

# **Cork Line Level Crossings – XC201 Ground Investigation**

Primary Author:	Ian Holley
Client:	Irish Rail
Client's Representative:	JACOBS
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# **Document Control Sheet**

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001	Draft	Ian Holley	Glen Byrne	Michael O'Connell	1st October 2020
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The works were conducted in accordance with:

Specification And Related Documents For Ground Investigation In Ireland. (2016) 2<sup>nd</sup> ed. Engineers Ireland.

BS EN 1997: Eurocode 7 - Geotechnical Design – Parts 1 & 2 (2007)

UK Specification for Ground Investigation 2<sup>nd</sup> Edition (2012)

British Standards Institute (2010) BS 5930:1999 + A2: 2010, Code of practice for site investigations. Incorporating Amendment Nos. 1 and 2, as partially replaced by:

- BS EN ISO 22475-1:2006: Geotechnical investigation and testing. Sampling methods and groundwater measurements. Technical principles for execution
- BS EN ISO 14688-1:2002/Amd 1:2013: Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- BS EN ISO 14688-2:2004/Amd 1:2013: Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification
- BS EN ISO 14689-1:2003: Geotechnical investigation and testing. Identification and classification of rock. Identification and description
- BS EN ISO 22476-2:2005/Amd 1:2011: Geotechnical investigation and testing. Field testing. Dynamic probing
- BS EN ISO 22476-3:2005/Amd 1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test



# **METHODS OF DESCRIBING SOILS AND ROCKS**

Soil and rock descriptions are based on the guidance in Section 6 of BS 5930: 1999 + A2: 2010, The Code of Practice for Site Investigation. The amendments revised the Standard to remove text superseded by BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and EN ISO 14689-1:2003 and refers to the relevant standard for each affected subclause. However, the following terms are used in the description of fine-grained soils, where applicable:

- Soft to Firm: fine-grained soil with consistency description close to the boundary between soft and firm soil (Table 13 of BS5930).
- Firm to Stiff: fine-grained soil with consistency description close to the boundary between firm and stiff soil (Table 13 of BS5930).

Abbreviations use	d on exploratory hole logs
U	Nominal 100mm diameter undisturbed open tube sample
Р	Nominal 100mm diameter undisturbed piston sample
В	Bulk disturbed sample
D	Small disturbed sample
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (C)	Standard penetration test using 60-degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPaV: undisturbed vane shear strengthVR: remoulded vane shear strength
<u>dd/mm/yy: 1.0</u> dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
Abbreviations rela	ting to rock core – reference Clause 44.4.4 of BS 5930: 1999
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non-Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.



# **Cork Line Level Crossings – XC201**

# **1 AUTHORITY**

On the instructions of JACOBS on behalf of Iarnród Éireann / Irish Rail, a ground investigation was undertaken at multiple locations along the Cork to Dublin railway line, between Limerick Junction and Mallow stations, to provide geotechnical and environmental information for input to the design and construction of proposed overbridges, embankments, culverts, access roads and footpaths to enable the closure of five manned level crossings.

This report details the work carried out both on site at XC201 and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those measured during the investigation.

This report was prepared by OCB Geotechnical Ltd for the use of Iarnród Éireann / Irish Rail and JACOBS in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

# 2 SCOPE

The extent of the investigation, as instructed by the JACOBS, included boreholes, trial pits, indirect CBR testing, installation of standpipes, water purging, soil sampling, in-situ and laboratory testing, and the preparation of a factual report on the findings.

# **3 DESCRIPTION OF SITE**

As shown on the site location plan in Appendix A, level crossing XC201 is located in the Thomastown townland, 4.9km southeast of Charleville, Co. Cork. An unnamed road crosses the Dublin-Cork railway line approximately 200m east of the N20. The level crossing is currently manned with a house and cabin located adjacent to the east of the railway line. The site is surrounded by agricultural land with a number of residential homes and farms in the area.



The site is relatively flat throughout. The main works areas are within agricultural fields, some may be marshy depending on weather conditions.

The existing site is presented on the site and exploratory hole location plans in Appendix A.

# 4 SITE OPERATIONS

Site operations, which were conducted between 5<sup>th</sup> June 2020 and 7<sup>th</sup> August 2020, included:

- Three (3) Cable Percussion Boreholes
- Three (3) Cable Percussion with Rotary follow-on Boreholes
- A Standpipe Installation in two (2) Boreholes
- Four (4) Trial Pits
- Indirect CBR tests at eight (8) locations
- Water Purging in two (2) locations

The exploratory holes and in situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

#### 4.1 Boreholes

A total of six boreholes were put down in a minimum diameter of 150mm through soil strata to their completion depths by a combination of methods, including cable percussion boring by Pilcon rigs, and rotary drilling by a T44 rig.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

Appendix B presents the borehole logs.

#### 4.1.1 Cable Percussion Boreholes

Three boreholes (CP01, CP01A & CP02) were put down to completion in minimum 200mm diameter using a Pilcon cable percussion soil boring rig. All boreholes were terminated either at their scheduled



completion depths, on instruction from a Jacobs engineer or else on encountering virtual refusal on obstructions, including large boulders and weathered bedrock.

Hand dug inspection pits were carried out between ground level and 1.2m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk bag and tub) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by Jacobs.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals using the split spoon sampler (SPT). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

#### 4.1.2 Boreholes by Combined Percussion Boring and Rotary Follow-On Drilling

Three boreholes (CPRC01, CPRC01A & CPRC02) were put down by a combination of cable percussion boring and rotary follow-on open hole drilling techniques. Where the cable percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to completion/obstruction.

Hand dug inspection pits were carried out between ground level and 1.2m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk bag and tub) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by Jacobs.

Standard penetration tests were carried out in accordance with EC7 at standard depth intervals throughout the overburden using the split spoon sampler (SPT). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.



No rock core recovered.

Appendix B presents the borehole logs.

#### 4.2 Standpipe Installations

A groundwater monitoring standpipe was installed in boreholes CPRC01A and CPRC02.

Details of the installations, including the diameter of the pipe and depth range of the response zone, are provided in Appendix B on the individual borehole logs.

Following the completion of the intrusive investigation work groundwater monitoring was undertaken at the site on four occasions. The results of the monitoring are presented in the report below in Section 6.3.

#### 4.3 Trial Pits

Four trial pits (TP01–TP04) were excavated using a 15t tracked excavator fitted with a 600mm wide bucket, to depths between 2.70m and 3.60m. The trial pits were all terminated upon encountering obstructions or upon the pit walls collapsing.

Environmental samples were taken at depths of 0.05m, 0.50m, 1.0m and 3.0m in each trial pit.

Disturbed (small tub and bulk bag) samples were taken at standard depth intervals and at change of strata.

Hand Vane testing was a tempted unsuccessfully due to the relatively high granular content of the strata.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix C presents the trial pit logs with photographs of the pits and arising provided in Appendix D.

#### 4.4 Indirect CBR Tests

An indirect CBR test was conducted at eight locations (CBR-TP01-1 to CBRTP04-2) using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, is used widely throughout the world, and is referred to in the UK Highway Agency Interim Advice Note 73/06.

The test results are presented in Appendix E in the form of plots of the variation with depth of the cumulative blow count. Straight lines have been fitted to the plots and the CBR for each depth range estimated using the following relationship, as proposed by DTP Interim Advice Note 73/06 (Design Guidance for Road Pavement Foundations):



Log CBR = 2.48-1.057 Log (mm/blow)

The occasionally elevated CBR values could be a consequence of the coarse-grained content of the penetrated soils and are often not representative of the soil matrix.

#### 4.5 Water Purging

Prior to sampling from each standpipe (in CPRC01A and CPRC02) water purging was carried out.

