



IRISH DRILLING LIMITED

LOUGHREA, CO. GALWAY, IRELAND

CONTRACT DRILLING
SITE INVESTIGATION

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PROPOSED DEVELOPMENT AT LOUGH ATALIA ROAD

SITE INVESTIGATION REPORT

Galway Harbour Company,
Galway Harbour,
Galway.

Tobin,
Consulting Engineers,
Fairgreen House,
Fairgreen Road,
Galway.

July 2011

FOREWORD

The borehole and trial pit records have been compiled from an examination of the trial pit and borehole samples by a Geotechnical Engineer and from the Driller's descriptions.

The report presents an opinion on the configuration of the strata within the site based on the borehole and trial pit results. The assumptions, though reasonable, are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes and trial pits.

The fieldwork was carried out in accordance with BS 5930:1999 Code of Practice for Site Investigations.

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1.0 Introduction.

Irish Drilling Ltd. (IDL) was instructed by Tobin Consulting Engineers, on behalf of Galway Harbour Company to carry out a site investigation on the site of a proposed civil works at Lough Atalia Road.

The proposed works includes for the lowering of the existing road under Lough Atalia Bridge by a depth of 1.20m.

The fieldwork commenced on June 13th 2011 and was completed on June 23rd 2011.

This site investigation was carried out to assess the feasibility of lowering the road under Lough Atalia Bridge, to assess the ground conditions and provide data to assist in the design of road formation.

In order to carry out the fieldwork at a busy road location Traffic Management Plans approved by the Local Authority would only allow fieldwork operations to be carried out and completed daily before noon.

2.0 Site & Geology

The site is located at Lough Atalia Bridge, Lough Atalia Road, Galway.

A Site plan (prepared by Tobin and amended by IDL to show 'as-built' locations in plan) is included with this report and shows the approximate fieldwork positions.

Geological Survey maps of the area indicate that the site is underlain by Glacial Till overlying Igneous Rock Formations.

3.0 Fieldwork.

The fieldwork consisted of the following:

Two light cable percussion (Shell & Auger) boreholes were bored to 'refusal' or to depths as instructed by the Client's Engineer, using a Dando 2000 Cable Percussion Drilling Rig.

In-Situ testing consisting of Standard Penetration Tests were carried out at regular intervals (predominantly 1.00m intervals).

Disturbed bulk soil samples were taken at each change in strata and were returned to the laboratory for logging and testing.

Four rotary core boreholes were completed using a BBS 37 Wireline Hydreq Drilling Rig.

The rotary core boreholes were carried out to establish rockhead and to establish the nature and integrity of the underlying rock.

NQ size (50mm diameter) coring was carried out, with samples stored in wooden boxes and returned to the laboratory where they were logged and photographed by a Geotechnical Engineer and presented for testing.

Four trial pits were excavated using a JCB excavator. The pits were logged and photographed by an Engineer with observations made on ground conditions, pit stability and water ingress.

The pits were also carried out to expose the foundations to the existing bridge abutments and the records of the foundations as exposed in the trial pits are included in Appendix 4 of this report.

Small and bulk disturbed soil samples were recovered at each change in strata and returned to the laboratory and presented for testing.

Prior to commencement of the boreholes and trial pits eight hand-dug inspection pits were carried out by John Madden & Sons Limited. Four of the pits were carried out at the trial pit locations with the remaining four completed at the rotary core borehole locations.

The inspection pits were carried out to observe and record the locations and depths of existing underground services. Observations were also made of ground conditions and whether any groundwater ingress was encountered.

The fieldwork was carried out in accordance with BS5930, 1999 Code of Practice for Site Investigations.

The soil and rock descriptions as noted on the borehole and trial pit logs are in general visual descriptions as observed and logged by our Engineers and are described in accordance with BS5930, 1999 Code of Practice for Site Investigations.

Where laboratory classification tests have been carried out on soil or rock samples then these visual descriptions have been amended accordingly to take into account the results of these classification tests.

4.0 Laboratory Testing

Representative samples recovered from the fieldwork were tested in the laboratory.

The test schedules were prepared by the Client's Engineer and included the following tests:

- * Natural Moisture Content.
- * Atterberg Limits.
- * Particle Size Distribution.
- * Sedimentation.
- * Chemical Tests (pH, Sulphate, Organic Content).

The test schedule also included the following tests on rock cores:

- * Point Load.
- * Uniaxial Compressive Strength.

The records of all fieldwork and laboratory test results are included in the Appendices of this Report.

5.0 Drawings

The report and logs should be read in conjunction with the following drawing:

<i>Drawing No.</i>	<i>Description</i>
1254-1011	Site Location Map ('as-built').

6.0 Ground Conditions.

Generally the soils are typical of Glacial Till with cohesive and non-cohesive materials encountered and with cobbles and large boulders being frequently encountered.

Made ground was encountered at many of the locations. The made ground generally comprised of hardcore and/or Clause 804 type material over silty gravelly sand and/or sandy gravelly clay with cobbles and boulders and concrete rubble.

Rock is generally very strong to extremely strong fresh granite.

For accurate details of Made Ground, sub-soil and rock conditions the logs should be consulted (see Appendices of the Report).

6.1 Groundwater.

There was no standing water in the trial pits, however water ingress was encountered in Trial Pit 2 at a depth of 0.80m (b.g.l.) which may have been seeping from the elevated ground to the west. Reference should be made to the logs in the Appendices of the Report for water observations.

Groundwater was not encountered during the boring of the cable percussive boreholes but it is considered possible that groundwater was sealed off from entering the boreholes by the steel casing used during the completion of these boreholes.

Groundwater inflows may occur during the excavation of trenches for the proposed pipelines and the rate of inflow will vary with the permeabilities of the soils and rock.

The following table summarises typical permeability values:

Coefficient of Permeability (m/sec)

SOILS

Gravel	$1 - 10^{-1}$
<i>Clean sands and sand-gravel mixtures</i>	$10^{-1} - 10^{-4}$
<i>Very fine sands, silts and silt/clay laminates</i>	$10^{-4} - 10^{-7}$
<i>Unfissured clays and silt/clay (>20% clay)</i>	$10^{-7} - 10^{-10}$
<i>Dessicated and fissured clays</i>	$10^{-1} - 10^{-7}$

ROCK

<i>Heavily fractured rock</i>	$1 - 10^{-1}$
<i>Open-jointed rock</i>	$10^{-1} - 10^{-3}$
<i>Jointed rock</i>	$10^{-3} - 10^{-6}$

It should be noted that where cavities are encountered that local permeabilities are likely to be higher than those quoted above.

7.0 Proposed Road Realignment

The light cable percussion boreholes 'refused' at depths ranging from 1.90m to 4.60m.

Bedrock was encountered in the rotary core boreholes at depths ranging from 6.60m to 8.60m below ground level and therefore rock will not be required to be excavated as part of the relocation of services or for the road realignment works.

For road formations, any loose or soft pockets of overburden should be removed and replaced with adequately compacted hardcore fill or 'lean-mix' concrete.

Excavations close to the existing bridge abutments will have to be carefully excavated, using appropriate machinery and temporary works, to avoid damaging the integrity of the existing structure.

In the interest of safety, personnel should not be allowed enter unsupported excavations deeper than 1.0m.

Excavations are likely to be unstable and some form of side supports are likely to be required to maintain stable temporary excavations.

The walls of excavations of depth in excess of 1.0m (with the exception of excavations in compact rock) may be secured by means of:

- Producing the excavation with inclined (escarpment) walls

- Installation of shoring, sheeting or bracing to the vertical walls to prevent movement that could cause damage to adjacent services, pavements and structures

Furthermore, the following requirements are recommended:

- Where possible at the crest of excavations, rainwater should be directed away from the excavation
- The escarpments should be checked after every rainfall and after a long break in work, as well as every time before starting work
- Safe distances must be maintained between the excavations and existing buildings
- The state of the lining or the escarpments must be inspected each time before works start in the excavation.

The use of sumps and pumping may be required to deal with groundwater inflows. This may be particularly likely during high tides, bearing in mind the very close proximity of the sea and during periods of high rainfall.

Excavations in the overburden and/or made ground are also likely to be difficult as the presence of boulders and cobbles was noted during the investigation.

The following parameters are recommended for retaining structures (lateral earth pressures)

Strata	Unit Wt. saturated/dry kN/m ³	Cohesion (undrained) kPa	Angle of internal friction φ degrees
Fill	22/20	0	20
Loose Sand and Gravel	20/16	0	28
Dense Sand and Gravel	21/17	0	35
Soft slightly organic clay	16/10	20	0
Firm sandy clay	17/12	40	0
Firm to stiff glacial till	20/17	75	0
Stiff glacial till	20/17	100	0
Very stiff glacial till	20/17	200	0
Rock	23	1,000	30 (drained)

The results of Sulphate and pH tests indicate that in general no special precautions are required with regard to protection of foundation concrete from chemical attack. Class 1 conditions apply.

It would be prudent, based on the structural engineer's recommendation, to carry out a vibration, noise and structural movement monitoring process before, during and after the construction works, in order to monitor and control excessive movements and vibrations with regard to the existing bridge structure. The advice of specialists should be obtained with regard to all types of monitoring.

Prior to construction works further site investigation operations could be considered, for example it would be prudent to carry out some Plate Bearing tests to confirm that road formation has been compacted adequately and to provide CBR values of formation before placing a sub-base.

Ronan Killeen
Chartered Engineer

REFERENCES:

- (1) B.S.5930:(1999), Code of Practice for Site Investigation.
- (2) B.S.1377:(1990), Methods of Test for Soils for Civil Engineering Purposes.
- (3) B.S.8004:(1986), Foundations.
- (4) Terzaghi, K. and Peck, R.B (1967) Soil Mechanics in Engineering Practice, 2nd ed., John Wiley, New York
- (5) Tomlinson M.J. (1980) Foundation Design and Construction, 4th ed., Pitman, London.

APPENDIX 1

BOREHOLE RECORDS
(SHELL & AUGER)



Irish Drilling Limited
Old Galway Road
Loughrea, Co. Galway
Telephone: 091 841274

BOREHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		BOREHOLE No BH 1
Job No	Date 13-06-11 13-06-11	Ground Level (m) 4.09	Co-Ordinates () E 130,388.7 N 225,146.6		
Engineer Tobin			GROUNDWATER STRIKES	Water strikes: Rose to (@ 20 min.): Sealed at: 1st: dry 2nd: 3rd:	Sheet 1 of 1 Rev.

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend (Thick-ness)	DESCRIPTION		
						MADE GROUND: Clause 804 type material.		
					(1.70)			
				2.39	1.70			
2.00	CPT	N = 7 (3, 2, 1, 2, 2, 2)				Loose light brown slightly sandy COBBLES with brown slightly gravelly slightly sandy CLAY. Cobbles are rounded to subrounded and angular.		
2.00	B							
3.00	CPT	N = 10 (2, 2, 3, 2, 2, 3)			(2.90)	3.00m: becoming medium dense.		
3.00	B							
4.00	CPT	N = 19 (3, 4, 5, 4, 5, 5)						
4.00	B							
4.60	CPT	50 for 0 mm (25, -, 50)		-0.51	4.60	TP terminated at 4.60m bgl - refusal.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water (bgl) Depth, m	From	To	Hours	From	To	
						4.6	4.6	1			BH backfilled.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Dando 2000	Bit Design	Driller DK	Logged By
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BOREHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		BOREHOLE No BH 2
Job No	Date 14-06-11 14-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin			GROUNDWATER STRIKES Water strikes: Rose to (@ 20 min.): Scaled at: 1st: dry 2nd: 3rd:		Sheet 1 of 1 Rev.

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend (Thick-ness)	DESCRIPTION		
1.50	B	50 for 0 mm (25, -, 50)			(1.50)	MADE GROUND: Clause 804 type material.		
1.90	CPT				1.50	Soft mottled brown slightly gravelly sandy CLAY.		
					1.90	TP terminated at 1.90m bgl - refusal.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water (bgl) Depth, m	From	To	Hours	From	To	
						1.9	1.9	1			BH backfilled.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Dando 2000	Bit Design	Driller DK	Logged By
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APPENDIX 2

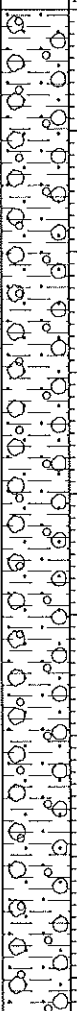

BOREHOLE RECORDS
(ROTARY CORE)



Irish Drilling Limited
Old Galway Road
Loughrea, Co. Galway
Telephone: 091 841274

DRILLHOLE LOG

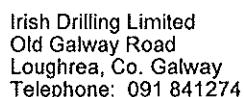
Project Lough Atalia Bridge			Location Lough Atalia, Galway		DRILLHOLE No RC 1
Job No	Date 20-06-11 20-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin					Sheet 1 of 1 Rev.

RUN DETAILS						STRATA		Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
						Discontinuities	Detail		
0.00	11 (-) -	NA			(8.30)	0.00 m to 8.30m: overburden.	Angular and subangular medium to coarse limestone GRAVEL with limestone cobbles and some brown slightly sandy gravelly SILT/CLAY. Gravel is subangular and subrounded fine and medium of assorted limestone.		
2.30	60 (-) -								
3.30	21 (-) -								
4.00	25 (-) -								
5.00	56 (-) -								
5.90	1 (-) -								
7.00	25 (-) -								
8.00	17 (-) -								
8.30	100 (99) 98								
8.90	100 (99) 98	3		+ + + + + +	(0.90)	8.30 m to 9.20m: Closely spaced, dipping 6°, undulating, smooth.	Extremely strong apparently massive pinkish reddish brown groundmass with green black and greyish white equigranular phenocrysts GRANITE. Fresh.		
9.20	98				9.20		BH terminated at 9.20m on RE's instruction.		

