many cobbles and occasional boulders.	
											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	15.60	90	0						

Remarks Standpipe Installation: 0.00m - 3.60m b.g.l. (50mm Plain) / 3.60m - 15.60m b.g.l. (50mm Slotted) End of Rotary Cored Borehole at 15.60m b.g.l.																	
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 01/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554551.20 N655693.00	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC03BL	Hole Type CP+RC	Level 2.10m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 2

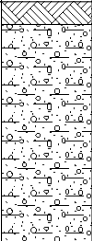
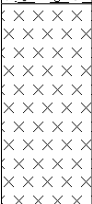
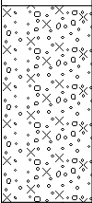
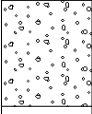
Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
		10.50 - 11.60	1	100	100	100		10.50	-8.40		Dense to very dense, grey, sandy GRAVEL with many cobbles and occasional boulders.	11
		11.60 - 13.10	5	100	82	66					Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium to widely fractured LIMESTONE.	12
		13.10 - 14.60	2	100	94	92						13
		14.60 - 15.60	2	100	94	94						14
								15.60	-13.50			15
											End of Borehole at 15.600m	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	15.60	90	0						

Remarks Standpipe Installation: 0.00m - 3.60m b.g.l. (50mm Plain) / 3.60m - 15.60m b.g.l. (50mm Slotted) End of Rotary Cored Borehole at 15.60m b.g.l.																	
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation			Client: Uisce Eireann			Date: 30/06/2021		
Location: Limerick, Co. Limerick			Contractor: Whiteford Geoservices Ltd			Co-ords: E554569.00 N655663.10		
Project No. : 2099-21			Crew Name: GII			Drilling Equipment: Beretta T44		
Borehole Number RC04BL		Hole Type CP+RC		Level 2.25m AoD		Logged By RC		Page Number Sheet 1 of 2

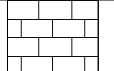
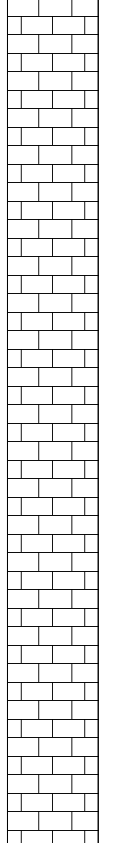
Well	Water	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.15	2.10		TOPSOIL. Firm, dark brown, slightly sandy CLAY with some cobbles.	1
							1.60	0.65		Firm, grey SILT.	2
							3.00	-0.75		Soft, light grey, slightly organic SILT.	3
							4.20	-1.95		Very soft, light grey, organic SILT.	4
							6.80	-4.55		Very soft, dark brown PEAT.	7
							7.60	-5.35		Firm, pinkish grey SILT.	8
							8.00	-5.75		Medium dense to dense, grey, silty GRAVEL with many angular cobbles.	9
							9.30	-7.05		Dense, grey GRAVEL with many angular cobbles and occasional boulders.	10
							10.00	-7.75			

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	16.10	90	0						

Remarks No Standpipe Installation. End of Rotary Cored Borehole at 16.10m b.g.l.																	
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Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 30/06/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554569.00 N655663.10	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC04BL	Hole Type CP+RC	Level 2.25m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD						
								10.50	-8.25		Weak, grey, fine grained, crystalline, distinctly weathered LIMESTONE.	11
		10.50 - 11.60	3	100	100	92					Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium to widely fractured LIMESTONE.	12
		11.60 - 13.10	2	100	100	93						13
		13.10 - 14.60	3	100	100	90						14
		14.60 - 16.10	2	100	100	91						15
												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	16.10	90	0						

Remarks

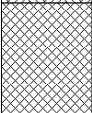
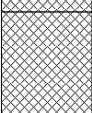
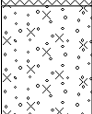
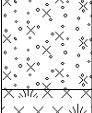
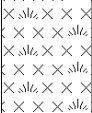
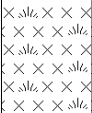
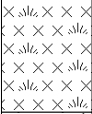
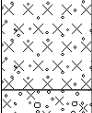
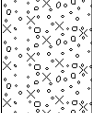
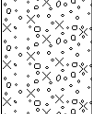
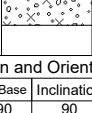
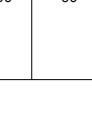
No Standpipe Installation.

End of Rotary Cored Borehole at 16.10m b.g.l.



Rotary Core Log

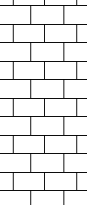
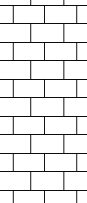
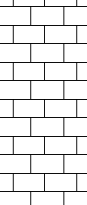
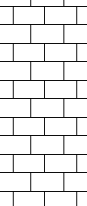
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Location: Limerick, Co. Limerick			Contractor: Whiteford Geoservices Ltd			Co-ords: E554604.46 N655859.32		
Project No. : 2099-21			Crew Name: GII			Drilling Equipment: Beretta T44		
Borehole Number RC05BL		Hole Type CP+RC		Level 2.30m AoD		Logged By RC		Page Number Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.20	2.10		TOPSOIL.	
							1.00	1.30		Soft to firm, brown clay with some angular cobbles and occasional boulders. [MADE GROUND]	1
							1.70	0.60		Stiff, grey, gravelly clay with some cobbles. [MADE GROUND]	
							3.00	-0.70		Loose, light blueish grey, silty GRAVEL.	2
										Very soft to soft, light grey, organic peaty SILT.	3
											4
											5
											6
											7
							7.60	-5.30		Soft, light pinkish grey, peaty, gravelly SILT.	8
							8.20	-5.90		Medium dense, light grey, silty, sandy GRAVEL with some angular cobbles and occasional boulders.	9
											10
											
											
											
											
											

Remarks														
No Standpipe Installation.														
End of Rotary Cored Borehole at 15.90m b.g.l.														

Rotary Core Log

Project Name: Limerick WWTP Upgrade Projects - Site Investigation		Client: Uisce Eireann		Date: 06/07/2021	
Location: Limerick, Co. Limerick		Contractor: Whiteford Geoservices Ltd		Co-ords: E554604.46 N655859.32	
Project No. : 2099-21		Crew Name: GII		Drilling Equipment: Beretta T44	
Borehole Number RC05BL	Hole Type CP+RC	Level 2.30m AoD	Logged By RC	Scale 1:50	Page Number Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring			Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description						
				TCR	SCR	RQD											
								10.20	-7.90		Medium dense, light grey, silty, sandy GRAVEL with some angular cobbles and occasional boulders.	11					
		10.20 - 11.60	4	95	92	82					Strong, grey, fine grained, crystalline, partially weathered to unweathered, medium to widely fractured LIMESTONE.	12					
		11.60 - 13.10	4	100	96	89						13					
		13.10 - 14.60	3	100	96	94						14					
		14.60 - 15.90	3	100	92	84						15					
																16	
								15.90	-13.60		End of Borehole at 15.900m	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	15.90	90	0						
Remarks																	
No Standpipe Installation.																	
End of Rotary Cored Borehole at 15.90m b.g.l.																	
																	

APPENDIX C

LABORATORY TESTING RESULTS

NATURAL MOISTURE CONTENT	1 x A4
ATTERBERG LIMITS	1 x A4
PARTICLE SIZE DISTRIBUTION (PSD) / SEDIMENTATION	20 x A4
CHEMICAL CONTENT	6 x A4
OEDOMETER 1D CONSOLIDATION	15 x A4
UNCONSOLIDATED UNDRAINED TRIAXIAL	2 x A4
POINT LOAD TESTING	1 x A4
UNIAXIAL COMPRESSIVE STRENGTH (UCS)	2 x A4

Moisture Content Results



Location: Bunlicky WWTP

Job No: 2099-21

Client: Irish Water

Sample no:	Depth (m)	Water Content (%)
BH01BL	2.0	175.0
BH01BL	3.5	57.8
BH01BL	5.0	110.1
BH01BL	6.0	14.6
BH02BL	1.0	67.2
BH02BL	3.0	89.9
BH02BL	3.5	63.8
BH02BL	4.0	67.3
BH02BL	5.0	83.6
BH02BL	6.0	76.9
BH03BL	1.0	29.9
BH03BL	2.0	50.9
BH03BL	3.0	58.0
BH03BL	6.0	75.6
BH03BL	7.4	31.5
BH04BL	2.0	39.5
BH04BL	3.0	55.7
BH04BL	5.0	50.7
BH04BL	7.0	124.7
BH05BL	3.5	74.4
BH05BL	4.5	52.3
BH05BL	6.5	7.9
BH05BL	7.5	55.7
BH06BL	1.0	9.6
BH06BL	2.0	5.2
BH06BL	5.2	53.5
BH06BL	7.2	62.0
BH06BL	8.2	43.3
BH06BL	9.2	16.3
TP01BL	0.5	37.7
TP02BL	1.0	50.3
TP03BL	2.0	71.1
TP04BL	1.0	42.6
TP04BL	3.0	65.4
TP05BL	1.0	106.4
TP05BL	3.0	103.0

Testing Carried out by Queens University Belfast

Operator	Checked	Approved
QUB / SV	SV	JMCN

Atterberg Limits



Location: Bunlicky WWTP

Client: Irish Water

Job No: 2099-21

Hole ID	Depth (m)	425 % PASS	LL (%)	PL (%)	PI (%)	Sample References	Results
BH01BL	2.0	100.0	179	41	138	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH01BL	5.0	100.0	106	32	74	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH01BL	6.0	100.0	31	16	15	Refer to Log	CLAY OF LOW PLASTICITY
BH02BL	3.0	100.0	100	34	66	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH02BL	5.0	100.0	93	29	64	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH03BL	1.0	100.0	79	32	47	Refer to Log	CLAY OF VERY HIGH PLASTICITY
BH03BL	2.0	100.0	72	28	44	Refer to Log	CLAY OF VERY HIGH PLASTICITY
BH03BL	3.0	100.0	69	26	43	Refer to Log	CLAY OF HIGH PLASTICITY
BH03BL	6.0	100.0	69	28	41	Refer to Log	CLAY OF HIGH PLASTICITY
BH03BL	7.4	98.0	50	23	27	Refer to Log	CLAY OF HIGH PLASTICITY
BH04BL	2.0	100.0	63	29	34	Refer to Log	CLAY OF HIGH PLASTICITY
BH04BL	3.0	100.0	68	29	39	Refer to Log	CLAY OF HIGH PLASTICITY
BH04BL	7.0	100.0	154	46	108	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH05BL	3.5	100.0	99	32	67	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH05BL	7.5	100.0	92	32	60	Refer to Log	CLAY OF EXTREMELY HIGH PLASTICITY
BH06BL	1.0	76.0	52	25	27	Refer to Log	CLAY OF HIGH PLASTICITY
BH06BL	5.2	100.0	70	29	41	Refer to Log	CLAY OF VERY HIGH PLASTICITY
BH06BL	8.2	100.0	71	29	42	Refer to Log	CLAY OF VERY HIGH PLASTICITY
BH06BL	9.2	72.0	55	19	36	Refer to Log	CLAY OF HIGH PLASTICITY
TP01BL	0.5	100.0	56	28	28	Refer to Log	CLAY OF HIGH PLASTICITY
TP04BL	1.0	86.0	88	35	53	Refer to Log	CLAY OF VERY HIGH PLASTICITY
TP04BL	3.0	99.0	73	32	41	Refer to Log	CLAY OF VERY HIGH PLASTICITY
Operator						Checked	Approved
SV						JM	JW

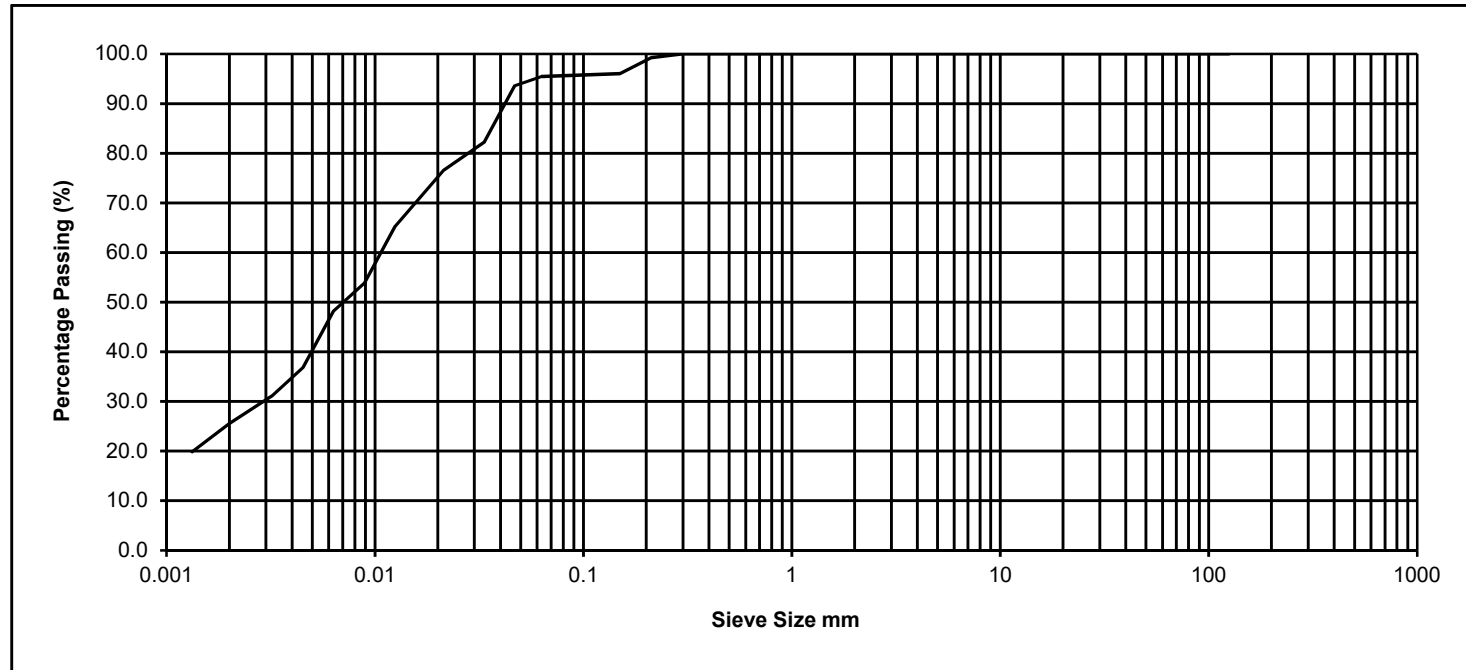
TESTS CARRIED OUT BY DR SIVAKUMAR VINAYAGAMOTHY OF QUEENS UNIVERSITY BELFAST

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	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	99.2
0.150	96.0
0.063	95.4
0.047	93.6
0.033	82.2
0.021	76.6
0.012	65.2
0.009	53.9
0.006	48.2
0.005	36.9
0.003	31.2
0.002	25.5
0.001	19.9

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size										Cobbles	Boulder
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
	Silt			Sand			Gravel				
	69.9			4.6			0.0			0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. BH02BL

Project Limerick WWTP

Sample No.

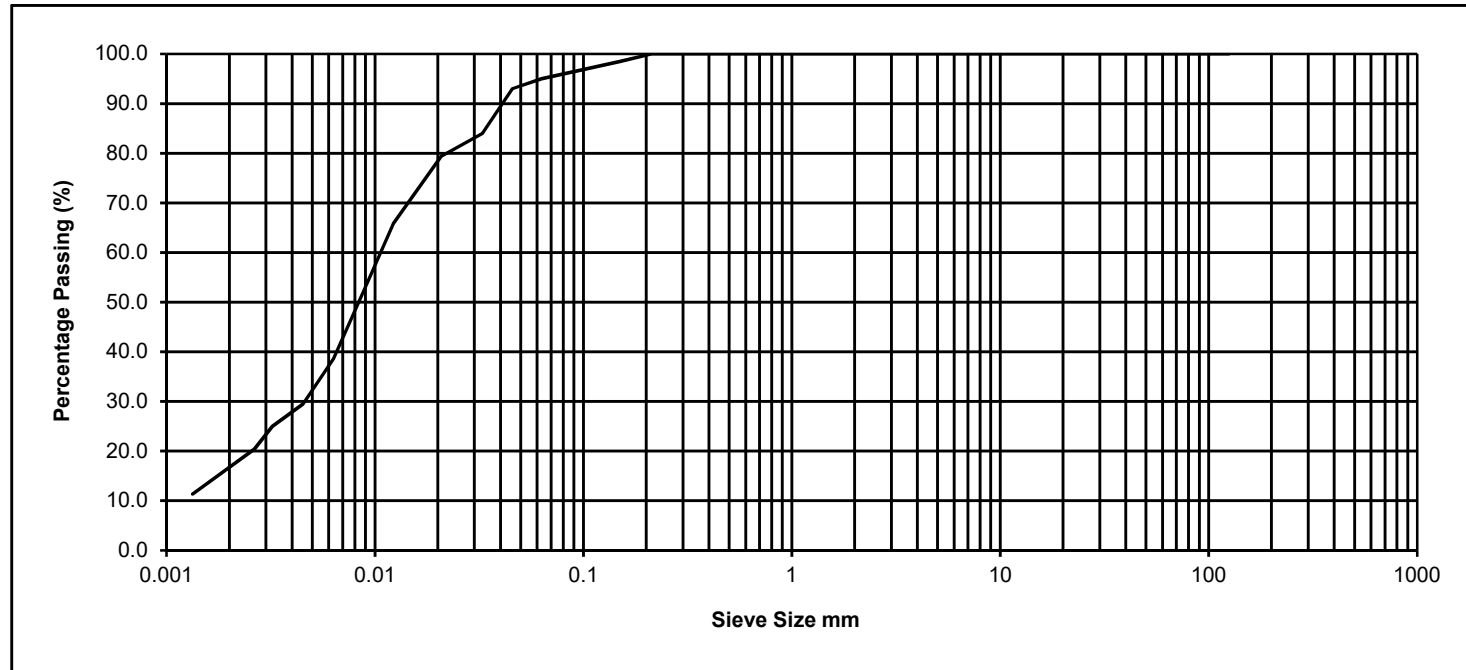
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	1.0m
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VINI Geotechnical Testing