Appendix F presents the water purging data logs.

#### 4.6 Surveying

A broad survey of the site using a handheld CAT scanner to identify any existing buried services or old foundations/obstructions to excavation was carried out before commencement of excavation works. A GPR survey to PAS 128 specification was carried out at each location prior to excavation. The GPR survey report is presented in an addendum to follow issuance of this report.

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from OCB Geotechnical. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator, ITM) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

Pre-work site conditions were surveyed and upon completion of all site works at each site a post-work site condition survey was carried out. The pre and post site condition photographs are presented in appendix I.



# 5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described and their descriptions incorporated into the borehole logs.

#### 5.1 Geotechnical Laboratory Testing of Soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **soil chemistry:** pH, Ammonia content, Chloride content, Nitrate content, Sulphur content and watersoluble and total sulphate content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute (1990) *BS 1377:1990, Methods of test for soils for civil engineering purposes. Parts 1 to 9.* 

The test results are presented in Appendix G.

#### 5.2 Environmental Laboratory Testing of Soils

In addition, environmental testing, as specified by Jacobs was conducted on selected environmental samples by Socotec at its laboratory in Burton-on-Trent, United Kingdom. Results of environmental testing are presented in Appendix H.



#### 6 GROUND CONDITIONS

#### 6.1 General Geology of the Area

Teagasc soil mapping indicates that the Thomastown area is underlain by Glacial Till derived chiefly from Devonian sandstones.

The Geological Survey of Ireland (GSI) bedrock mapping database indicates that soils in the site area are underlain at depth by the Lower Carboniferous-age undifferentiated Visean Limestones. The Lower Carboniferous strata were subjected to compressional deformation (tectonic shortening) during the Variscan Orogeny in Late Carboniferous and Early Permian times. Bedrock strata in the site vicinity typically strike west-southwest to east-northeast with variable dips having undergone folding and faulting.

The site is underlain by a locally important aquifer, consisting of bedrock which is moderately productive only in local zones, and has a moderate groundwater vulnerability. Numerous Karst features, such as depressions, swallow holes, caves and springs, occur in the valley underlain by limestones to the north-northwest of the Ballyhoura Mountains.

Note: Bedrock level assumed approximately >30m bgl based on a historic ground investigation in the area.

#### 6.2 Ground Types Encountered During Investigation of the Site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- Topsoil: encountered typically in 200mm thickness, with topsoil and subsoil extending to 400mm depth noted in the Trial Pits.
- Glacial Till: Sandy gravelly silty clay, frequently with cobble and boulder content, typically soft or firm in upper horizons, becoming very stiff with increasing depth.
- Bedrock: Rockhead was not encountered to a maximum depth of 19.70m in CPRC02.

#### 6.3 Groundwater

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



Data	Depth to standing water level (m)									
Date	CPRC01A	CPRC02								
13/08/20	0.63	0.92								
17/08/20	0.5	0.86								
21/08/20	0.2	0.31								
29/09/20	0.795	1.06								

Groundwater monitoring to date in standpipe installations, yielded the following results:

Continued monitoring of the two installed standpipes will give an indication of the seasonal variation in groundwater level.

#### 7 DISCUSSION

#### 7.1 Proposed Construction

It is proposed to construct overbridges, embankments, culverts, access roads and footpaths to enable the closure of five manned level crossings.

No further details were available to OCB Geotechnical at the time of preparing this report.



#### 8 **REFERENCES**

Specification And Related Documents For Ground Investigation In Ireland. (2016) 2<sup>nd</sup> ed. Engineers Ireland.

BS EN 1997-1: 2007. *Eurocode 7 - Geotechnical design - Part 1 General Rules*. British Standards Institution, London.

BS EN 1997-2: 2007. *Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing*. British Standards Institution, London.

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

BS 5930: 2015. *Code of practice for ground investigations*. British Standards Institution, London.

BS EN ISO 14688-1: 2002. *Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description*. British Standards Institution, London.

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

Building Research Establishment, 2005. BRE Special Digest 1, Concrete in aggressive ground.

Building Research Establishment, 2007. BRE Digest 365: Soakaways.

BS EN 12457-2: 2002 Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges. One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction).

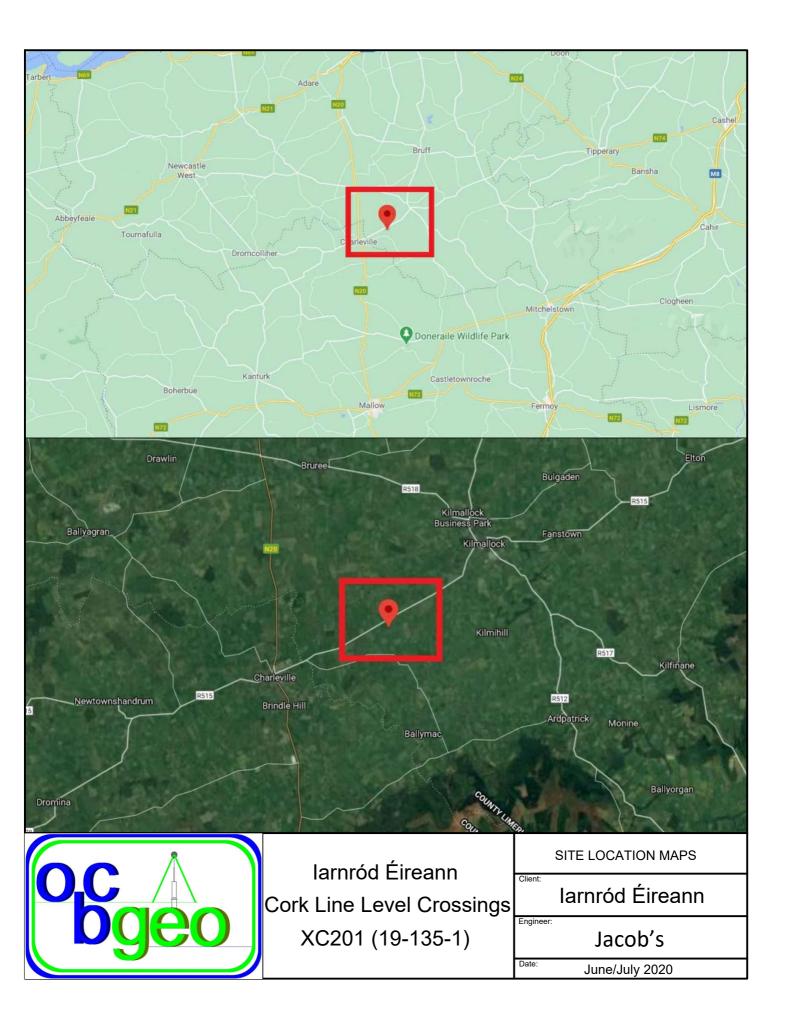
Environmental Protection Agency / Draft Guidance Note on Soil Recovery Waste Acceptance Criteria. December 2017. http://www.epa.ie/pubs/consultation/soilrecoveryconsultation/