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)	
												Borehole reinstated.



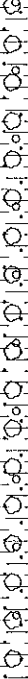
All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Hydreq	Bit NQ Design	Driller DK	Logged By EAT
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DRILLHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		DRILLHOLE No RC 2
Job No	Date 21-06-11 21-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin					Sheet 1 of 1 Rev.

RUN DETAILS				STRATA			Geology	Instrument/ Backfill	
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'ed Level	Legend	Depth (Thick- ness)	DESCRIPTION			
						Discontinuities			Detail
0.00	13 (-) -	NA			0.05	0.00 m to 8.60m: overburden.	TARMAC.		
2.20	25 (-) -				2.80	POSSIBLE MADE GROUND: Subangular medium gravel.			
3.80	40 (-) -					Grey slightly sandy gravelly SILT/CLAY. Gravel is subangular and subrounded fine and medium of assorted limestone clasts.			
4.50	43 (-) -								
5.90	50 (-) -								
6.90	35 (-) -								
7.40	60 (-) -								
7.90	30 (-) -								
8.60	57 (-) -								
9.60	100 (81) 0					15	8.60 m to 9.60m: Closely spaced, dipping 6 to 8, undulating, smooth, with a little brown silt. 8.61 m to 9.40m: Joint: vertical dip, irregular, locally undulating, rough, with a little grey clay, open.		
				BH terminated at 9.60m on RE's instruction.					

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)	
												Borehole reinstated.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Hydreq	Bit NQ Design	Driller DK	Logged By EAT
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DRILLHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		DRILLHOLE No RC 3
Job No	Date 22-06-11 22-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin					Sheet 1 of 2 Rev.

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
						Discontinuities	Detail	Main		
0.00	9 (-) -	NA			(6.60)	0.00 m to 6.60m: overburden.			Assorted limestone gravel and cobbles with some grey slightly sandy gravelly SILT/CLAY. Gravel is subangular and subrounded fine and medium of assorted limestone clasts.	
2.60										
3.60	20 (-) -									
4.40	50 (-) -									
5.40	30 (-) -									
6.60	25 (-) -				6.60	6.60 m to 9.70m: Closely spaced, dipping 12 to 14, undulating, smooth, with minor orange brown iron stain.			Very strong to extremely strong thinly banded grey and green fine grained MARBLE type material with much finely disseminated pyrite. Fresh.	
7.50	100 (88) 39	4		(3.10)	8.10 m to 8.30m: No recovery. Probable area of core loss as washout of fines during drilling.					
8.30	75 (59) 29	15								
9.10	100 (97) 71	NR?								
		6								
9.70	100 (97) 71	5				9.70	BH terminated at 9.70m on RE's			

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)	
												Borehole reinstated.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used	Hydreq	Bit Design	NQ	Driller DK	Logged By EAT
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DRILLHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		DRILLHOLE No RC 3
Job No	Date 22-06-11 22-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin					Sheet 2 of 2 Rev.

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
						Discontinuities	Detail	Main		
								instruction.		

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)	
												Borehole reinstated.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Hydreq	Bit NQ Design DK	Driller DK	Logged By EAT
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DRILLHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		DRILLHOLE No RC 4
Job No	Date 23-06-11 23-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin					Sheet 1 of 2 Rev.

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth	TCR (SCR)	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
Date	RQD					Discontinuities	Detail	Main		
0.00		NA								

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)	
												Borehole reinstated.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Hydreq	Bit NQ Design	Driller DK	Logged By EAT
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DRILLHOLE LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		DRILLHOLE No RC 4
Job No	Date 23-06-11 23-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin					Sheet 2 of 2 Rev.

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'ed Level	Legend	Depth (Thick- ness)	DESCRIPTION				
						Discontinuities	Detail	Main		
								BH terminated at 9.50m on RE's instruction.		

Drilling Progress and Water Observations								Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)	
												Borehole reinstated.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used Hydreq	Bit Design NQ	Driller DK	Logged By EAT
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APPENDIX 3

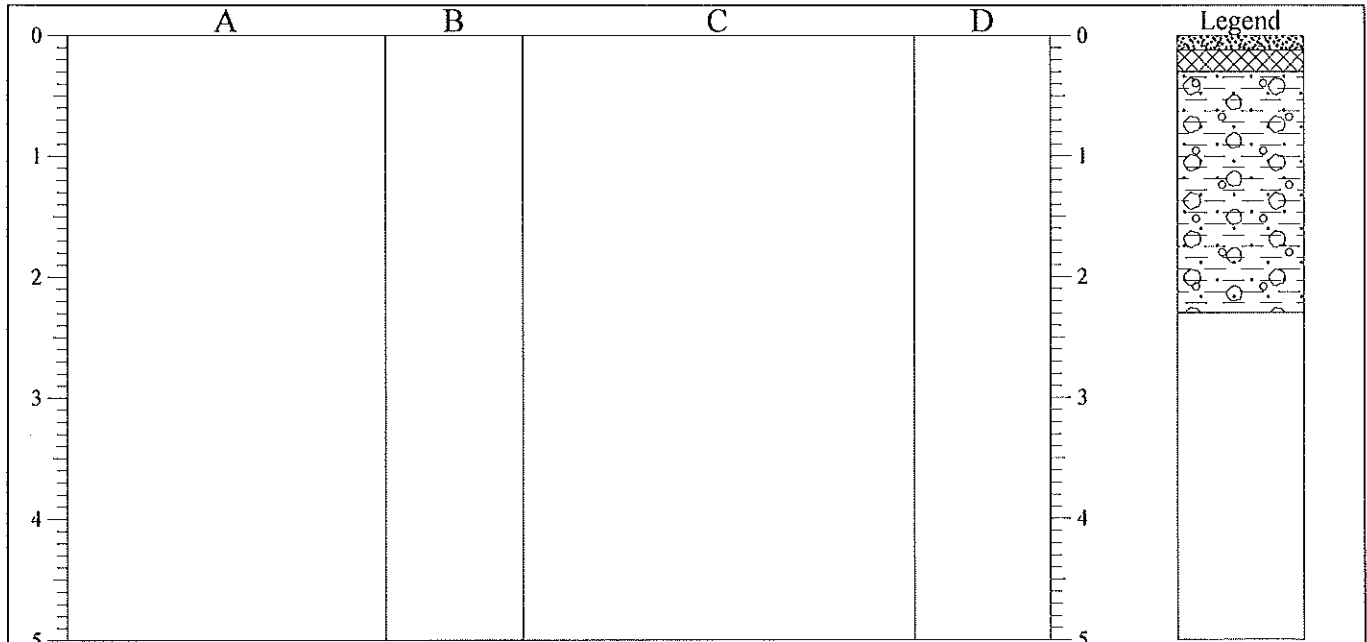
TRIAL PIT RECORDS



Irish Drilling Limited
Old Galway Road
Loughrea, Co. Galway
Telephone: 091 841274

TRIAL PIT LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		TRIAL PIT No TP 1
Job No	Date 09-06-11 09-06-11	Ground Level (m) 4.26	Co-Ordinates () E 130,377.8 N 225,151.9		
Engineer Tobin		GROUNDWATER STRIKES	Water strikes: Rose to (@ 20 min.): Sealed at: 1st: dry 2nd: 3rd:		Sheet Rev. 1 of 1

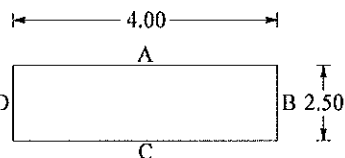


STRATA

SAMPLES & TESTS

Depth	No	DESCRIPTION	In Situ Tests	Water	Depth (m)	No	Remarks/Tests
0.00-0.12		CONCRETE: Footpath.					
0.12-0.30		MADE GROUND: Clause 804 type material.					
0.30-2.30		Firm light brown slightly sandy slightly gravelly CLAY with many cobbles. Cobbles are subangular and subrounded.			0.60 0.80	B J	
2.30		TP terminated at 2.30m bgl.					

Shoring/Support: N/A
Stability: Pit stable.



GENERAL REMARKS

Pit dry during excavation.

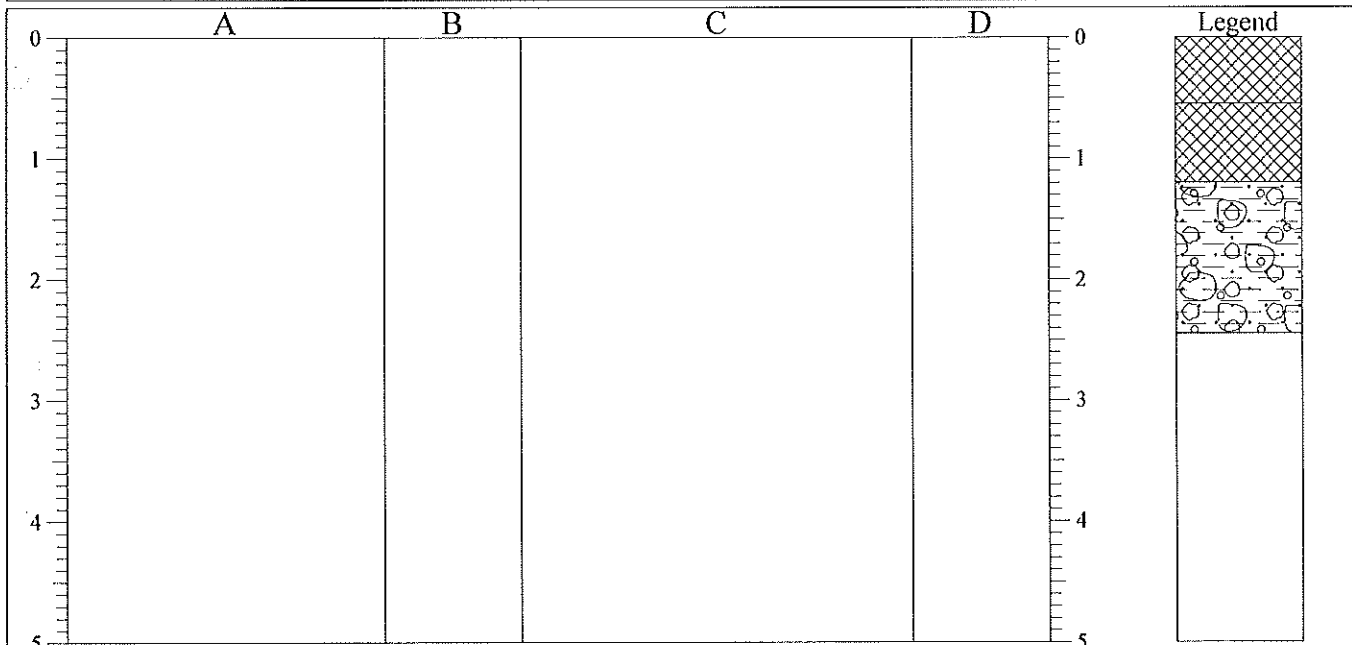
All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used JCB	Bit Design	Driller DF	Logged By
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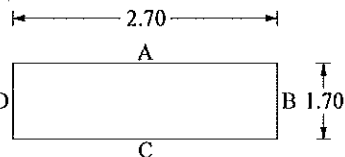
Irish Drilling Limited
Old Galway Road
Loughrea, Co. Galway
Telephone: 091 841274

TRIAL PIT LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		TRIAL PIT No TP 2
Job No	Date 09-06-11 09-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin			GROUNDWATER STRIKES	Water strikes: Rose to (@ 20 min.): Sealed at: 1st: 1.20m 2nd: 3rd:	Sheet Rev. 1 of 1



Shoring/Support: N/A
Stability: Pit unstable. Sidewall collapse.



GENERAL REMARKS

Slight ingress of water at 1.20m bgl. Hydrocarbon odour from water.