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	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	95.0
0.046	93.0
0.033	83.9
0.021	79.4
0.012	65.8
0.009	52.2
0.006	38.6
0.005	29.5
0.003	25.0
0.003	20.4
0.001	11.3

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				
	74.6			5.0			0.0				
										0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. BH02BL

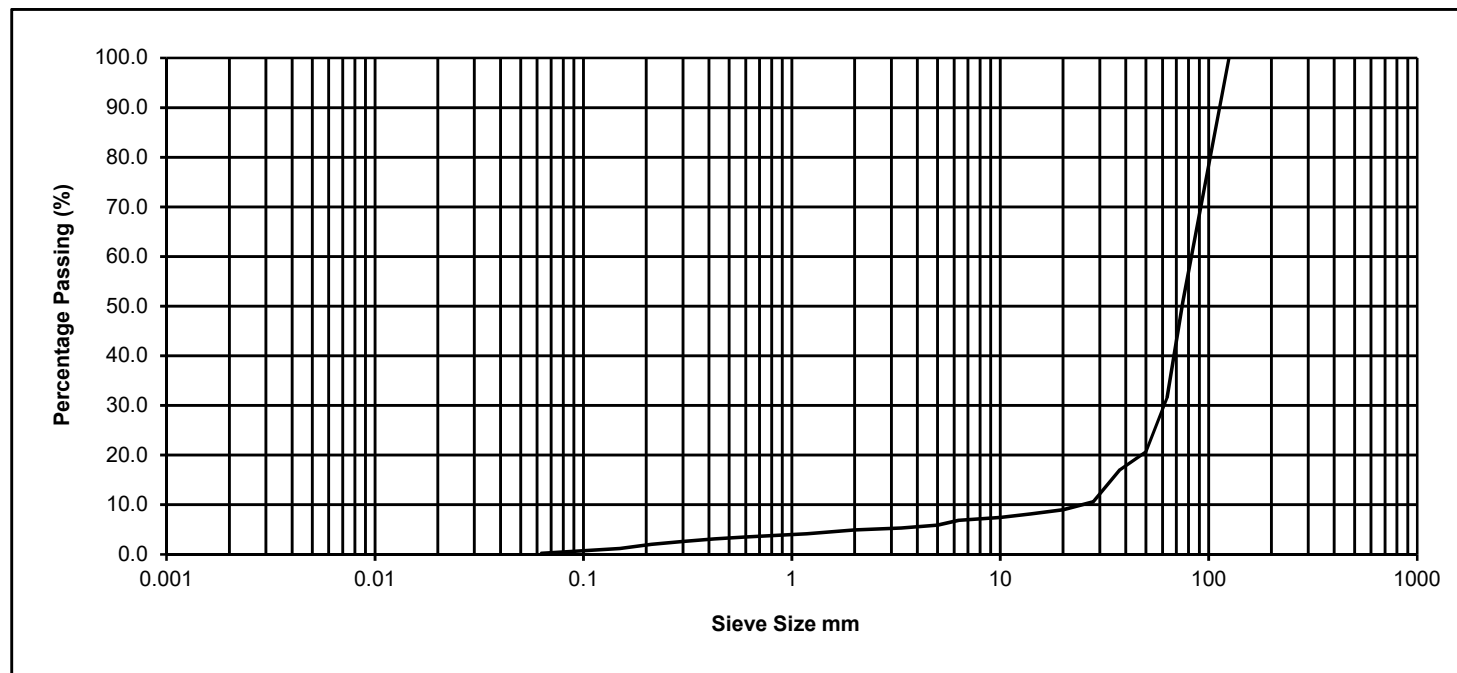
Project Limerick WWTP

Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	4.0m
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[illegible]

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				
	0.2			4.7			26.6				
										0.0	0.0

Sample Description Gravel cont Cobbles

Project No. 2099-21

BH/TP No. BH02BL

Sample No.

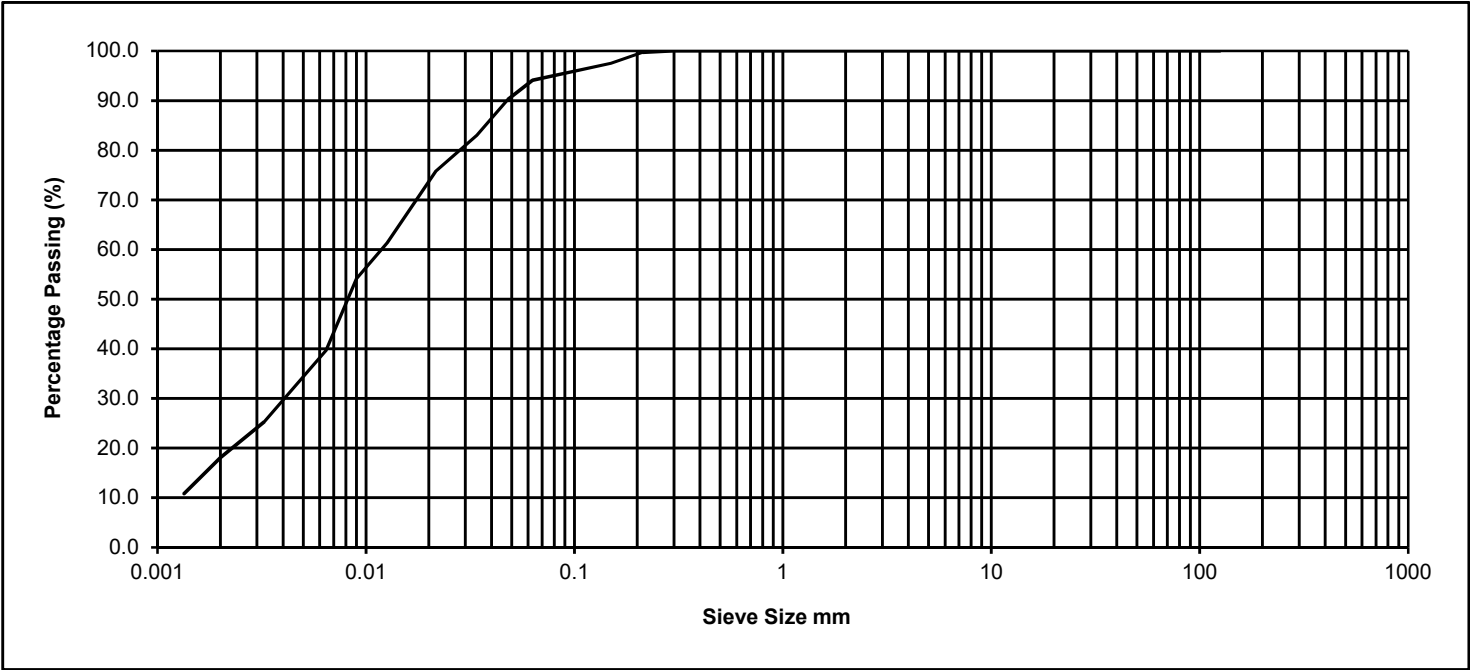
Project Limerick WWTP

Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	7.5m
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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	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	99.7
0.150	97.5
0.063	94.1
0.048	90.2
0.034	83.0
0.022	75.8
0.013	61.4
0.009	54.1
0.006	39.7
0.005	32.5
0.003	25.3
0.002	18.0
0.001	10.8

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				
	76.0			5.9			0.0				

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. BH03BL

Project Limerick WWTP

Sample No.

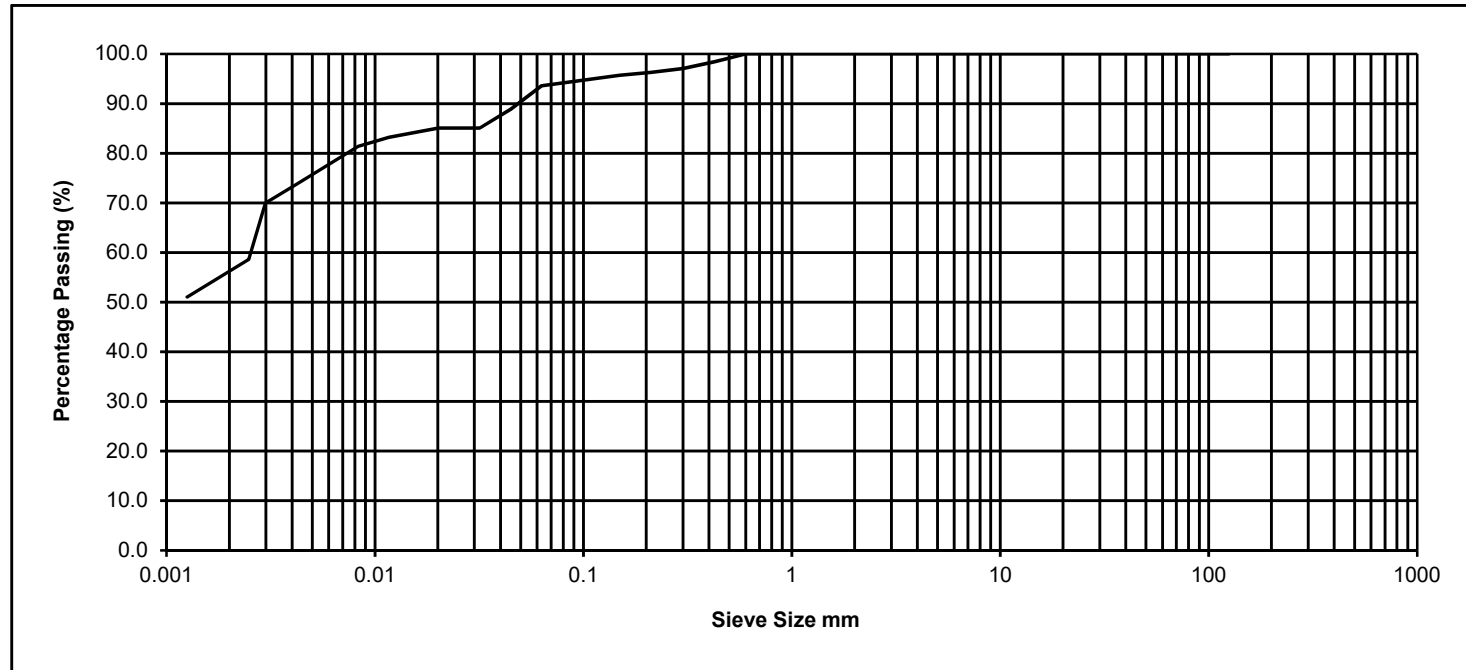
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	3.0m
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VINI Geotechnical Testing

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	100.0
5.000	100.0
3.350	100.0
2.000	100.0
1.180	100.0
0.600	100.0
0.425	98.4
0.300	97.1
0.212	96.3
0.150	95.7
0.063	93.6
0.045	88.9
0.032	85.1
0.020	85.1
0.012	83.2
0.008	81.3
0.006	77.5
0.004	73.7
0.003	70.0
0.002	58.6
0.001	51.1

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				
	35.0			6.4			0.0				
										0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. BH03BL

Project Limerick WWTP

Sample No.

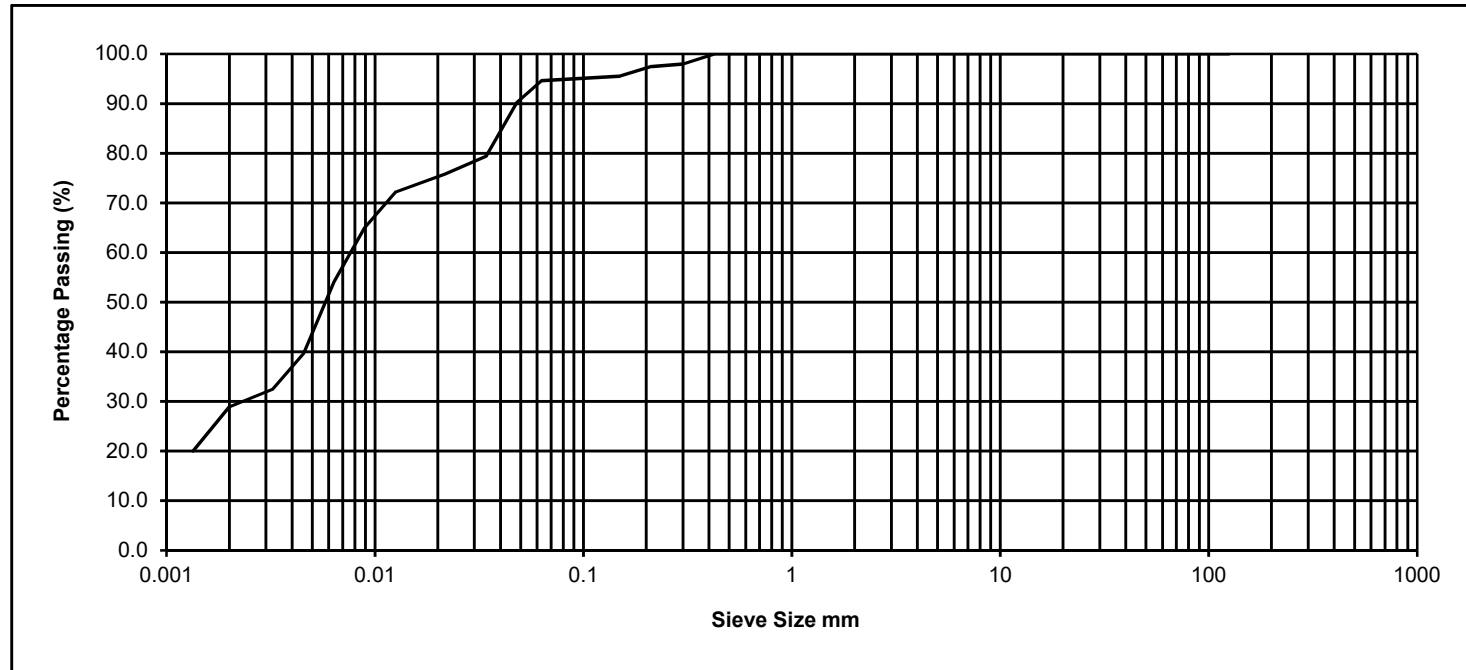
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	7.4m
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VINI Geotechnical Testing

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	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	98.0
0.212	97.4
0.150	95.5
0.063	94.6
0.048	90.2
0.034	79.4
0.022	75.8
0.013	72.2
0.009	65.0
0.006	54.1
0.005	39.7
0.003	32.5
0.002	28.9
0.001	20.0

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



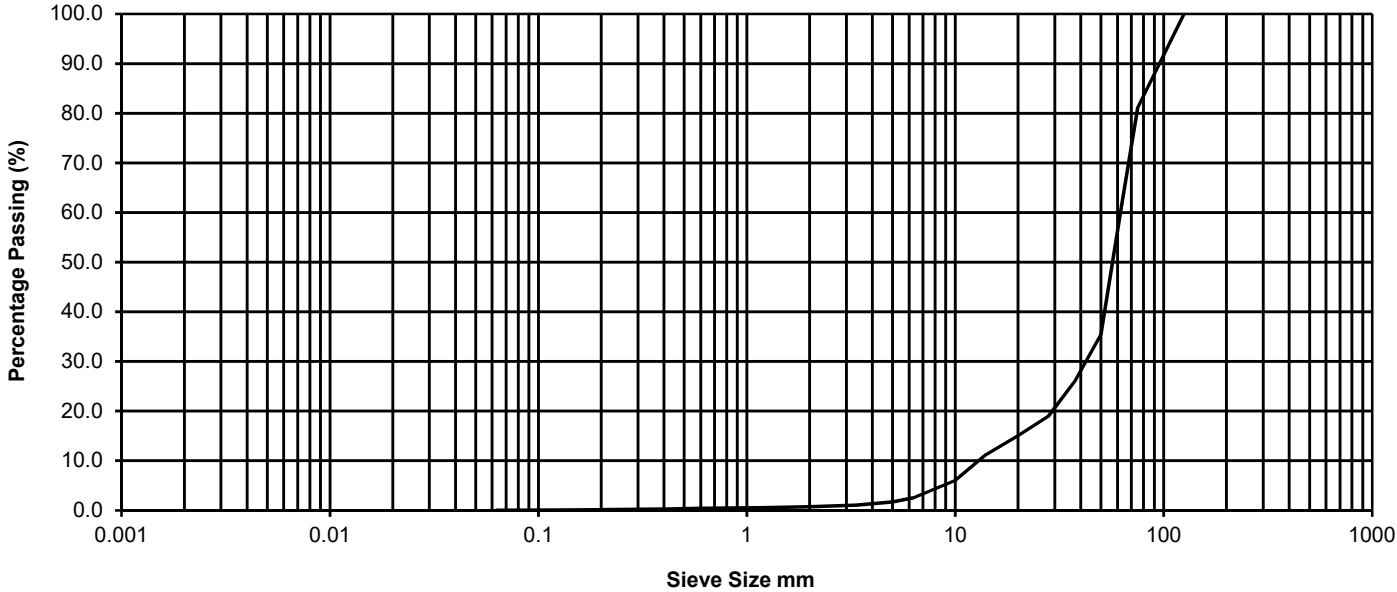
Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	65.7			5.4			0.0				
										0.0	0.0

VINI Geotechnical Testing

[illegible]

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			0.7			61.3				
										0.0	0.0

Sample Description Gravel cont Cobbles

Project No. 2099-21

BH/TP No. BH05BL

Sample No.

