



Moyvannan Electricity Substation

Environmental Impact Assessment Report

Annex 6.2: Ground Investigation Report

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Ground Investigations Ireland

Seven Hills Wind Farm

Energia

Ground Investigation Report

October 2023





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GROUND INVESTIGATIONS IRELAND
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1.0 Preamble

On the instructions of Malachy Walshe and Partners Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between August and October 2023 at the site of the wind farm substation and grid connection. The site is located within the townland of Moyvannan, County Roscommon, approximately 2.5km west of Lough Ree and approximately 2.8km southeast of Funshinagh Lough, County Roscommon.

2.0 Overview

2.1. Background

It is proposed to construct a new substation and grid connection with associated services, access roads and car parking at the proposed site. At the time of the site investigation the site was greenfield and in agricultural use.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 5 No. Trial Pits to a maximum depth of 4.10m BGL
- Carry out 1 No. Soakaway to determine a soil infiltration value to BRE digest 365
- Carry out 5 No. Cable Percussion boreholes to a maximum depth of 3.30m BGL
- Carry out 6 No. Rotary Core Boreholes to a maximum depth of 24.80m BGL
- Installation of 1 No. Groundwater monitoring well
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a 6T tracked excavator at the locations shown in the exploratory hole location plan in Figure 1 in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Soakaway Testing

The soakaway testing was carried out in the selected trial pit (TP-01) at the location shown in in Figure 1. The pit was carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pit was allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pit was logged prior to completing the soakaway test and was backfilled with arisings upon completion. The soakaway test results are provided in Appendix 3 of this Report.

3.4. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled, at the locations shown in Figure 1, using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata. Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 4 of this Report.

3.5. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown in Figure 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the “overshoot” recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 5 of this Report.

3.6. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.7. Groundwater/Gas Monitoring Installations

A groundwater monitoring installation was installed upon the completion of the borehole RC-02 to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.8. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.

Environmental & Chemical testing as required by the specification, including the Rilta Suite, organic matter content, water soluble sulphate, water soluble chloride, pH, acid soluble sulphate and total sulphur testing was carried out by Element Materials Technology Laboratory in the United Kingdom. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.

Geotechnical testing consisting of moisture content, Atterberg limits, particle size distribution (PSD), hydrometer, particle density, California Bearing Ratio (CBR), Moisture Condition Value (MCV) and five point compaction tests were carried out in NMTL's Geotechnical Laboratory in County Carlow.

Rock strength testing including Point Load (I_{s50}) and Unconfined Compressive Strength (UCS) testing was carried out in CMTL in Portlaoise, County Laois.

The results of the laboratory testing are included in Appendix 6 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were relatively consistent across the site and generally comprised;

- Topsoil
- Cohesive Deposits
- Granular Deposits
- Weathered Bedrock
- Bedrock

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.30m BGL.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil and were described typically as *reddish brown slightly sandy gravelly CLAY with low cobble content*. This deposit was present to depths ranging from 0.40m to 0.80m BGL. A second cohesive deposit was encountered in TP-02 only and was described as *light brown slightly sandy gravelly CLAY with medium cobble and boulder content*. This deposit was present to a depth of 2.00m BGL. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had low (<5%), medium (5%-20%) or high (>20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were encountered at the base of the cohesive deposits and were typically described as *brown clayey gravelly fine to coarse SAND with medium to high cobble and boulder content*. The secondary gravel and silt/clay constituents varied across the site and with depth while low (<5%), medium (5%-20%) or high (>20%-50%) cobble and boulder content was present where noted on the exploratory hole logs.

It should be noted that many of the trial pits where granular deposits or groundwater were encountered, experienced instability. This was described either as side wall spalling or as side wall collapse in the remarks section at the base of the trial pit logs.

BEDROCK: The rotary core boreholes recovered strong to very strong massive light grey fine grained fossiliferous LIMESTONE interstratified with Moderately weak to medium strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Cavities which were infilled with clay or sand were noted in the borehole logs.

The depth to rock varies from 4.05m BGL in BH+RC-04 to a maximum of 12.20m BGL in BH+RC-01. The total core recovery is good, typically 100% with some of the runs dropping to 80 or 90% where cavities are noted.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. It should be noted that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, a standpipe was installed in RC-02 to allow the equilibrium groundwater level to be determined.

Groundwater levels were also recorded in an existing on site domestic and agricultural supply well and a Turlough located to the south of the proposed site.

The groundwater monitoring is included in Appendix 7 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The laboratory results were outstanding at the time of writing this report.

4.3.2. Chemical Laboratory Testing

The laboratory results were outstanding at the time of writing this report.

4.3.3. Environmental Laboratory Testing

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-*

hazardous. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.

The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present or the previous site use or location indicate a risk of environmental variation. A waste classification report is recommended to be carried out to provide an interpretation of the laboratory data should any material be required to be disposed of off site.

The laboratory results were outstanding at the time of witing this report.

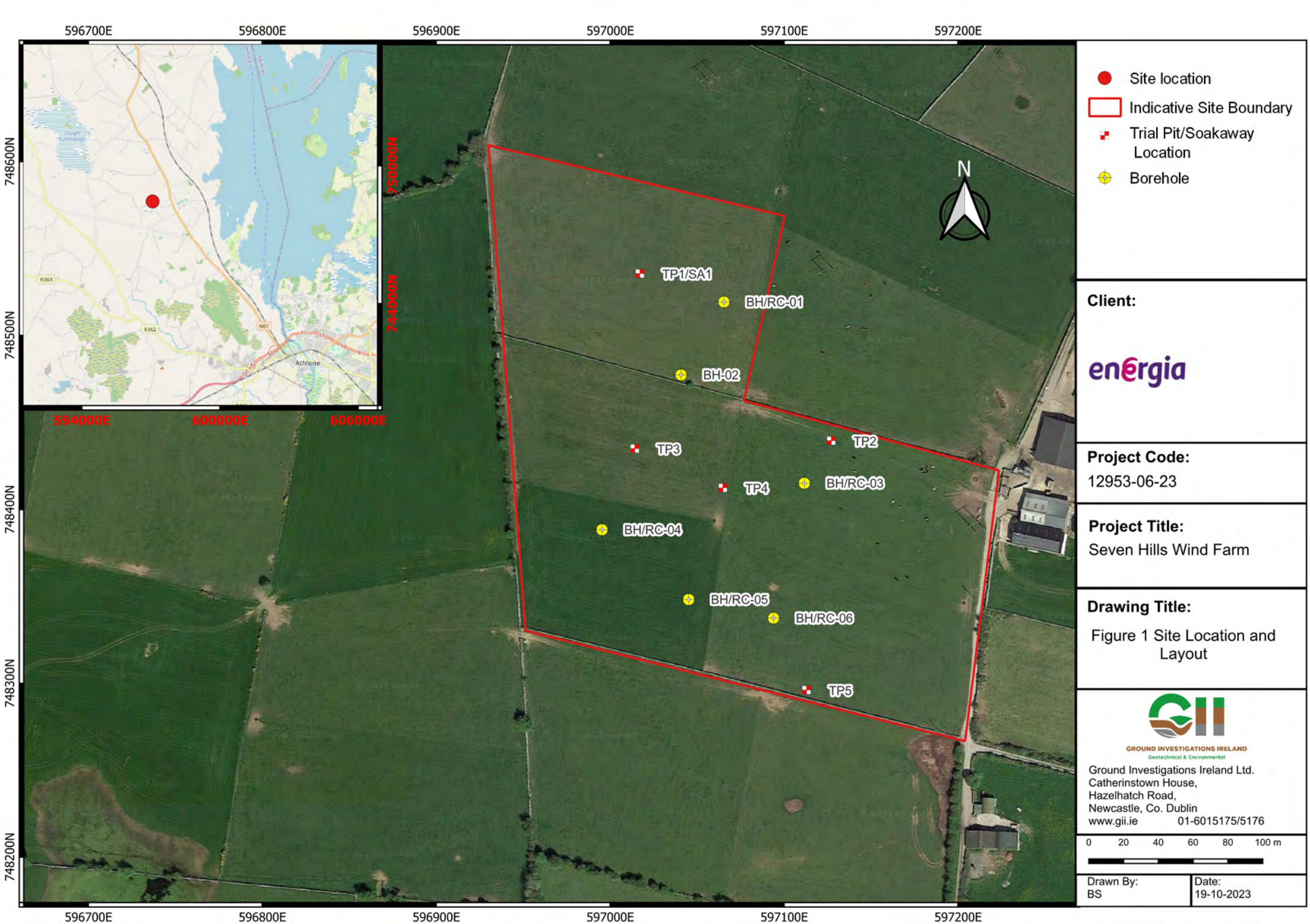
4.3.4. Rock Laboratory Testing

The laboratory results were outstanding at the time of witing this report.

The results from the completed laboratory testing are included in Appendix 6 of this report.