All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used JCB	Bit Design	Driller DF	Logged By
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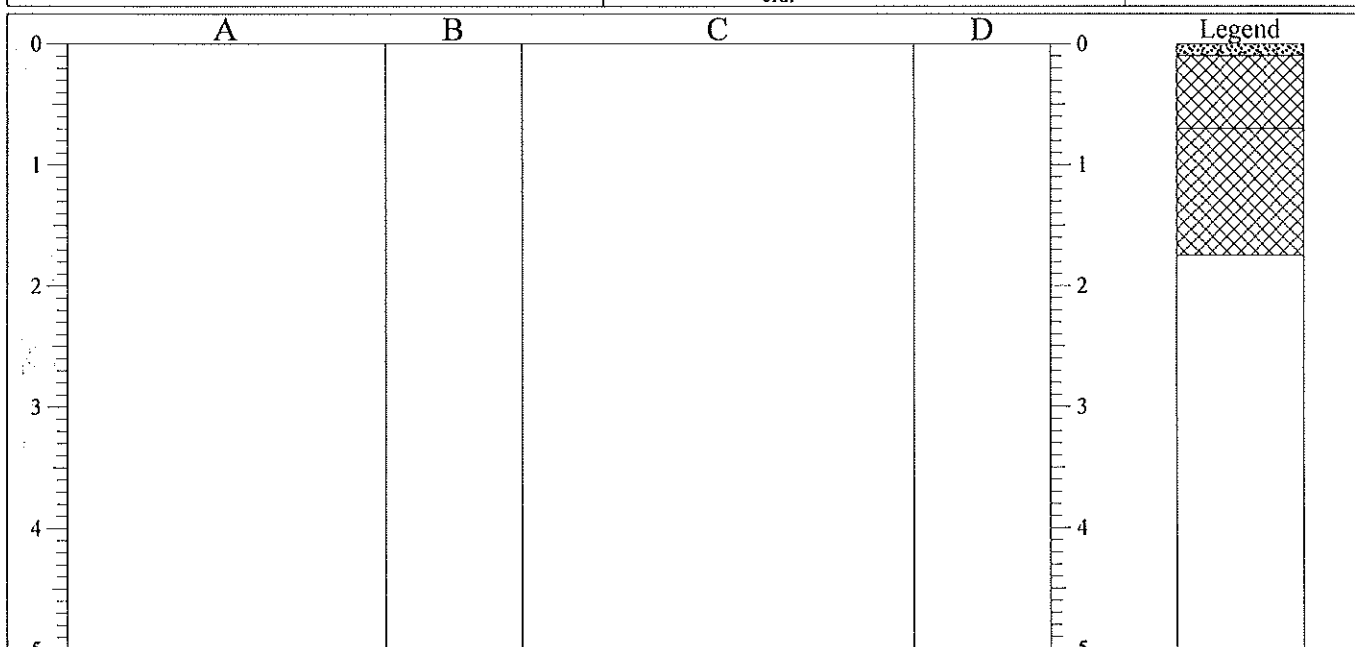
IDL AGS3 UK TP LOUGH ATALIA BRIDGE TFS.GPJ AGS 3.1.GDT 15/7/11



Irish Drilling Limited
Old Galway Road
Loughrea, Co. Galway
Telephone: 091 841274

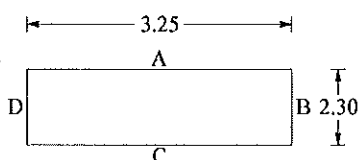
TRIAL PIT LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		TRIAL PIT No TP 3
Job No	Date 10-06-11 10-06-11	Ground Level (m) 4.05	Co-Ordinates () E 130,389.2 N 225,146.9		
Engineer Tobin			GROUNDWATER STRIKES Water strikes: Rose to (@ 20 min.): Sealed at: 1st: dry 2nd: 3rd:		Sheet Rev. 1 of 1



STRATA				SAMPLES & TESTS			
Depth	No	DESCRIPTION	In Situ Tests	Water	Depth (m)	No	Remarks/Tests
0.00-0.10		CONCRETE: Footpath.					
0.10-0.70		MADE GROUND: Clause 804 type material with grey silty sand.					
0.70-1.75		MADE GROUND: light brown silty sand & gravel with cobbles and concrete debris.			0.70	B	
1.75		TP terminated at 1.75m bgl - obstruction as top of foundation.					

Shoring/Support: N/A
Stability: Pit stable.



GENERAL
REMARKS

Pit dry during excavation.

All dimensions in
metres
Scale 1:62.5

Client **Galway Harbour
Company**

Method/ **JCB**
Plant Used

Bit
Design

Driller
DF

Logged By

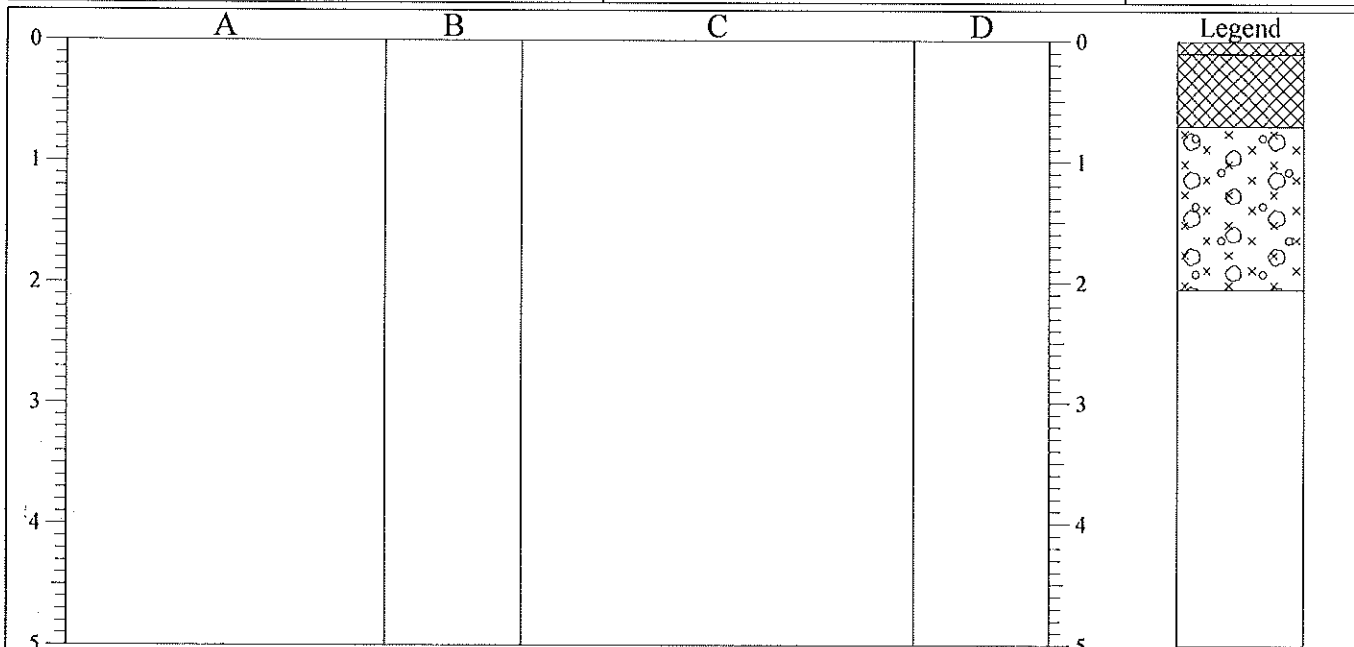
IDL AGS3 UK TP LOUGH ATALIA BRIDGE TPS.GPJ AGS 3.1.GDT 15/7/11



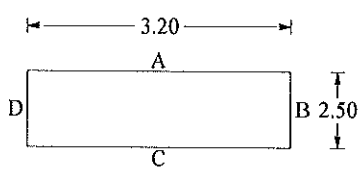
Irish Drilling Limited
Old Galway Road
Loughrea, Co. Galway
Telephone: 091 841274

TRIAL PIT LOG

Project Lough Atalia Bridge			Location Lough Atalia, Galway		TRIAL PIT No TP 4
Job No	Date 10-06-11 10-06-11	Ground Level (m)	Co-Ordinates ()		
Engineer Tobin		GROUNDWATER STRIKES Water strikes: 1st: dry 2nd: 3rd: Rose to (@ 20 min.): Sealed at:			Sheet Rev. 1 of 1



STRATA				SAMPLES & TESTS			
Depth	No	DESCRIPTION	In Situ Tests	Water	Depth (m)	No	Remarks/Tests
0.00-0.10		MADE GROUND: Tarmac over Clause 804 type material.					
0.10-0.70		MADE GROUND: Loose grey brown and black slightly silty sand & gravel.					
0.70-2.05		MADE GROUND: Soft light and dark brown slightly gravelly sandy CLAY with some cobbles and concrete debris.			0.80	B	
2.05		TP terminated at 2.05m bgl.					

Shoring/Support: N/A Stability: Pit stable. 	GENERAL REMARKS Pit dry during excavation.
---	--

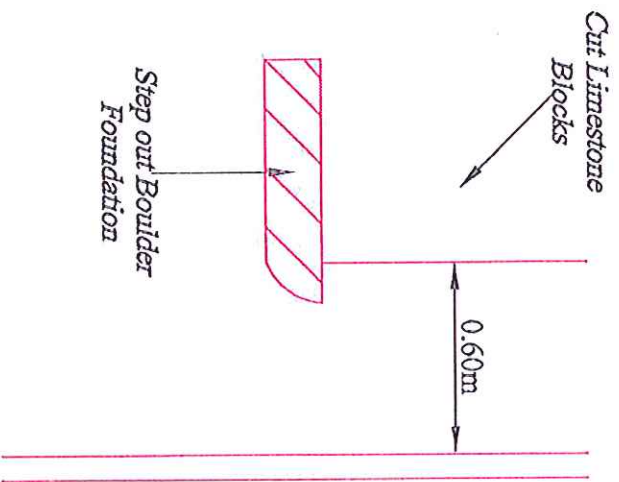
All dimensions in metres Scale 1:62.5	Client Galway Harbour Company	Method/ Plant Used JCB	Bit Design	Driller DF	Logged By
--	--------------------------------------	----------------------------------	---------------	---------------	-----------