Project Limerick WWTP

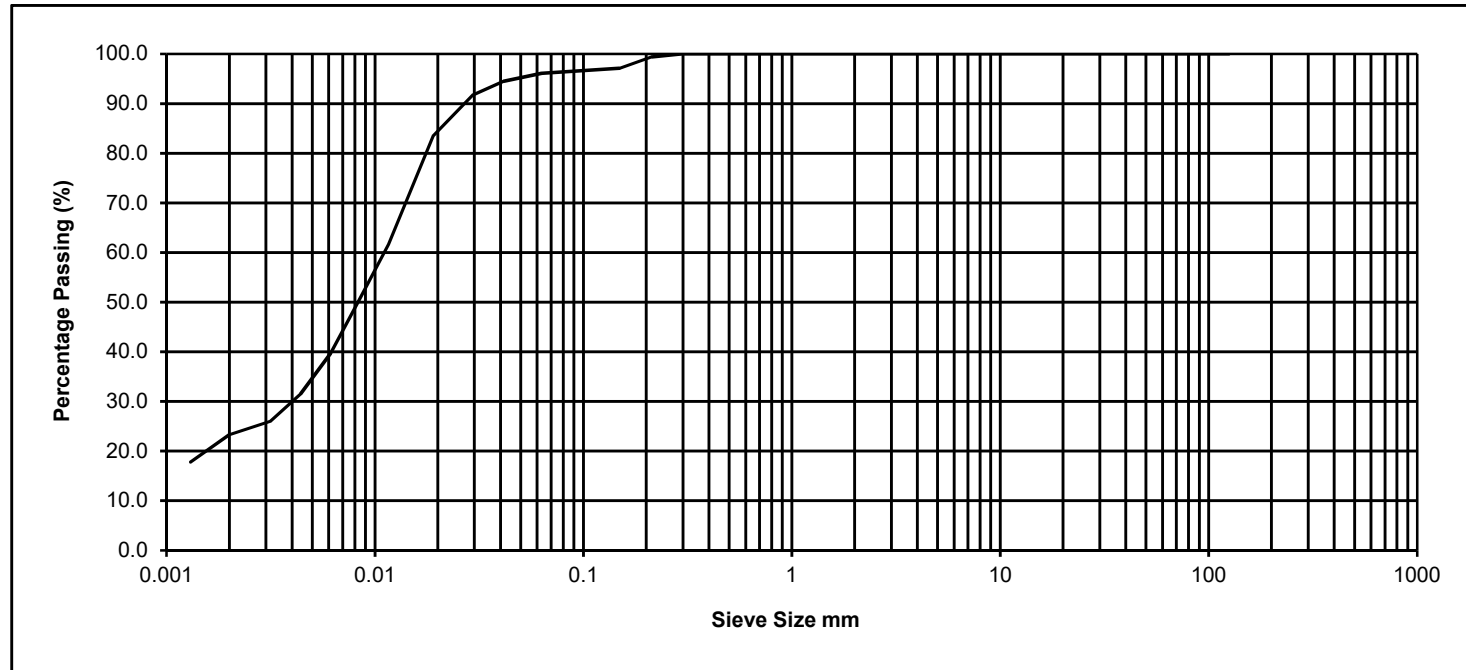
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	2.5m
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VINI Geotechnical Testing

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	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	99.4
0.150	97.2
0.063	96.1
0.041	94.5
0.029	91.7
0.019	83.5
0.012	61.6
0.008	50.7
0.006	39.7
0.004	31.5
0.003	26.0
0.002	23.3
0.001	17.8

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				
	72.8			3.9			0.0				
										0.0	0.0

Sample Description Silty CLAY

Project No. 2099-21

BH/TP No. BH05BL

Project Limerick WWTP

Sample No.

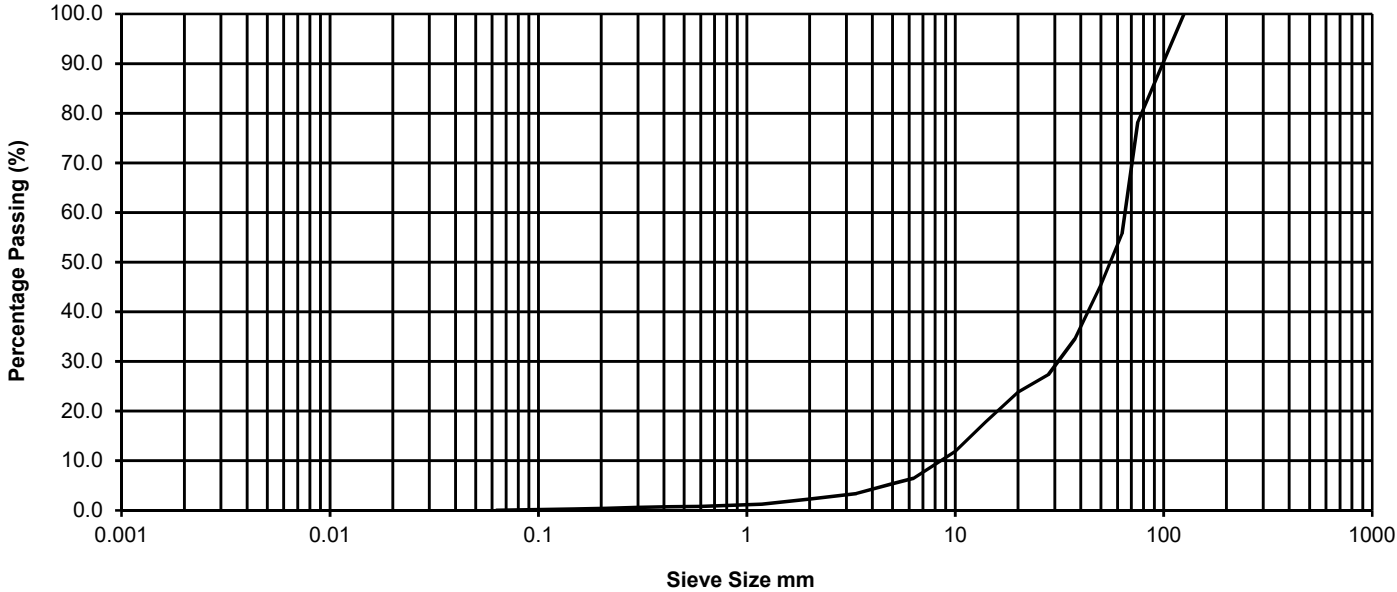
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	4.5m
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VINI Geotechnical Testing

[illegible]

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				
	0.1			2.2			53.4				
										0.0	0.0

Sample Description Gravel cont Cobbles

Project No. 2099-21

BH/TP No. BH05BL

Sample No.

Project Limerick WWTP

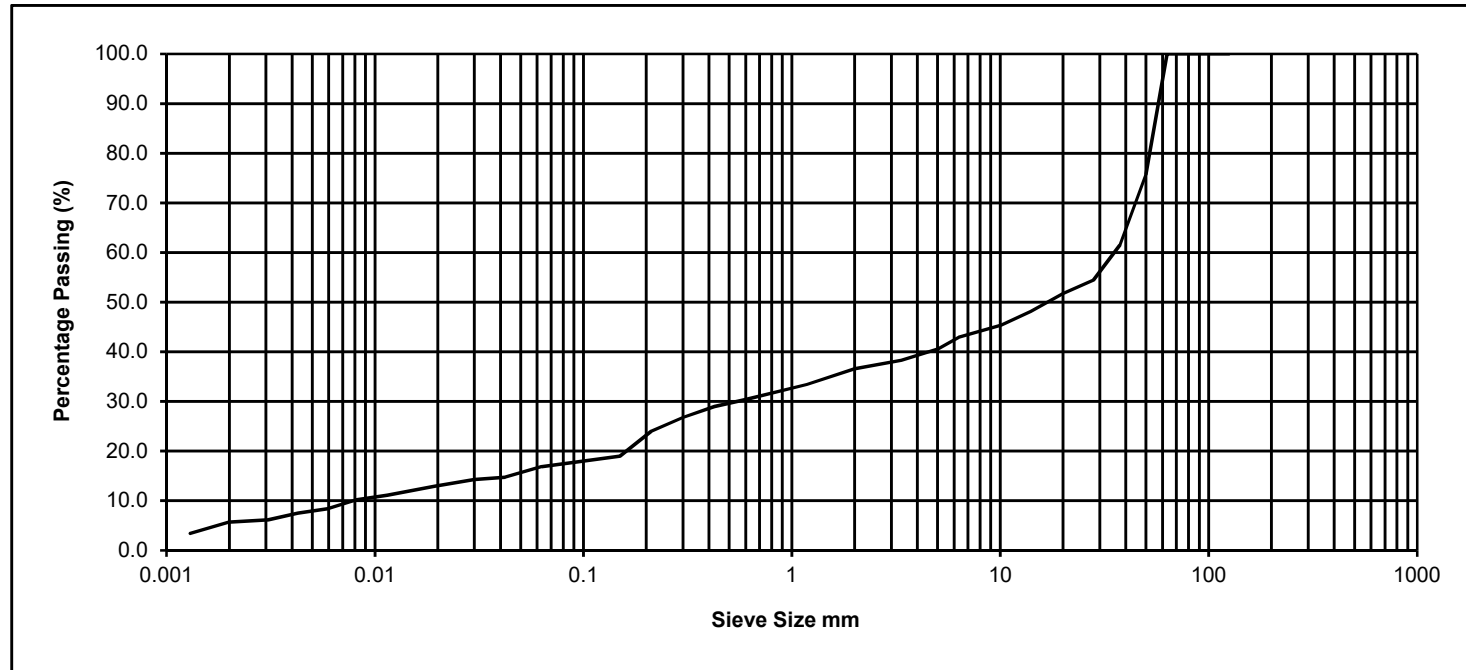
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	8.96m
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VINI Geotechnical Testing

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	75.7
37.500	61.5
28.000	54.4
20.000	51.7
14.000	48.1
10.000	45.3
6.300	42.9
5.000	40.5
3.350	38.2
2.000	36.6
1.180	33.4
0.600	30.4
0.425	29.0
0.300	26.8
0.212	24.0
0.150	19.0
0.063	16.8
0.042	14.7
0.030	14.3
0.019	12.9
0.011	11.1
0.008	10.2
0.006	8.4
0.004	7.5
0.003	6.1
0.002	5.7
0.001	3.4

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Percentage Particle Size										Cobbles	Boulder
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
	Silt			Sand			Gravel				
	11.2			19.8			63.4			0.0	0.0

Sample Description Silty sandy GRAVEL

Project No. 2099-21

BH/TP No. BH06BL

Project Limerick WWTP

Sample No.

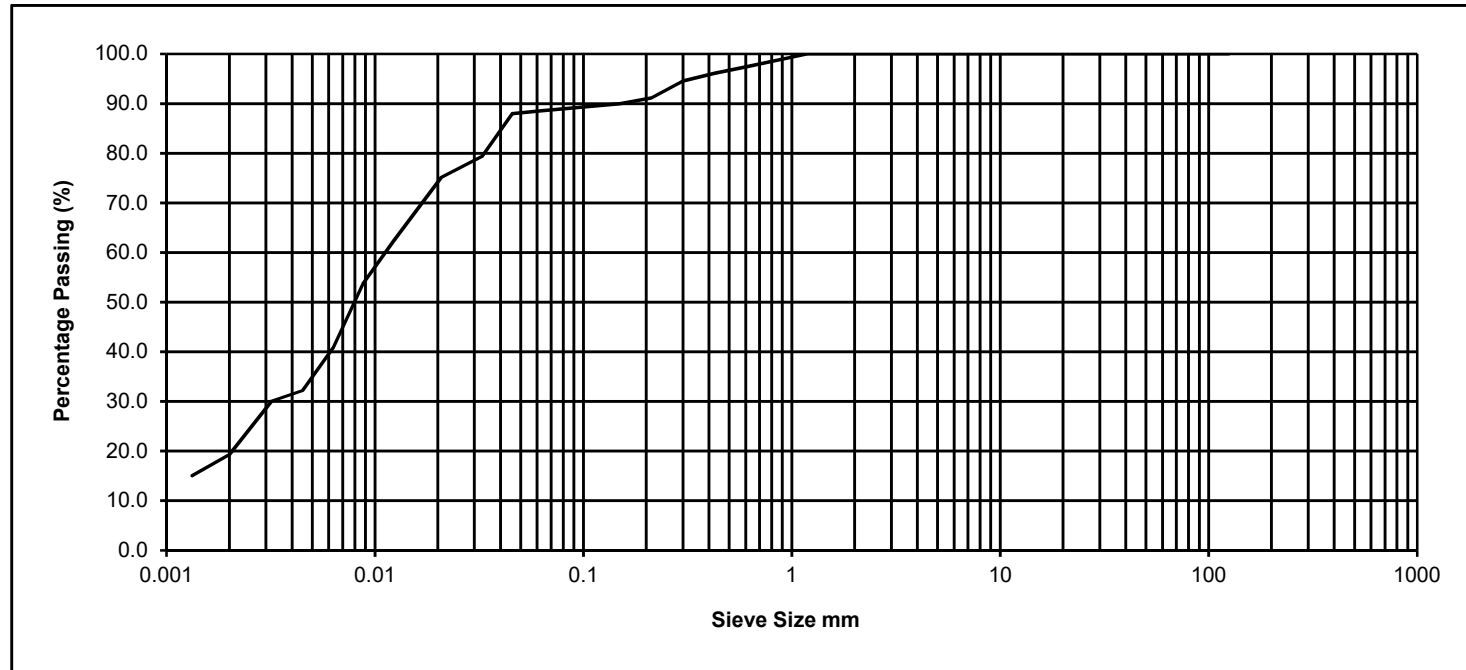
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	2.0m
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VINI Geotechnical Testing

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	100.0
5.000	100.0
3.350	100.0
2.000	100.0
1.180	100.0
0.600	97.4
0.425	96.1
0.300	94.5
0.212	91.2
0.150	90.0
0.063	88.6
0.046	88.0
0.033	79.4
0.021	75.1
0.012	62.2
0.009	53.7
0.006	40.8
0.004	32.2
0.003	30.0
0.002	19.3
0.001	15.0

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				
	69.3			11.4			0.0				

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. BH06BL

Project Limerick WWTP

Sample No.

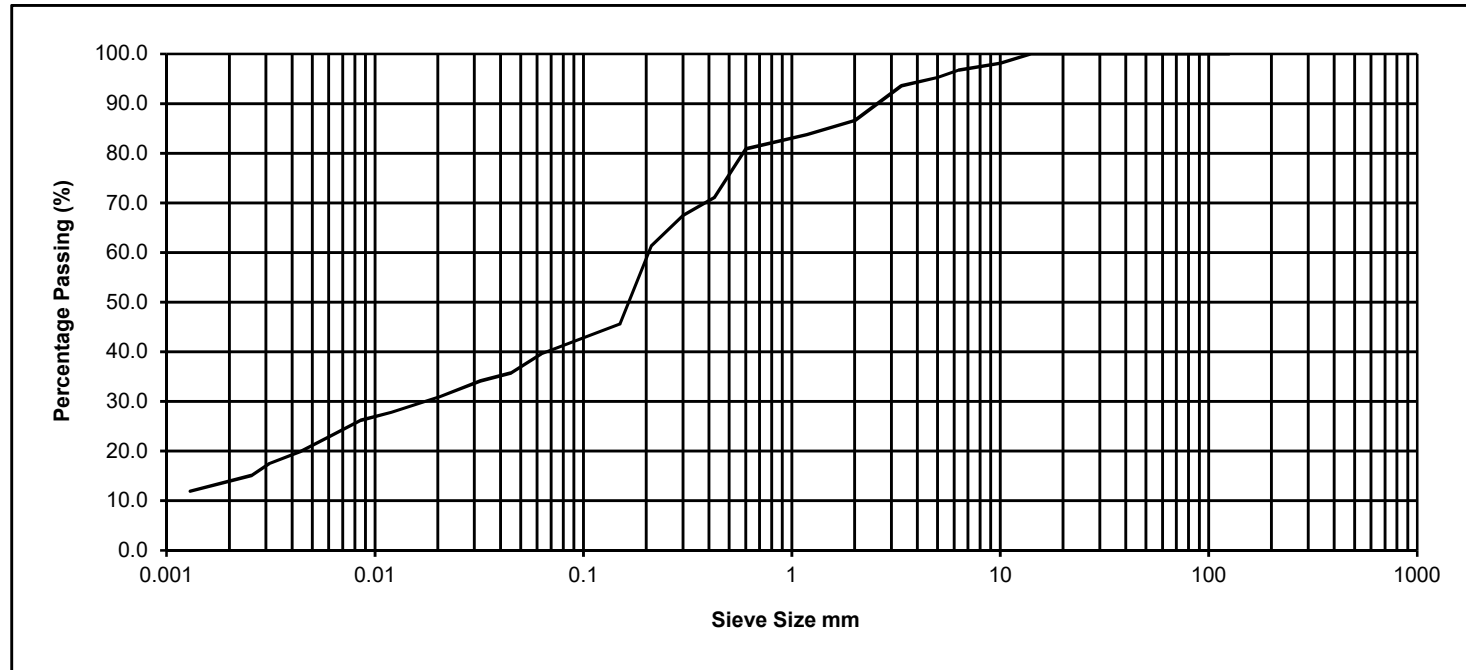
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	7.2m
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VINI Geotechnical Testing

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	98.1
6.300	96.8
5.000	95.2
3.350	93.6
2.000	86.5
1.180	83.7
0.600	80.9
0.425	71.1
0.300	67.5
0.212	61.4
0.150	45.6
0.063	39.6
0.045	35.7
0.032	34.1
0.021	31.0
0.012	27.8
0.009	26.2
0.006	23.0
0.004	19.9
0.003	17.5
0.003	15.1
0.001	11.9

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				
	24.5			46.9			13.5				
										0.0	0.0

Sample Description Gravelly silty SAND

Project No. 2099-21

BH/TP No. BH06BL

Project Limerick WWTP

Sample No.