APPENDIX 1 - Figures





596700E 596800E 596900E 597000E 597100E 597200E

748600N

750000N

744000N

748500N

594000E 600000E 606000E

748400N

748300N

748200N

596700E 596800E 596900E 597000E 597100E 597200E

- Site location
- Indicative Site Boundary
- ⊠ Trial Pit/Soakaway Location
- ⊕ Borehole



Client:



Project Code:

12953-06-23

Project Title:

Seven Hills Wind Farm

Drawing Title:

Figure 1 Site Location and Layout



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0 20 40 60 80 100 m

Drawn By:
BS

Date:
19-10-2023

APPENDIX 2 – Trial Pit Records





Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 4.0m x 0.50m x 4.10m (L x W x D)	Ground Level (mOD) 76.27	Client Malachy Walsh	Job Number 12953-06-23
	Location 597017.1 E 748535.2 N	Dates 14/08/2023	Engineer	Sheet 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B			76.07	(0.20)	TOPSOIL		
					0.20	Soft reddish brown sandy gravelly CLAY		
1.50	B			75.87	(0.20)	Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content		
					0.40			
2.50	B			74.27	(1.60)	Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content		
					2.00			
3.50	B				(2.10)			
4.00	B							

Plan .	Remarks No groundwater encountered Trial pit stable No shear vane - too granular Refusal at 4.10m BGL Trial pit backfilled upon completion	
		Scale (approx) 1:25



Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 4.0m x 0.50m x 4.10m (L x W x D)	Ground Level (mOD) 76.27	Client Malachy Walsh	Job Number 12953-06-23
	Location 597017.1 E 748535.2 N	Dates 14/08/2023	Engineer	Sheet 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				72.17	4.10	OBSTRUCTION due to large cobbles and boulders Complete at 4.10m		

Plan .	Remarks 	Scale (approx) 1:25	Logged By AB	Figure No. 12953-06-23.TP-01
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Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 4.00m x 0.50m x 2.60m (L x W x D)	Ground Level (mOD) 75.15	Client Malachy Walsh	Job Number 12953-06-23
	Location 597127.1 E 748439 N	Dates 14/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	L 14.33kPa B		22,24,40/Av. 28.67	74.95	(0.20) 0.20	TOPSOIL Soft reddish brown slightly sandy gravelly CLAY with low cobble content		
1.50	B			74.45	(0.50) 0.70	Soft to firm light brown slightly sandy gravelly CLAY with medium cobble and boulder content		
2.50	B			73.15	(1.30) 2.00	Light brown clayey gravelly fine to coarse SAND with medium cobble and boulder content		
				72.55	(0.60) 2.60	OBSTRUCTION due to bedrock or large boulders Complete at 2.60m		

Plan .	Remarks No groundwater encountered Trial pit stable Shear vane at 0.50m BGL Refusal at 2.60m BGL Trial pit backfilled upon completion	
		Scale (approx) 1:25



Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 3.80m x 0.50m x 3.70m (L x W x D)	Ground Level (mOD) 71.94	Client Malachy Walsh	Job Number 12953-06-23
	Location 597014.1 E 748434.5 N	Dates 14/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	L 18.67kPa B		32,40,40/Av. 37.33	71.74	(0.20) 0.20	TOPSOIL Soft to firm reddish brown sandy gravelly CLAY		
1.50	B			71.24	(0.50) 0.70	Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content		
2.50	B			69.44	(1.80) 2.50	Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content		
3.50	B			68.24	(1.20) 3.70	OBSTRUCTION due to large cobbles and boulders Complete at 3.70m		

Plan .	Remarks No groundwater encountered Trial pit stable Shear Vane at 0.50m BGL Refusal at 3.70m BGL Trial pit backfilled upon completion	
		Scale (approx) 1:25



Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 3.90m x 0.50m x 3.00m (L x W x D)	Ground Level (mOD) 71.81	Client Malachy Walsh	Job Number 12953-06-23
	Location 597064.8 E 748412.1 N	Dates 14/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50 0.50	L 38.33kPa B		65,80,85/Av. 76.67	71.71	(0.10) 0.10	TOPSOIL Soft to firm reddish brown slightly sandy gravelly CLAY		
1.50	B			71.01	(0.70) 0.80	Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content		
2.50	B			69.61	(1.40) 2.20	Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content		
3.00	B			68.81	(0.80) 3.00	OBSTRUCTION due to large cobbles and boulders Complete at 3.00m		

Plan .	Remarks No groundwater encountered Trial pit spalling below 0.50m BGL Shear Vane at 0.50m BGL Refusal at 3.00m BGL Trial pit backfilled upon completion					
	<table border="1"> <tr> <td>Scale (approx)</td> <td>Logged By</td> <td>Figure No.</td> </tr> <tr> <td>1:25</td> <td>AB</td> <td>12953-06-23.TP-04</td> </tr> </table>	Scale (approx)	Logged By	Figure No.	1:25	AB
Scale (approx)	Logged By	Figure No.				
1:25	AB	12953-06-23.TP-04				



Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 3.70m x 0.50m x 2.80m (L x W x D)	Ground Level (mOD) 69.69	Client Malachy Walsh	Job Number 12953-06-23
	Location 597112.9 E 748295.7 N	Dates 14/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B			69.49	(0.20)	TOPSOIL		
					0.20	Soft reddish brown slightly sandy gravelly CLAY		
1.50	B			69.29	(0.20)	Light brown slightly clayey gravelly fine to coarse SAND with medium cobble and boulder content		
					0.40			
2.50	B			67.59	(1.70)	Light brown slightly clayey gravelly fine to coarse SAND with high cobble and boulder content		
					2.10			
				66.89	(0.70)	OBSTRUCTION due to large cobbles and boulders Complete at 2.80m		
				2.80				

Plan .	Remarks No groundwater encountered Trial pit stable No shear vane - too granular Refusal at 2.80m BGL Trial pit backfilled upon completion	
		Scale (approx) 1:25



Machine : 6T Tracked Excavator Method : Trial Pit	Dimensions 1.60m x 0.50m x 0.50m (L x W x D)	Ground Level (mOD) 76.27	Client Malachy Walsh	Job Number 12953-06-23
	Location 597017.1 E 748537.2 N	Dates 14/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				75.97	0.30 (0.10)	Soft reddish brown sandy gravelly CLAY		
				75.87	0.40 (0.10)	Light grey slightly clayey gravelly fine to coarse SAND		
				75.77	0.50	Complete at 0.50m		

Plan .	Remarks No groundwater encountered Trial pit stable Complete at 0.50m BGL Soakaway test carried out in trial pit in accordance to BRE Digest 365 Trial pit backfilled upon completion					
	<table border="1"> <tr> <td>Scale (approx)</td> <td>Logged By</td> <td>Figure No.</td> </tr> <tr> <td>1:25</td> <td>AB</td> <td>12953-06-23.TP-SA01</td> </tr> </table>	Scale (approx)	Logged By	Figure No.	1:25	AB
Scale (approx)	Logged By	Figure No.				
1:25	AB	12953-06-23.TP-SA01				

Trial Pit Photographs

TP-01



Trial Pit Photographs

TP-02



Trial Pit Photographs

TP-03



Trial Pit Photographs

TP-04



Trial Pit Photographs

TP-05



APPENDIX 3 – Soakaway Test Record





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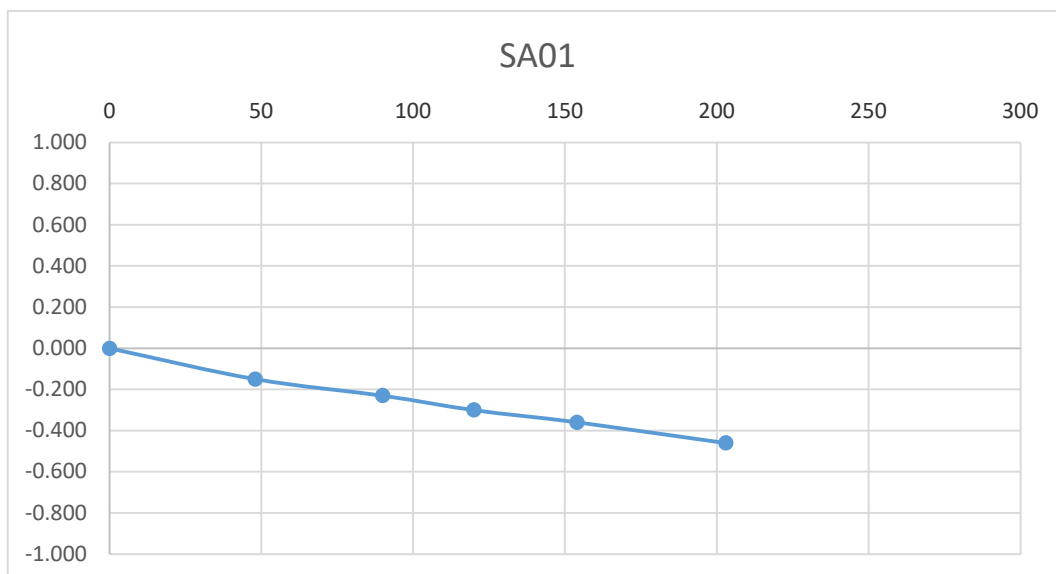
SA01

Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 1.50m x 0.70m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
14/08/2023	0	0.000
14/08/2023	48	-0.150
14/08/2023	90	-0.230
14/08/2023	120	-0.300
14/08/2023	154	-0.360
14/08/2023	203	-0.460

Start depth 0.00	Depth of Pit 0.500	Diff 0.500	75% full 0.125	25%full 0.375
Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
1.600	0.500		0.250	0.20
Tp75-25 (from graph) (s)	7800		50% Eff Depth	ap50 (m2)
			0.250	1.85
f =	1.386E-05	m/s		



APPENDIX 4 – Cable Percussion Borehole Records





Machine : Dando 2000 & Beretta T44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 1.10m	Ground Level (mOD)	Client Malachy Walsh	Job Number 12953-06-23
	Location	Dates 18/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B					(0.30) 0.30	TOPSOIL		
1.00-1.00	SPT(C) 50*0 50/0			50/50		(0.80)	Reddish brown sandy gravelly CLAY with medium cobble and boulder content		
1.00	B					1.10	OBSTRUCTION due to large boulders		
							Complete at 1.10m		

Remarks No groundwater encountered Refusal at 1.10m BGL Rotary follow on from 1.10m BGL Chiselling from 1.00m to 1.10m for 1 hour.	Scale (approx) 1:50	Logged By AB
	Figure No. 12953-06-23.BH01	



Machine : Dando 2000 & Beretta T44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 1.20m	Ground Level (mOD)	Client Malachy Walsh	Job Number 12953-06-23
	Location	Dates 17/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B					(0.40)	TOPSOIL		
						0.40 (0.20) 0.60	Light brown sandy gravelly CLAY with medium cobble content		
				14,36/50		(0.60)	Stiff light brown sandy gravelly CLAY with medium cobble and boulder content		
1.00-1.15 1.00	SPT(C) 50/0 B					1.20	OBSTRUCTION due to large boulders Complete at 1.20m		

Remarks No groundwater encountered Refusal at 1.20m BGL Rotary follow on from 1.20m BGL Chiselling from 0.60m to 0.80m for 0.5 hours. Chiselling from 1.10m to 1.20m for 1 hour.	Scale (approx) 1:50	Logged By AB
	Figure No. 12953-06-23.BH03	