APPENDIX 4

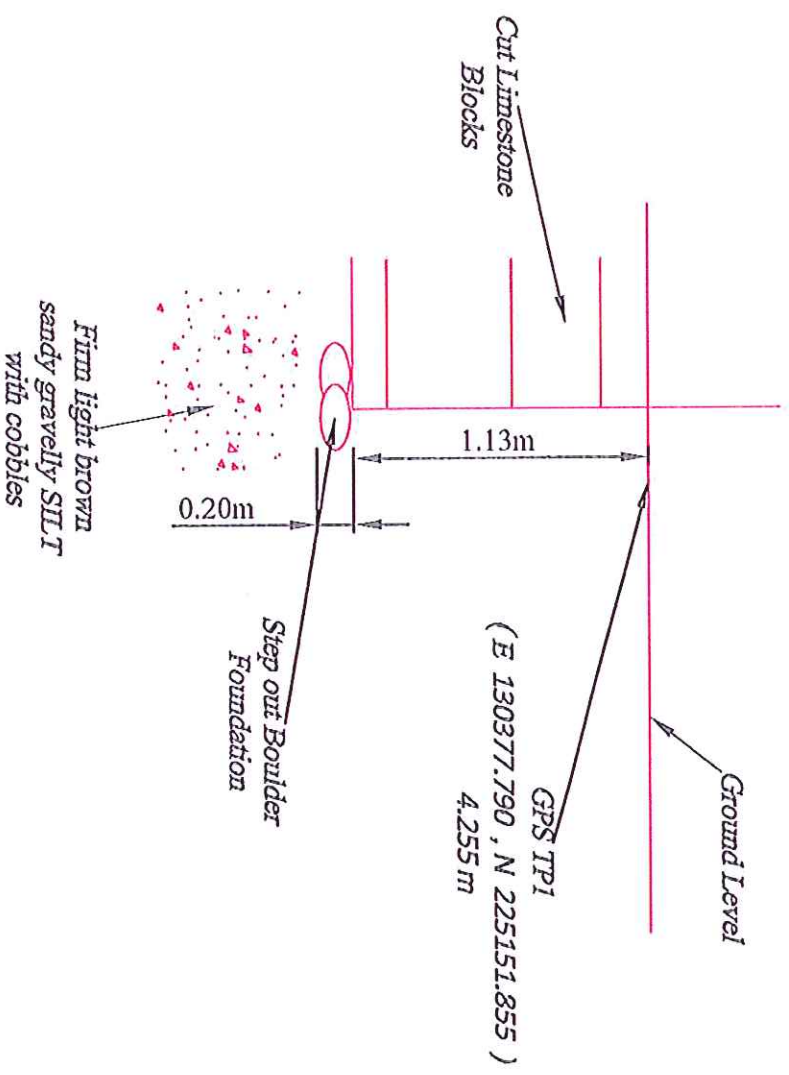
INSPECTION PIT RECORDS

TP-1 (Lough Atalia) 9/06/11 Scale: not to scale

Plan

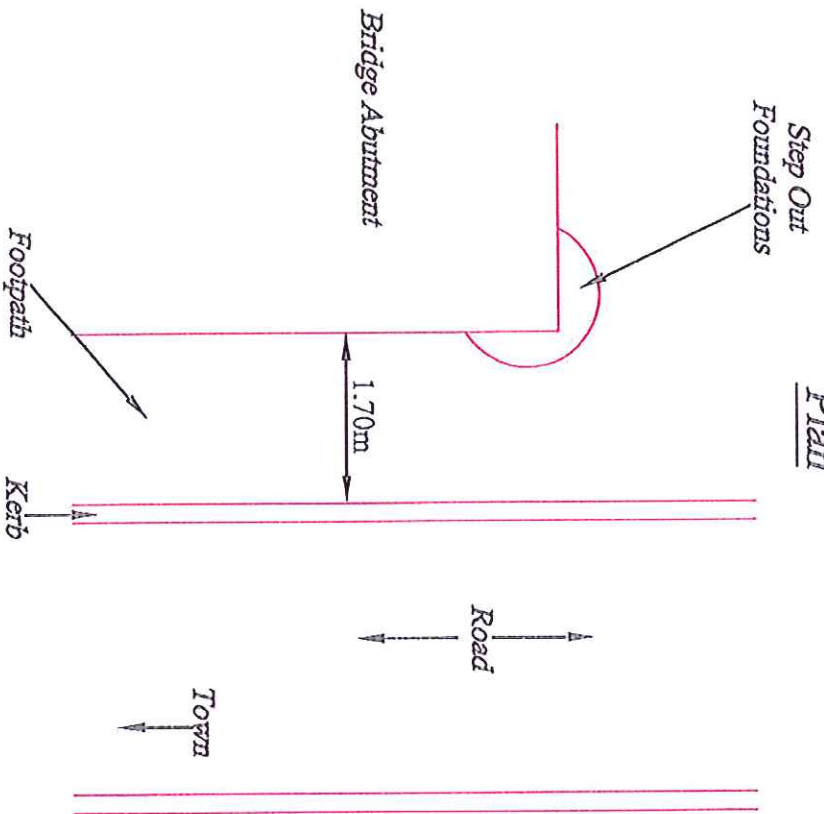


Section

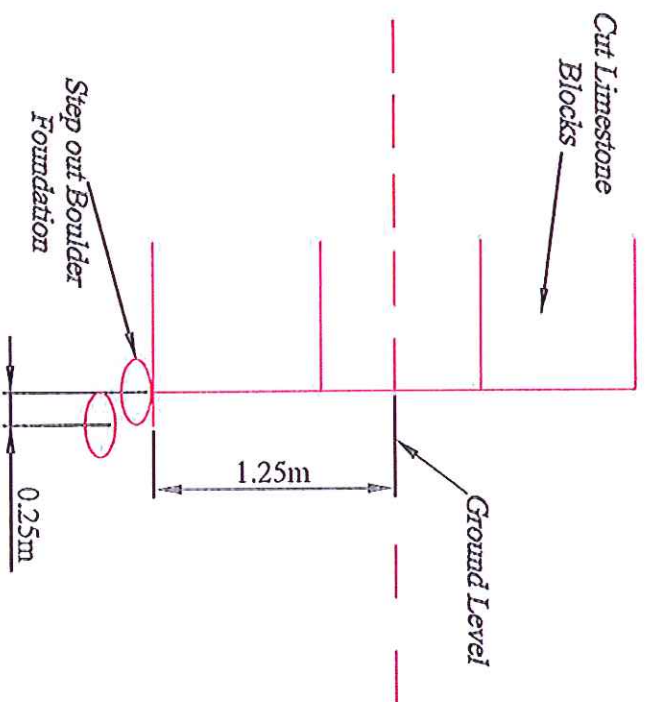


TP-2 (Lough Atalia) 9/06/11 Scale: not to scale

Plan

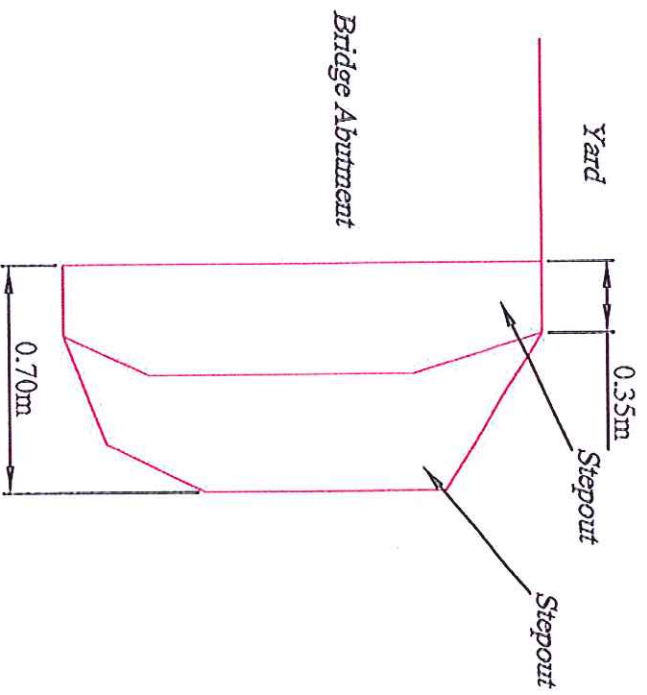


Section

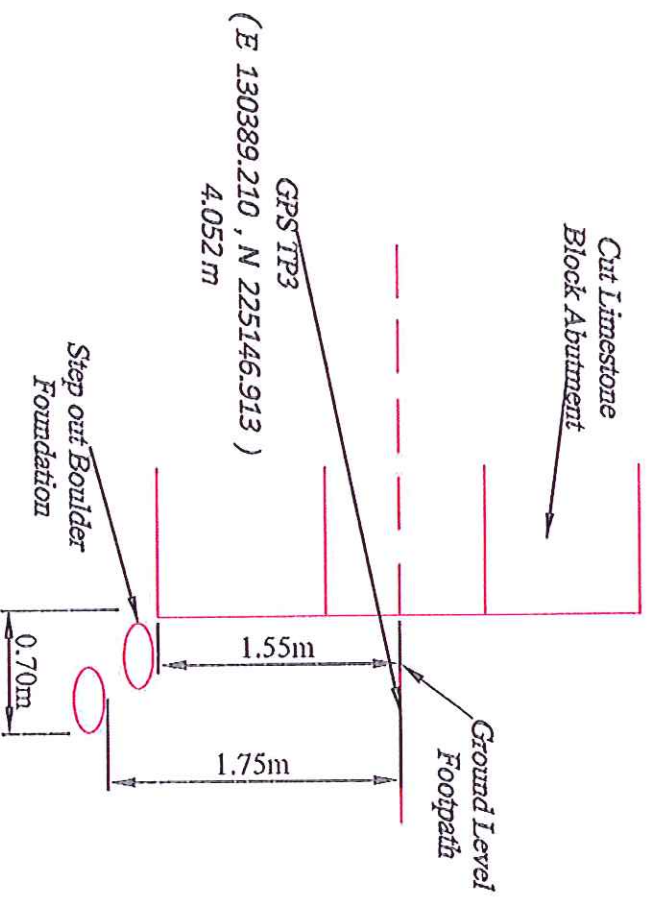


TP-3 (Lough Atalia) 10/06/11 Scale: not to scale

Plan



Section



TP3 (Lough Atalia) 10/06/11 Scale: not to scale

GPS BH1
(E 130338.677 , N 225146.581)
4.088 m

Eircom Box
Cover

Town

Fence

4" green fibre optic.
0.28m deep

6" storm drain
0.40m-0.60 deep

Street Drain

Bridge Abutment

Yard

0.80m

0.60m

Concrete Footpath

4" water main.
0.70m deep

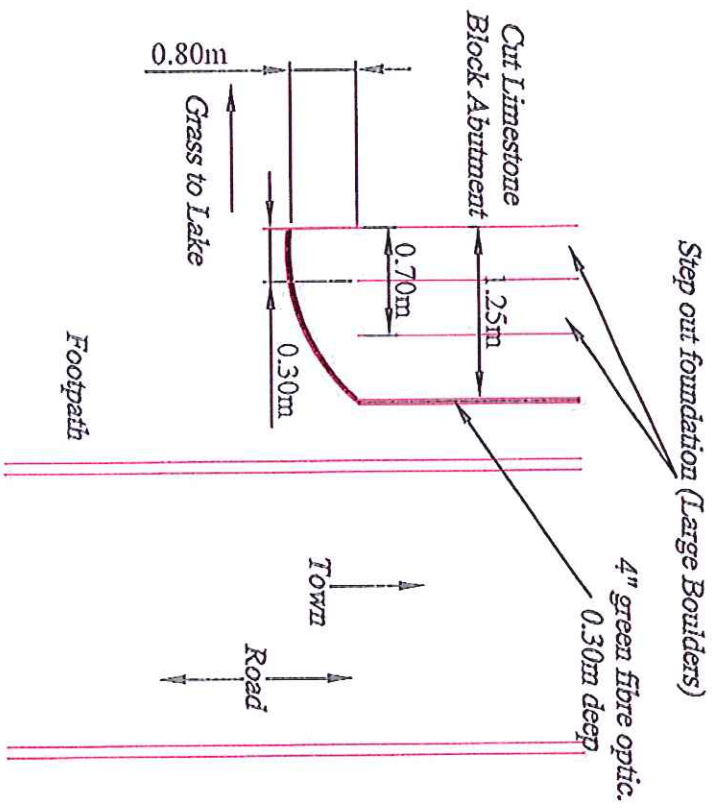
Kerb

Radisson

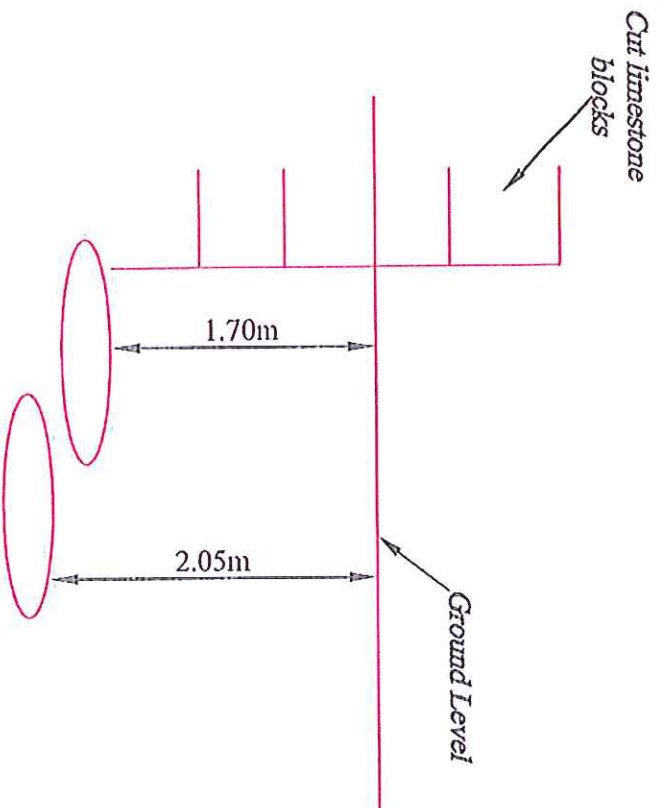


TP-4 (Lough Atalia) 10/06/11 Scale: not to scale

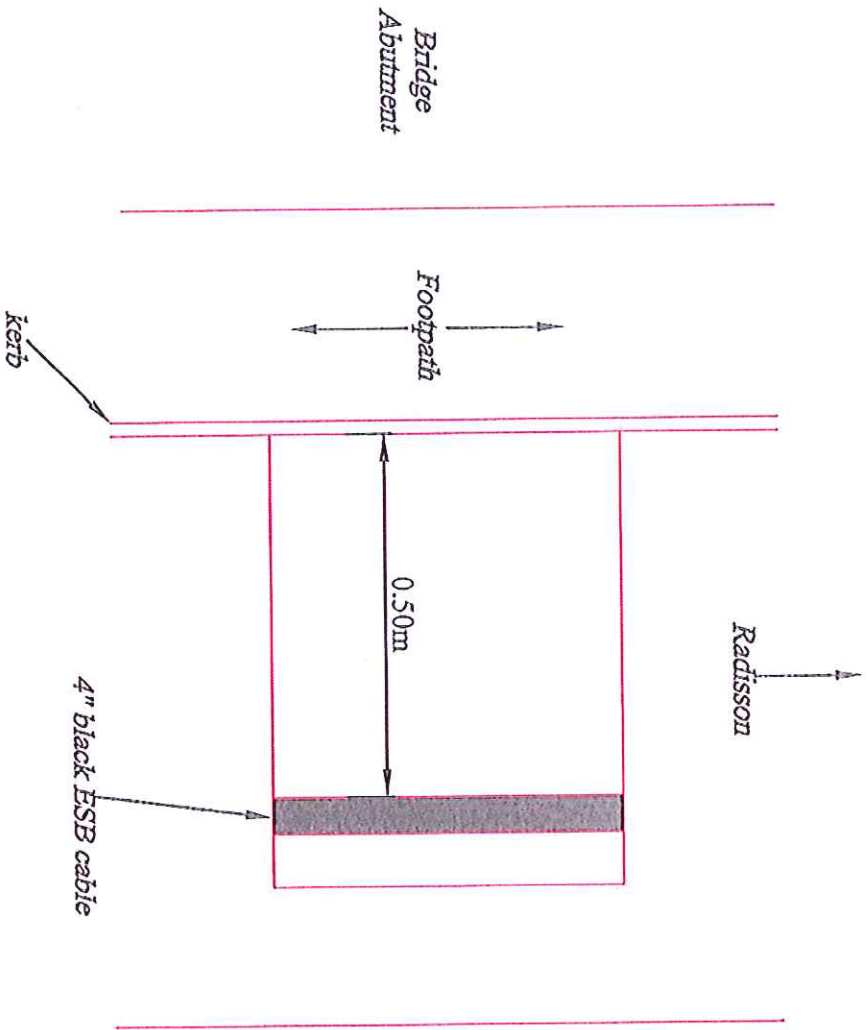
Plan



Section

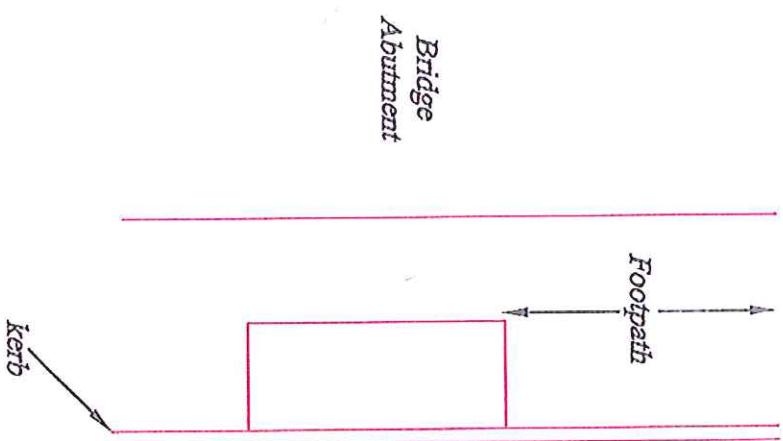


IP-RC1 (Lough Atalia) 10/06/11 Scale: not to scale



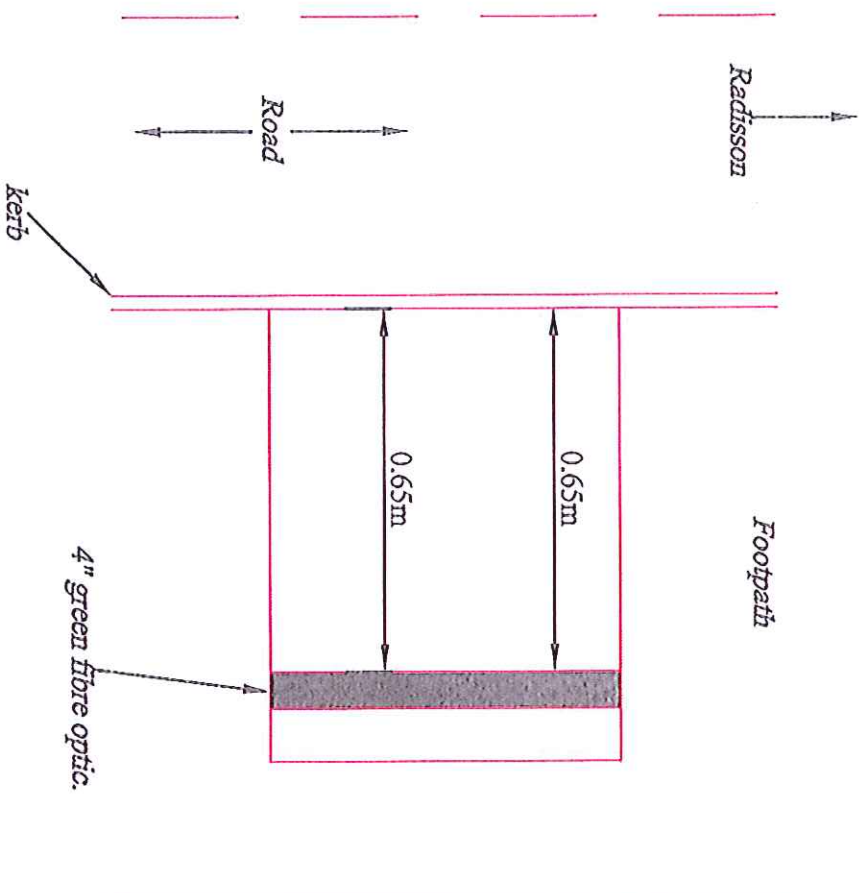
Note: Pit excavated on road

IP-RC2 (Lough Atalia) 10/06/11 Scale: not to scale

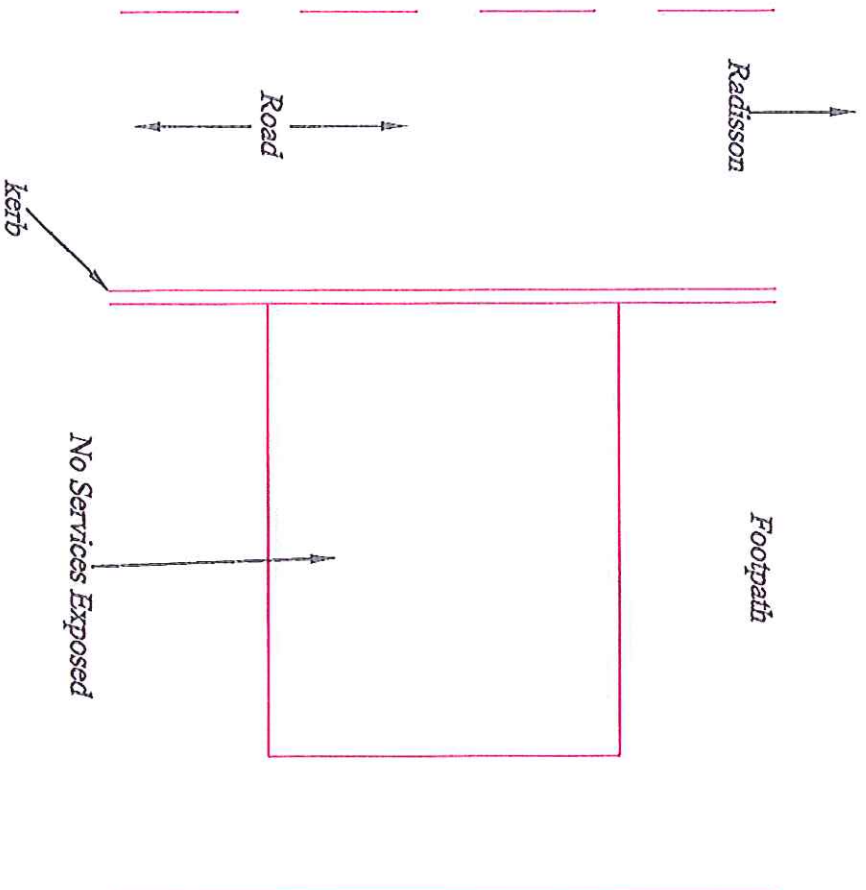


Note: No Services Exposed

IP-RC3 (Lough Atalia) 10/06/11 Scale: not to scale



IP-RC4 (Lough Atalia) 10/06/11 Scale: not to scale



APPENDIX 5

LABORATORY TEST RESULTS

CONTRACT: Lough AtaliaClient
EngineerGHC
Tobin**Office Code**

11G109

Date:

04/07/2011

Scheduled By:

rk/dcl 001

BH/TP No.	Sample Type	Sample Depth	Classification		Bulk Density	PSD	Hydro	Earthworks		5 Point Comp only	5 Point Comp with CBR	Consol (Oed)	Settlement		Triaxial (Q-U)	Triaxial (Con-U)	Lab Vane	Shear Box	Chemical		Chloride	Organic Content	Remarks/Loading
			MC (%)	Atterberg Limits				5-point MCV	CBR 1 point										CO ₂	H ₂			
BH 1	B	2	1	1		1	1												1	1			
	B	3																					
	B	4																					
BH 2	B	1.5	1	1		1	1												1	1			
	B	0.6	1	1		1	1												1	1			
TP 1	J	0.8																					