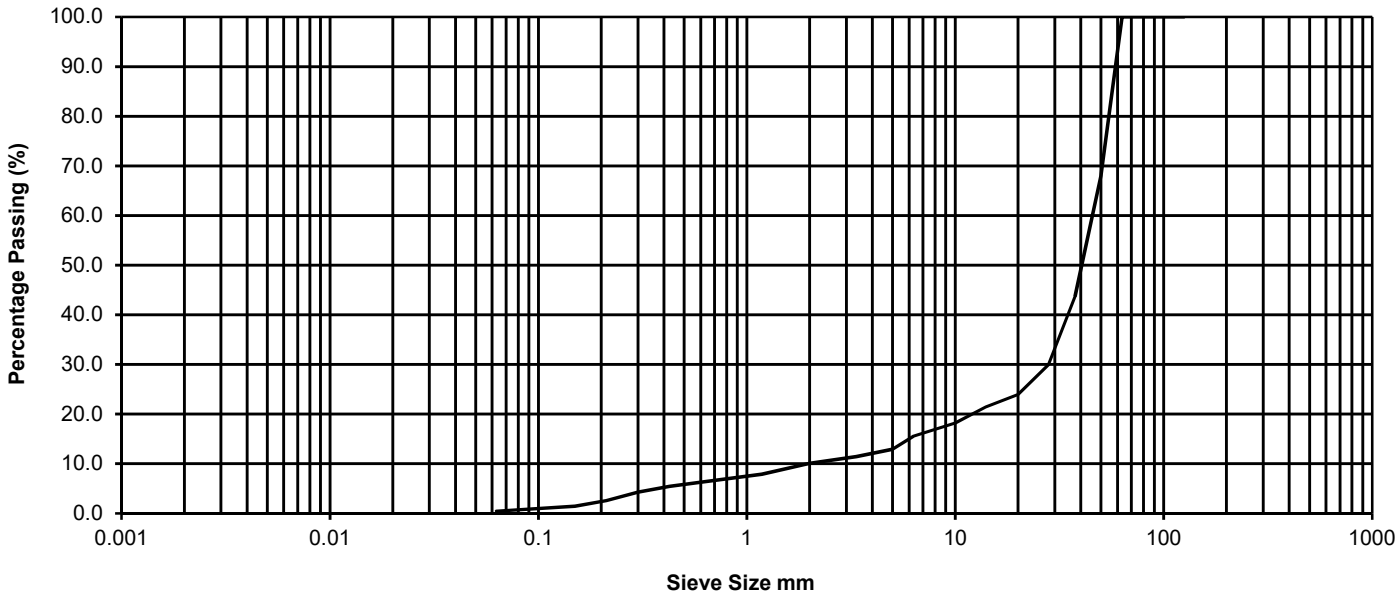
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	9.2m
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VINI Geotechnical Testing

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	68.0
37.500	43.7
28.000	30.0
20.000	23.9
14.000	21.4
10.000	18.2
6.300	15.6
5.000	12.9
3.350	11.4
2.000	10.1
1.180	7.9
0.600	6.3
0.425	5.4
0.300	4.3
0.212	2.5
0.150	1.4
0.063	0.4

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				
	0.4			9.6			89.9				
										0.0	0.0

Sample Description Sandy GRAVEL

Project No. 2099-21

BH/TP No. BH06BL

Sample No.

Project Limerick WWTP

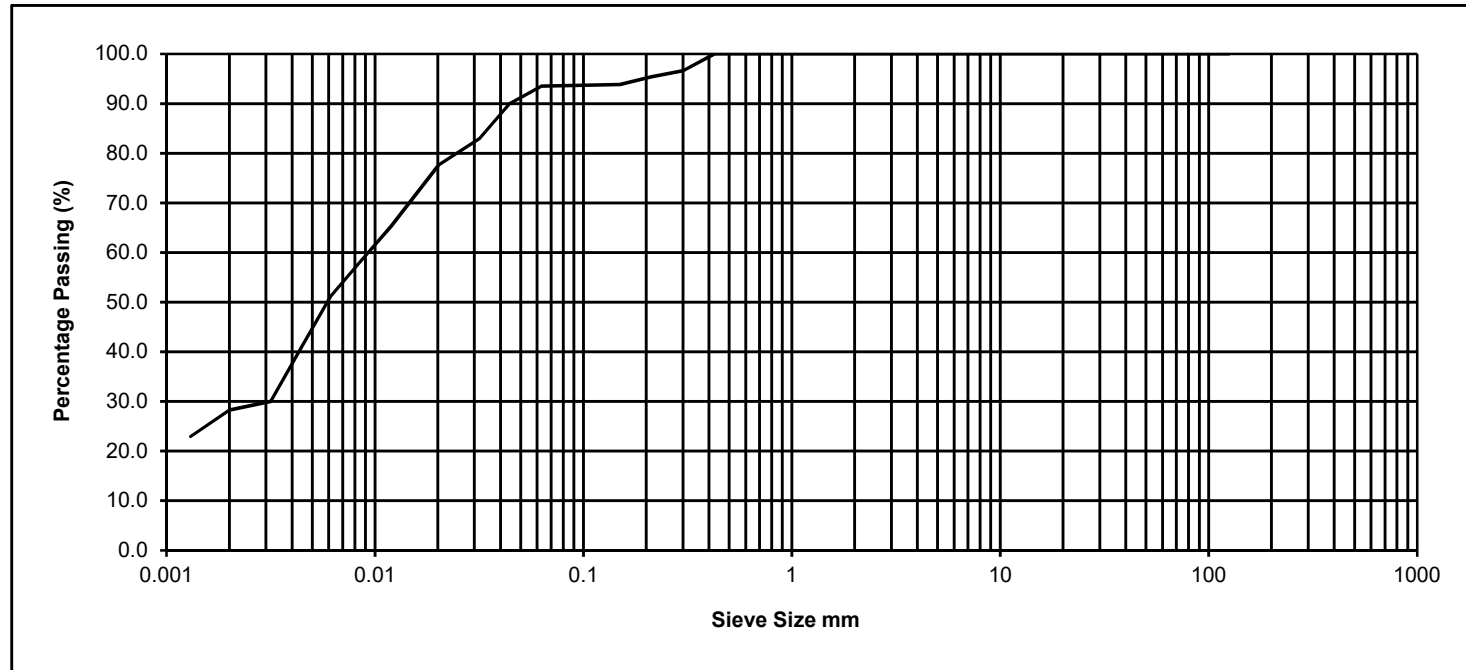
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	11.2m
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VINI Geotechnical Testing

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	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	96.6
0.212	95.4
0.150	93.9
0.063	93.5
0.044	90.0
0.032	82.9
0.020	77.6
0.012	65.3
0.009	58.2
0.006	51.2
0.004	40.6
0.003	30.0
0.002	28.2
0.001	22.9

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



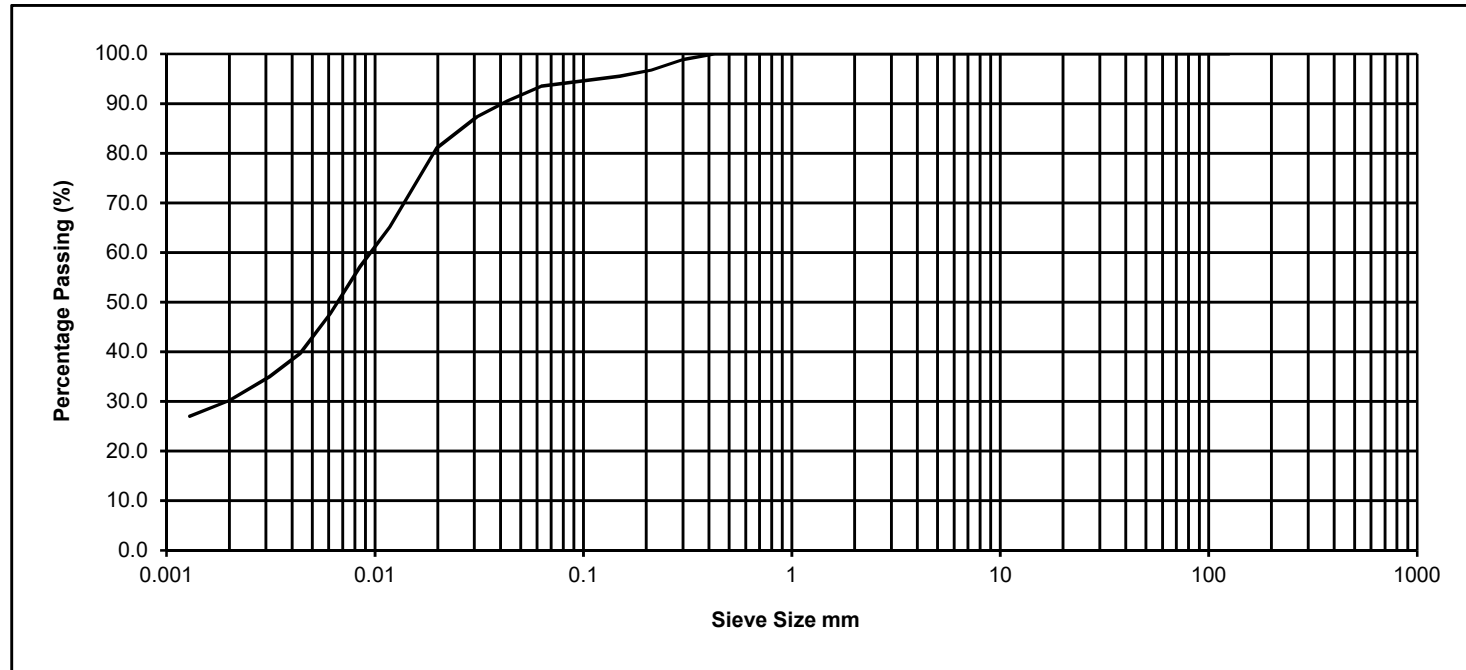
Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	65.3			6.5			0.0				
										0.0	0.0

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	98.9
0.212	96.7
0.150	95.5
0.063	93.5
0.043	90.5
0.031	87.4
0.020	81.0
0.012	65.1
0.008	57.2
0.006	47.6
0.004	39.7
0.003	34.9
0.002	30.2
0.001	27.0

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				
	63.3			6.5			0.0				
										0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. TP02BL

Project Limerick WWTP

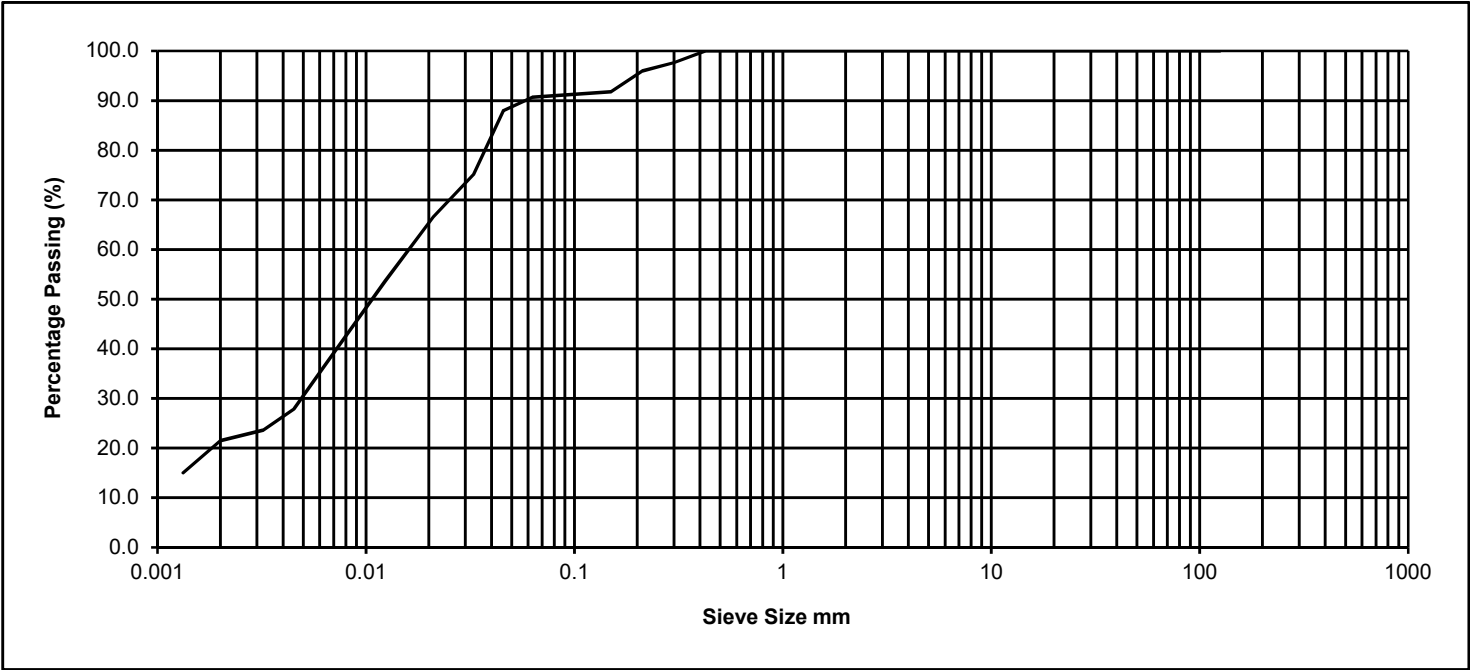
Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	1.0m
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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	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	97.7
0.212	96.0
0.150	91.8
0.063	90.7
0.046	88.0
0.033	75.1
0.021	66.5
0.012	53.7
0.009	45.1
0.006	36.5
0.005	27.9
0.003	23.6
0.002	21.5
0.001	15.0

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				
	69.2			9.3			0.0				

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. TP03BL

Project Limerick WWTP

Sample No.

Operator

SS

Checked

VS

Approved

VS

Date sample tested

09/08/2021

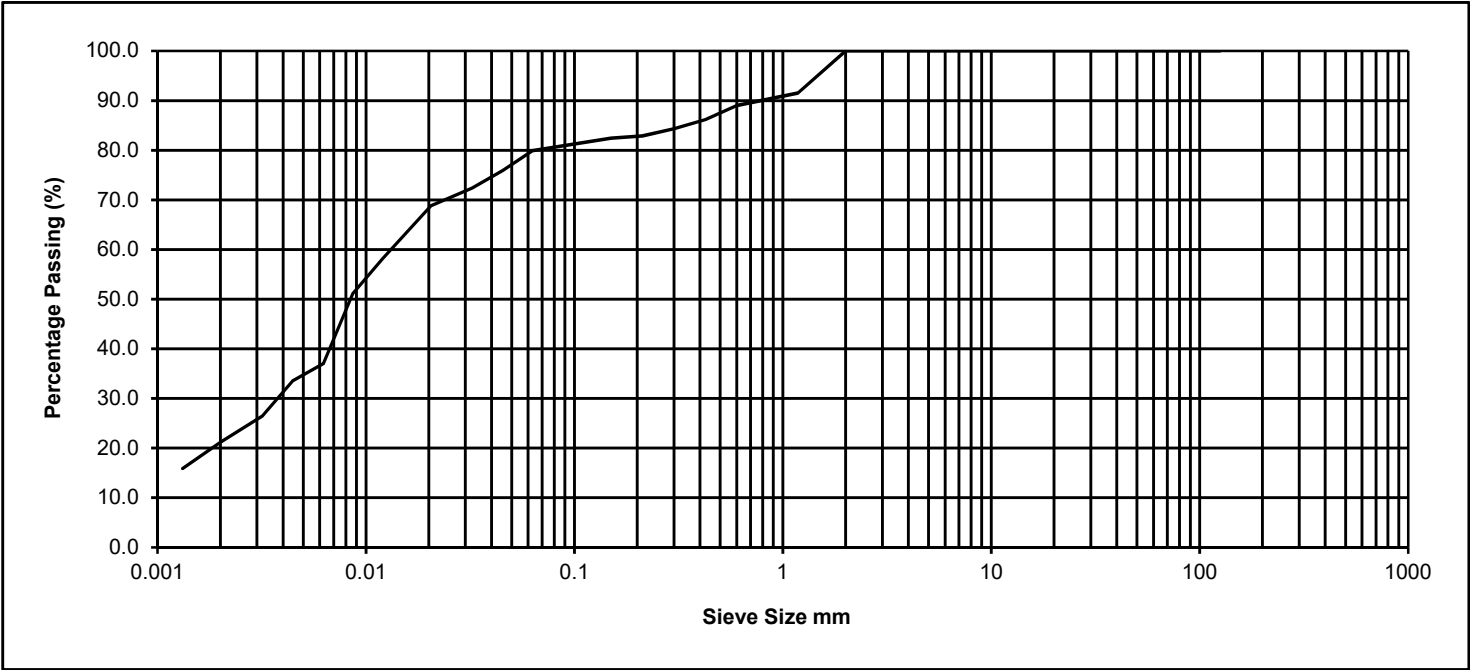
Depth

2.0m

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	91.5
0.600	89.0
0.425	86.2
0.300	84.3
0.212	82.9
0.150	82.4
0.063	79.9
0.045	75.9
0.032	72.4
0.021	68.8
0.012	58.2
0.009	51.2
0.006	37.1
0.004	33.5
0.003	26.5
0.002	21.2
0.001	15.9

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				
	58.7			20.1			0.0				
										0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. TP04BL

Project Limerick WWTP

Sample No.