Machine : Dando 2000 & Beretta T44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 1.10m	Ground Level (mOD)	Client Malachy Walsh	Job Number 12953-06-23
	Location	Dates 18/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B					(0.30) 0.30	TOPSOIL		
1.00-1.00	SPT(C) 50*0 50/0			50/50		(0.80)	Light brown sandy gravelly CLAY with medium cobble and boulder content		
1.00	B					1.10	OBSTRUCTION due to large boulders Complete at 1.10m		

Remarks No groundwater encountered Refusal at 1.10m BGL Rotary follow on from 1.10m BGL Chiselling from 0.90m to 1.10m for 1 hour.	Scale (approx) 1:50	Logged By AB
	Figure No. 12953-06-23.BH04	



Machine : Dando 2000 & Beretta T44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 3.30m	Ground Level (mOD)	Client Malachy Walsh	Job Number 12953-06-23
	Location	Dates 17/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B					(0.40)	TOPSOIL		
1.00-1.00	SPT(C) 50*/0			50/50		0.40	Light brown sandy gravelly CLAY with medium cobble and boulder content		
1.00	B					(0.50)			
2.00-2.45	SPT(C) N=50			3,5/9,9,18,14		0.90	Stiff light brown sandy gravelly CLAY with medium cobble and boulder content		
2.00	B					(1.50)			
3.00-3.15	SPT(C) 50/0			10,21/50		2.40	Stiff brown sandy gravelly CLAY with high cobble and boulder content		
3.00	B					(0.90)			
						3.30	OBSTRUCTION due to large boulders		
							Complete at 3.30m		

Remarks No groundwater encountered Refusal at 3.30m BGL Rotary follow on from 3.30m BGL Chiselling from 0.90m to 1.40m for 0.5 hours. Chiselling from 2.40m to 3.00m for 0.5 hours. Chiselling from 3.20m to 3.30m for 1 hour.	Scale (approx) 1:50	Logged By AB
	Figure No. 12953-06-23.BH05	



Machine : Dando 2000 & Beretta T44 Method : Cable Percussion with Rotary follow on	Casing Diameter 200mm cased to 1.60m	Ground Level (mOD)	Client Malachy Walsh	Job Number 12953-06-23
	Location	Dates 18/08/2023	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B					(0.20) 0.20	TOPSOIL		
						(0.80)	Light brown sandy gravelly CLAY with medium cobble and boulder content		
1.00-1.38 1.00	SPT(C) 50/225 B			4,6/9,11,30		1.00 (0.60)	Stiff light brown sandy gravelly CLAY with medium cobble and boulder content OBSTRUCTION due to large boulders		
						1.60	Complete at 1.60m		

Remarks No groundwater encountered Refusal at 1.60m BGL Rotary follow on from 1.60m BGL Chiselling from 1.40m to 1.60m for 1 hour.	Scale (approx) 1:50	Logged By AB
	Figure No. 12953-06-23.BH06	

APPENDIX 5 - Rotary Borehole Records





Machine : Beretta T-41		Casing Diameter 96mm cased to 23.30m		Ground Level (mOD) 77.47		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597065.4 E 748519.1 N		Dates 26/09/2023- 28/09/2023		Engineer		Sheet 1/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
2.30	43					75.17	(2.30)	Recovery consists of brown slightly sandy gravelly CLAY with high cobble content. Drillers note: boulder CLAY (very stiff)		
2.30-2.30					25/50 SPT 25*/0 50/0		2.30	Recovery consists of brown slightly sandy gravelly CLAY with high cobble content. Drillers note: boulder CLAY (very stiff)		
3.80	57					73.67	(1.50)	Very stiff brown slightly sandy gravelly CLAY with low cobble and boulder content		
3.80-3.95					17,8/50 SPT 50/0		3.80	Very stiff brown slightly sandy gravelly CLAY with low cobble and boulder content		
5.30	93						(3.00)	Very stiff brown slightly sandy gravelly CLAY with high cobble and boulder content		
5.30-5.45					16,9/50 SPT 50/0		6.80	Very stiff brown slightly sandy gravelly CLAY with high cobble and boulder content		
6.80	77					70.67	(3.00)	Very stiff brown slightly sandy gravelly CLAY with high cobble and boulder content		
6.80-6.87					19,6/50 SPT 25*/70 50/0		8.30	Very stiff brown slightly sandy gravelly CLAY with medium		
8.30	73						(3.00)	Very stiff brown slightly sandy gravelly CLAY with medium		
8.30-8.37					21,4/50 SPT 25*/70 50/0		9.80	Very stiff brown slightly sandy gravelly CLAY with medium		
9.80					19,6/50 SPT 25*/70	67.67	9.80	Very stiff brown slightly sandy gravelly CLAY with medium		
9.80-9.87								Very stiff brown slightly sandy gravelly CLAY with medium		

Remarks Borehole complete at 23.30m BGL Borehole backfilled upon completion	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC01	



Machine : Beretta T-41		Casing Diameter 96mm cased to 23.30m		Ground Level (mOD) 77.47		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597065.4 E 748519.1 N		Dates 26/09/2023- 28/09/2023		Engineer		Sheet 2/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.30 11.30-11.37	80				23.2/50 SPT 25*/70 50/0		(2.40)	cobble and boulder content		
12.20	90	7	7			65.27	12.20	Strong massive light grey fine grained fossiliferous LIMESTONE. Fresh to slightly weathered with clay infill between fractures.		
12.80				6			(2.10)			
14.30	100	83	70			63.17	14.30	(12.20m to 14.30m BGL) Two Fracture sets. F1: 5 to 20 degrees, closely to medium spaced, planar an rough with occasional clay and sand infill. F2: 40 to 60 degrees, closely spaced, planar and rough with clay infill.		
15.80	70	40	33			61.67	15.80	Moderately weak to medium strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Moderately weathered. Reduced recovery. (Infilled CAVITY: 14.30m to 14.40m BGL- Brown slightly sandy slightly gravelly CLAY) (Infilled CAVITY: 14.55m to 14.70m BGL- Brown slightly sandy slightly gravelly CLAY with medium cobble content) (Infilled CAVITY: 14.85m BGL- No recovery. CLAY on fracture surface)		
17.30	100	50	50	4			(3.95)	(14.30m to 15.80m BGL) One fracture set. F1: 5 to 20 degrees, closely to medium spaced, planar an rough with clay infill.		
18.80								Strong to very strong massive light grey fine grained fossiliferous LIMESTONE. Fresh to slightly weathered. (Infilled CAVITY: 19.40m to 19.45m BGL- Orangish brown slightly sandy CLAY)		
19.75	83	70	63			57.72	19.75	(15.80m to 19.75m BGL) Three fracture sets. F1: 0 to 20 degrees, closely to medium spaced, planar and rough with occasional clay infill. F2: 40 to 60 degrees, closely to medium spaced, planar and rough with rare clay infill. F3: 75 to 90 degrees, one fracture present, planar and rough with clay infill.		
								Medium strong to strong light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs.		

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC01	



Machine : Beretta T-41		Casing Diameter 96mm cased to 23.30m		Ground Level (mOD) 77.47		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597065.4 E 748519.1 N		Dates 26/09/2023- 28/09/2023		Engineer		Sheet 3/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.30								Fresh to slightly weathered.		
	100	83	83	3			(3.55)	(Infilled CAVITY: 20.75m to 20.85m BGL- Orangish brown slightly sandy slightly gravelly CLAY) (Infilled CAVITY: 21.10m to 21.20m BGL- Orangish brown slightly sandy slightly gravelly CLAY)		
21.80										
	87	87	87							
23.30						54.17	23.30	Complete at 23.30m		

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC01	



Machine : Beretta T-41		Casing Diameter 20.30mm cased to 96.00m		Ground Level (mOD) 74.76		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597040.7 E 748477.2 N		Dates 29/09/2023-02/10/2023		Engineer		Sheet 1/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
2.30	30				11,12/14,17,17,2 SPT 23*0 50/0	72.46	2.30	Recovery consists of brown slightly sandy slightly gravelly CLAY with medium cobble content. Drillers note:sandy CLAY with cobbles (very stiff)			
2.30-2.30											
3.80	60			7	25/50 SPT 25*0 50/0	70.96	3.80	Recovery consists of brown slightly sandy slightly gravelly CLAY with medium cobble content. Drillers note:sandy CLAY with cobbles (very stiff)			
3.80-3.80											
5.30	90	0	0		25/50 SPT 25*0 50/0	68.41	(2.55)	Possible weathered rock recovered as very stiff brown slightly sandy slightly gravelly CLAY with high cobble content.			
5.30-5.30											
6.80	80	10	0		25/50 SPT 25*0 50/0	66.46	6.35	Medium strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Moderately weathered with clay infill between fractures. (Infilled CAVITY: 7.75m to 7.80m BGL- Brown slightly sandy slightly gravelly CLAY)			
6.80											
8.30	100	20	13			66.46	8.30	(6.35m to 8.30m BGL)Three fracture sets. F1: 0 to 20 degrees, very closely to medium spaced, planar and rough with clay infill. F2: 40 to 60 degrees, one fracture present, planar and rough with rare clay infill. F3: 75 to 90 degrees, one fracture present, planar and rough with clay infill.			
8.30											
9.80	100	93	90	5				Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.			
9.80											

Remarks Borehole complete at 20.30m BGL. 50mm slotted standpipe with pea gravel surround installed from 20.30m to 14.30m BGL. 50mm plain standpipe with a bentonite seal installed from 14.30m to GL with a raised cover.									Scale (approx)	Logged By
									1:50	SB
									Figure No. 12953-06-23.RC02	



Machine : Beretta T-41		Casing Diameter 20.30mm cased to 96.00m		Ground Level (mOD) 74.76		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597040.7 E 748477.2 N		Dates 29/09/2023-02/10/2023		Engineer		Sheet 2/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
11.30	100	66	66						Dol		
12.80	100	100	100						Dol		
14.30	100	87	80				(12.00)		Dol		
15.80	97	97	97	3				(8.30m to 20.30m BGL) Three fracture sets. F1: 0 to 20 degrees, closely to widely spaced, planar and rough with occasional clay smearing. F2: 40 to 60 degrees, one fracture present, planar and rough with yellowish brown staining. F3: 75 to 90 degrees, one fracture present, planar and rough with yellowish brown staining.	Dol		
17.30	100	93	93						Dol		
18.80	100	100	100						Dol		
	100	87	87						Dol		