TP 2	B	0.8	1	1		1	1												1	1		1	
	J	0.8																					
	B	1.5	1	1		1	1												1	1		1	
TP 3	B	0.7	1	1		1																	
TP 4	B	0.8	1	1		1													1	1		1	
TOTAL SCHEDULED			7	7		7	5	0	0	0	0	0			0	0	0	0	6	6	0	3	
TOTAL COMPLETED			7	7		7	5	0	0	0	0	0			0	0	0	0	6	6	0	3	

IRISH DRILLING LTD.
Loughrea Co. Galway.

Tel: (091)841274

Fax: (091) 847687

Lab@IrishDrilling.ie

Contract: Lough Atalia Bridge
Client:
Engineer: Tobin

Date: 06/07/2011

Tested By: KC

Code: 11G109

Checked: DCD

Summary of Soil Classification Tests

BS1377: Part 2: 1990

Borehole/ Trialpit	Type	Depth m	Clause 7.2		Clause 3.2		Clause 8.2		Clause 4.3		Clause 5.3		Clause 5.4		Clause 9		Description of fraction passing 425 micron sieve.
			Bulk Density Mg/m3	Moisture Content %	Particle Density Mg/m3	Liquid Limit %	Plastic Limit %	Plasticity Index %	% passing 425 micron %								
BH 1	B	2.0-2.5		8.2			18.2	9.4				8.8			57		Clay - Low Plasticity
BH 2	B	1.5-1.9		9.2			20.4	11.5				8.9			60		Clay - Low Plasticity
TP 1	B	0.6		9.2			18.1	11.3				6.8			58		Clay - Low Plasticity
TP 2	B	0.8		11.7			20.3	11.2				9.1			52		Clay - Low Plasticity
TP 2	B	1.5		10.3			20.5	11.1				9.4			68		Clay - Low Plasticity
TP 3	B	0.7		16.7			32.6	20.8				11.8			46		Clay - Low Plasticity
TP 4	B	0.8		22.9			32.8	19.2				13.6			59		Clay - Low Plasticity

IRISH DRILLING LTD. Loughrea Co. Galway.	Lough Atalia Bridge 0
Tel: (091)841274 Fax: (091) 847687 Lab@IrishDrilling.ie	Tobin 06/07/2011 KC 0

Note: Soils are described using BS5930 :1999.Clause 41.

V: visual only description

P: description using values obtained from PSD results.

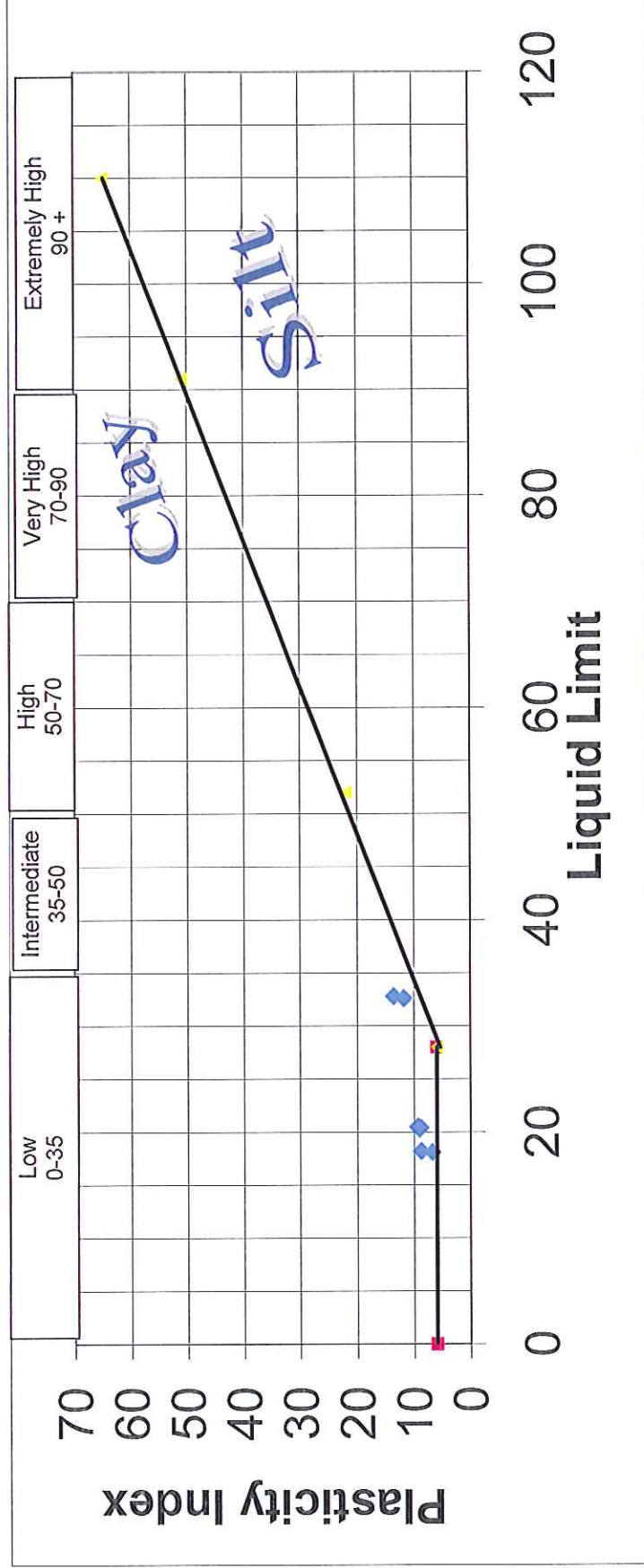
Borehole/ Trialpit	Type	Depth m	Visual Description of Natural soil BS5930	Liquidity Index (w-wp)/IP	Consistency Limit (wl-w)/IP
BH 1	B	2.0-2.5	P	-0.14	1.14
BH 2	B	1.5-1.9	P	-0.26	1.26
TP 1	B	0.6	P	-0.31	1.31
TP 2	B	0.8	P	0.05	0.95
TP 2	B	1.5	P	-0.09	1.09
TP 3	B	0.7	P	-0.35	1.35
TP 4	B	0.8	P	0.27	0.73

IRISH DRILLING LTD.
Loughrea Co. Galway.