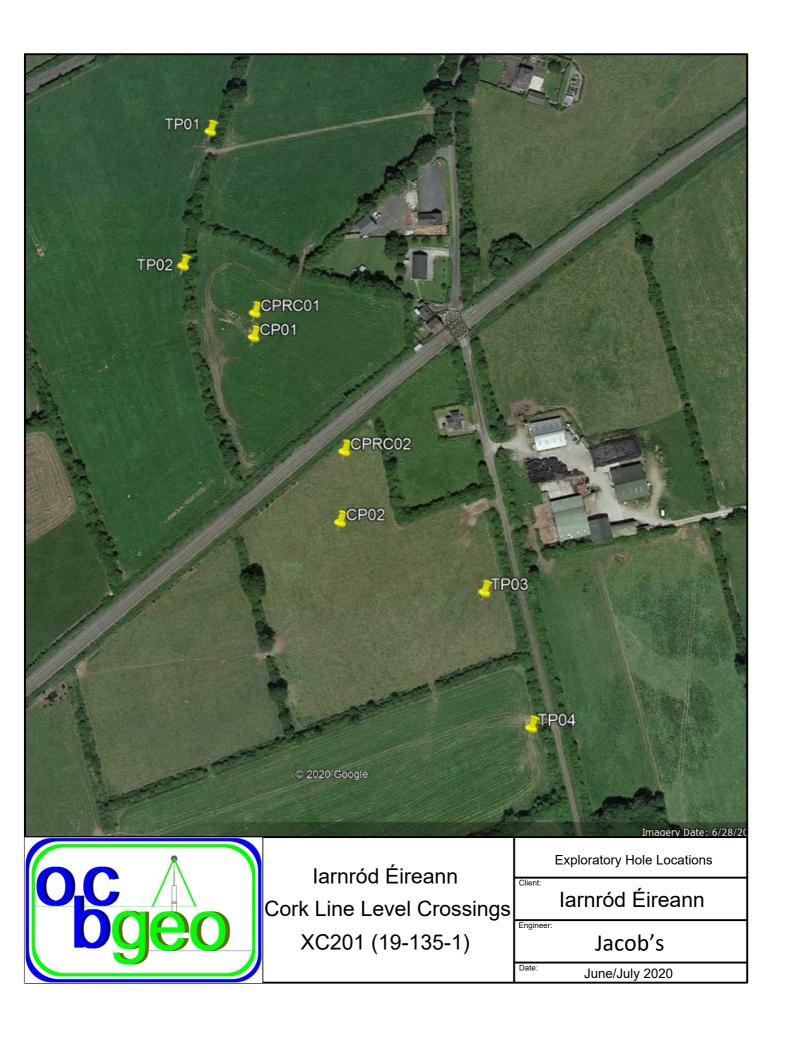
Environmental Protection Agency / Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous. 1st June 2015 <u>https://www.epa.ie/pubs/reports/waste/stats/wasteclassification/EPA\_Waste\_Classification\_2015\_Web.</u> <u>pdf</u>

Environment Agency UK (2009). Soil Guideline Values (SGVs). https://www.gov.uk/government/collections/land-contamination-technical-guidance

Soil Remediation Circular 2013, Ministry for Environment and Infrastructure, The Hague, Netherlands. <u>https://rwsenvironment.eu/subjects/soil/legislation-and/soil-remediation/</u>

Appendix A Site and Exploratory Hole Location Plans





Appendix B Borehole Logs

				Projec	t No :	Droject	: Name:	De	rehole	Net
		$\wedge$		19-135			: <b>Name:</b> ne Level Crossings		C201-	
	ha			Coordi		Client:				
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Method:			2				s Representative:	Sca	ale:	1:50
Cable Percus	sion			62457	3.03 N	JACOB:			iller: /	
Plant:					d Level:	Dates:				
Pilcon			-		0 mOD		05/06/2020 - 05/06/2020		gger:	H
Depth (m)	Sample / Tests	Casing Wa Depth Dep (m) (n	Pth Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfi	п
0.05 0.20 - 1.20 0.20 - 1.20 0.50	ES1 B2 D3 ES4			80.40	(0.20) 0.20 - (1.00)		TOPSOIL Firm light greyish brown with some yellow mottling slightly sandy slightly gravelly slity CLAY with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.			0.5 -
1.20 - 2.00 1.20 - 2.00 1.20 - 1.65 1.50	85 D6 SPT (C) N=9 ES7		N=9 (2,1/2,2,3,2)	79.40	(0.80)		Firm light brown modeled grey slightly sandy gravelly SILT with low to medium cobble content and low boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are subrounded.			
2.00 - 2.45	SPT (C) N=7		N=7 (3,2/1,2,2,2)	78.60	- 2.00	****	End of borehole at 2.000m			2.0
					-					2.5
					- - - - - -					3.0
					- - - -					4.0
					-					4.5
					-					5.0
					-					6.0
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<b>lant:</b> ilcon				Ground	d Level:	Dates:	08/06/2020 08/06/2020		gger: IH	
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(m)	Sample / Casing Depth Tests (m)	Depth (m)	Field Records	(mOD)	(Thickness)	Legend	Description	Water	Backfill	
(m) 202 - 1.20 202 - 1.20 202 - 1.20 203 - 2.00 204 - 2.00 205 - 2.00 205 - 2.00 205 - 2.00 206 - 3.00 206 - 3.00 207 - 2.45 200 200 - 3.40 200 - 3.	Tests         (m)           B1         D2           ES3         -           B4         D5           SPT (C)         N=7           ES6         -           B7         D8           SPT (C)         N=7           ES9         B10           D11         SPT (C)           SPT (C)         SPT (C)		N=7 (1,1/2,1,2,2) N=7 (2,2/1,2,2,2) N=48 (1,1/48 for 255mm) 50 (25 for 0mm/50 for 0mm)	(mOD)	(Thickness) (0.20) 0.20 1.20 (1.00) 2.00 (0.80) 3.00 (0.40) 3.40 		TOPSOIL         Brown slightly silty slightly sandy slightly gravelly CLAY with frequent roottets and low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.         Soft brown slightly silty slightly sandy slightly gravelly CLAY with frequent roottets and medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.         Soft to Firm greyish brown slightly sandy slightly gravelly slity CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subrounded.         Very Stiff greyish brown slightly sandy slity gravelly CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles and boulders are subangular to subrounded. Sign bounded bounders are subangular to subrounded. Cobbles and boulders are subangular to subrounded. Sign bounders are subangular to subrounded.			
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Depth         Sample / Field Records         Level         Depth / Field Records         Level         Depth / Field Records         Dep							Dates:				
Open Description         Description <thdescription< th=""></thdescription<>		Sample / Casi	ing Water					10/06/2020 - 10/06/2020	_		י ד
320-120         B2         B2         B2.1         0.02	(m)	Tests (m	n) (m)	Field Records					Wate	Backfill	1
	.05 .20 - 1.20 .20 - 1.20 .50 .20 - 2.00 .20 - 2.00 .20 - 2.00 .20 - 1.65 .50 .00 - 2.20 .00 - 2.20 .00 - 2.00	lests         (m           ES1         B2           D3         ES4           B5         D6           SPT (C)         N=26           ES7         B8           D9         SPT (C)		N=26 (1,1/4,11,7,4) 50 (50 for 2mm/50 for 0mm) 50 (25 for 0mm/50	82.11 81.11 80.31	(1.00) (1.00) (1.00) (1.00) (0.80)		TOPSOIL         Light brown slightly sandy gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.         Cobbles are subangular to subrounded.         Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content and occasional rootlets. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular.         Brown slightly sandy gravelly sandy CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded. Cobbles are subangular, predominantly limestone.			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
						-					
											t
	emarks										
									ь ю (Ш)	e (min) KG	<u></u>
Matrix     Matrix     Matrix     Matrix       Image: Semarks     Image: Semarks     Image: Semarks     Image: Semarks     Image: Semarks											
								Casing Details Chis	elling	Details	
From (m) To (m) Struck at (m) Casing to (m) Time (min) Rose											