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC02	



Machine : Beretta T-41		Casing Diameter 20.30mm cased to 96.00m		Ground Level (mOD) 74.76		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597040.7 E 748477.2 N		Dates 29/09/2023- 02/10/2023		Engineer		Sheet 3/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
20.30						54.46	20.30	Complete at 20.30m			

Remarks	Scale (approx)	Logged By
	1:50	SB
Figure No. 12953-06-23.RC02		



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 73.73		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597111.6 E 748415.1 N		Dates 25/09/2023- 26/10/2023		Engineer		Sheet 1/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
2.30	41						(2.30)	Recovery consists of brown slightly sandy slightly gravelly CLAY onto brownish grey slightly clayey subangular to subrounded fine to coarse GRAVEL. Drillers note: sandy CLAY with cobbles (very stiff)		
2.30-2.37					15.10/50 SPT 25*/70 50/0	71.43	2.30	Recovery consists of light brown slightly sandy clayey GRAVEL with medium cobble content. Drillers note: CLAY with cobbles (very stiff)		
3.80	57						(1.50)			
3.80-3.95					10.15/50 SPT 50/0	69.93	3.80	Very stiff brown slightly sandy gravelly CLAY with medium cobble content		
5.30	100						(3.00)			
5.30-5.37					20.5/50 SPT 25*/70 50/0		6.80	Very stiff brown slightly sandy gravelly CLAY with low cobble content		
6.80	83						(1.50)			
6.80-6.87					14.11/50 SPT 25*/70 50/0	66.93	6.80	Very stiff brown slightly sandy gravelly CLAY with low cobble content		
8.30	47						(1.50)			
8.30-8.37					14.11/50 SPT 25*/70 50/0	65.43	8.30	Recovery consists of brown sandy gravelly CLAY with medium cobble content. Drillers note: sandy GRAVEL (dense)		
9.80							(1.50)			
9.80-9.80					25/50 SPT 25*/0	63.93	9.80	Recovery consists of slightly clayey slightly sandy		

Remarks Borehole complete at 20.30m BGL Borehole backfilled upon completion								Scale (approx) 1:50	Logged By SB
								Figure No. 12953-06-23.RC03	



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 73.73		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597111.6 E 748415.1 N		Dates 25/09/2023- 26/10/2023		Engineer		Sheet 2/3	
Core Dia : 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.90	53	15	11			62.83	(1.10)	subangular to subrounded fine to coarse GRAVEL with low cobble content. Drillers note weathered rock.		
11.30				8			(1.30)	Medium strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Moderately weathered.		
12.20	100	80	60			61.53	(12.20)	(10.90m to 12.20m BGL) Two fracture sets. F1: 0 to 20 degrees, very closely to medium spaced, planar and rough with clayey sand infill. F2: 30 to 50 degrees, one fracture present, planar and rough with rare clay infill. F3: 70 to 90 degrees, one fracture present, planar and rough with clay infill.		
12.80								Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Slightly weathered.		
14.30	100	100	90				(4.60)			
15.80	100	80	80	3				(12.20m to 16.80m BGL) Two fracture sets. F1: 0 to 20 degrees, very closely to medium spaced, planar and rough with clayey sand infill. F3: 70 to 90 degrees, one fracture present, planar and rough with clay smearing.		
17.30	100	90	87			56.93	(16.80)	Strong to very strong massive light grey fine grained fossiliferous LIMESTONE. Fresh to slightly weathered.		
18.80	100	83	77				(2.45)	(16.80m to 19.25m BGL) Two Fracture sets. F1: 0 to 20 degrees, closely to medium spaced, planar and rough with occasional clay smearing. F2: 30 to 50 degrees, one fracture present, planar and rough with clay smearing.		
19.20	100	83	73	8		54.48	(19.25)	Strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Slightly weathered.		
							(1.05)	(19.25m to 20.30m BGL) Two Fracture sets F1: 0 to 20		

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC03	



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 73.73		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597111.6 E 748415.1 N		Dates 25/09/2023- 26/10/2023		Engineer		Sheet 3/3	
Core Dia: 63.5 mm		Method : Rotary Cored							

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.30						53.43	20.30	degrees, closely to medium spaced, planar and rough with rare clay infill. F2: 30 to 50 degrees, one fracture present, planar and rough. Complete at 20.30m		

Remarks	Scale (approx)	Logged By
	1:50	SB
Figure No. 12953-06-23.RC03		



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 72.74		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 596995.3 E 748388.3 N		Dates 19/09/2023- 20/09/2023		Engineer		Sheet 1/3	
Core Dia: 63.5 mm		Method : Rotary Cored							

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
2.30	20						(2.30)	Recovery consists of clayey sandy subangular to subrounded fine to coarse GRAVEL. Drillers note: sandy GRAVEL (dense)		
2.30-2.30					25/50 SPT 25*0 50/0	70.44	2.30	Recovery consists of pale brown slightly gravelly clayey silty fine to medium SAND. Drillers note sandy GRAVEL (dense)		
3.80	37						(1.50)			
3.80-4.25					5,6/6,8,10,11 SPT N=35	68.94	3.80 (0.25)	Very stiff brown sandy gravelly CLAY		
4.05	100	83	83			68.69	4.05	Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
5.30										
	100	100	90							
6.80				5				(4.05m to 20.30m BGL) Three Fracture sets. F1: 0 to 20 degrees, very closely to widely spaced, planar and rough with occasional clay infill/ smearing. F2: 30 to 50 degrees, widely spaced, planar and rough. F3: 70 to 90 degrees, closely to widely spaced, planar and rough with occasional orange staining and clay infill		
8.30	100	93	90							
9.80	100	87	77							
10.05										

Remarks Borehole complete at 20.30m BGL Borehole bakfilled upon completion								Scale (approx) 1:50	Logged By SB
								Figure No. 12953-06-23.RC03	



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 72.74		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 596995.3 E 748388.3 N		Dates 19/09/2023- 20/09/2023		Engineer		Sheet 2/3	
Core Dia: 63.5 mm		Method : Rotary Cored							

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.30	100	43	40	NI				(10.05m to 11.60m BGL) Mostly non-intact		
11.60	100	57	50							
12.80	100	73	73							
14.30	100	83	80							
15.80	100	87	80	3						
17.30	100	87	80							
18.80	100	90	80							

Remarks	Scale (approx)	Logged By
	1:50	SB
Figure No. 12953-06-23.RC03		



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 72.74		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 596995.3 E 748388.3 N		Dates 19/09/2023- 20/09/2023		Engineer		Sheet 3/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.30						52.44	20.30	Complete at 20.30m		

Remarks	Scale (approx)	Logged By
	1:50	SB
Figure No. 12953-06-23.RC03		



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 70.46		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597045.1 E 748348.1 N		Dates 14/09/2023-18/09/2023		Engineer		Sheet 1/3	
Core Dia: 63.5 mm		Method : Rotary Cored							

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Open hole- Cable Percussion Follow on		
3.20	92					67.26	3.20 (0.60)	Recovery consists of COBBLES with a little slightly clayey sandy GRAVEL. Drillers note: CLAY with cobbles		
3.80	53				5,5/7,7,8,9 SPT N=31	66.66	3.80 (1.50)	Recovery consists of brownish grey slightly sandy clayey subangular to subrounded fine to coarse GRAVEL. Drillers note: CLAY with cobbles		
5.30 5.30-5.75	40					65.16	5.30 (1.50)	Recovery consists of grey slightly sandy subangular to subrounded fine to coarse GRAVEL onto possible weathered rock. Drillers note: CLAY onto possible weathered rock		
6.80 6.80-6.87	93				9,16/50 SPT 25*/70 50/0	63.66	6.80 (0.60)	Possible weathered rock recovered as orangish brown slightly sandy gravelly CLAY with medium cobble content with a dolomitic limestone boulder from 7.40m to 7.80m BGL.		
						63.06	7.40 (1.25)	Possible cavity infill recovered as orangish brown slightly sandy slightly gravelly CLAY		
8.30										
8.65	97	43	38			61.81	8.65 (1.30)	Strong to very strong massive light grey fine grained fossiliferous LIMESTONE. Fresh to slightly weathered.		
9.80						60.51	9.95	(8.65m to 9.95m BGL) One Fracture set. F1: 0 to 20 degrees, very closely to widely spaced, planar and rough with rare clay smearing.		

Remarks Borehole complete at 20.30m BGL Borehole backfilled upon completion	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC05	



Machine : Beretta T-41 Flush : Water Core Dia : 63.5 mm Method : Rotary Cored	Casing Diameter 96mm cased to 20.30m	Ground Level (mOD) 70.46	Client Malachy Walsh	Job Number 12953-06-23
	Location 597045.1 E 748348.1 N	Dates 14/09/2023-18/09/2023	Engineer	Sheet 2/3

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.30	90	57	53	4		60.01	(0.50)	Infilled CAVITY: Orangish brown slightly sandy slightly gravelly CLAY		
							10.45	Medium strong to strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Moderately weathered.		
12.80	87	60	55			58.46	(1.55)	(10.45m to 12.00m BGL) Two fracture sets. F1: 0 to 20 degrees, closely to medium spaced, planar and rough with occasional clay infill/ smearing. F3: 70 to 90 degrees, one fracture present, planar and rough with clay infill. (Infilled CAVITY: 11.55m to 11.65m BGL- orangish brown slightly sandy slightly gravelly CLAY)		
							12.00	Strong to very strong strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
14.30	80	55	49			57.26	(1.20)	(12.00m to 13.20m BGL) One fracture set. F1: 0 to 20 degrees, closely to medium spaced, planar and rough with rare clay smearing		
							13.20	Infilled CAVITY: Orangish brown slightly sandy slightly gravelly CLAY		
15.80	97	63	60			56.96	(0.30)	Strong to very strong strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
							13.50	(13.50m to 15.45m BGL) One fracture set. F1: 0 to 20 degrees, closely to widely spaced, planar and rough with occasional clay infill (Infilled CAVITY: 15.15m to 15.25m BGL- orangish brown slightly sandy slightly gravelly CLAY)		
17.30	90	70	63	3		55.01	15.45	Infilled CAVITY: Orangish brown slightly sandy slightly gravelly CLAY		
							15.65	Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
18.80	100	61	49			54.81	(2.15)	(15.65m to 17.80m BGL) One fracture set. F1: 0 to 20 degrees, closely to widely spaced, planar and rough with rare clay smearing		
							17.80	Very weak to weak massive dark brown medium grained DOLOMITIC LIMESTONE with vugs. Highly weathered.		
	97		85			52.66	(0.50)	Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
						18.30	(Infilled CAVITY: 19.30m to 19.40m BGL- orangish brown slightly sandy slightly gravelly CLAY)			