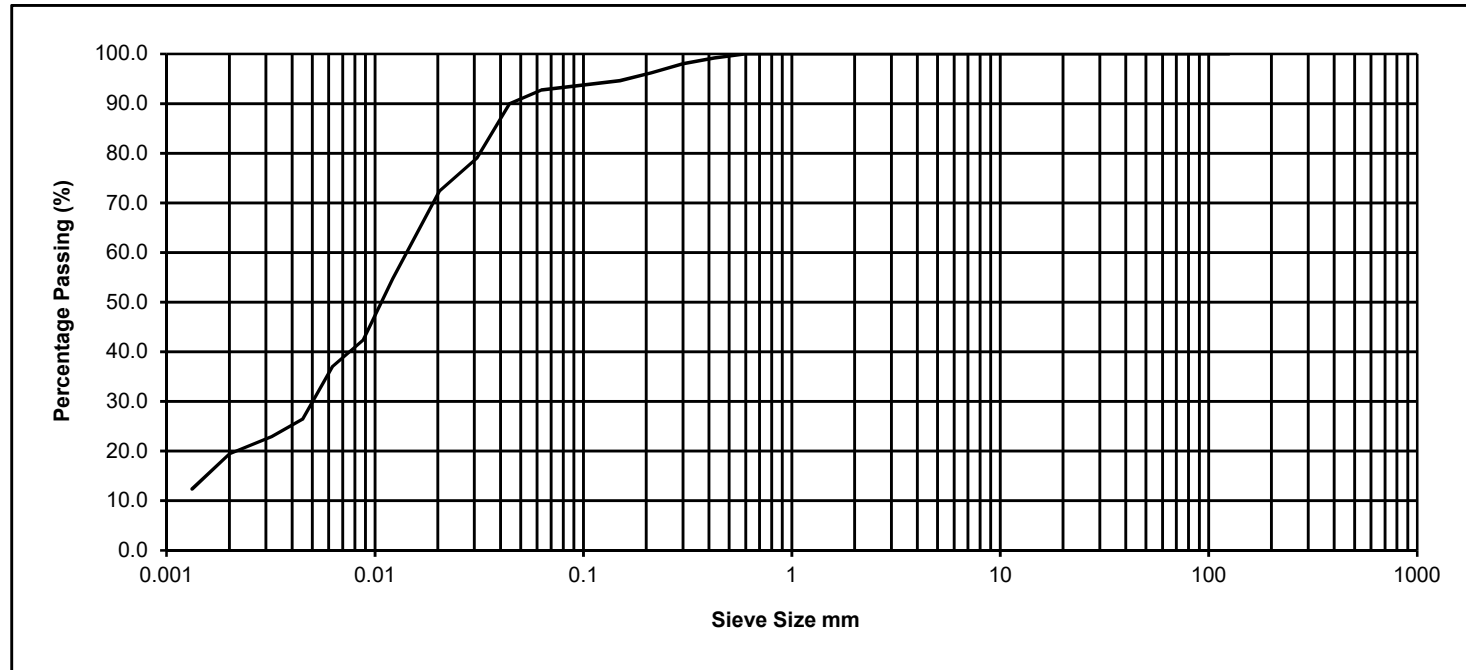
Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	1.0m
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VINI Geotechnical Testing

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	100.0
5.000	100.0
3.350	100.0
2.000	100.0
1.180	100.0
0.600	100.0
0.425	99.2
0.300	98.0
0.212	96.2
0.150	94.6
0.063	92.8
0.044	90.0
0.031	79.0
0.020	72.4
0.012	54.7
0.009	42.4
0.006	37.1
0.004	26.5
0.003	22.9
0.002	19.4
0.001	12.4

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



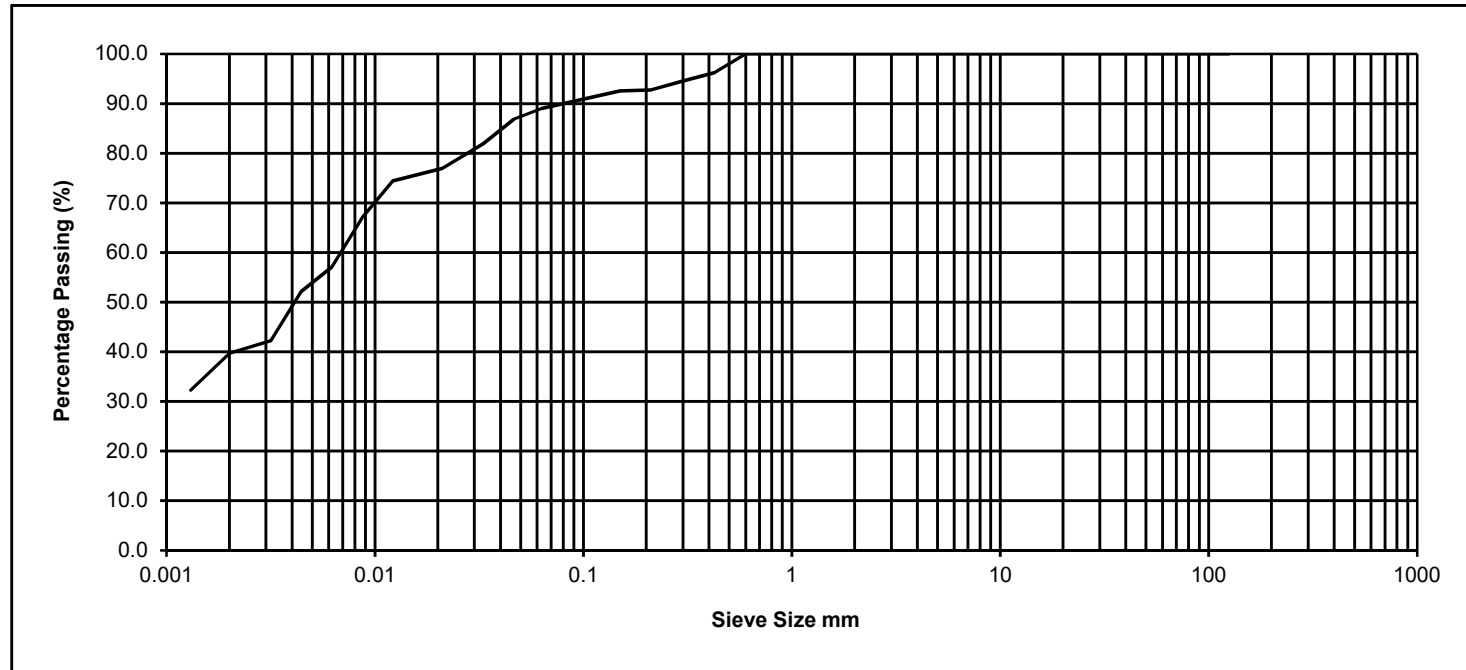
Percentage Particle Size											
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
	73.4			7.2			0.0				
										0.0	0.0

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	96.2
0.300	94.5
0.212	92.8
0.150	92.6
0.063	89.0
0.047	86.9
0.033	81.9
0.021	76.9
0.012	74.4
0.009	67.0
0.006	57.1
0.004	52.1
0.003	42.2
0.002	39.7
0.001	32.3

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				
	49.3			11.0			0.0				

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. TP05BL

Project Limerick WWTP

Sample No.

Operator	SS	Checked	VS	Approved	VS	Date sample tested	09/08/2021	Depth	1.0m
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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	100.0
5.000	100.0
3.350	100.0
2.000	100.0
1.180	99.4
0.600	97.1
0.425	95.4
0.300	93.9
0.212	92.4
0.150	90.3
0.063	88.8
0.045	84.8
0.032	81.2
0.020	77.6
0.012	70.4
0.009	59.6
0.006	45.1
0.004	34.3
0.003	27.1
0.002	23.5
0.001	14.4

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				
	65.4			11.2			0.0				
										0.0	0.0

Sample Description Sandy silty CLAY

Project No. 2099-21

BH/TP No. TP05BL

Project Limerick WWTP

Sample No.

Operator

SS

Checked

VS

Approved

VS

Date sample tested

09/08/2021

Depth

3.0m



DETS

Certificate of Analysis

Certificate Number 21-16299

Issued: 09-Aug-21

Client Whiteford
Straid House
2 Main Street
Straid
Ballyclare
BT39 9NE

Our Reference 21-16299

Client Reference 2099-21

Order No (not supplied)

Contract Title Limerick WWT Si

Description 27 Soil samples.

Date Received 03-Aug-21

Date Started 03-Aug-21

Date Completed 09-Aug-21

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 21-16299

Client Ref 2099-21

Contract Title Limerick WWT Si

Lab No	1884964	1884965	1884966	1884967	1884968	1884969	1884970	1884971	1884972
Sample ID	BH01BL	BH02BL	BH02BL	BH03BL	BH03BL	BH04BL	BH04BL	BH04BL	BH04BL
Depth	2.00	1.00	3.00	1.00	3.00	2.00	3.00	5.00	7.00
Other ID									
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units									
Inorganics												
pH	DETSC 2008#		pH	5.4		4.3		7.1	7.4		7.6	
Organic matter	DETSC 2002#	0.1	%	6.3	6.3		2.3	4.2		5.3	5.0	5.6
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.76	0.61			0.37	0.17		0.26	

Summary of Chemical Analysis

Soil Samples

Our Ref 21-16299

Client Ref 2099-21

Contract Title Limerick WWT Si

Lab No	1884973	1884974	1884975	1884976	1884977	1884978	1884979	1884980	1884981	1884982	1884983	1884984
Sample ID	BH05BL	BH05BL	BH05BL	BH06BL	BH06BL	BH06BL	BH01CR	BH01CR	BH02CR	BH02CR	BH03ACR	BH04CR
Depth	3.50	6.50	7.50	1.00	8.20	9.20	2.00	4.00	4.00	5.00	4.00	5.50
Other ID												
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units											
Inorganics														
pH	DETSC 2008#		pH	6.9			7.9			8.2	7.3	8.0	7.8	7.8
Organic matter	DETSC 2002#	0.1	%		4.6	8.3		4.6	2.3		3.6		3.6	4.6
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.64			0.27			0.09	0.11	0.13	0.13	0.12

Summary of Chemical Analysis

Soil Samples

Our Ref 21-16299

Client Ref 2099-21

Contract Title Limerick WWT Si

Lab No	1884985	1884986	1884987	1884988	1884989	1884990
Sample ID	BH05CR	BH06CR	BH06CR	BH06CR	BH06CR	TP01CR
Depth	1.00	1.50	2.50	4.50	6.50	2.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Inorganics									
pH	DETSC 2008#		pH	7.9	8.4	7.9			7.8
Organic matter	DETSC 2002#	0.1	%			3.0	7.1	10	
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.16	0.06	0.14			0.08

Information in Support of the Analytical Results

Our Ref 21-16299
 Client Ref 2099-21
 Contract Limerick WWT Si

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1884964	BH01BL 2.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1884965	BH02BL 1.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days)	
1884966	BH02BL 3.00 SOIL		PT 500ml	Sample date not supplied, pH + Conductivity (7 days)	
1884967	BH03BL 1.00 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884968	BH03BL 3.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1884969	BH04BL 2.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884970	BH04BL 3.00 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884971	BH04BL 5.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1884972	BH04BL 7.00 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884973	BH05BL 3.50 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884974	BH05BL 6.50 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884975	BH05BL 7.50 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884976	BH06BL 1.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884977	BH06BL 8.20 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884978	BH06BL 9.20 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884979	BH01CR 2.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884980	BH01CR 4.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1884981	BH02CR 4.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884982	BH02CR 5.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1884983	BH03ACR 4.00 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884984	BH04CR 5.50 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884985	BH05CR 1.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1884986	BH06CR 1.50 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	

Information in Support of the Analytical Results

Our Ref 21-16299
 Client Ref 2099-21
 Contract Limerick WWT Si

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1884987	BH06CR 2.50 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1884988	BH06CR 4.50 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884989	BH06CR 6.50 SOIL		PT 500ml	Sample date not supplied, Organic Matter (Manual) (28 days)	
1884990	TP01CR 2.00 SOIL		PT 500ml	Sample date not supplied, Total Sulphate ICP (30 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

QUB Geotechnical Testing Laboratory

Client	WF
Job Ref	2099-21
Date	10/08/2021
Borehole number	BH01BL
Sample number	
Depth m	3.5m
Soil type	Soft silty CLAY
Test	1 D Consolidation

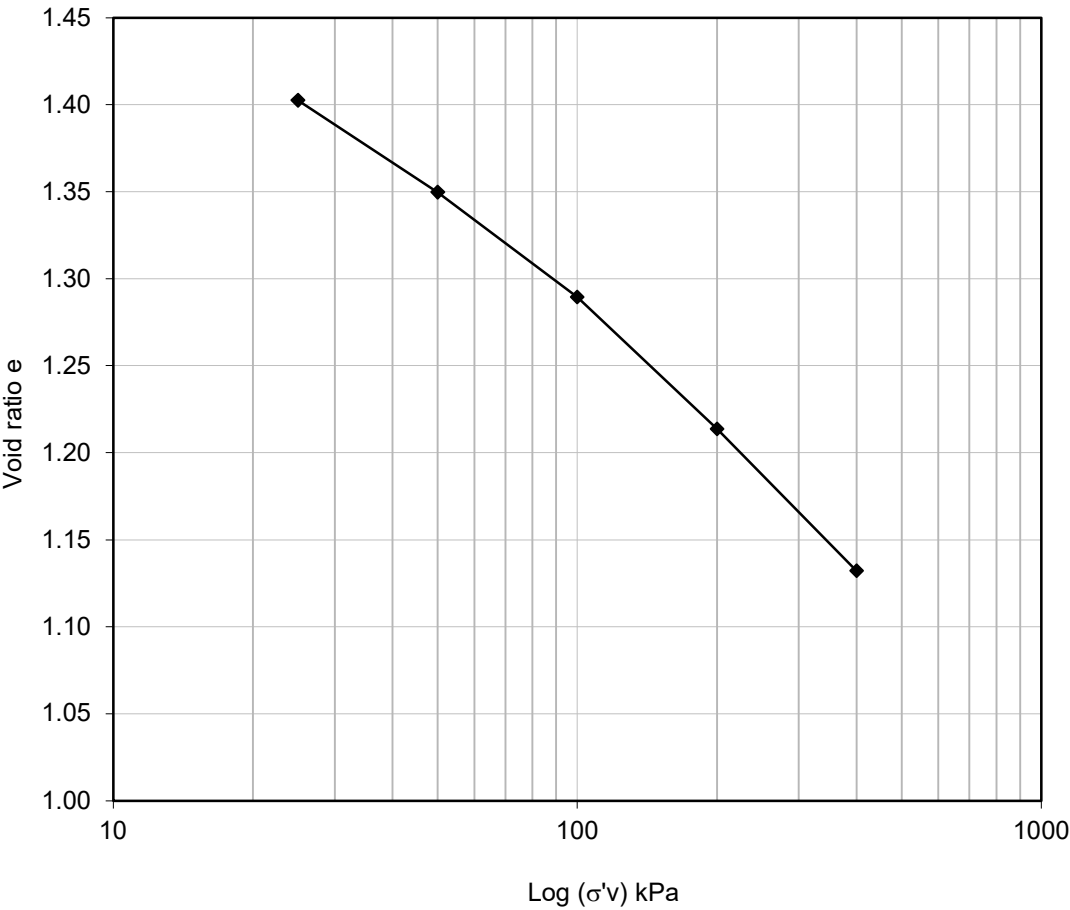
Remoulded sample

Ring Diameter mm	75.9
Ring Height mm	17.8
Initial Vol m3	8.0496E-05

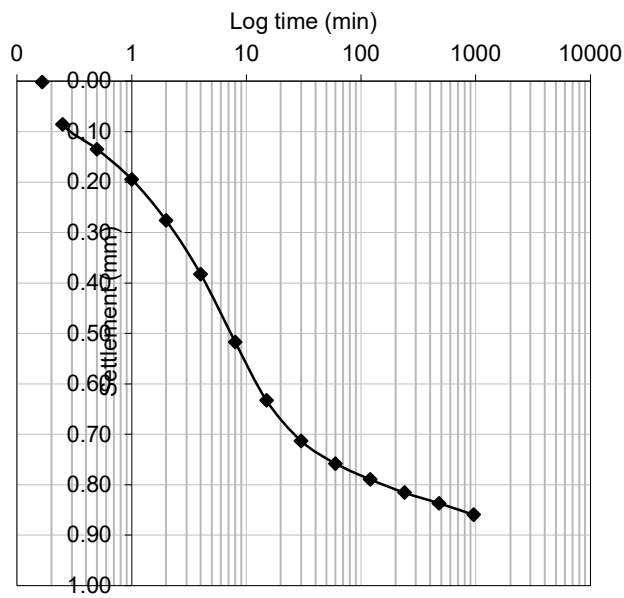
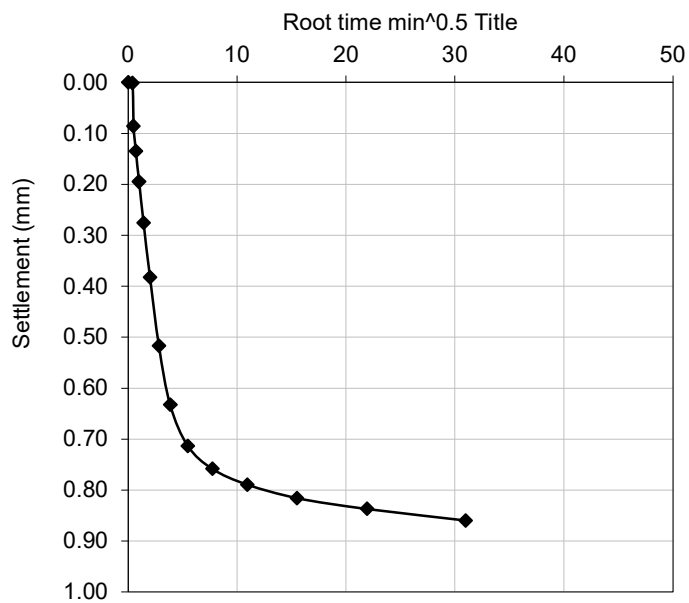
Wet mass (i) g	133.5
Wet mass (f) g	114.5
Dry mass g	84.5
Water content (i) %	58.0
Water content (f) %	35.5
Bulk density kg/m3	1658.5
Dry density kg/m3	1049.7