Cable Percussion terminated at 3. /Um due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.						Projec	t No.:	Projec	t Name:	Во	rehol	e No.:
SP301.38 E         Immed Encard (mish Bail         Street 101           Cable         Screet 101         Encite         Screet 101           Plant:         Cound ceret:         Date:         AcAbdrow         Screet 101           Dimension         Total         Cound ceret:         Date:         AcAbdrow         Dimension         Total           Dimension         Total         Cound ceret:         Date:         AcAbdrow         Discipling		). <b>C</b>	$\mathbb{A}$			19-135		Cork Li	ine Level Crossings	xc	201-0	PRC01
Method:     Sofzen 1.8 rc     Binned Ensam / Mink Rall       Cable Percensitaries/Lotary Open     Solar:     1:0       Plant:     Guoda Seprementative:     Deprementative:       Solar:     1:0     Tested       Sol		ba	e			Coordi	nates:	Client:		- c	hoot '	1 of 1
Method:         Date:         Date:         Dient's Representative: NACESS         Dien's Representative: NACESS <td></td> <td>~9</td> <td></td> <td></td> <td></td> <td>55750</td> <td>1 38 F</td> <td>larnróo</td> <td>d Éireann / Irish Rail</td> <td></td> <td>neet .</td> <td>1 01 1</td>		~9				55750	1 38 F	larnróo	d Éireann / Irish Rail		neet .	1 01 1
Carbon Frequencies         Definition         Definition <th< td=""><td>Method:</td><td></td><td></td><td></td><td></td><td>1</td><td>1.50 L</td><td>Client'</td><td>s Representative:</td><td>Sca</td><td>ale:</td><td>1:50</td></th<>	Method:					1	1.50 L	Client'	s Representative:	Sca	ale:	1:50
Plant:         Ground Levie:         Dates:         11.002           Depto:         Test:         0.4/06/7020 - 19/06/2021         Ugger: MN           Depto:         Test:         0.4/06/7020 - 19/06/2021         Ugger: MN           Depto:         Test:         Test:         Description         2         Amount Levie:         2         Amount Levie:         Description         2         Amount Levie:         Description         2         Description	Cable Percuss	ion+Rota	ry O	pen		62458	8.30 N	JACOB	S			AA
Description         Single / (m)         Field Record.         Level (Problem)         East of the construction on the light graphs there are signify and y light of the construction.         East of the construction on the light graphs there are signify and y light of the construction.         East of the construction on the light graphs there are signify and y light of the construction.         Image: Significant of the construction on the light graphs there are significant of the construction.         Image: Significan	Plant:					Groun	d Level:	Dates:		Dr	iller:	+NOB
or         total         to	Pilcon+T44					80.4	7 mOD		04/06/2020 - 19/06/2020	Lo	gger:	MN
Dod         S23 (00)         Dose         Dose <thdose< th=""> <thdose< th=""> <thdose< th=""> <th< th=""><th></th><th></th><th>Casing Depth</th><th>Water Depth</th><th>Field Records</th><th></th><th></th><th>Legend</th><th>Description</th><th>ater</th><th>Backf</th><th>ill</th></th<></thdose<></thdose<></thdose<>			Casing Depth	Water Depth	Field Records			Legend	Description	ater	Backf	ill
02.02.03         03.03         N=4         0.03			(m)	(m)		(mOD)			TOPSOIL			- I
250         E54         256         0.57         256         0.57         256         0.57         256         100         0.57         100						80.26			Light yellowish brown mottled light greyish brown slightly sandy slightly	-		2
0.00-1.20       BP       P						79.96						0.5 -
0.00         0.00 <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Λ</td><td></td><td>× 1</td></th<>										Λ		× 1
100 - 200       07 57       120	0.50 - 1.20	D6					(0.70)	<u> </u>	Yellowish brown mottled light grey and orange brown slightly sandy			× 1
1.30 - 1.60       06       N=6 (0, Y1, 2, 2, 1)       0.00       00       0.00       000	1 20 2 00	07				70.26	1 20				07770	1.0 -
Lab         Los         Los <thlos< th=""> <thlos< th=""> <thlos< th=""></thlos<></thlos<></thlos<>						79.20	1.20	<u>x</u>	to subrounded, predominantly limestone.	Λ		
1.50       659       200	1.20 - 1.65				N=6 (0,1/1,2,2,1)		- - (0.80)	0				1.5 -
200 1.00 200 2.45 30 1/2 200 2.45 300 1/2 200 2.45 300 1/2 200 2.45 300 1/2 200 2.45 300 1/2 300 1/2 30	1 50						(0.00)					-
2.00 - 3.00 2.00 - 2.45 3.00 - 2.00 3.00 - 2.45 3.00 - 2.00 3.00 - 2.00 - 2.00 3.00 - 2.00 3.00						78.46	2.00	<u>~~~</u> ~~~	subangular to subrounded.	_		2.0
240-243       9110       N=17	2.00 - 3.00	D11										
3.00       834       77.26       3.20       100-100-100000000000000000000000000000	2.00 - 2.45				N=17 (1,1/2,4,6,5)			$\sim \sim \sim$				
3.00       3.00       122       3.00							(1.20)		limestone.			2.5 -
3.00       3.00       122       3.00								×				-
3.00       3.00							E	<u>x _ 0</u>				3.0
3.00       3.00       SPT (C)       Somm       76,76       (0.50)       Somm       fme to coarse, angular to subangular.       Image: Somm       Image:						77.26	3.20	×°	Yellowish brown sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is	-		-
3.20 - 3.70       915       3.70       76.76       3.70       3.70       Gopen Hole Boring, Driller Described:					75 (4,5/75 for		(0.50)	$\times \times \times \times \times$				3.5 -
3.30 3.70 3.70 3.70 3.70 3.70 3.70 3.70	2 20 2 70	D15			50mm)	76.76	3.70	XXXXX		_		
3.70 - 3.70       SPT (C)       S0 (25 for 0mm/S0       T5.35       5.10       Image: Control (1.40)       Imag							E					
5.10 - 5.18       SPT (c)       S0 (50 for 75mm/50 for 0mm)       75.36       5.10       End of borehole at 5.100m       Image: Control of the con	3.70 - 3.70	SPT (C)						0				4.0
5.10 - 5.18       SPT (C)       S0 (50 for 75mm/50)       75.36       5.10       End of borehole at 5.100m       Image: Control of the control of					for 0mm)		(1.40)	0				-
5.10 - 5.18       SPT (C)       S0 (50 for 75mm/50)       75.36       5.10       End of borehole at 5.100m       Image: Control of the set of the							(1.40)	0				4.5 -
5.10 - 5.18 SPT (C) S100 S0 (S0 for 75mm/S0 75.36 5.10 C - End of borehole at 5.100 For 0mm) S1050 for 75mm/S0 75.36 5.10 C - End of borehole at 5.100 For 0mm								0				
5.10-5.18       SPT (C)       S0 (50 for 75mm/50)       75.36       5.10       End of borehole at 5:100m         for 0mm)       for 0mm)       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m         state       Find of borehole at 5:100m       Find of borehole at 5:100m       Find of borehole at 5:100m <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Ē</td> <td>0,00</td> <td></td> <td></td> <td></td> <td>5.0</td>							Ē	0,00				5.0
Remarks       Numerical and a structure dup client to move off and relocate to X2201-CPRC01A.       Vater Addee       Vater Addee       Vater Addee       Consents of the movement	5.10 - 5.18	SPT (C)				75.36	5.10		End of borehole at 5.100m	-		-
Remarks       Solution Action Description Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Added to Mater Strike - General To move the Time Mater at the Mater at												
Remarks       Solution of the control of							-					5.5 -
Remarks       Solution of the control of												
Remarks       Mater Added       Nature 4 and a 1.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike- General         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike- General         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Total and Conselling Details							<u>-</u> -					6.0
Remarks       Mater Added       Nature 4 and a 1.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike- General         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike- General         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to \$5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Total and Conselling Details							-					
Remarks       Solution terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Vater Added Vater Strue - General Procession												6.5 -
Remarks       Solution terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Vater Added Vater Strue - General Procession												
Remarks       Solution terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Vater Added Vater Strue - General Procession							Ē					-
Remarks       Sole Percussion terminated at 3.70m due to possible boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike - General         Image: Non-structure in the image of the							-					7.0
Remarks       Sole Percussion terminated at 3.70m due to possible boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike - General         Image: Non-structure in the image of the							Ē					
Remarks       Subject of the construction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike - General         From (m)       To (m)       Struck at (m)       Casing Details         To (m)       Data (m)       Time (mm)       Time (mm)         3.70       Time (mm)       Time (mm)       Time (mm)         3.70       Time (mm)       Time (mm)       Time (mm)         3.70       Time (mm)       Time (mm)       Time (mm)     <												7.5
Remarks       Subject of the construction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added       Water Strike - General         From (m)       To (m)       Struck at (m)       Casing Details         To (m)       Data (m)       Time (mm)       Time (mm)         3.70       Time (mm)       Time (mm)       Time (mm)         3.70       Time (mm)       Time (mm)       Time (mm)         3.70       Time (mm)       Time (mm)       Time (mm)     <							Ē					
Remarks         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.         Value Added       Vater Added         Vater Added       Vater Strike - General         From (m)       To (m)         3.00       3.60         3.70       200         3.70       200         3.70       200         3.70       200         3.70       200							È.					8.0
Remarks         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.         Value Added       Vater Added         Vater Added       Vater Strike - General         From (m)       To (m)         3.00       3.60         3.70       200         3.70       200         3.70       200         3.70       200         3.70       200							Ē					
Remarks         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.         Value Added       Vater Added         Vater Added       Vater Strike - General         From (m)       To (m)         3.00       3.60         3.70       200         3.70       200         3.70       200         3.70       200         3.70       200							Ē					
Remarks         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.         Water Added       Water Strike - General         From (m)       To (m)         3.20       3.60         Casing Details       To (m)         To (m)       To (m)         To (m)       To (m)         3.70       200							E .					8.5
Remarks         Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.         Water Added       Water Strike - General         From (m)       To (m)         3.20       3.60         Casing Details       To (m)         To (m)       To (m)         To (m)       To (m)         3.70       200							Ē					
Remarks       Struck at (m) Casing to (m) Time (min) Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added Water Strike - General From (m) To (m) Struck at (m) Casing to (m) Time (min) Rotary (m) Time (m) Rotary (m) Time (							Ē					9.0 -
Remarks       Struck at (m) Casing to (m) Time (min) Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Water Added Water Strike - General From (m) To (m) Struck at (m) Casing to (m) Time (min) Rotary (m) Time (m) Rotary (m) Time (												
Mater Added       Water Added       Water Added       Water Strike - General         Remarks       Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Vater Added       Water Added       Water Added       Water Added       Casing to (m)       Time (min) Rose to (m)         3.20       3.60       0       1 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Ę</td> <td></td> <td></td> <td></td> <td></td> <td>9.5 -</td>							Ę					9.5 -
Mater Added       Water Added       Water Added       Water Strike - General         Remarks       Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Vater Added       Water Added       Water Added       Water Added       Casing to (m)       Time (min) Rose to (m)         3.20       3.60       0       1 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>È</td> <td></td> <td></td> <td></td> <td></td> <td>-</td>							È					-
Mater Added       Water Added       Water Added       Water Strike - General         Remarks       Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       Vater Added       Water Added       Water Added       Water Added       Casing to (m)       Time (min) Rose to (m)         3.20       3.60       0       1 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Ē</td> <td></td> <td></td> <td></td> <td></td> <td></td>							Ē					
Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       From (m) To (m) Struck at (m) Casing to (m) Time (min) Rose to (m) Struck at (m) Casing to (m) Struck at (							Ē					10.0 -
Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       From (m) To (m) Struck at (m) Casing to (m) Time (min) Rose to (m) Struck at (m) Casing to (m) Struck at (			-				E			⊢		
Cable Percussion terminated at 3.70m due to possible boulder obstruction. Rotary Open Hole techniques employed to 5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.       From (m) To (m) Struck at (m) Casing to (m) Time (min) Rose to (m) Struck at (m) Casing to (m) Struck at (	<u> </u>								Water Addad Water	Strike	- Genera	
5.10m upon encountering a boulder obstruction. Instructed by client to move off and relocate to XC201-CPRC01A.           Casing Details         Chiselling Details           To (m)         Diam (mm)           3.70         200           3.20         3.40		n termina	ated a	1 3 7	Om due to nossible h	oulder d	bstruction	Rotary	Prom Hole techniques ampleved to From (m) To (m) Struck at (m) Casing			
To (m)         Diam (mm)         From (m)         To (m)         Time (hh:mm)           3.70         200         3.20         3.40         00.40												
To (m)         Diam (mm)         From (m)         To (m)         Time (hh:mm)           3.70         200         3.20         3.40         00.40										ellinø	Details	
									To (m) Diam (mm) From (m)	To (n	n) Tin	
										3.40		