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC05	



Machine : Beretta T-41		Casing Diameter 96mm cased to 20.30m		Ground Level (mOD) 70.46		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597045.1 E 748348.1 N		Dates 14/09/2023-18/09/2023		Engineer		Sheet 3/3	
Core Dia: 63.5 mm				Method : Rotary Cored					

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.30						50.16	20.30	<p>(18.30m to 20.30m BGL) Two fracture sets. F1: 0 to 20 degrees, medium to widely spaced, planar and rough with occasional clay infill. F3: 70 to 90 degrees, one fracture present, planar and rough.</p> <p>Complete at 20.30m</p>		

Remarks	Scale (approx)	Logged By
	1:50	SB
Figure No. 12953-06-23.RC05		



Machine : Beretta T-41		Casing Diameter 96mm cased to 24.80m		Ground Level (mOD) 70.19		Client Malachy Walsh		Job Number 12953-06-23	
Flush : Water		Location 597093.9 E 748337.4 N		Dates 20/09/2023- 25/09/2023		Engineer		Sheet 2/3	
Core Dia: 63.5 mm		Method : Rotary Cored							

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.30	100			5		60.19	10.00	Medium strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Moderately weathered.		
12.40	100	30	30	NI			(2.95)	(10.00m to 12.95m BGL) Two fracture sets. F1: 0 to 20 degrees, closely to medium spaced, planar and rough with occasional sand infill. F2: 30 to 50 degrees, one fracture present planar and rough.		
12.80						57.24	12.95 (0.20)	Infilled CAVITY: Orangish brown slightly clayey slightly gravelly fine to coarse SAND		
14.30	100	69	62	6		57.04	13.15	Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
15.80	100	88	77				(2.65)	(Infilled CAVITY: 15.40m to 15.50m BGL - Orangish brown slightly clayey fine to coarse SAND)		
16.10						54.39	15.80	(13.15m to 15.80m BGL) One fracture set present. F1: 0 to 20 degrees, very closely to medium spaced, planar and rough with occasional sand infill.		
17.30	100	45	30	7			(1.60)	Medium strong to strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Slightly to moderately weathered.		
17.40								(15.80m to 17.40m BGL) Two fracture sets. F1: 0 to 20 degrees, closely to medium spaced, planar and rough. F2: 30 to 50 degrees, one fracture present, planar and rough.		
18.80	100	100	100	3		52.79	17.40	Strong to very strong massive light brownish grey crystalline medium grained DOLOMITIC LIMESTONE with vugs. Fresh to slightly weathered.		
18.80	100	100	92							

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC05	



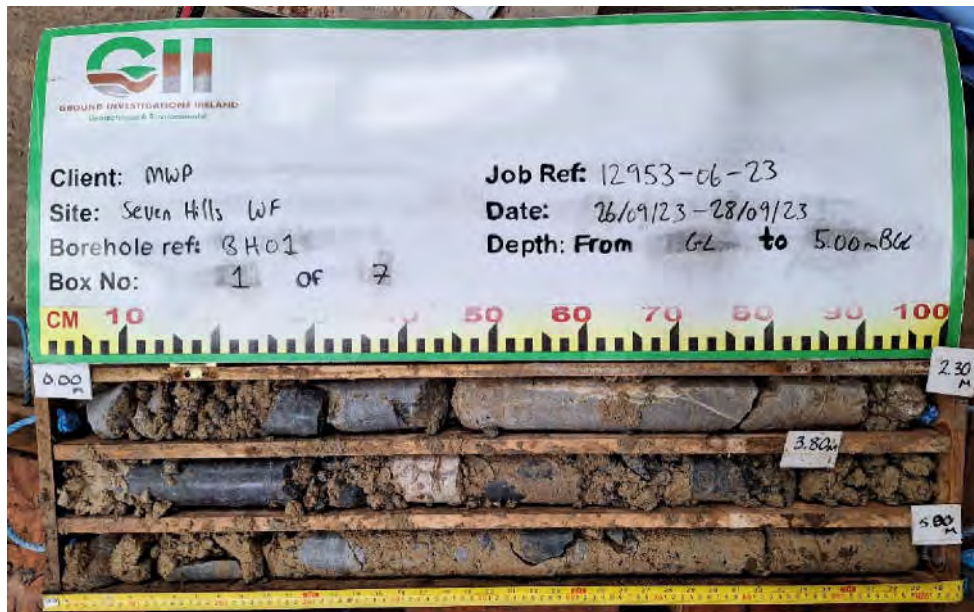
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Flush : Water		Location 597093.9 E 748337.4 N		Dates 20/09/2023- 25/09/2023		Engineer		Sheet 3/3	
Core Dia: 63.5 mm									
Method : Rotary Cored									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.30								(17.40m to 24.80m BGL) Three fracture sets. F1: 0 to 20 degrees, closely to medium spaced, planar and rough. F2: 30 to 50 degrees, one fracture present, planar and rough. F3: 70 to 90 degrees, one fracture present, planar and rough.		
	100	97	83	6		(7.40)				
21.80										
22.50	100	56	40							
23.30				3						
	100	93	92							
24.80						45.39	24.80	Complete at 24.80m		