Diameter mm	75.9		
Initial Height mm	17.8	Specific gravity	2.65

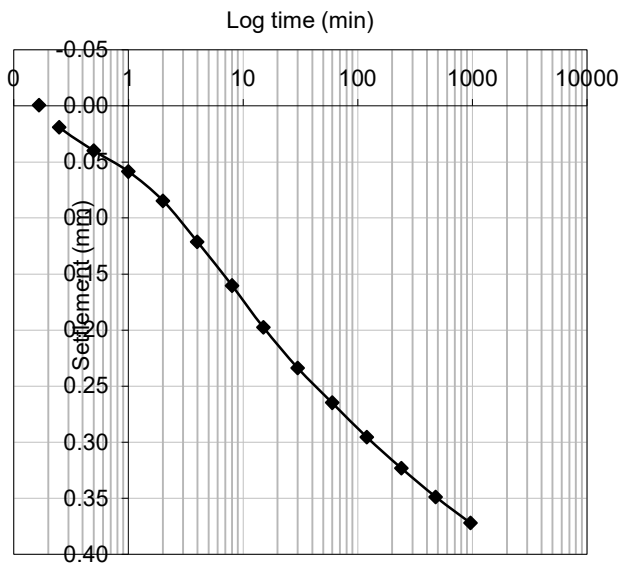
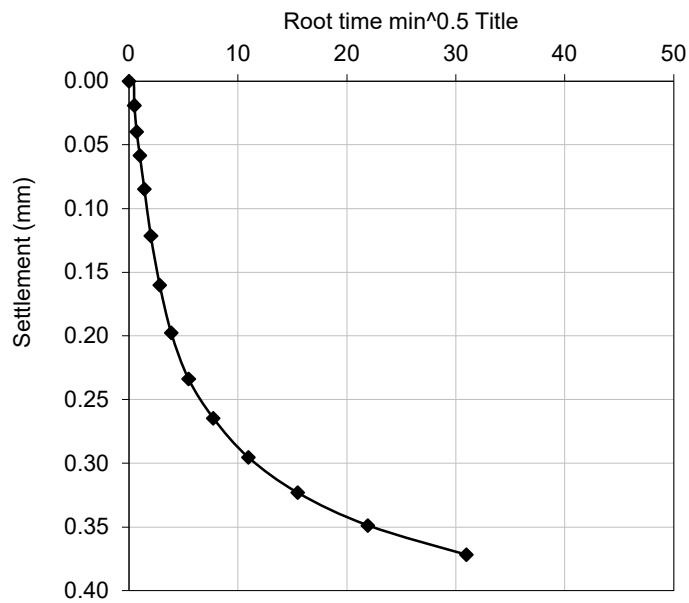
σ'_v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'_v)	Compressibility m2/MN	Cv m2/year
25	0.860	16.940	76.607	44.721	1.402	1.40		
50	0.372	16.568	74.925	43.039	1.350	1.70	0.88	0.38
100	0.425	16.143	73.002	41.115	1.289	2.00	0.51	0.36
200	0.534	15.609	70.589	38.702	1.214	2.30	0.33	0.33
400	0.576	15.034	67.985	36.099	1.132	2.60	0.18	0.51



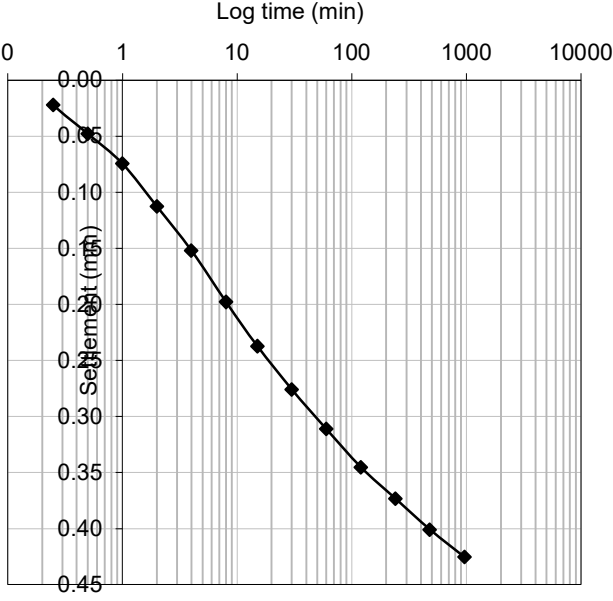
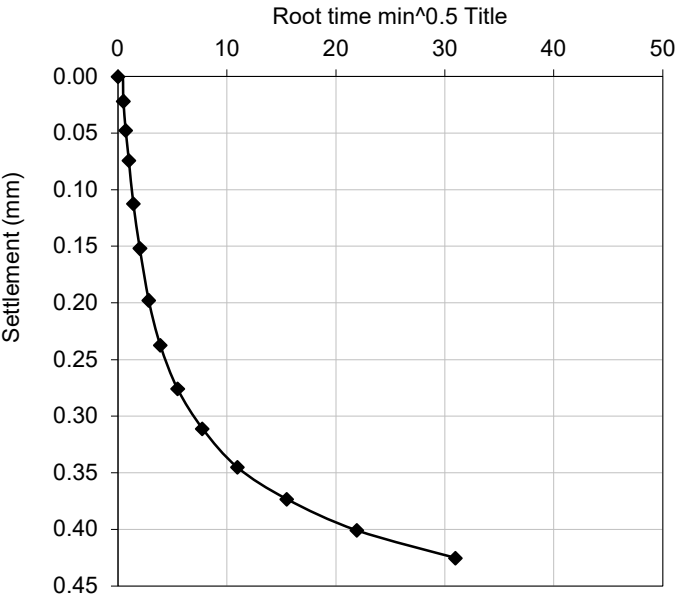
25kPa



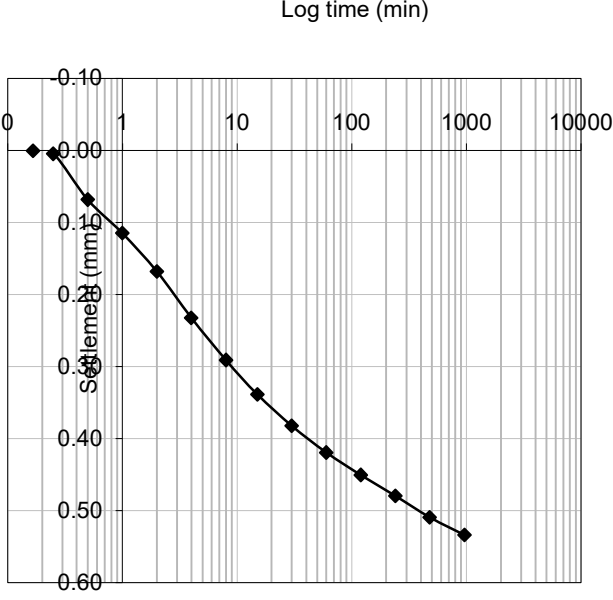
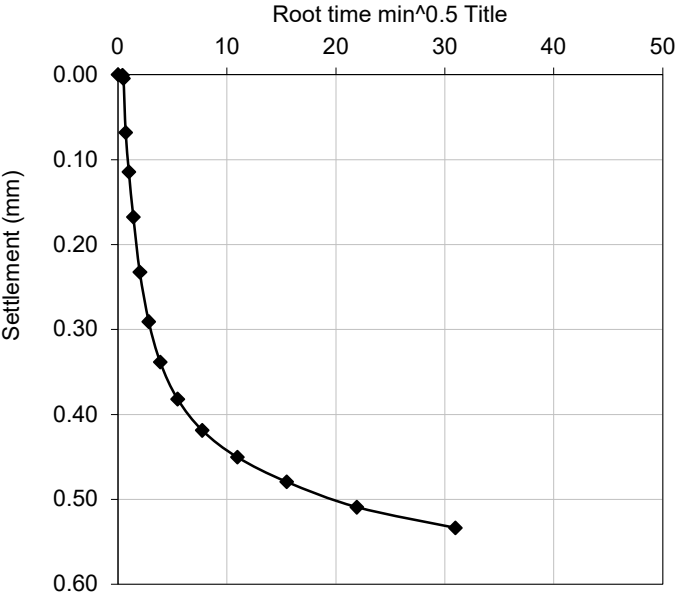
50kPa



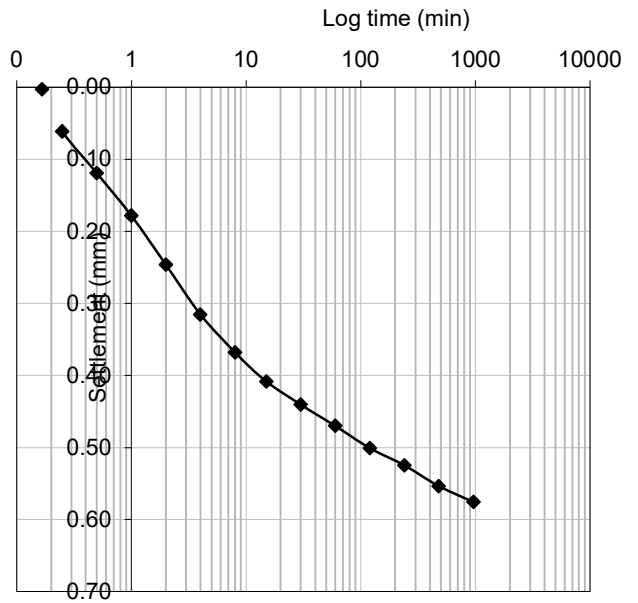
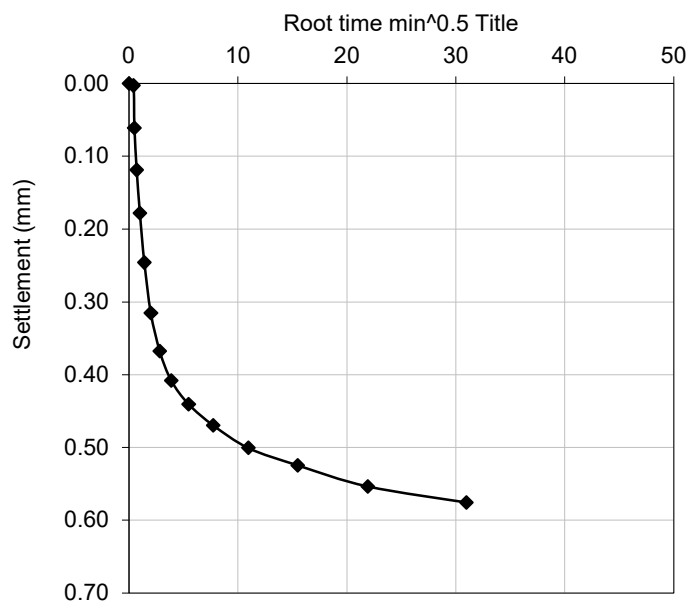
100kPa



200kPa



400kPa



QUB Geotechnical Testing Laboratory

Client	WF
Job Ref	2099-21
Date	10/08/2021
Borehole number	BH01BL
Sample number	
Depth m	6.0m
Soil type	Gravelly sandy silty CLAY
Test	1 D Consolidation

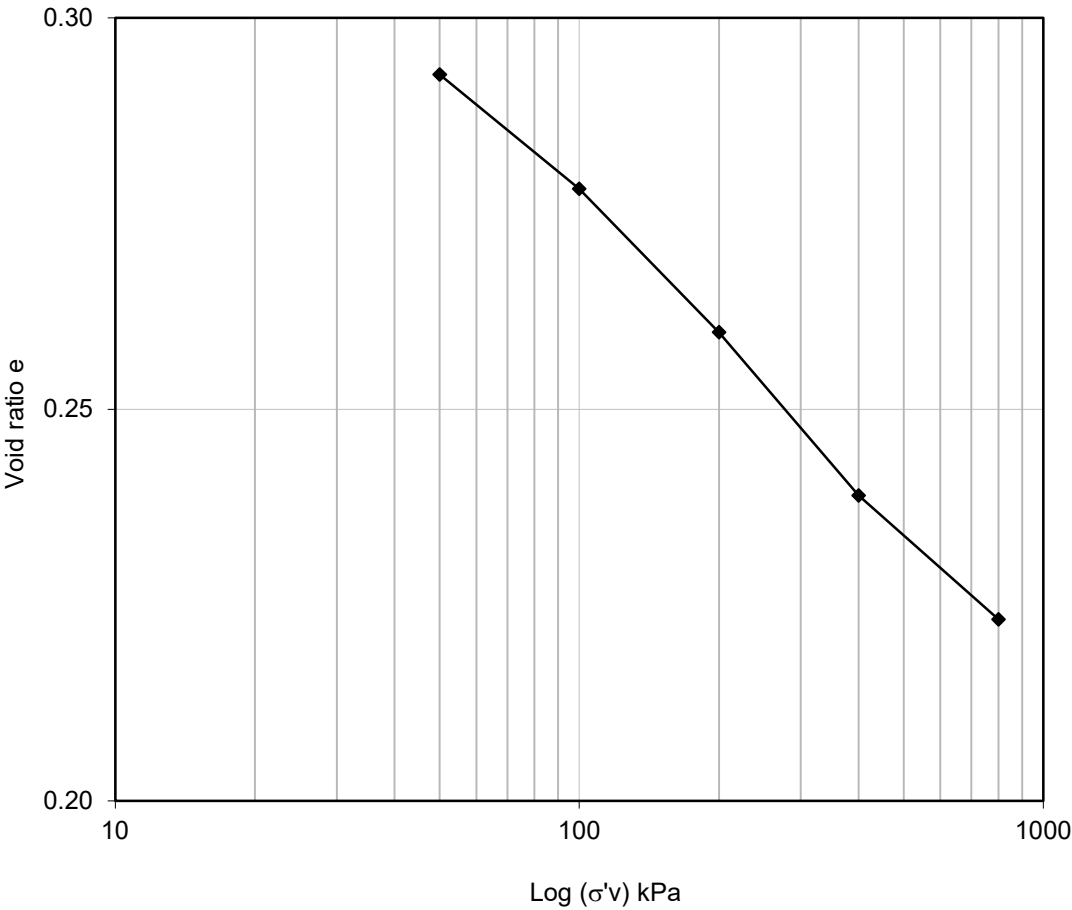
Remoulded sample

Ring Diameter mm	76.3
Ring Height mm	18.2
Initial Vol m3	8.3174E-05

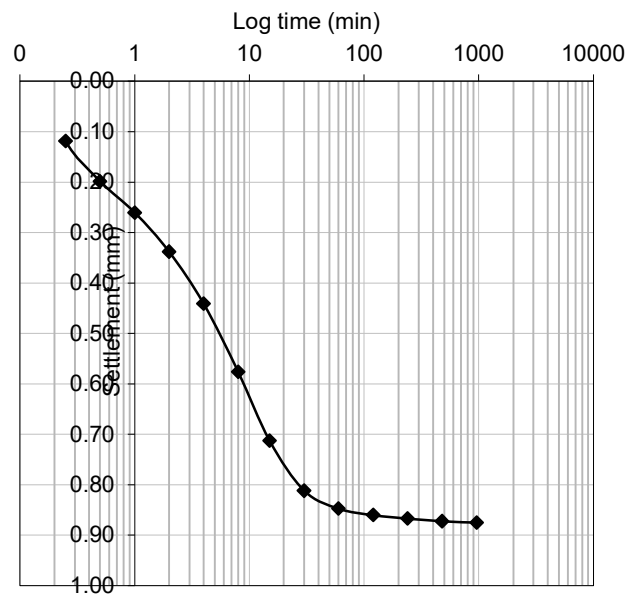
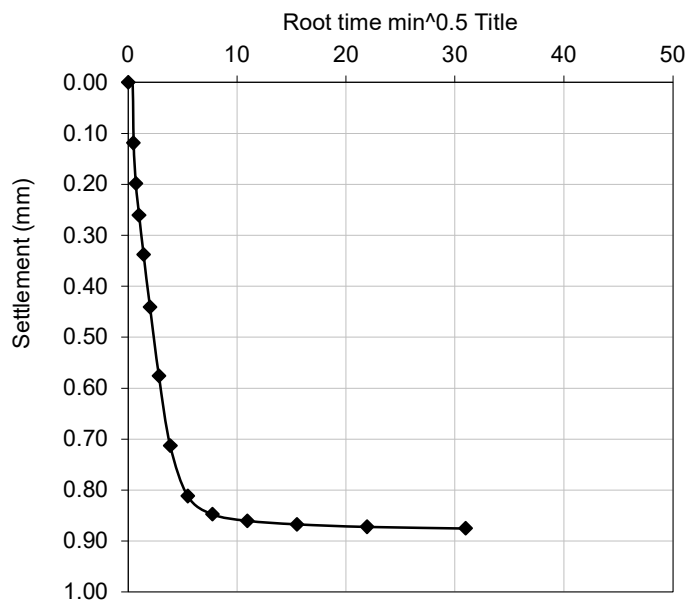
Wet mass (i) g	188.5
Wet mass (f) g	178.3
Dry mass g	162.3
Water content (i) %	16.1
Water content (f) %	9.9
Bulk density kg/m3	2266.3
Dry density kg/m3	1951.3

Diameter mm	76.3		
Initial Height mm	18.2	Specific gravity	2.65

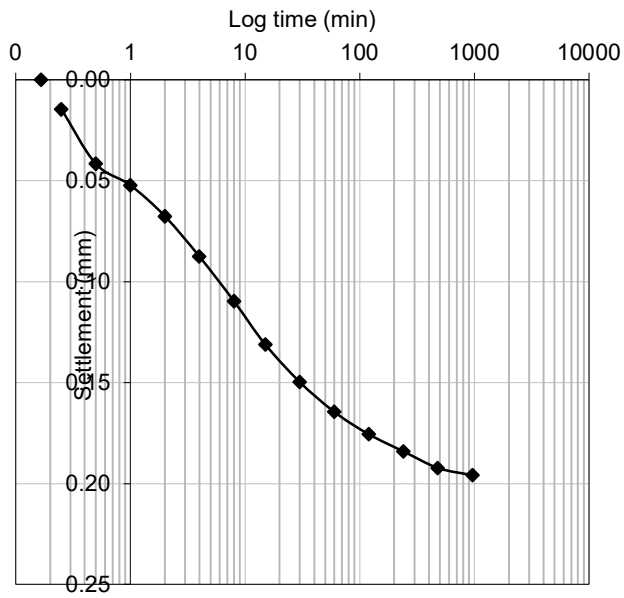
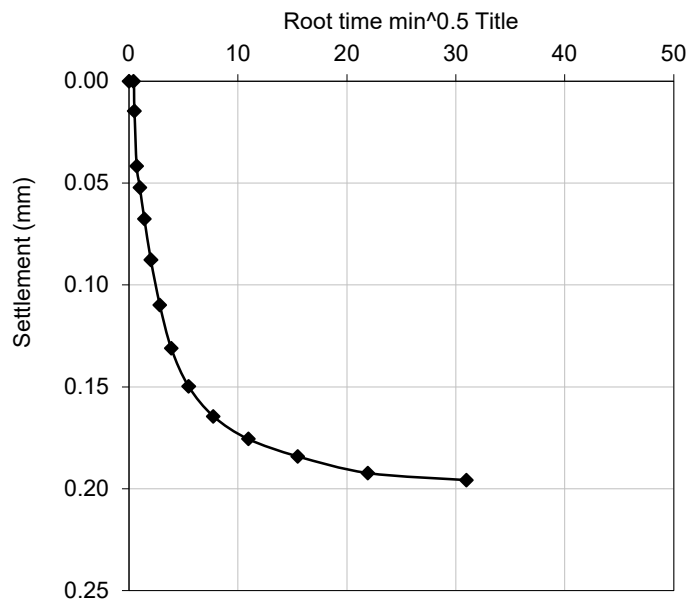
σ'_v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	$\log(\sigma'_v)$	Compressibility m2/MN	Cv m2/year
50	0.875	17.325	79.174	17.929	0.293	1.70		
100	0.196	17.129	78.280	17.034	0.278	2.00	0.23	0.91
200	0.245	16.884	77.159	15.913	0.260	2.30	0.14	0.88
400	0.279	16.604	75.882	14.637	0.239	2.60	0.08	0.85
800	0.212	16.392	74.913	13.668	0.223	2.90	0.03	0.83