Tel: (091)841274
Fax: (091) 847687
Lab@IrishDrilling.ie

Contract: Lough Atalia Bridge
Client: 0
Engineer: Tobin

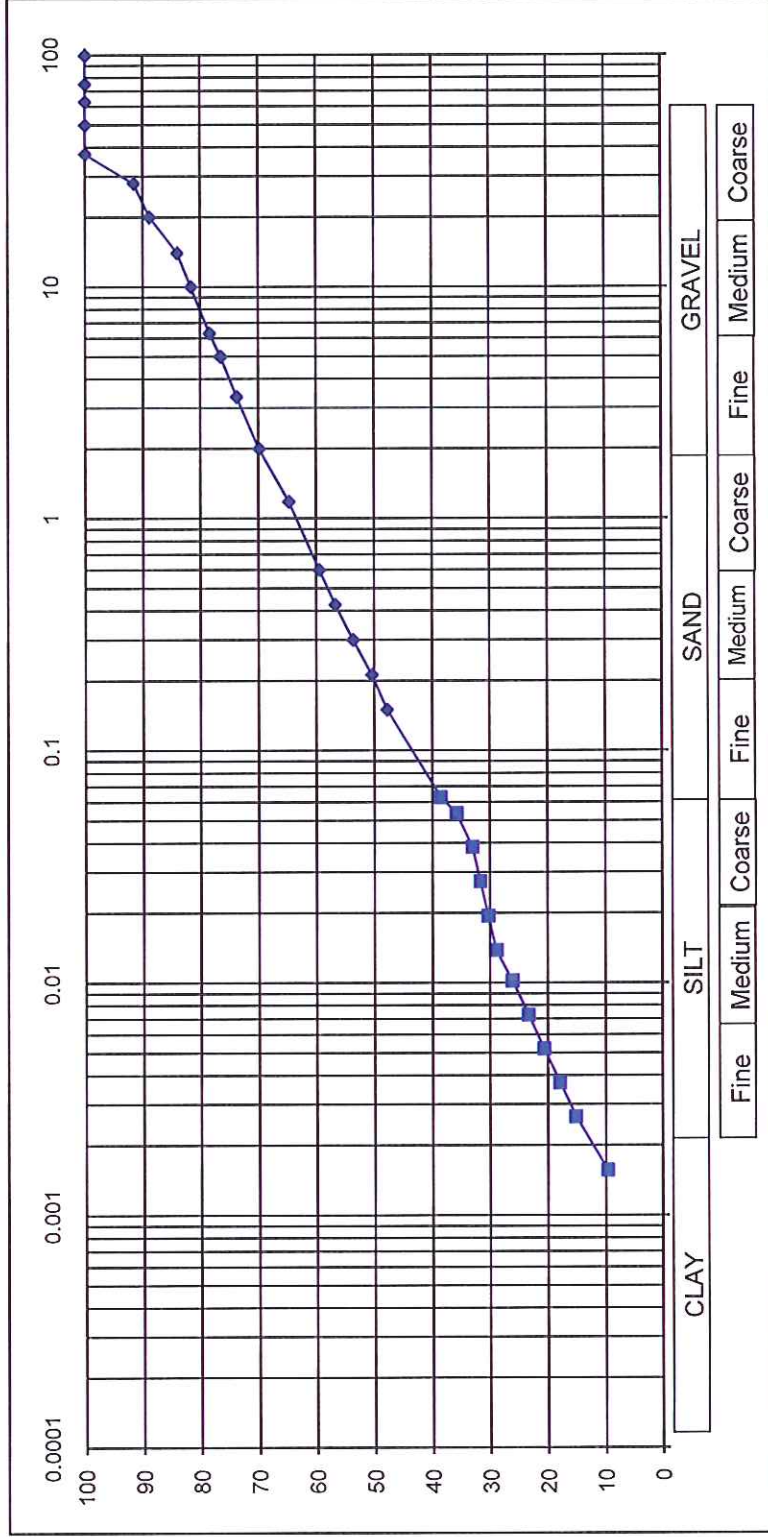
Date: 06/07/2011
Tested By: KC
Checked: DCD



PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	100
28	92
20	89
14	84
10	82
6.3	78
5	77
3.35	74
2	70
1.18	65
0.600	59
0.425	57
0.300	54
0.212	50
0.150	48
0.063	38
0.054	36
0.038	33
0.027	32
0.019	30
0.014	29
0.010	26
0.007	23
0.0052	21
0.0037	18
0.0027	15
0.0016	10

**Soil Description:** Light olive-brown slightly gravelly slightly sandy SILT .

Contract: Lough Atalia Bridge
Client: Tobin Engineers
Engineer: 6.7.11
Date: PMD
Tested by:

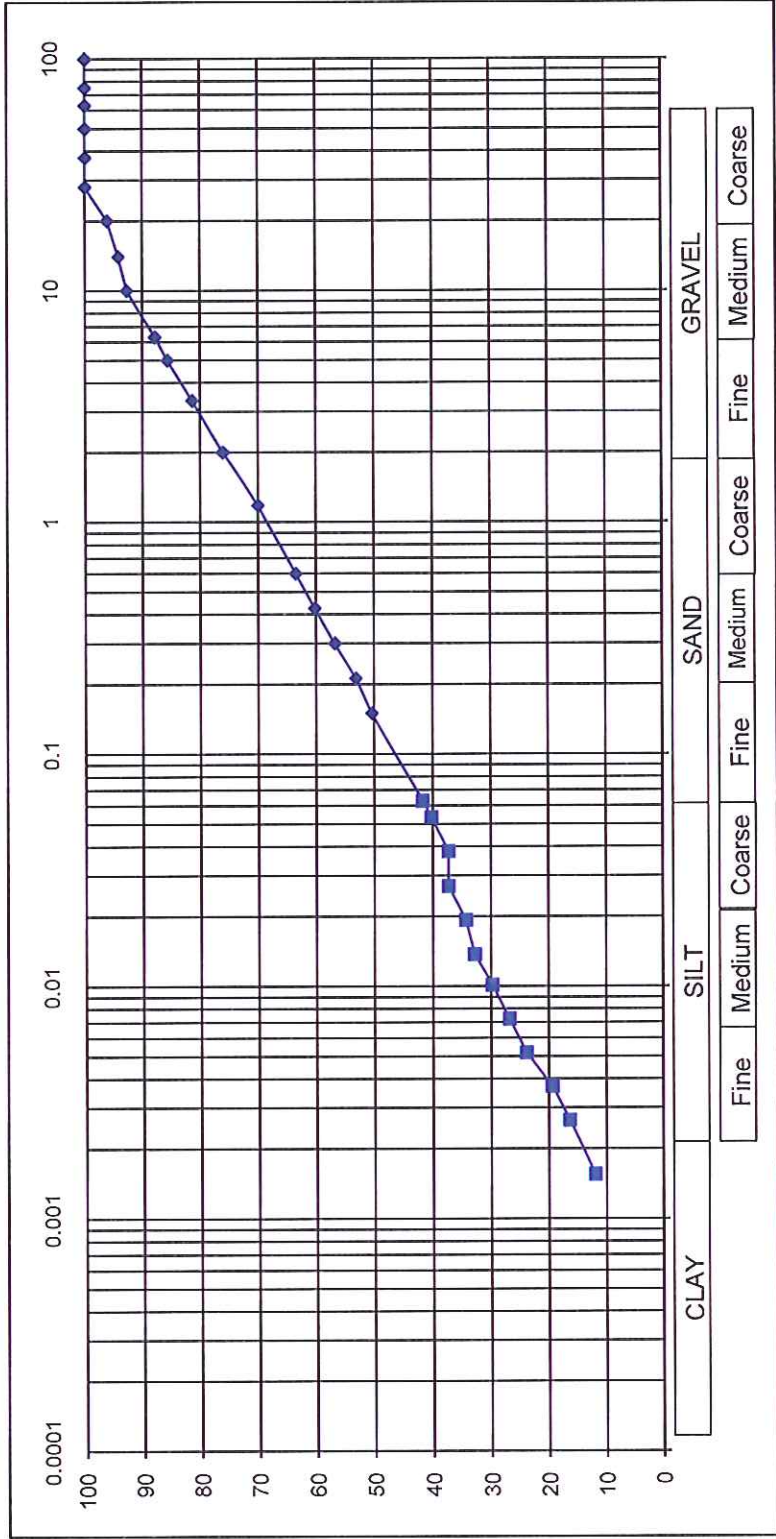
Location
BH 1
Depth: 2.0-2.5 m

Code: 11G109
Checked: DCD

PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	100
28	100
20	96
14	94
10	93
6.3	88
5	86
3.35	81
2	76
1.18	70
0.600	64
0.425	60
0.300	57
0.212	53
0.150	50
0.063	42
0.053	40
0.038	37
0.027	37
0.019	34
0.014	33
0.010	30
0.007	27
0.0052	24
0.0037	19
0.0027	16
0.0016	12



Soil Description: Multicoloured slightly gravelly sandy SILT .

Contract: Lough Atalia Bridge
 Client: Tobin Engineers
 Engineer: 6.7.11
 Date: PMD
 Tested by:

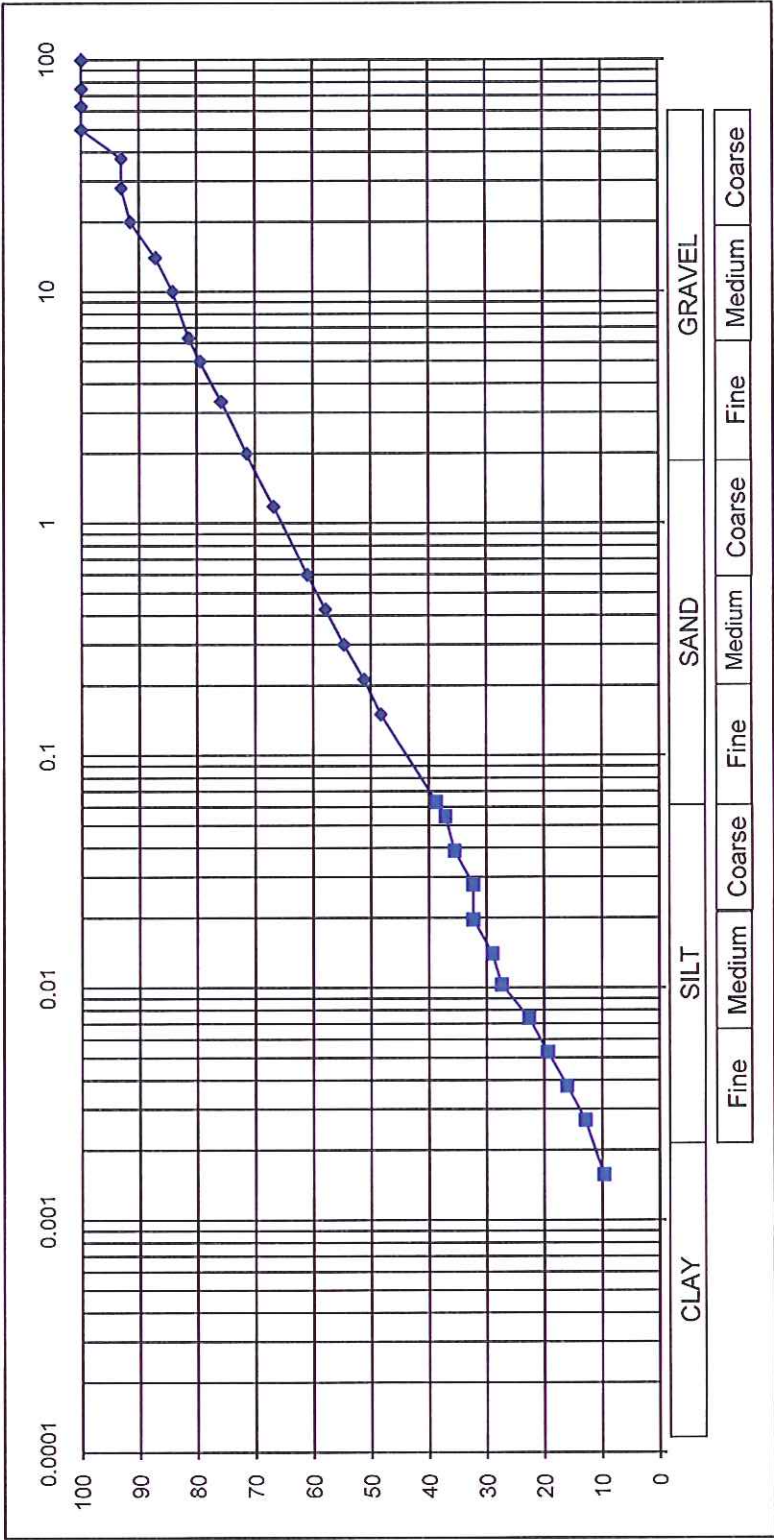
Code: 11G109
 Checked: DCD

Location **BH 2**
 Depth: **1.5-1.9 m**

PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	93
28	93
20	92
14	87
10	84
6.3	81
5	79
3.35	76
2	72
1.18	67
0.600	61
0.425	58
0.300	55
0.212	51
0.150	48
0.063	39
0.055	37
0.039	35
0.028	32
0.020	32
0.014	29
0.010	27
0.007	23
0.0053	19
0.0038	16
0.0027	13
0.0016	10



Soil Description: Yellowish-brown slightly gravelly slightly sandy SILT.