Remarks	Scale (approx)	Logged By
	1:50	SB
	Figure No. 12953-06-23.RC05	

Rotary Core Borehole Photographs

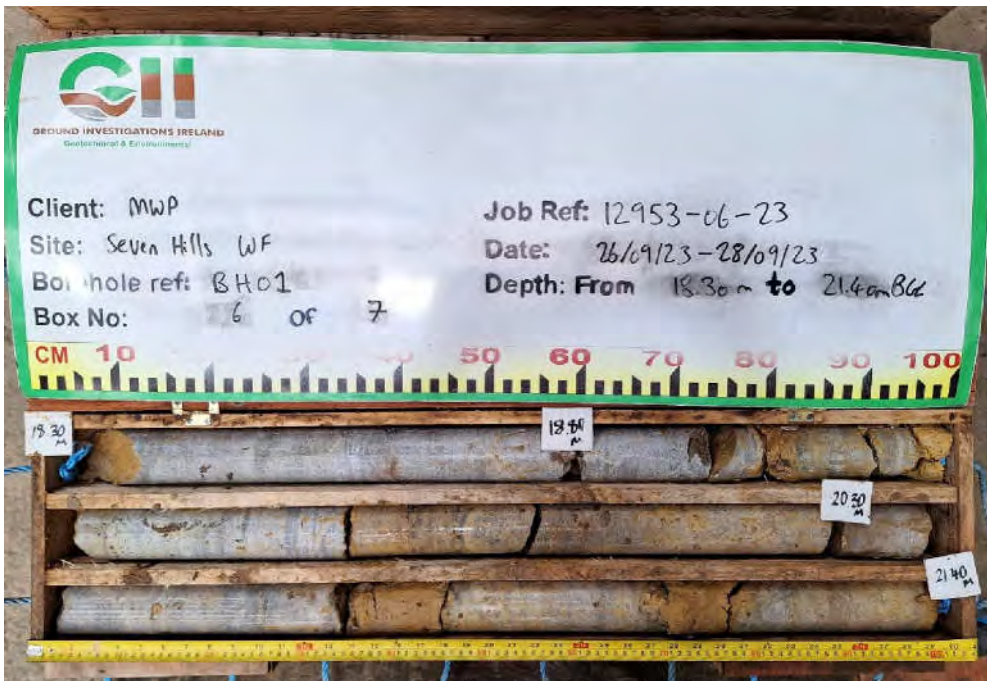
RC-01



Rotary Core Borehole Photographs



Rotary Core Borehole Photographs



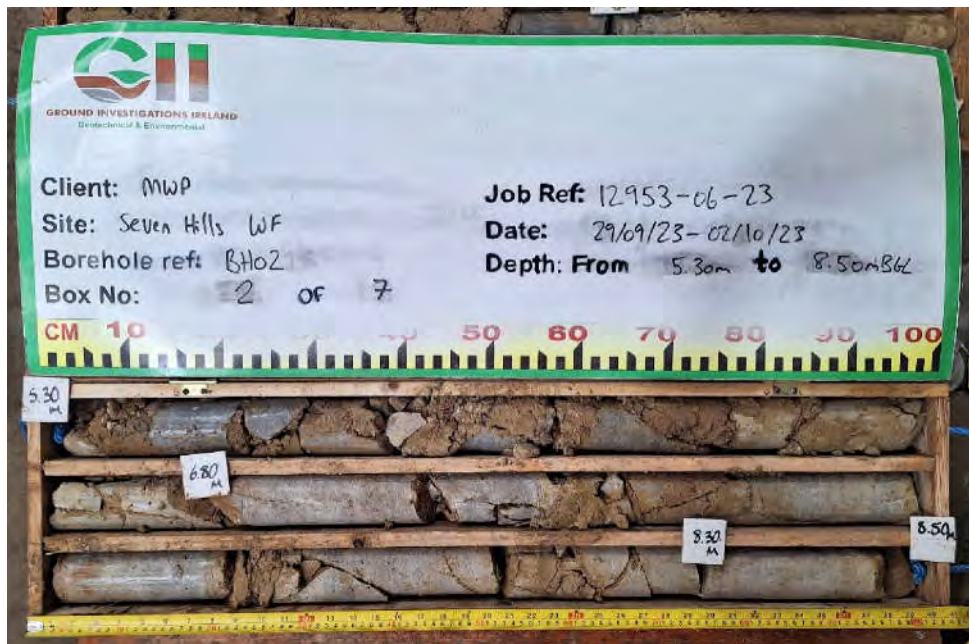
Rotary Core Borehole Photographs



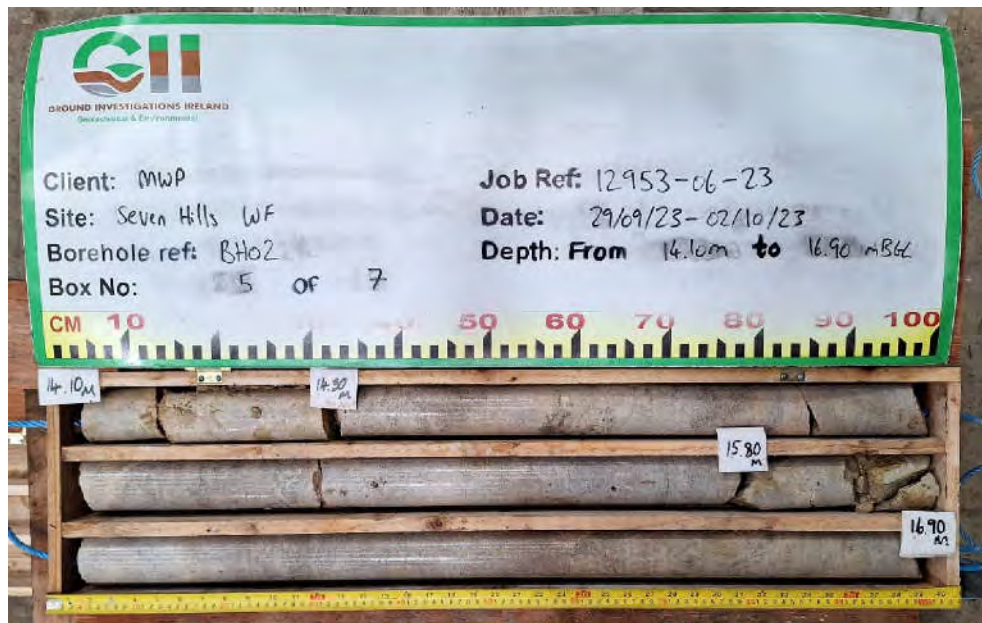
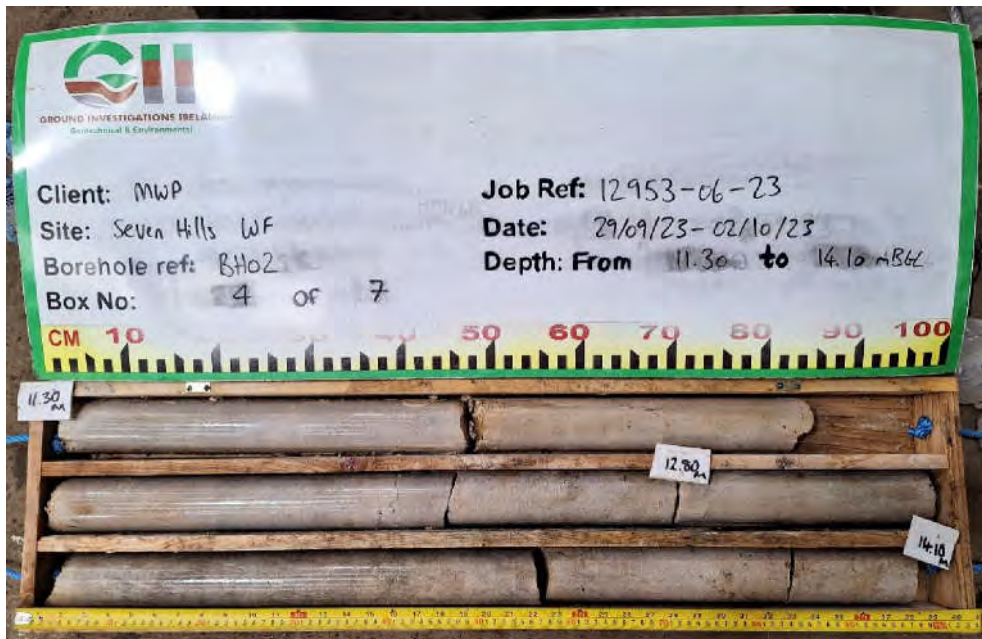
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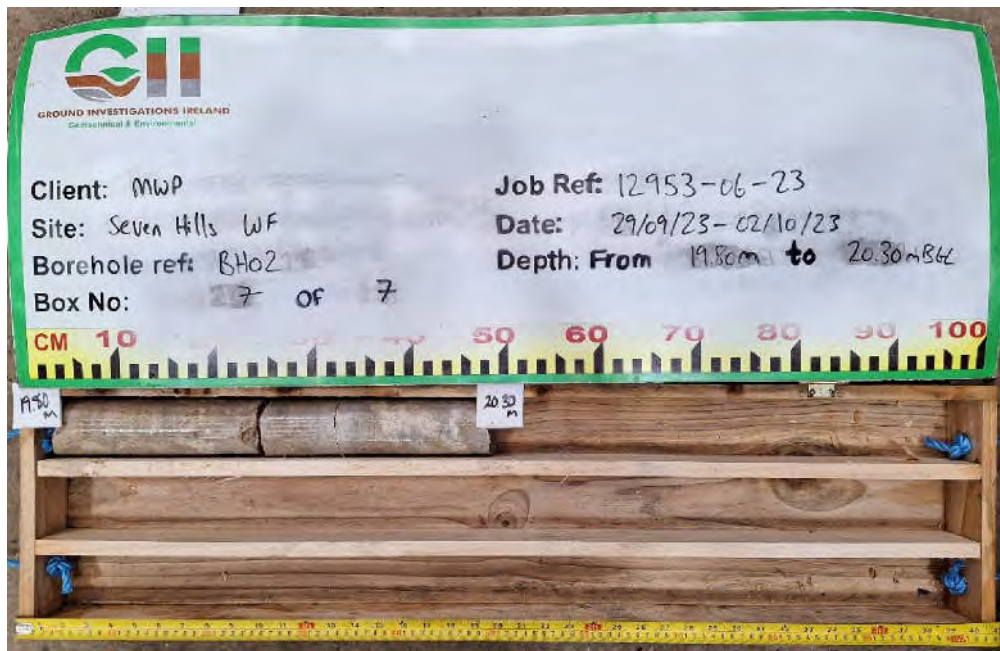
Rotary Core Borehole Photographs