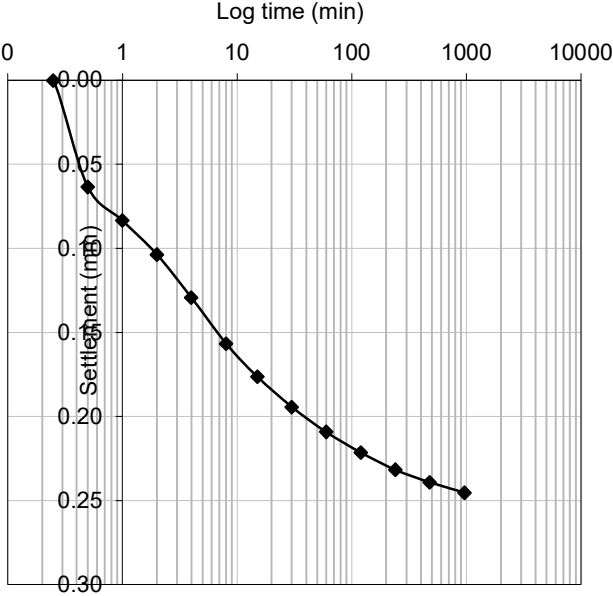
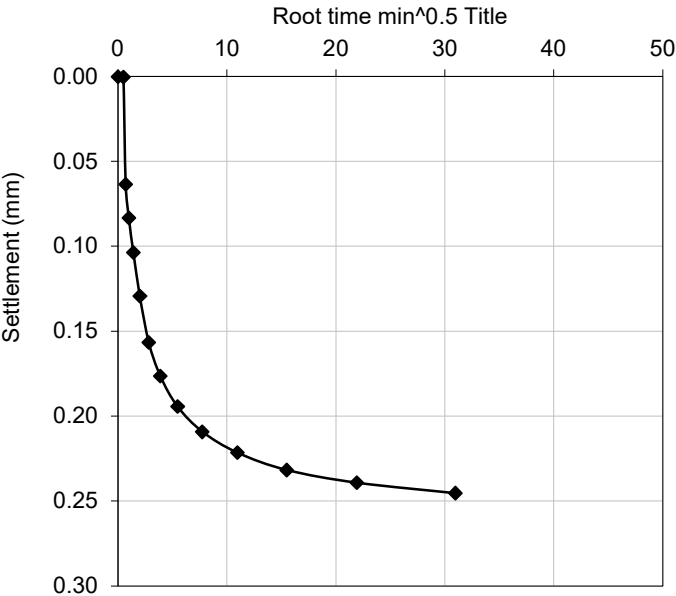
50kPa



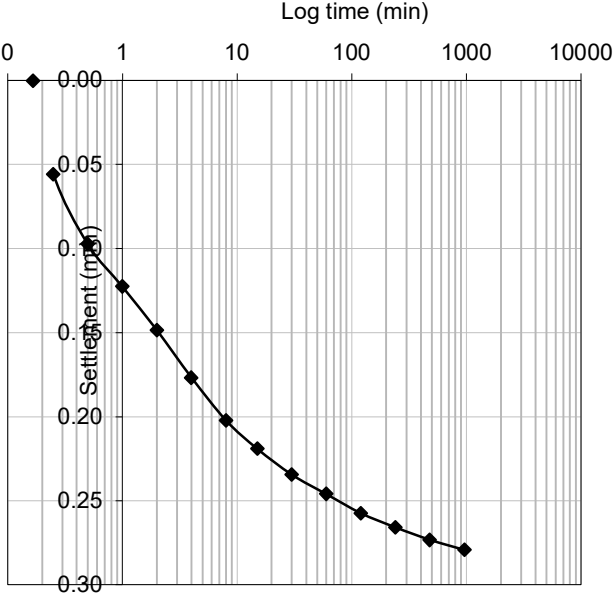
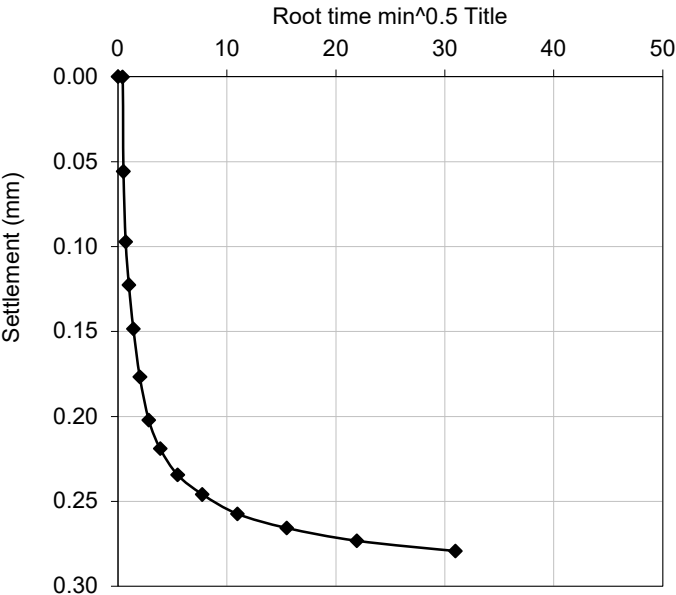
100kPa



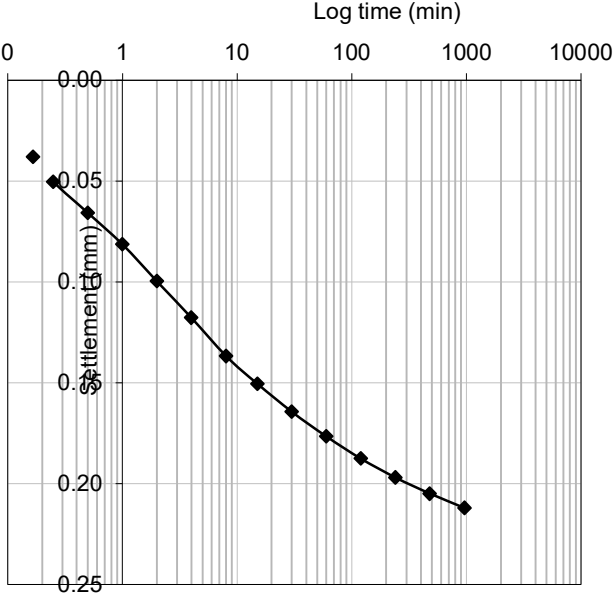
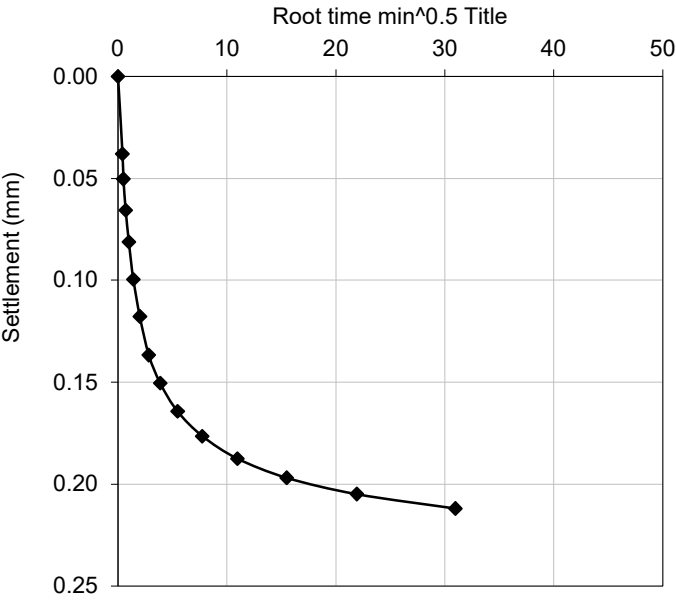
200kPa



400kPa



800kPa



QUB Geotechnical Testing Laboratory

Client	WF
Job Ref	2099-21
Date	10/08/2021
Borehole number	BH02BL
Sample number	
Depth m	6.0m
Soil type	Silty CLAY
Test	1 D Consolidation

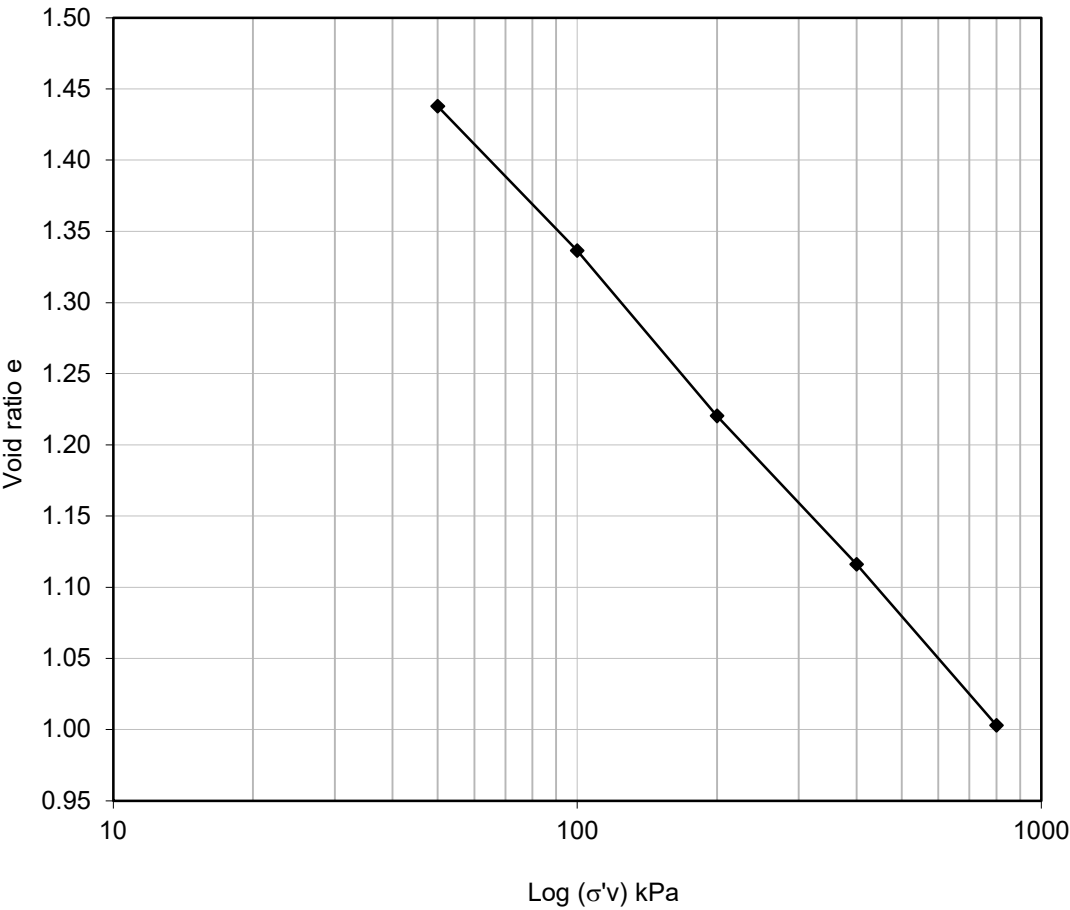
Remoulded sample

Ring Diameter mm	76.0
Ring Height mm	18.0
Initial Vol m3	8.1615E-05

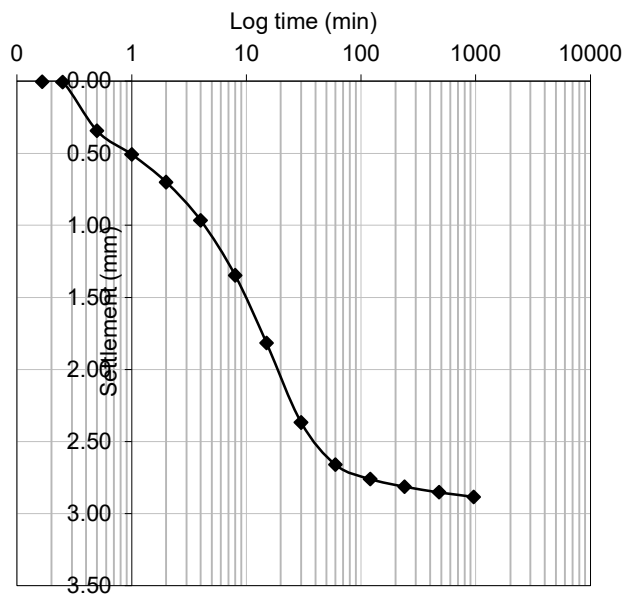
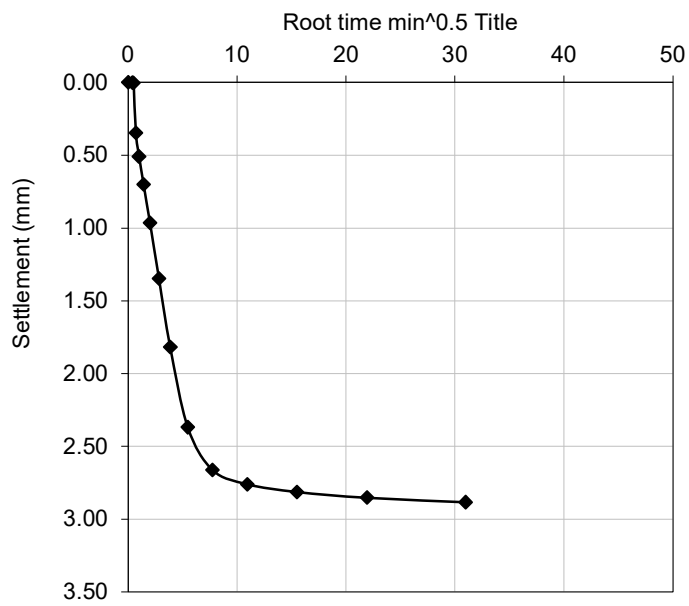
Wet mass (i) g	133.7
Wet mass (f) g	105.9
Dry mass g	74.5
Water content (i) %	79.5
Water content (f) %	42.1
Bulk density kg/m3	1638.2
Dry density kg/m3	912.8

Diameter mm	76.0		
Initial Height mm	18.0	Specific gravity	2.65

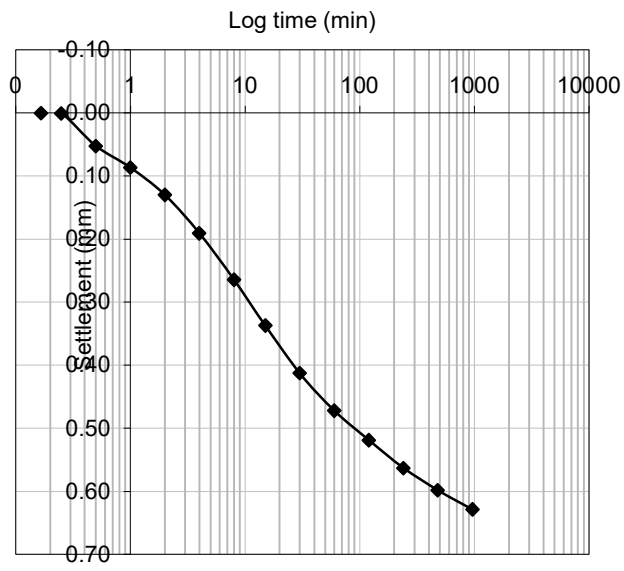
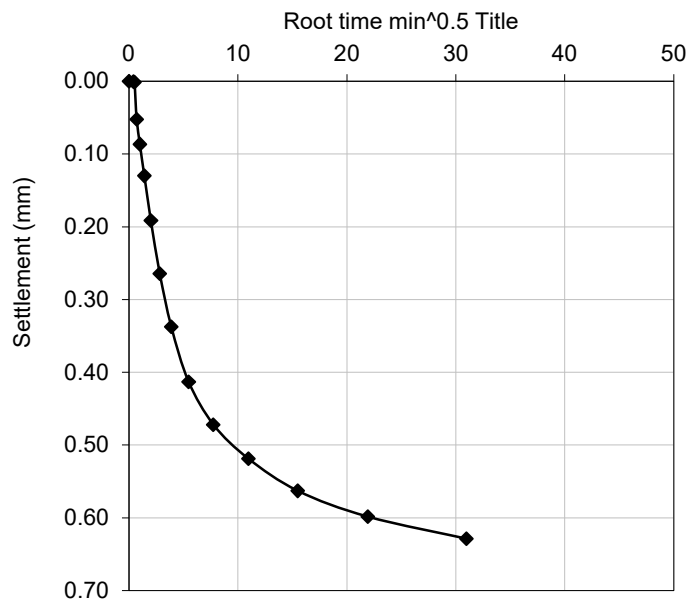
σ'_v kPa	ΔH mm	H mm	V cm3	Vv cm3	e	log(σ'_v)	Compressibility m2/MN	Cv m2/year
50	2.885	15.116	68.536	40.423	1.438	1.70		
100	0.629	14.487	65.686	37.573	1.336	2.00	0.83	0.29
200	0.721	13.766	62.419	34.305	1.220	2.30	0.50	0.26
400	0.647	13.119	59.484	31.371	1.116	2.60	0.24	0.30
800	0.700	12.419	56.309	28.196	1.003	2.90	0.13	0.27