6				Project		<b>Project</b>						No.:
				19-135 <b>Coordi</b>		Cork Li	ne Level Crossings		xC	201	-CPI	RC01.
l	bge	J		coorai			Éireann / Irish Rail		5	Shee	et 1	of 2
Method:					E		Representative:		Sc	ale:	1	:50
	sion+Rotary O	pen			Ν	JACOBS	•				-	A
Plant:				Ground	d Level:	Dates:			Dr	ille	÷ +	NOB
Pilcon+T44					mOD		08/06/2020 - 22/06/2020		_	gge	r: ⊪	+
Depth (m)	Sample / Casing Depth Tests (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description		Water	Ва	ckfill	1
0.20 - 0.50 0.20 - 0.50 0.50 0.50 - 1.20 0.50 - 1.20 1.20 - 2.00 1.20 - 2.00 1.20 - 1.65	B1 D2 ES3 B4 D5 B6 D7 SPT (C)		N=6 (1,1/1,2,1,2)		(0.20) 0.20 (1.00)		TOPSOIL Brown slightly silty slightly sandy CLAY with mediu is fine to coarse. Gravel is fine to coarse, angular t are angular to subrounded, predominantly grey lin Soft brown mottled grey slightly sandy gravelly CL content. Sand is fine to coarse. Gravel is fine to co subrounded. Cobbles are angular to subrounded,	o subrounded. Cobbles nestone. AY with medium cobble arse, angular to	_			1.0 -
1.50 2.00 - 2.20 2.00 - 2.20 2.00 - 2.45 2.20 - 2.40 2.20 - 2.40	N=6 ES8 B9 D10 SPT (C) N=11 B11 D12		N=11 (1,3/2,3,3,3)		(0.80) 2.00 (0.20) 2.20 (0.20) 2.40		limestone. Firm brown slightly sandy slightly gravelly silty CLA content. Sand is fine to coarse. Gravel is fine to co subrounded. Cobbles are subangular to subround Light brown slightly sandy slightly silty gravelly CLA content. Sand is fine to coarse. Gravel is fine to co	Y with medium cobble arse, subangular to ed. YY with low cobble		•		2.0 -
2.40 - 3.40 2.40 - 3.40 3.00 3.00 - 3.46 3.40 - 3.60 3.40 - 3.60	B13 D14 ES15 SPT (C) N=68 B16 D17		N=68 (3,5/68 for 305mm)		(1.00) 3.40 (0.20) 3.60		Subrounded. Cobbles are subangular. Very Stiff - Hard grey / brown slightly sandy gravel high cobble content. Sand is fine to coarse. Gravel subangular to subrounded. Cobbles are subround Dark grey slightly clayey sandy very gravelly suban COBBLES with low boulder content. Open Hole Boring, Driller Described:	is fine to coarse, ed.	-			3.0 -
5.10 - 5.18	SPT (C)		50 (25 for 0mm/50 for 0mm) 50 (25 for 75mm/50				BOULDERS with sand and gravel.					4.0 -
6.60 - 6.90	SPT (C)		for 0mm) 88 (16,18/88 for 150mm)		(4.50)							6.5
8.10 - 8.25	SPT (C)		50 (14,20/50 for Omm)		8.10		Open Hole Boring, Driller Described: BOULDERS		<b>-</b>			7.0
9.60 - 9.68	SPT (C)		50 (25 for 75mm/50 for 0mm)									* 8.5 * 9.0 * 9.5
					-		Continued on Next Page					<b>I</b>
Remarks				<u> </u>		<u> </u>	From (r 2.20	3.40 2.20 5.60 5 8.60 7 9.60 8	g to (m) 5.60 7.60 8.50	Time 2 2 2 2 2	[min) <b>R</b> ) ) )	Rose to 2.20 4.90 7.60 8.50
							To (m)	Diam (mm) From (m)	elling To (r	n)	Time	e (hh:m
			due to possible boulde				3.60 19.60	200 3.40 151	3.60	)		01:00