Rotary Core Borehole Photographs

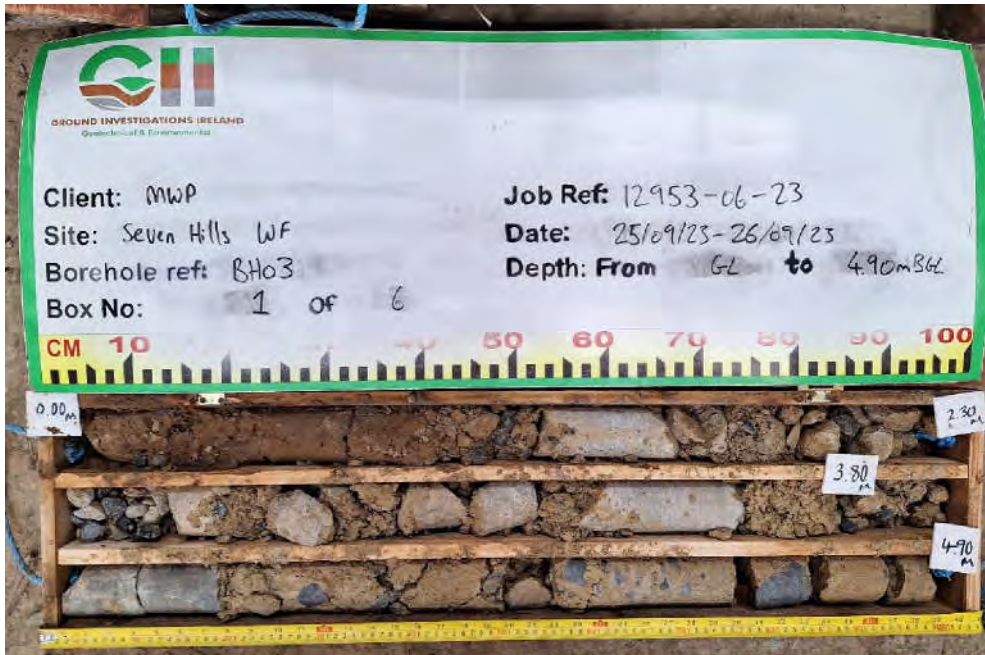


Rotary Core Borehole Photographs



RC-03

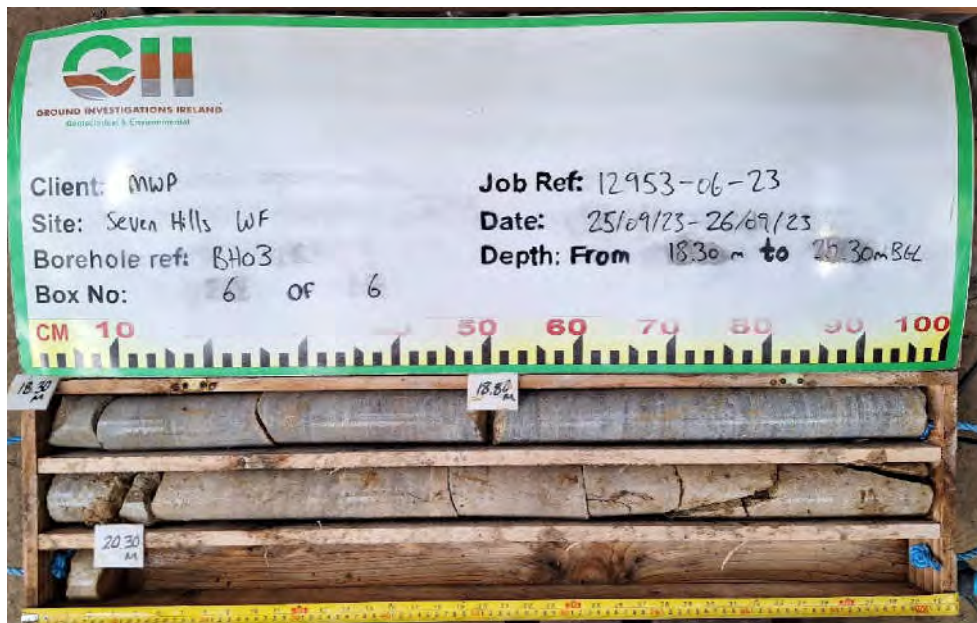
Rotary Core Borehole Photographs



Rotary Core Borehole Photographs

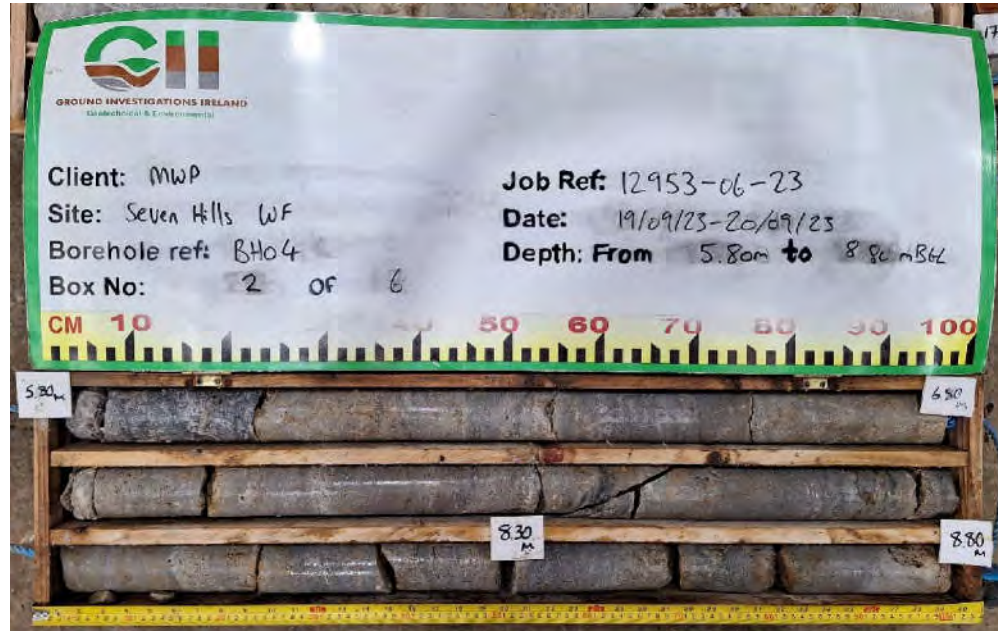
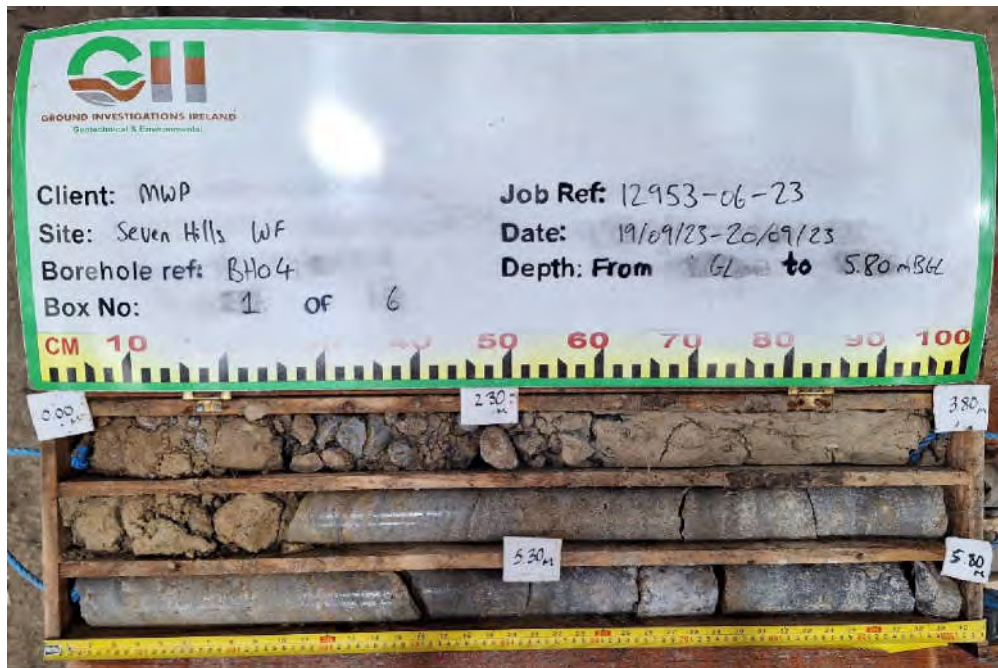


Rotary Core Borehole Photographs

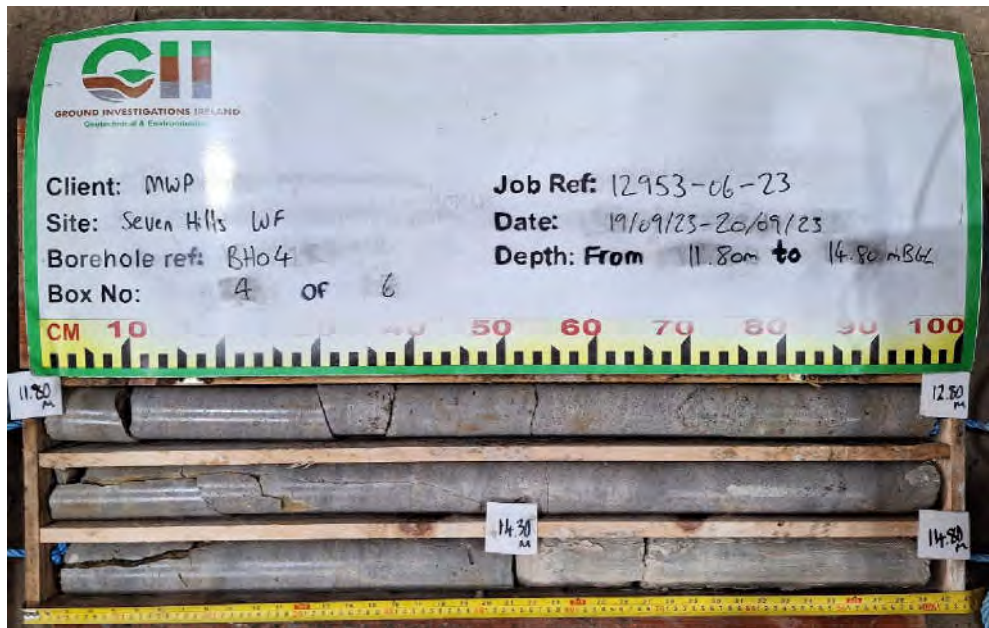
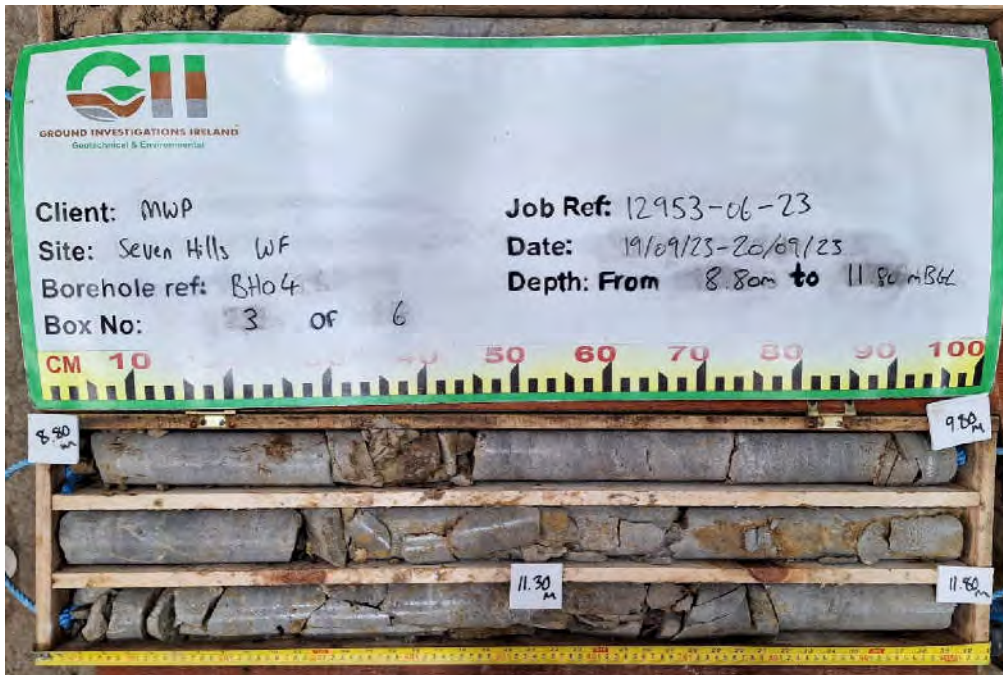