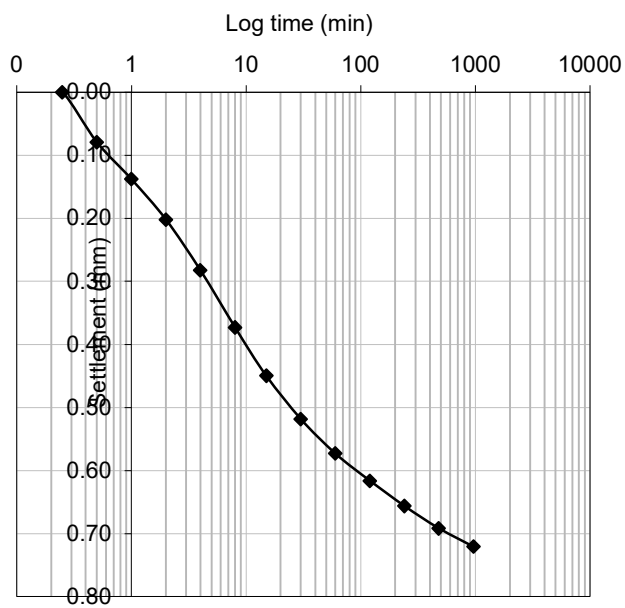
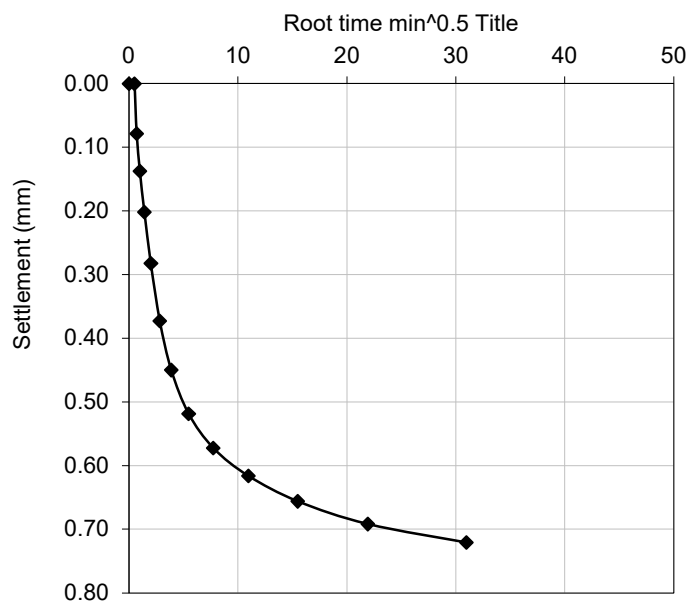
50kPa



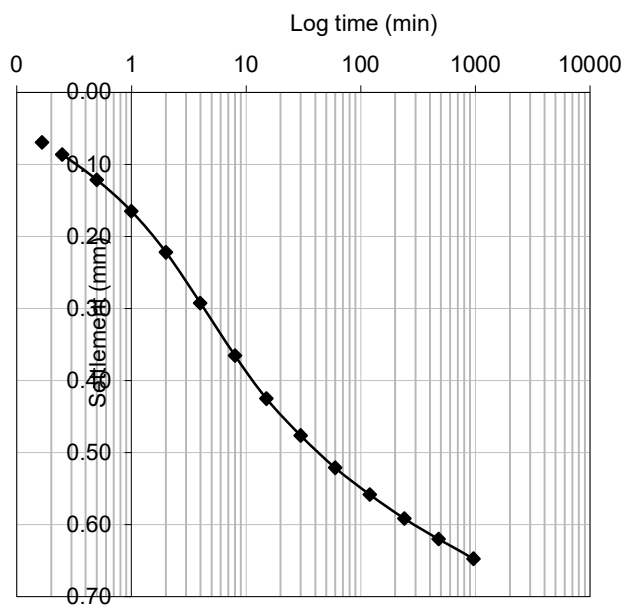
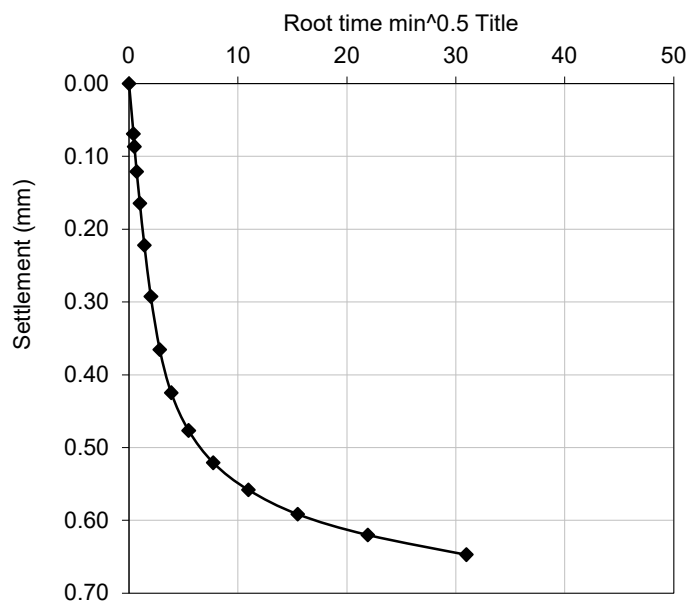
100kPa



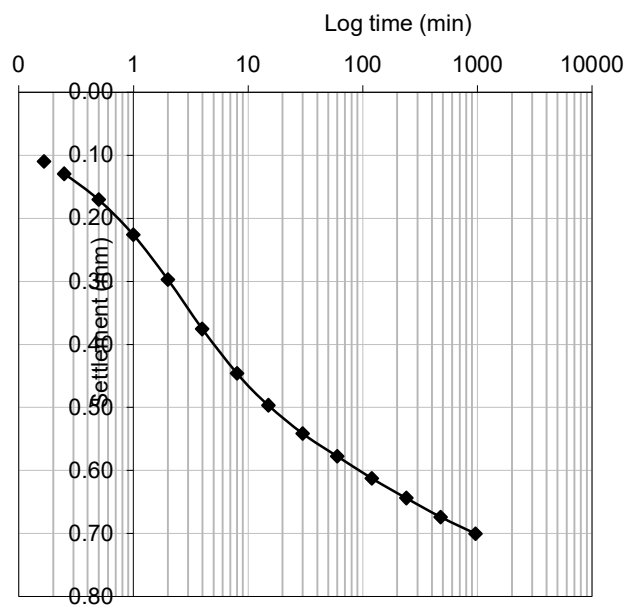
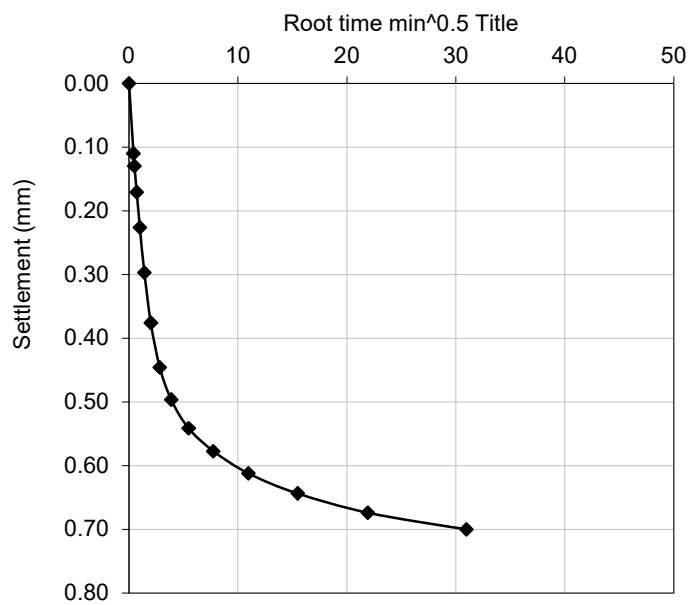
200kPa



400kPa



800kPa



Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	2099-21			
Borehole/sample no.	BH02BL			
Depth	3.5m			
Soil type	Sandy silty CLAY			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	105		
Height	mm	200		
Initial moisture content	%	63.80		
Initial bulk density	kg/m3	1533		
Dry density	kg/m3	936		
Cell pressure	kPa	70		
Rate of strain	%/min	1.00		
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	24		
c _u			10 kPa	
Mode of failure	Bulging			
Checked and approved by V Sivakumar				

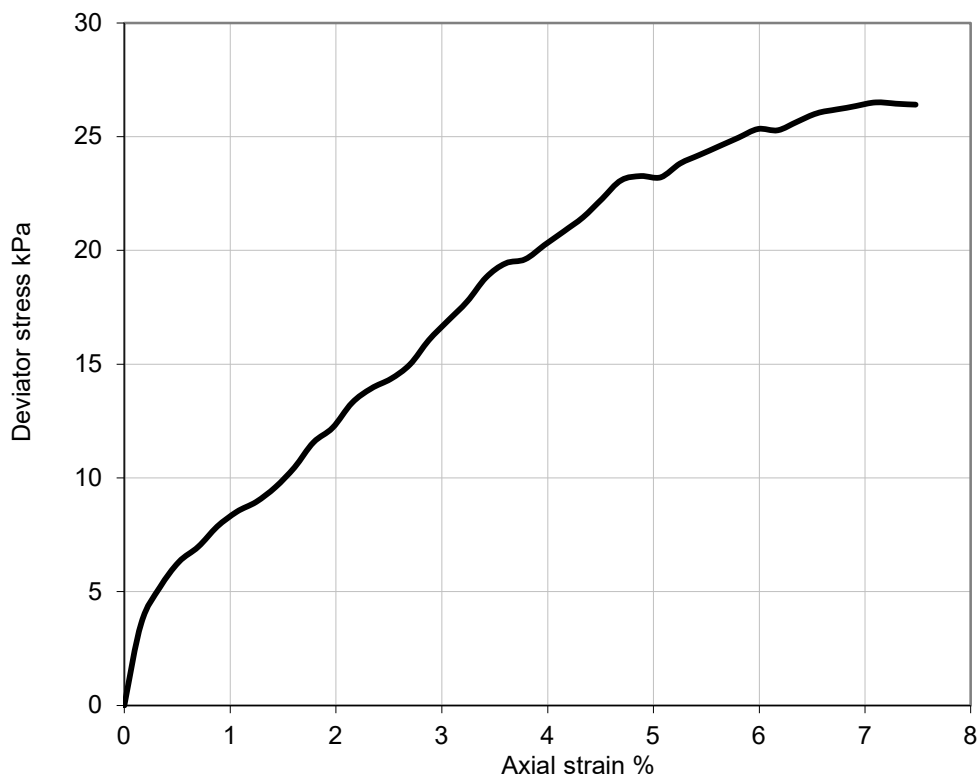


Figure 1 Deviator stress vs axial strain

Unconsolidated Undrained test (BS1377:1990 7/8)				
Location&Ref	2099-21			
Borehole/sample no.	BH03BL			
Depth	6.0m			
Soil type	Sandy silty CLAY			
Sampling	U			
Stage No.		1	2	3
Diameter	mm	105		
Height	mm	200		
Initial moisture content	%	50.90		
Initial bulk density	kg/m3	1652		
Dry density	kg/m3	1095		
Cell pressure	kPa	120		
Rate of strain	%/min	1.00		
CONDITIONS AT FAILURE				
Mem. and side drains corrections	kPa	3		
Maximum deviator stress	kPa	56		
c _u			26 kPa	
Mode of failure	Bulging			
Checked and approved by V Sivakumar				

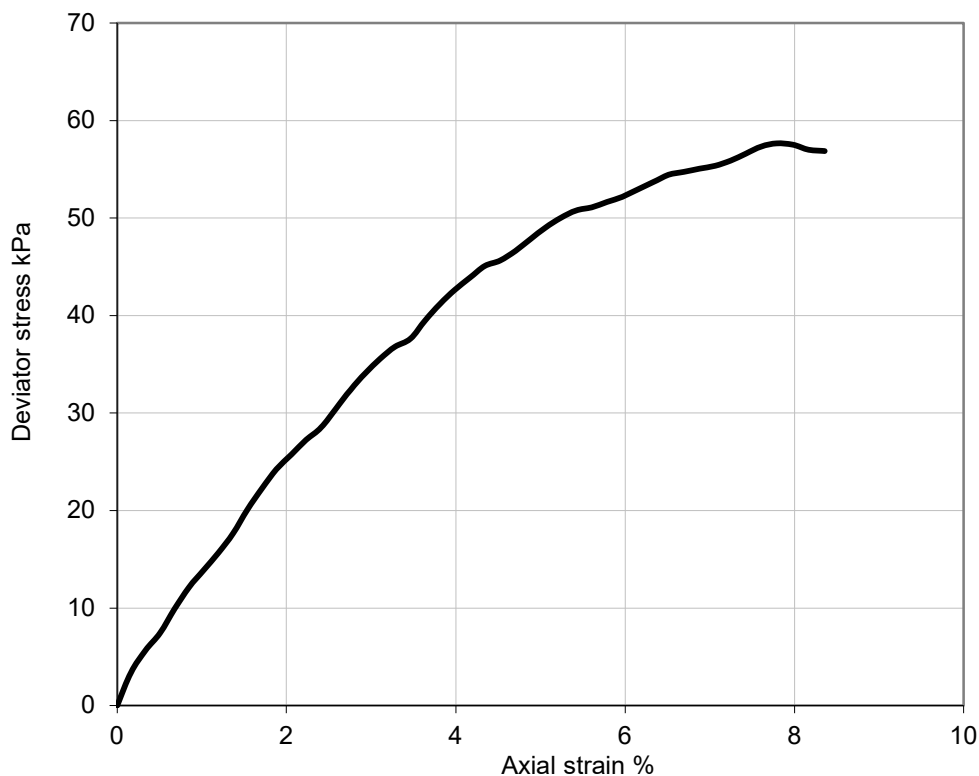


Figure 1 Deviator stress vs axial strain

Point Load Testing



Location: Bunlicky WWTP

Project No: 2099-21

Sample no:	Postion	Sample Depth (m)	Diameter (mm) "D"	Max Load (kN) "P"	Point Load Strength (Mpa) "I _s "	Size Correction Factor (F)	Corrected Point Load Strength (MPa) "I _{s(50)} "
RC01BL	D	12.60	63	22.818	5.75	1.11	6.38
RC01BL	A	12.60	63	17.735	4.47	1.11	4.96
RC01BL	D	14.60	63	22.438	5.65	1.11	6.27
RC01BL	A	14.60	63	9.57	2.41	1.11	2.68
RC02BL	D	12.90	63	21.317	5.37	1.11	5.96
RC02BL	A	12.90	63	16.72	4.21	1.11	4.67
RC02BL	D	14.60	63	19.307	4.86	1.11	5.40
RC02BL	A	14.60	63	10.143	2.56	1.11	2.84
RC03BL	D	11.60	63	16.423	4.14	1.11	4.59
RC03BL	A	11.60	63	19.615	4.94	1.11	5.48
RC03BL	D	10.80	63	18.412	4.64	1.11	5.15
RC03BL	A	10.80	63	13.77	3.47	1.11	3.85
RC04BL	D	11.40	63	21.418	5.40	1.11	5.99
RC04BL	A	11.40	63	16.324	4.11	1.11	4.56
RC04BL	D	14.40	63	23.477	5.92	1.11	6.56
RC04BL	A	14.40	63	15.548	3.92	1.11	4.35
RC05BL	D	10.20	63	22.836	5.75	1.11	6.38
RC05BL	A	10.20	63	20.444	5.15	1.11	5.72
RC05BL	D	11.70	63	16.871	4.25	1.11	4.72
RC05BL	A	11.70	63	17.019	4.29	1.11	4.76
					Operator	Checked	Approved
					DR	JMCN	JW

AS TM D5731-08

COMPRESSIVE STRENGTH OF ROCK CORE SPECIMENS

Client: Whiteford Geoservices Ltd
Project: Bunlicky

UCS1856
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

Lab Core ID	R2635	R2636	R2637	R2638	R2639	R2640
Core Markings	RC01 11.4m	RC01 13.1m	RC02 14.4m	RC03 10.6m	RC03 13.7m	RC04 12.7m
Date of coring	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Date received	30-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21	30-Sep-21
Diameter of core (Average mm)	63.4	63.4	63.4	63.4	63.4	63.4
Length at test (mm)	149.1	175.1	171.2	172.2	174.0	177.2
Length / Diameter Ratio	2.35	2.76	2.70	2.72	2.74	2.79
Mass (g)	1270	1493	1469	1463	1503	1521
Density (Mg/m ³)	2.69	2.70	2.72	2.69	2.73	2.72
Date of test	27-Oct-21	27-Oct-21	27-Oct-21	27-Oct-21	27-Oct-21	27-Oct-21
Fail Load (KN)	114.4	127.4	194.5	133.6	279.0	57.2
Measured compressive strength (MPa)	36.2	40.3	61.6	42.3	88.3	18.1
Failure Type	Axial splitting	Axial splitting	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

COMPRESSIVE STRENGTH OF ROCK CORE SPECIMENS

Client: Whiteford Geoservices Ltd
Project: Bunlicky

UCS1857
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

Lab Core ID	R2641	R2642				
Core Markings	RC05 10.6m	RC05 13.1m				
Date of coring	Unknown	Unknown				
Date received	30-Sep-21	30-Sep-21				
Diameter of core (Average mm)	63.0	63.3				
Length at test (mm)	178.1	177.2				
Length / Diameter Ratio	2.83	2.80				
Mass (g)	1505	1503				
Density (Mg/m ³)	2.71	2.69				
Date of test	27-Oct-21	27-Oct-21				
Fail Load (KN)	110.6	230.8				
Measured compressive strength (MPa)	35.4	73.3				
Failure Type	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 D PHOTOGRAPHS

TRIAL HOLE PHOTOGRAPHS

10 x A4

ROCK CORE PHOTOGRAPHS

9 x A4



TP-01BL



TP-01BL



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