		8		Project	: No.:	Project	Name:	Bo	orehole	No.
C	<b>).C</b> /		1	19-135		Cork Li	ne Level Crossings	xc	201-CPR	۲C01
	DOF	20		Coordi	nates:	Client:			Sheat 2	of 7
	~9		J		E	larnród	Éireann / Irish Rail		Sheet 2	Ur 2
Method:			-	1		Client's	Representative:	Sc	ale: 1:	:50
Cable Percuss	sion+Rotary	v Open			Ν	JACOBS				A
Plant:				Ground	d Level:	Dates:			+	NO
Pilcon+T44					mOD		08/06/2020 - 22/06/2020		gger: I⊦	+
Depth (m)	Sample / G	Casing Water Depth Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legenu	Description	Water	Backfill	1
(m) 10.60 - 10.90 13.60 - 13.90 16.60 - 17.05	Tests         SPT (C)         SPT (C)         SPT (C)         SPT (C)	(m) (m)	N=81 (11,11/16,20,20,25)	(mOD)	(Thickness) (6.00) (6.00) (1.50) (1.50)		Open Hole Boring, Driller Described: Sandy gravelly CLAY Open Hole Boring, Driller Described: Sandy CLAY with boulders.			11.0 - 11.0 - 11.0 - 12.0 - 12.5 13.0 - 13.5 14.0 - 14.5 15.5 16.0 - 16.5 16.5
					(2.50)		Open Hole Boring, Driller Described: BOULDERS			17.0 17.5 18.0 18.5 19.0
19.60 - 19.82	SPT (C)		70 (17,19/70 for 75mm)		19.60		End of borehole at 19.600m			20.0
Remarks							Water Added	Water Strike		
							2.20 3.40 2.20	tt (m) Casing to (m)	20	2.20
							5.6i 8.8i 9.6i	7.60	20 20 20	4.90 7.60 8.50
							Casing Details	Chiselling		
								n (m) To (1 40 3.6	11) (ime	e (hh:m 01:00

6		۸.		Project		Project					No.:
				Coordi		Cork Li	ne Level Crossings		201	-CP	KCU
	Dye	20		55755			l Éireann / Irish Rail		Shee	t10	of 2
Method:			/				s Representative:	Sc	ale:	1:	50
Cable Percuss	ion+Rotary	/ Oper	ı	62450	1.31 N	JACOB:			illor	. A	A
Plant:				Ground Level:		Dates:		Driller: <sup>AA</sup> +NOB			
Pilcon+T44			1		8 mOD		09/06/2020 - 17/06/2020	_	gge	:: I⊦	
Depth (m)	Sample / Tests	Casing Wa Depth Dep (m) <sup>(m</sup>	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Ba	kfill	
0.05 0.20 - 1.20 0.20 - 1.20 0.50	ES1 B2 D3 ES4			81.78	(0.20) 0.20 (1.00)		TOPSOIL Orange brown slightly sandy gravelly CLAY with low cobble content and frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.			· · · · · · · · · · ·	0.5
1.20 - 2.00 1.20 - 2.00 1.20 - 1.65 1.50	B5 D6 SPT (C) N=13 ES7		N=13 (2,4/3,3,3,4)	80.78	1.20 (0.80)		Firm light brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.		•		1.0 -
2.00 - 2.50 2.00 - 2.50 2.00 - 2.45	B8 D9 SPT (C) N=27		N=27 (1,1/4,5,8,10)	79.98	2.00		Stiff light brown slightly gravelly sandy silty CLAY with low cobble content Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.				2.0 -
2.50 - 2.80 2.50 - 2.80 2.80 - 3.30 2.80 - 3.30 3.00	B10 D11 D12 D13 ES14			79.48	2.50 (0.80)		Light brown slightly gravelly sandy CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded.				2.5
3.00 - 3.00 3.30 - 3.30	SPT (C)		50 (25 for 0mm/50 for 0mm) 50 (25 for 0mm/50 for 0mm)	78.68	3.30		Open Hole Boring, Driller Described: Boulder CLAY.				3.5
4.70 - 5.01	SPT (C)		N=107 (9,11/107 for 160mm)		(2.40)						4.5 5.0 -
6.20 - 6.51	SPT (C)		N=103 (10,12/103 for 160mm)	76.28	5.70		Open Hole Boring, Driller Described: Sandy gravelly boulder CLAY.				6.0
					(3.00)						6.5 7.0 7.5
				73.28	8.70		Open Hole Boring, Driller Described: Sandy CLAY				8.0 8.5 9.0
9.20 - 9.60	SPT (C)		N=67 (9,9/67 for 255mm)		(2.00)						9.5 10.0
		_			-	말음을	Continued on Next Page	+			┞
Remarks			1	<u> </u>	1	<u> </u>		er Strike			se to
Cable Percussion	terminated :	at 3 30	n due to probable bould	er obstru	ction Rotary	Onen Ho	To (m) Diam (mm) From (m) 3.30 200 2.60 2.00 2.60	hiselling To (1 2.6 3.0 3.3	m) 0 0	Time 0 0	(hh:m 00:15 00:20 00:15

6		$\Lambda$			-	No.:	Project	ne Level Crossings	v.	C201 CT	No.
	<b>K</b>				19-135 <b>Coordi</b>		Cork Li	ne Level Crossings		C201-CF	-RUU
l	bge	30	,	J	55755			Éireann / Irish Rail		Sheet 2	of 2
Method:			_		55/55	5.87 E		s Representative:	Sc	cale: 1	L:50
Cable Percuss	sion+Rotar	у Ор	en		62450	1.31 N	JACOB				۱A
Plant:					Ground	d Level:	Dates:				NO
Pilcon+T44					81.98	3 mOD		09/06/2020 - 17/06/2020	Lo	ogger:	Н
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfil	11
10.70 - 11.10	SPT (C)			N=70 (14,14/70 for	71.28	10.70		Open Hole Boring, Driller Described:			10.5
				255mm)		(2.00)		Gravelly SAND with boulders.			11.0 11.5
											12.0 12.5
					69.28	12.70		Open Hole Boring, Driller Described: SAND with boulders.			13.0 13.5
3.70 - 13.78	SPT (C)			50 (25 for 75mm/50 for 0mm)		(2.00)					14.0
					67.28	14.70	000 	Open Hole Boring, Driller Described:			14.5
						(1.00)		Boulder CLAY.			15.0
					66.28	15.70		Open Hole Boring, Driller Described: Gravelly SAND with boulders.			16.0
16.70 - 17.00	SPT (C)			78 (10,16/78 for 150mm)		(3.00)					16.5 17.0 17.5 18.0
					63.28	18.70		Open Hole Boring, Driller Described: Very sandy CLAY with boulders.			18.5 19.0
						(1.00)					19.0
19.70 - 20.00	SPT (C)			78 (11,17/78 for 150mm)	62.28	19.70		End of borehole at 19.700m			20.0
											20.0
Remarks								Water Added           From (m)         To (m)         Struct	Water Strike		
								Casing Details	Chiselling	g Detaile	
								To (m) Diam (mm) Fr	om (m) To (	(m) Time	e (hh:m
		at 2 2	Om	dua ta probabla bauldi	ar abatruu		Onan IIa	a.3.0 200 19.70 151 200 151 151 200	2.60 2.6 3.00 3.0 3.30 3.3	20	00:15 00:20