Rotary Core Borehole Photographs

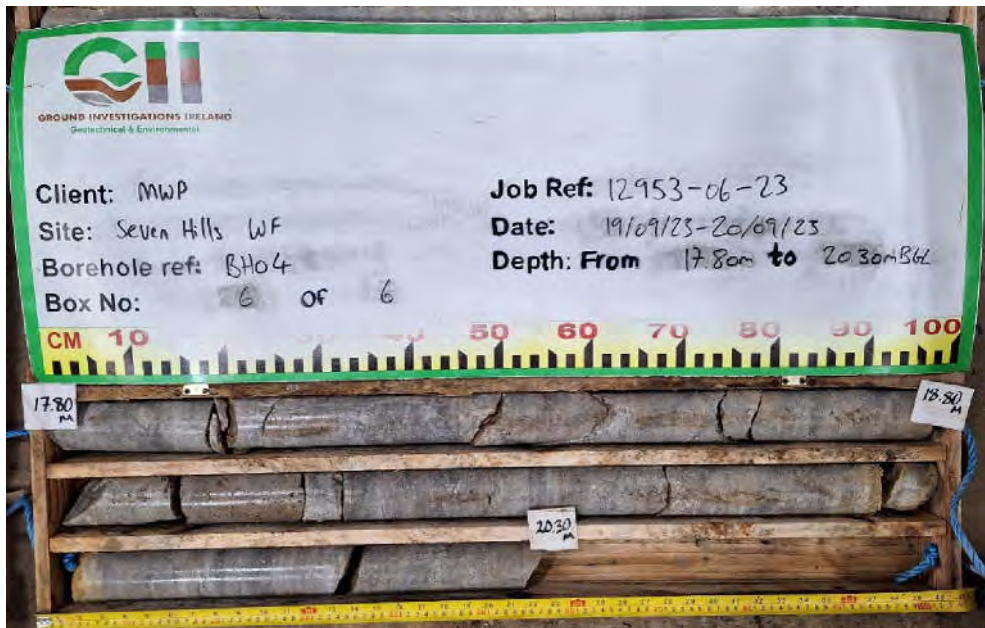
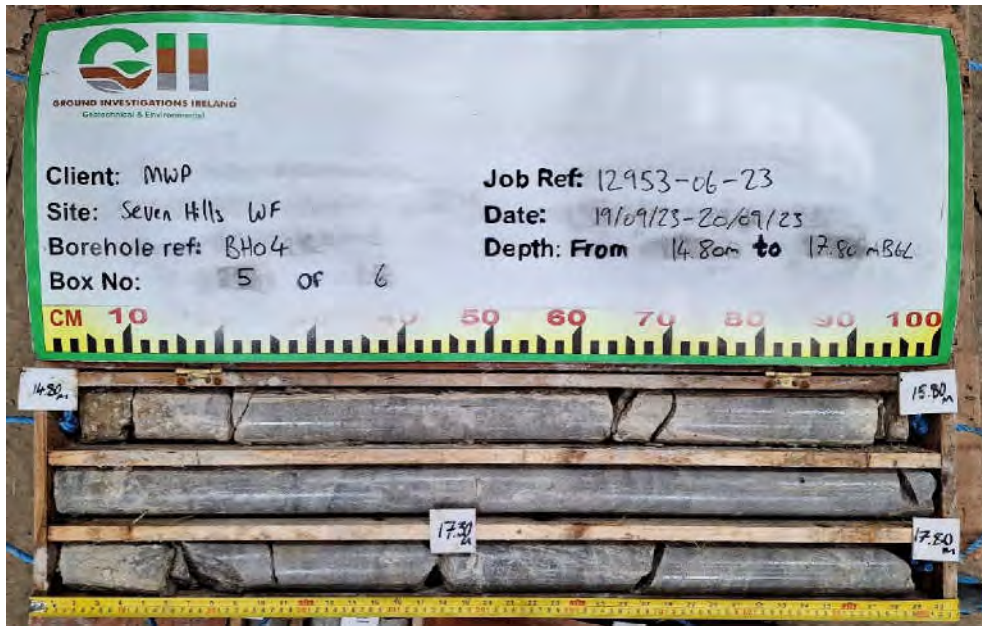
RC-04



Rotary Core Borehole Photographs



Rotary Core Borehole Photographs

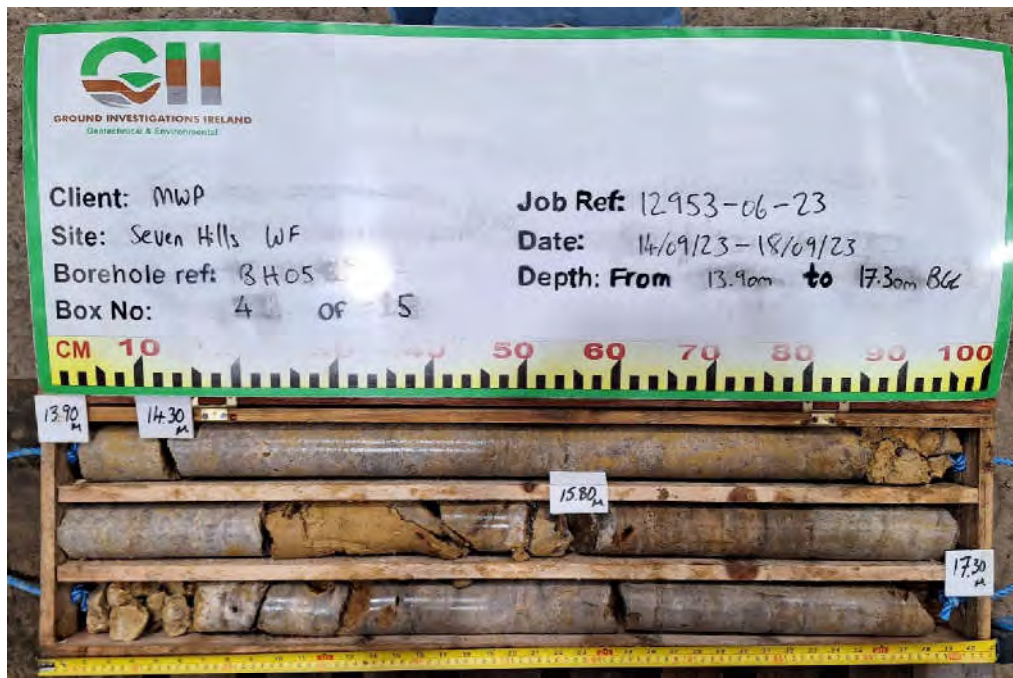


Rotary Core Borehole Photographs

RC-05



Rotary Core Borehole Photographs



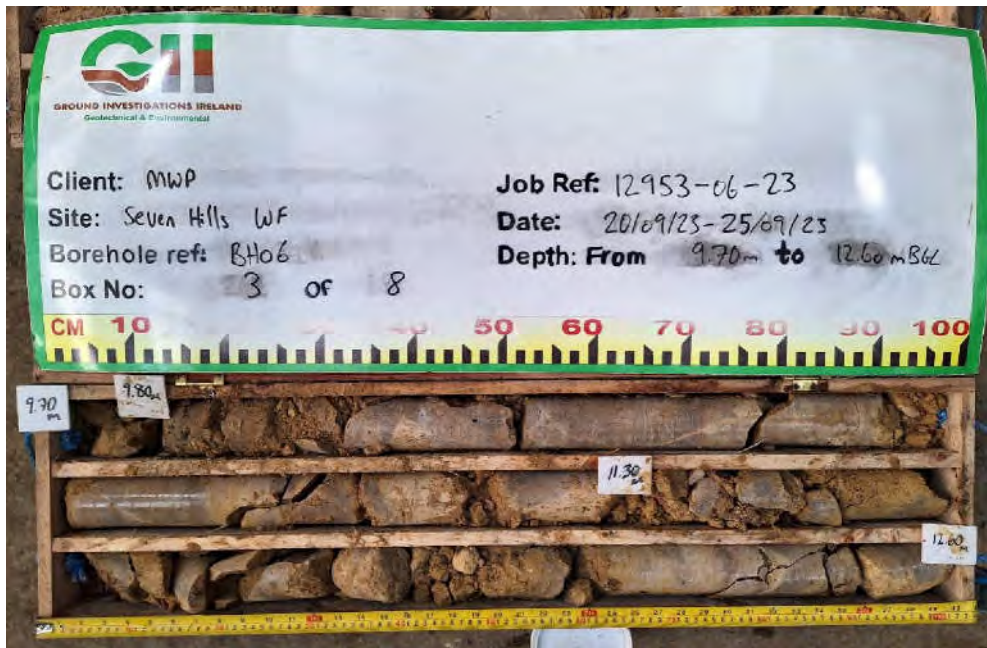
Rotary Core Borehole Photographs



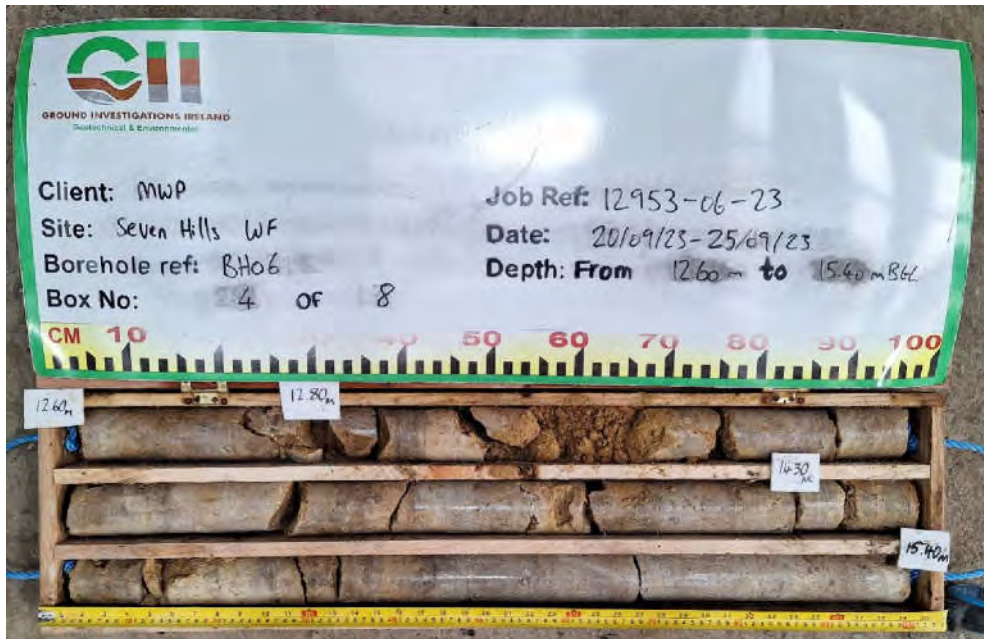
RC-06



Rotary Core Borehole Photographs



Rotary Core Borehole Photographs



Rotary Core Borehole Photographs



Rotary Core Borehole Photographs



APPENDIX 6 – Laboratory Testing



APPENDIX 7 – Groundwater Monitoring





GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinstown House,
Hazelhatch Road,
Newcastle,
Co. Dublin,
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Seven Hills Wind Farm

Monitoring Location	DATE	TIME	Groundwater Level (m BGL)	Monitoring Location Elevation (mOD)	Groundwater Level (mOD)	Comments
BH-02	10/10/2023	14:15:00	8.67	74.76	66.09	
Turlough	10/10/2023	14:37:00	0.00	60.95	60.95	
Farmers Well	10/10/2023	14:01:00	16.12	72.26	56.14	