Contract: Lough Atalia Bridge
Client: Tobin Engineers
Engineer: 6.7.11
Date: PMD
Tested by:

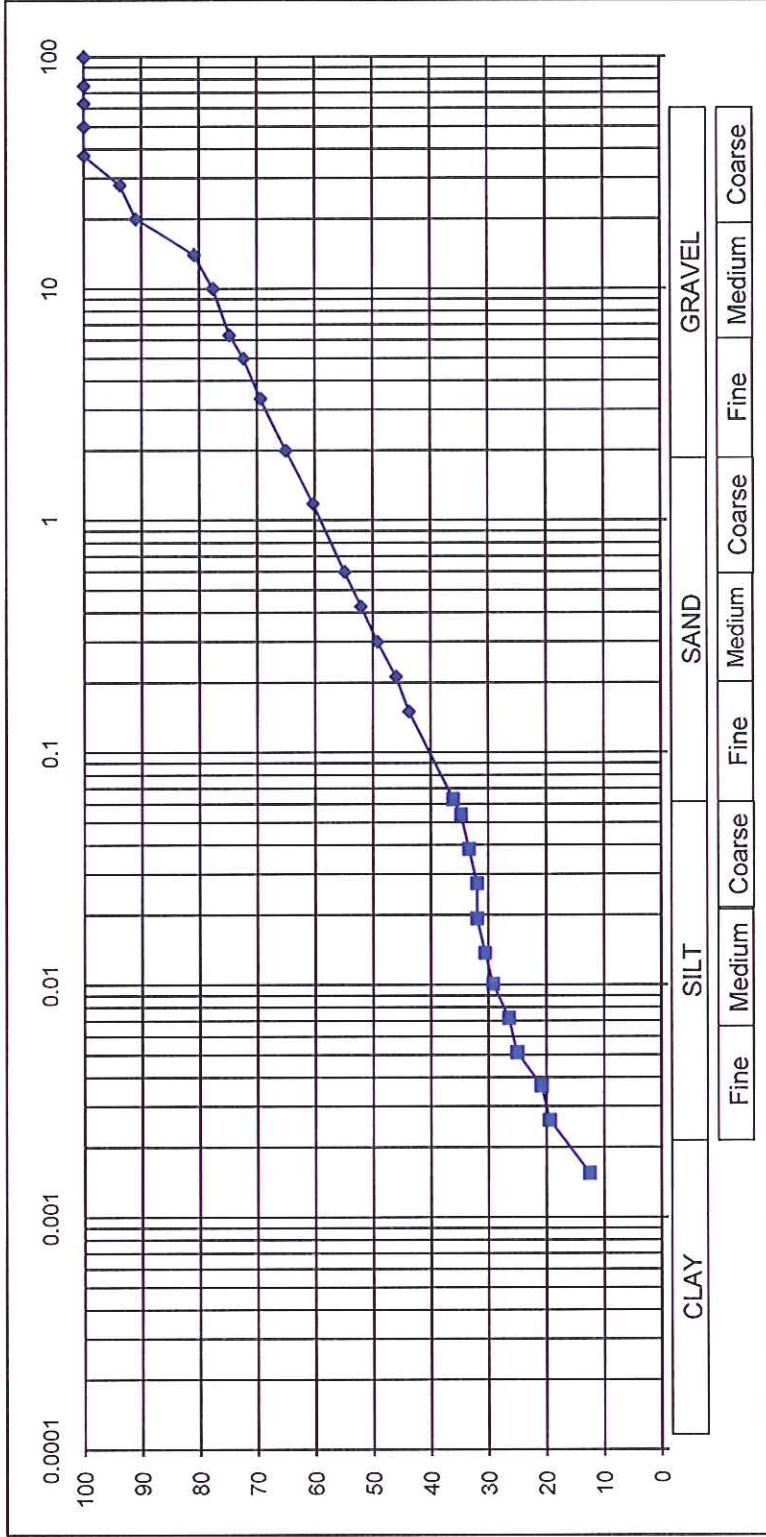
Code: 11G109
Checked: DCD

Location TP 1
Depth: 0.6 m

PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	100
28	94
20	91
14	81
10	78
6.3	75
5	72
3.35	69
2	65
1.18	60
0.600	55
0.425	52
0.300	49
0.212	46
0.150	44
0.063	36
0.054	35
0.038	33
0.027	32
0.019	32
0.014	31
0.010	29
0.007	26
0.0051	25
0.0037	21
0.0026	19
0.0015	12



Soil Description: Yellowish-brown slightly sandy gravelly SILT.

Contract: Lough Atalia Bridge
 Client: Tobin Engineers
 Engineer: 6.7.11
 Date: PMD
 Tested by:

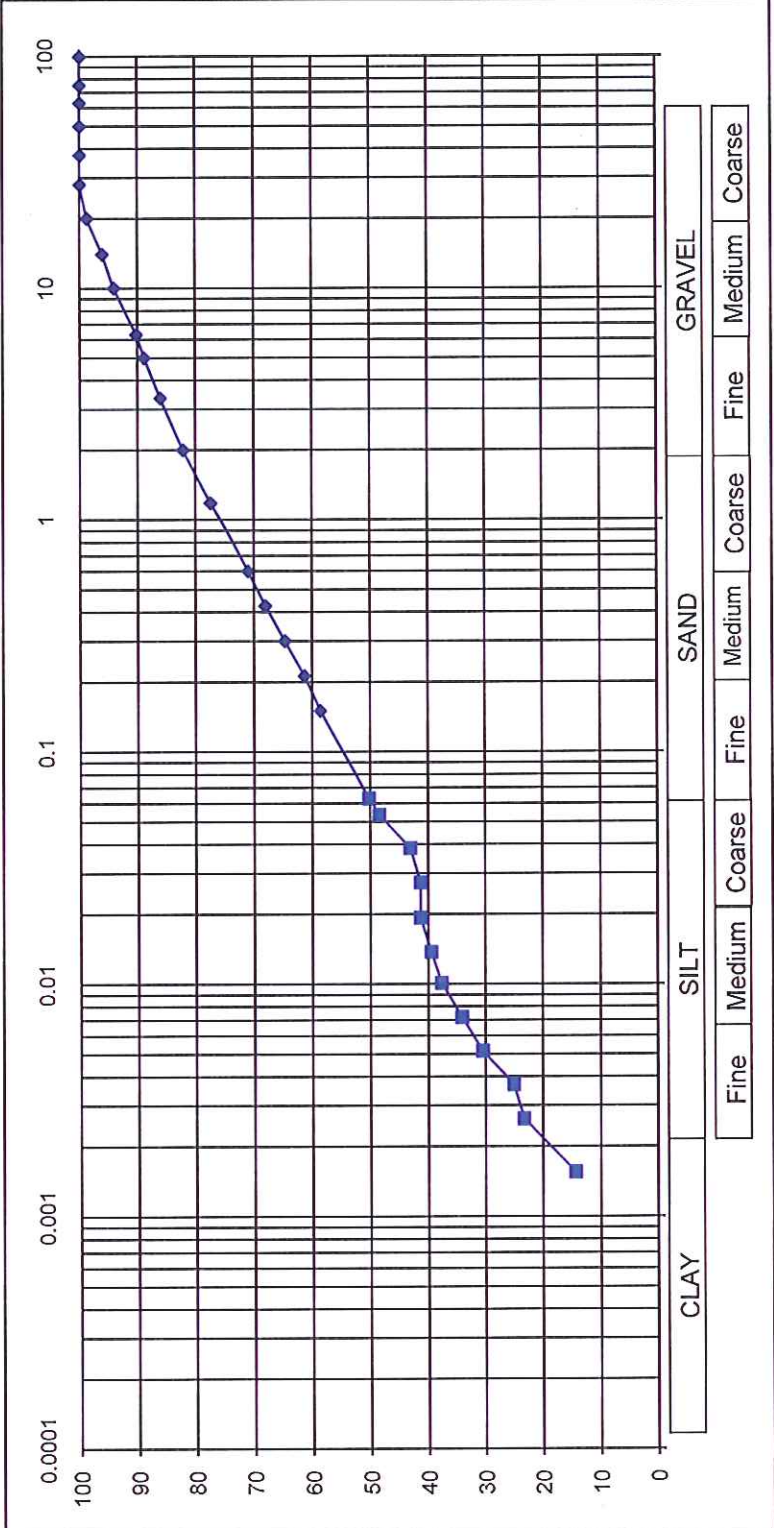
Code: 11G109
 Checked: DCD

Location TP 2
 Depth: 0.8 m

PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	100
28	100
20	99
14	96
10	94
6.3	90
5	89
3.35	86
2	82
1.18	77
0.600	71
0.425	68
0.300	65
0.212	61
0.150	59
0.063	50
0.053	48
0.038	43
0.027	41
0.019	41
0.014	39
0.010	38
0.007	34
0.0052	30
0.0037	25
0.0026	23
0.0016	14



Soil Description: Multi-coloured slightly gravelly slightly sandy SILT .

Contract: Lough Atalia Bridge
Client: Tobin Engineers
Engineer: 6.7.11
Date: PMD
Tested by:

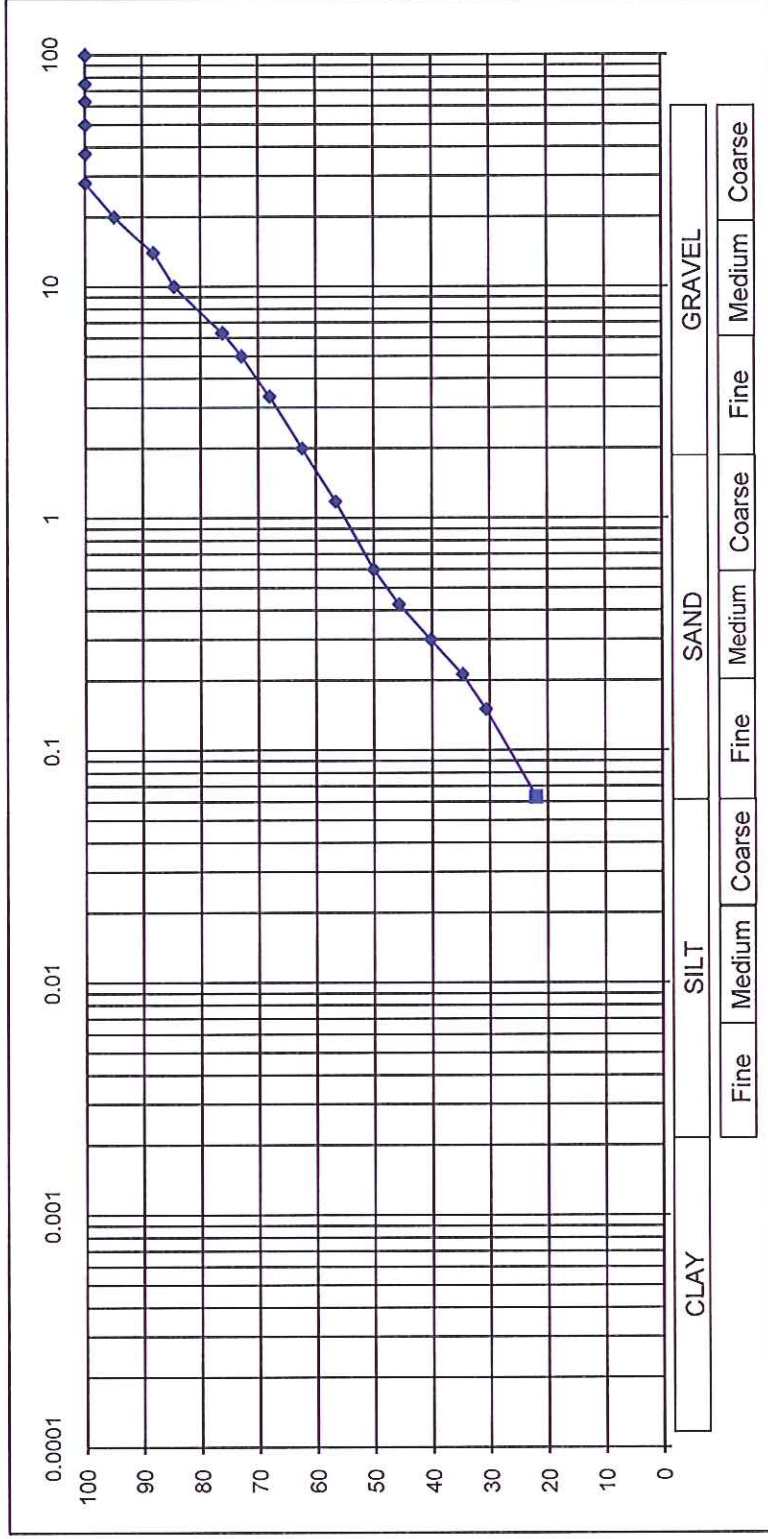
Location TP 02
Depth: 1.5 m

Code: 11G109
Checked: DCD

PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	100
28	100
20	95
14	88
10	85
6.3	76
5	73
3.35	68
2	62
1.18	57
0.600	50
0.425	46
0.300	40
0.212	35
0.150	31
0.063	22
0.054	
0.038	
0.027	
0.019	
0.014	
0.010	
0.007	
0.0051	
0.0037	
0.0026	
0.0015	



Soil Description: Yellowish-brown very silty SAND and GRAVEL.