Appendix C

**Trial Pit Logs** 

6	Å		Project	t No.:	-	t Name:			Tr	ial Pit	No.:
C	<b>)_C</b> //\		19-135			ne Level Crossings			2	XC201	L-TP01
	Dgeo		Co-ord		Client:					Sheet	1 of 1
Method:		J	55747	3.29 E		l Éireann / Irish Rail s <b>Representative:</b>				ale:	1.20
Excavation			62470	6.32 N	JACOB				50	.aie:	1.20
Plant:			Ground	d Level:	Date:	_			D	river:	AL
Kobelco SK14	IOSRLC			9 mOD	03/07/	2020			Lo	ogger:	MN
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)			Description		Water		
0.05	ES1		79.39	- - (0.20) - 0.20		TOPSOIL: Soft dark brown slight and frequent rootlets, moist SUBSOIL: Firm orange brown sli		-			
			79.19	- (0.20) - 0.40	×	occasional rootlets, moist. San predominantly limestone.	d fine to coarse. Gr	avel fine to coarse			
0.50 0.50 - 1.00 0.50 - 1.00	ES2 B3 D4		75.15	-	8 9 9 9 9 9 9 9 9 9 9 9 9 9	Stiff yellowish brown and light g cobble and small boulder conte to coarse. Gravel, cobbles and predominantly light and dark gr	ent, moist. Sand fin boulders subangula	e to coarse. Gravel f			0.5 —
1.00	ES5			- - - (1.30) -	10 10 10 10 10 10 10 10 10 10						1.0
				-	x x y y y y y y y y y y y y y						1.5 -
1.70 - 2.20 1.70 - 2.20	B6 D7		77.89	- 1.70 - - - - - - -	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Firm yellowish brown sightly sa cobble and boulder content, ve coarse. Gravel fine to coarse. C subrounded predominantly ligh 1.0m x 0.6m x 0.5m.	ry moist becoming Gravel, cobbles and	wet. Sand fine to boulders subangula	r to		2.0 —
2.20 - 2.50 2.20 - 2.50	B8 D9			- (0.80) - - - - - -	200 200 200 200 200 200 200 200 200 200						
2.70 - 3.20 2.70 - 3.20	B10 D11		77.09	- 2.50 - - - -	× × × × × × × × × × × × × ×	Very stiff yellowish to greyish bu medium cobble and boulder co fine to coarse, angular to subro to subrounded light and dark gr	ntent, moist. Sand unded. Cobbles an	fine to coarse. Grav		2	2.5 -
3.00	E512			- (0.70) - - -							3.0
			76.39	- 3.20 	<u>******</u> 8	End o	of trial pit at 3.200m				
				- - - - - -							3.5 —
				-							
Remarks				-				Stuikee	Stabili	tv:	
	ts attempted unsuc	ccessfully due to relati	vely high	granular co	ontent.		Water Struck at (m):	Strikes: Remarks:	Sides c	•	ng
							2.50		Width	n:	2.00
	at a d at 2 20	ither a large limeston							Lengtl		4.50

G			Project 19-135		-	t Name:			No.:		
					Cork Line Level Crossings				XC201-T		
l	ngeo		Co-ord		Client:	d Éireann / Irish Rail		S	heet	1 of 1	
Method:		<u>/</u>	55745	6.95 E		s Representative:		Sca	le:	1:20	
Excavation			62461	8.69 N	JACOB						
Plant:			Ground	d Level:	Date:	<u>,</u>		Dri	ver:	AL	
Kobelco SK14	40SRLC			4 mOD	03/07/	2020		Log	ger:	MN	
Depth	Sample / Tests	Field Records	Level	Depth (m)			Description	Water			
(m) 0.05	ES1		(mOD)	(Thickness)		TOPSOIL: Soft dark brown slight	ly sandy silty CLAY with occasional gravel,	5			
				(0.20)		frequent rootlets and occasiona	al roots, moist				
			80.04	0.20		SUBSOIL: Firm light brown mott	led orange slightly sandy slightly gravelly	-			
				(0.20)	×_×_	silty CLAY with occasional roots	and rootlets, moist. Sand fine to coarse.				
			79.84	0.40	<u>x</u>	Gravel fine to coarse predomina	sh brown and light grey sandy gravelly silty	-			
0.50	ES2			-		CLAY with medium cobble and I	ow small boulder content, moist. Sand fine			0.5	
0.50 - 1.00 0.50 - 1.00	B3 D4			-		to coarse. Gravel fine to coarse to subrounded predominantly li	. Gravel, cobbles and boulders subangular ight and dark grey limestone.				
				-	<u>x 0 x 8</u>						
				- (0.70)							
				-							
1.00	ES5			-						1.0 -	
			79.14	- 1.10	<u>×0×</u> 6	•				-	
			75.14	1.10	<u>~~~</u> 8		wn sandy gravelly silty CLAY with medium ry moist. Sand fine to coarse. Gravel fine				
						to coarse. Gravel, cobbles and l	boulders subangular to subrounded				
				-		predominantly light and dark gr conglomerate.	ey limestone with occasional purple				
				-	<u>x 0 4</u>						
1.50 - 2.00 1.50 - 2.00	B6 D7			-	<u>×°°×</u> 8					1.5	
				-	<u>×0×8</u>						
				- (1.30)	<u>×0×8</u>						
				-	<u>x 0 6</u>						
				-	<u>x</u> <u>x</u> <u>x</u>						
				-						2.0 -	
				-							
				ļ	<u>x 0 x 8</u>						
				-	<u>x 0 x 6</u>						
			77.84	2.40		Very stiff yellowish to greyish br	rown sandy gravelly silty CLAY with medium	-▼			
				-		cobble and boulder content, mo	pist with occasional wet pockets. Sand fine , angular to subrounded. Cobbles and			2.5	
2.60 - 3.10	B8			ŀ	$\begin{bmatrix} & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & & $	boulders subangular to subrour	nded light and dark grey limestone. Largest				
2.60 - 3.10	D9			ļ	$\begin{bmatrix} & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & & $	boulder is 0.7m x 0.45m x 0.4m					
				(0.0	$\begin{bmatrix} & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & & \\ & & & & & & & $						
				- (0.90)	<u> </u>						
3.00	ES10			-	<u> </u>					3.0 -	
				+ -	<u>x 0 x 6</u>						
				-	<u> </u>						
			76.94	- 3.30	<u>× 0 × 6</u>		f trial ait at 2 200m				
			-	-		End o	f trial pit at 3.300m				
				-						3.5	
				-							
				ŀ							
				-							
				-							
Remarks								bility	<i>,</i> .		
	sts attempted unsue	ccessfully due to relat	tively high	granular co	ontent.		Sic	es sp			
							Struck at (m): Remarks:	10			
							2.40	idth:		1.40	
		to a large boulder in						ngth:		5.60	