Contract: Lough Atalia Bridge
 Client: Tobin Engineers
 Engineer: 6.7.11
 Date: PMD
 Tested by:

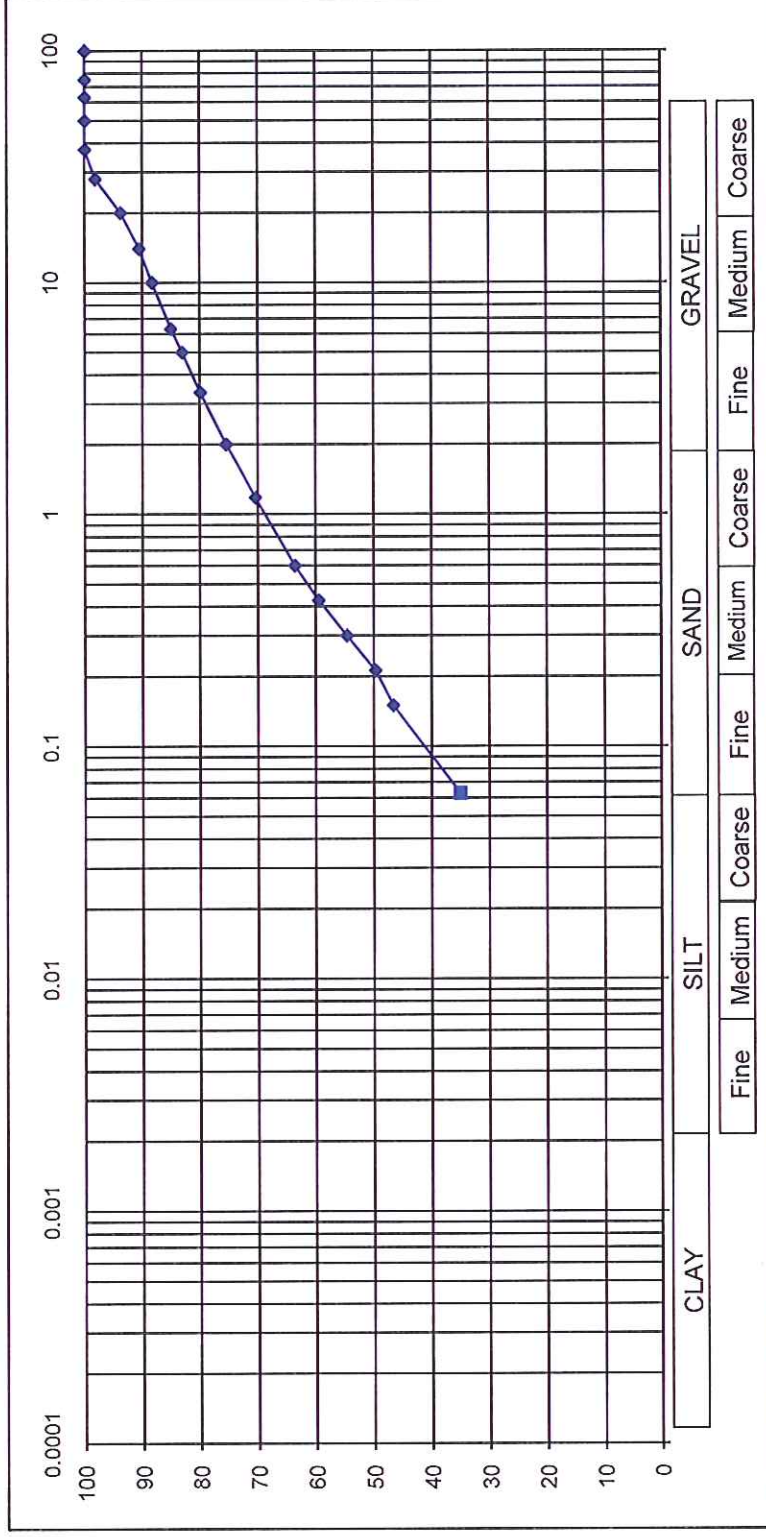
Code: 11G109
 Checked: DCD

Location **TP 3**
 Depth: **0.7 m**

PARTICLE SIZE DISTRIBUTION

BS 1377: 1990: PART 2 (9.2, 9.5)

Sieve size mm	Percentage passing, %
100	100
75	100
63	100
50	100
37.5	100
28	98
20	94
14	91
10	88
6.3	85
5	83
3.35	80
2	76
1.18	70
0.600	64
0.425	59
0.300	55
0.212	50
0.150	47
0.063	35
0.053	
0.038	
0.027	
0.019	
0.014	
0.010	
0.007	
0.0052	
0.0037	
0.0026	
0.0016	



Soil Description: Yellowish-brown slightly gravelly sandy SILT / CLAY.

Contract: Lough Atalia Bridge
Client: Tobin Engineers
Engineer: 6.7.11
Date: PMD
Tested by:

Location
TP 04

Depth: 0.8 m

Code: 11G109
Checked: DCD

Contract:	Lough Atalia
Client:	
Engineer:	JOD
Date:	5.7.11
Tested by:	DcD
	Code: 11 G 109
	Checked: DcD

Chemical And Electro-chemical Tests: BS1377:Part 3:1990

Note: Sulphate expressed as SO₃. If SO₄ required, multiply by 1.2.

Sample	Depth m	pH pH units	Water soluble Sulphate in 2:1 extract g/l SO ₃	Water soluble Sulphate in soil % SO ₃	Acid Soluble Sulphate in soil % SO ₃	Water Soluble Chloride in Soil (as 2:1 water soil extract) mg/kg	Loss on Ignition %	Organic Content (W&B Oxidation) %	Percent passing 2mm sieve %
BH 1	2.0-2.5	8.9	0.185	0.037					
BH 2	1.5	8.53	0.117	0.023					
TP 01	0.6	8.83	0.014	0.003					
TP 02	0.8	8.77	0.014	0.003			0.91		
TP 02	1.5	8.36	0.199	0.04			1.39		
TP 04	0.8	8.44	0.055	0.011			3.4		

Client
Engineer

Tobins

Total Completed
Total Scheduled

IRISH DRILLING LTD. Loughrea Co. Galway Lab@IrishDrilling.ie Tel: (091) 841274 Fax: (091) 847687	Contract:	Lough Atalia Bridge	
	Client:		
	Engineer:	JOD	
	Date:	7.7.11	
	Tested by:	KC	Checked: DCD

Point Load Tests

ISRM Methods

(UCS by calculation from Rock Slope Engineering: E.Hoek and JW Bray)

Diametrical Tests:

Borehole	Depth	D	W	De ²	P	Is MPa	F	Is ₍₅₀₎ MPa	Factor	UCS (calc) MPa	Remarks
RC 1	8.42-8.62	47.4	47.4	2249	31.3	13.92	0.976	13.59	22.40	304.45	Extremely Strong
RC 1	8.91-9.10	47.4	47.4	2246	35.0	15.58	0.976	15.21	22.40	340.77	Extremely Strong
RC 2	8.82-9.0	47.4	47.4	2245	30.4	13.54	0.976	13.22	22.40	296.08	Extremely Strong
RC 2	9.29-9.4	47.4	47.4	2247	30.7	13.66	0.976	13.34	22.40	298.81	Extremely Strong
RC 3	3.6-3.82	47.3	47.3	2234	11.4	5.10	0.975	4.98	22.40	111.47	Very Strong
RC 3	9.28-9.48	47.3	47.3	2239	20.6	9.20	0.976	8.97	22.40	201.03	Extremely Strong
RC 4	2.6-3.4	47.2	47.2	2231	7.0	3.14	0.975	3.06	22.40	68.51	Strong
RC 4	9.28-9.5	47.2	47.2	2229	18.4	8.26	0.974	8.05	22.40	180.21	Very Strong

Note: UCS calculated as 21.4 x Point Load is an estimate of expected strength for a 42mm core.

Note: UCS calculated as 25.4 x Point Load is an estimate of expected strength for a 63mm core.

Note: UCS calculated as 29.4 x Point Load is an estimate of expected strength for a 85mm core.

Irish Drilling Ltd Unconfined Compressive Strength of rock cores: ASTM D7012-07

Contract	Lough Atalia Bridge.	Job Code:	11G109
Client		Date:	11.7.11
Engineer	JOD	Tested By:	KC

Borehole No:	Depth (m)	Sample Diameter (mm)	Sample Length (mm)	Bulk density (Mg/m ³)	Test Duration (secs)	Mode of Failure	Maximum Load (kN)	Uniaxial Compressive Strength (Mpa)	Strength Designation
RC 4	7.9-8.15	47.25	136.25	2.764	190.0	Vertical Shear	158.70	90.5	Strong



APPENDIX 6

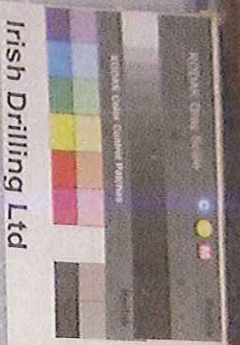
PHOTOGRAPHS



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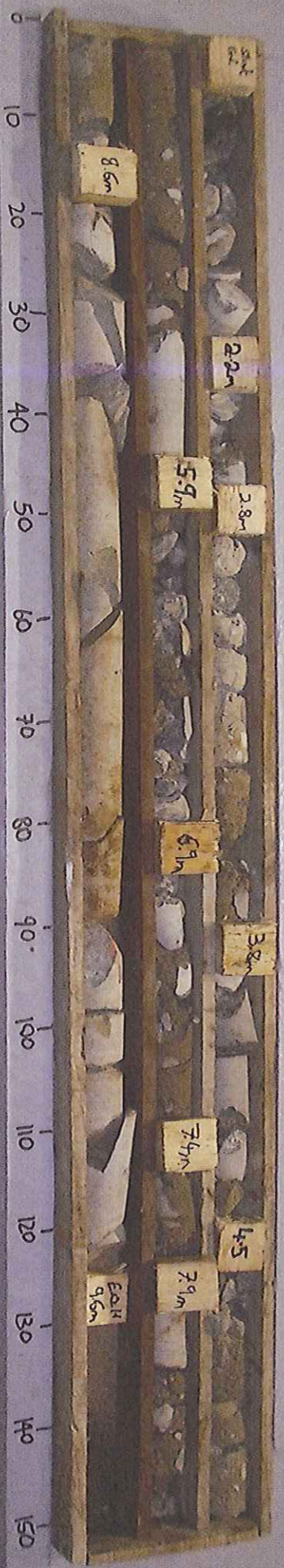
RG1

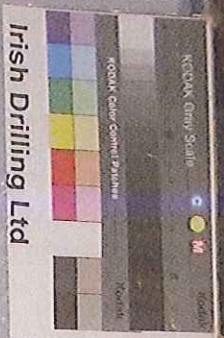




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RG 2





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REC 3





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RG 4.





TP: 01




TP: 01

TP: 01





TP: 02

The image shows a close-up of a highly textured, uneven surface. The colors range from light beige and tan to dark brown and black, suggesting a mix of mineral or organic materials. There are numerous small pits, ridges, and irregularities across the entire surface. In the bottom right corner, there is a white rectangular label with rounded corners containing the text 'TP: 02'.

TP: 02



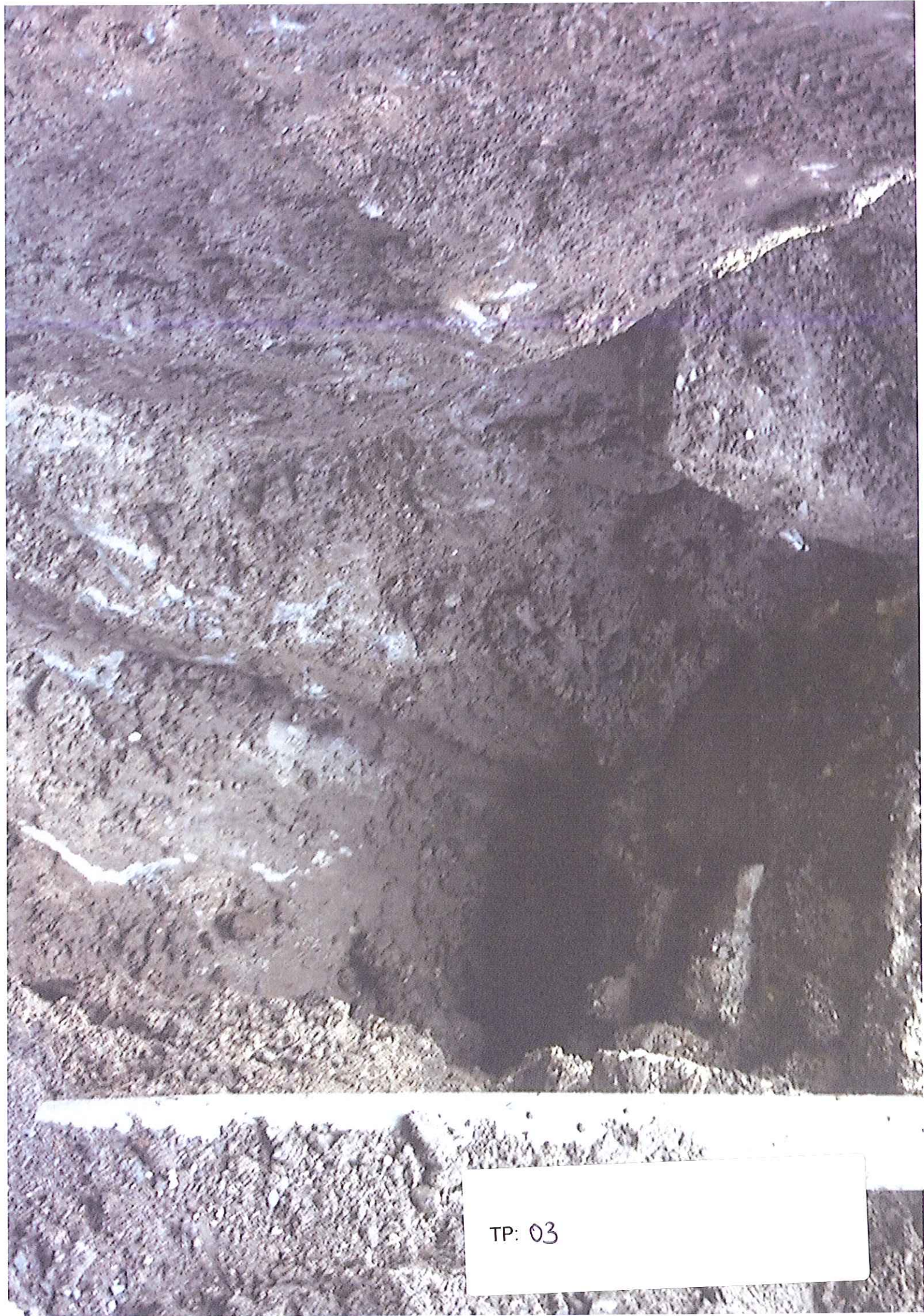
TP: 02



TP: 03




TP: 03



TP: 03



TP: 04



TP: 04



TP: 04