C			Projec			: Name:				: No.:
			19-135			ne Level Crossings		×	C201	L-TP03
l	<b>ugeo</b>			linates:	Client:	l Éireann / Irish Rail		S	heet	1 of 1
Method:		J	55763	8.45 E		s Representative:		Sci	ale:	1:20
Excavation			62441	5.67 N	JACOB					
Plant:			Groun	d Level:	Date:			Dr	iver:	AL
Kobelco SK1	40SRLC			0 mOD	03/07/	2020		_	gger:	MN
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend		Description	Water		
0.05	ES1			- (0.20)		TOPSOIL: Soft dark brown slight and frequent rootlets, moist	tly sandy silty CLAY with occasional gravel			
			82.70	- 0.20 - - (0.20)		silty CLAY with occasional rootle	orange brown slightly sandy slightly gravellets, moist. Sand fine to coarse. Gravel fine	/		
			82.50	- 0.40	80,00	to coarse predominantly limest	one. owish brown and light grey sandy gravelly	_		
0.50 0.50 - 1.00 0.50 - 1.00	ES2 B3 D4			-		silty CLAY with medium to high moist. Occasional large boulde	cobble and medium small boulder content, rs. Sand fine to coarse. Gravel fine to ulders subangular to subrounded			0.5
5.50 1.00				-	-0.00 8.02 -0.00		rey limestone with occasional purple			
				-	<u>~~~</u> 8					
1.00	ES5			-	<u>×0×</u> 8					1.0 -
1.00				-	-0 -0 8 -0 - 8 -0 - 90					
				- (1.50) -	-0, <u>-20</u> -0,-20 -0,-20					
				-	×0×8					
1.40 - 1.90 1.40 - 1.90	B6 D7			-	-0, 30 x 0, 26 -0, -0					1.5
				-	<u>****</u> ***					
				-						
				-	-0.90 *0-26 *0-26					
			81.00	- 1.90 - -	<u>x 0</u> 28		wn slightly sandy gravelly CLAY with Jlder content, wet. Sand fine to coarse.			2.0 -
				-	<u>×0</u> ~8	Gravel fine to coarse. Gravel, co subrounded predominantly ligh	obbles and boulders subangular to It and dark grey limestone.			
2.20 - 2.70 2.20 - 2.70	B8 D9			-	-0, 30 x 0, 26 -0, -0					
				-	<u>~~~</u> 0					
				(1.10)	<u>×0×</u> 8					2.5
				-	-0.90 *0-26 *0-26					
				-						
				-	<u>80</u> 28					
3.00	ES10		79.90	- - 3.00	-0- <u>-90</u> - x 090- x 090- 	Vory stiff vollowish to provide to	rown sandy gravelly silty CLAY with medium			3.0 -
3.00 - 3.50 3.00 - 3.50	B11 D12			-	<u>× 0</u> × 8	cobble and boulder content, mo	own sandy gravely sity CLAY with medium oist. Sand fine to coarse. Gravel fine to Cobbles and boulders subangular to			
				-		subrounded predominantly ligh				
				- (0.60) - -						
				-	<u>~~~~</u> 0					3.5
			79.30	- 3.60	<u>× 0 × 6</u>	End o	of trial pit at 3.600m	-		
				-						
				-						
				-			· ·			
<b>Remarks</b> Hand Vane Te	ests attempted unsu	ccessfully due to relat	tively high	ı granular co	ontent.		water strikes.	abilit <sup>i</sup> les co	<b>y:</b> ollapsi	ing
			_				Struck at (m): Remarks:			
								/idth	:	2.30
Trial Pit termi	nated at 3.60m due	to pit walls collapsing	g.				Le	ngth	:	4.80

6			Projec		Project Name: Cork Line Level Crossings				Trial Pit N		
			19-135						XC201		
	Dgeo			inates:	Client:			s	heet	1 of 1	
Mothad		J	55766	3.87 E		d Éireann / Irish Rail		-	ale:	1.20	
<b>Method:</b> Excavation			62433	6.31 N		s Representative:		Sca	ale:	1:20	
			Crown	d Lavali	JACOB	5		Dri	iver:	AL	
Plant: Kobelco SK14	40SRLC			<b>d Level:</b> 0 mOD	Date: 03/07/	2020		Log	gger:	MN	
Depth	Sample / Tests	Field Records	Level	Depth (m)			Description	Water		-	
(m) 0.05	ES1		(mOD)	(Thickness)		TOPSOIL: Soft dark brown slight	tly sandy silty CLAY with occasional gravel	5			
				(0.20)		and frequent rootlets, moist					
			84.00	0.20	×	SUBSOIL: Firm light brown, light	t greyish brown and orange brown slightly	-			
				(0.20)	×	sandy slightly gravelly silty CLAY to coarse. Gravel fine to coarse	with occasional rootlets, moist. Sand fine				
			83.80	0.40			light grey sandy gravelly silty CLAY with	-			
0.50	ES2			-	<u>x 0 6</u>	medium to high cobble and sma	all boulder content, moist. Sand fine to			0.5 -	
0.60 - 1.10	В3			-	<u>×0×</u> 6	subrounded predominantly ligh	Gravel, cobbles and boulders subangular to it and dark grey limestone.				
0.60 - 1.10	D4			-	<u>×0×</u> 6						
				-	<u>×0×</u> 6						
				- (0.90)	<u>x 0 x 8</u>						
1.00	ES5			-	<u>x 0 × 8</u>					1.0 -	
1.00	200			_	<u>8026</u>						
				-	<u>x 0 x 8</u>						
				-	<u>×0×6</u>						
1.30 - 1.80 1.30 - 1.80	B6 D7		82.90	- 1.30 -	<u>×0×</u> 6		andy gravelly CLAY with medium to high				
				-	<u>~0~6</u>		et. Sand fine to coarse. Gravel fine to ulders subangular to subrounded				
				-	<u>~0~8</u>		rey limestone. Boulders up to 0.7m. Pocket a sand from 1.6m to 1.8m at southeast	t		1.5 -	
				(0.60)	<u>~0~8</u>	corner.					
					× 0× 6	2 2 2					
				-	$\sim 0^{-6}$	8 7 -					
			82.30	- 1.90	<u>~~~</u>	Very stiff vellowish to grevish br	rown sandy gravelly silty CLAY with medium	_			
2.00 - 2.50	B8			_	× 0× 6	cobble and boulder content, mo	oist. Sand fine to coarse. Gravel fine to			2.0	
2.00 - 2.50	D9			-	× 0× 6	subrounded light and dark grey	Cobbles and boulders subangular to				
				-	× 0× 6	2 2 2					
				- (0.80)	× 0× 6						
				-	<u>~0~</u> 6	-					
				-	× 0× 6	2 2 2				2.5 -	
				-	<u>~~~</u> 8	2 * -					
			81.50	- 2.70	<u>~~~~</u> 0	5 5 2					
			81.50	2.70		End o	f trial pit at 2.700m				
				-							
				-						-	
				-						3.0 —	
				-							
				-							
				-							
				-							
				-						3.5 -	
				-							
				ŀ							
				-							
				-							
				-				_			
Remarks							Water Strikes: Sta	ability	<b>/</b> :		
Hand Vane Te	sts attempted unsue	ccessfully due to rela	tively high	granular co	ontent.			les co	llapsi	ng	
							1.20				
								/idth:		2.70	
rial Pit termir	nated at 2.70m due	to large boulder obs	tructions.				Le	ngth	:	4.60	

Appendix D

**Trial Pit Photographs** 

