Appendix 9.1 Laois - Kilkenny Reinforcement Project - Coolnabacky 400kV Substation and Ballyragget 110kV Substation - Factual Report on Ground Investigation

A. Report No. Y2012-12A for Coolnabacky 400kV Substation

B. Report No Y2012-12B for Ballyragget 110kV Substation

Report No Y2012-12A

LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY 400kV SUBSTATION:

FACTUAL REPORT ON GROUND INVESTIGATION

Carried out for:
EirGrid

Engineer:
ESB International

July 2012

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LAOIS KILKENNY REINFORCEMENT PROJECT – COOLNABACKY 400kV SUBSTATION

FACTUAL REPORT ON GROUND INVESTIGATION

Report No: Y2012-12A

Date: July 2012

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Issue No	Date	Details
1	July 2012	Report as submitted

CONTENTS

1 INTRODUCTION

In February 2012 Soil Mechanics (SM) was commissioned by ESB International (ESBI), on behalf of EirGrid, to carry out a ground investigation at Coolnabacky, County Laois. The investigation was required to obtain geotechnical and geoenvironmental information for a proposed 400kV substation development.

The scope of the investigation, which was specified by ESBI, comprised cable percussion boreholes, trial pits, in situ testing and laboratory testing. The investigation was carried out in accordance with the contract specification, Eurocode 7 and relevant related standards identified below (see also References). The fieldwork was carried out between 7 March 2012 and 21 March 2012.

This report presents the factual records of the fieldwork and laboratory testing.

A soil characterisation and Soil Suitability Assessment Report was carried out by Traynor Environmental Ltd (Ref 12.050 TE, dated 28 March 2012) and is presented in Enclosure F.

2 THE SITE AND GEOLOGY

2.1 The Site

Coolnabacky is situated approximately 2.5km north of Timahoe, County Laois, see Site Location Plan in Enclosure G. The site is at National Grid reference S 928 537.

The site consists of a large roughly rectangular field where the proposed substation is planned and another field through which the proposed site access route is planned. The site area is level and is presently being used as agricultural land. The access route rises towards the south west over its length by about 15 m. The field where the substation is planned was short grass while the proposed access route was through a newly ploughed arable field. The fields were separated by deep ditches containing water and mature trees. The site is bordered by a disused quarry to the south and agricultural land in all other directions.

2.2 Published Geology

The published geological map covering the site, GSI Sheet 16, shows the bedrock in the area to be the Ballyadams Formation comprising crinoidal wackestone and packstone limestone.

3 FIELDWORK

3.1 General

The fieldwork was carried out in general accordance with BS 5930+A2 (2010), BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006).

The exploratory hole and in situ test locations were selected by ESBI. The locations were set out by SM approximately to the supplied co-ordinates. The co-ordinates and reduced levels were subsequently resurveyed by SM to Irish National Grid and Ordnance Datum. Table 1 presents a summary of the levels and coordinates of the exploratory positions both to ITM and Irish National Grid.

The exploratory hole and in situ test locations are shown on the Site Plan in Enclosure G.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

SUMMARY OF EXPLORATORY HOLES

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Cable Percussion Boring	10	8.50	Designated BH1 to 10
Trial Pits	15	3.00	Designated SA1 to 3 and TP1 to TP12.. Machine dug

The exploratory hole records are presented in Enclosure A and should be read in conjunction with the Key which is included in that enclosure. The records provide descriptions of the materials encountered in accordance with BS 5930 (1999) without amendment. BS EN ISO 14688-1 (2002) and 14689-1 (2003), for soils and rocks respectively, as amplified by BS 5930+A2 (2010). The

records also give details of the samples taken together with observations made during boring and pitting. Photographs of the trial pits are presented in Enclosure E.

On completion of the fieldwork the samples were placed in sealed containers and transported to the Cork office of Soil Mechanics for temporary retention in secure frostproof premises. Samples required for geotechnical testing were subsequently transferred to the in-house laboratory on receipt of the Client's testing instructions. Geoenvironmental samples were transported from site directly to the ESG Scientifics laboratory.

3.3 In Situ Testing

In situ testing was carried out in accordance with the relevant standards as tabulated below. The testing is summarised in the following table and the results are presented in Enclosure C unless noted otherwise. A calibration certificates for the SPT hammer is included with the results of the SPTs in Enclosure A.

SUMMARY OF IN SITU TESTING

TYPE	QUANTITY	REMARKS
Standard Penetration Test	59	BS EN ISO 22476-3 (2005). Results presented on logs in Enclosure A
Dynamic Cone Penetration Test (DCP's)	15	Completed by Dynamic Cone Penetration Test BS 1377 (1990) with calculated CBR values
EPA Percolation Test		Completed by Traynor Environmental presented in Enclosure F
Soakaway	3	BRE Digest 365 (2007)

4 LABORATORY TESTING

4.1 Geotechnical Testing

The testing was scheduled by ESBI and was carried out in accordance with BS 1377 (1990). The testing is summarised below and the results are presented in Enclosure C.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

TYPE	REMARKS
Moisture Content Determination	19 no
Atterberg Limit Determination	16 no
Particle Size Distribution Analysis	13 no

TYPE	REMARKS
pH and Water Soluble Sulphate Content of Soils	11 tests. Test methods are BS 1377 or others recognised in BRE Special Digest 1 (2005); they are indicated on the results report sheets in Enclosure <<D>>.
Unconsolidated Undrained Triaxial Compression Testing	1 no

4.2 Geoenvironmental Testing

The testing was scheduled by ESBI and was carried out by ESG Scientifics. The results are presented in Enclosure E.

Prepared By	**Alex Orrell BSc**
Reviewed By	**M N Harris BSC MSC DIC CEng MICE FGS**
Approved for Issue By	

REFERENCES

BRE Digest 365 : 2007 : Soakaway design. Building Research Establishment, Garston, Watford.

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

BS 5930 : 1999 : Code of practice for site investigations. British Standards Institution.

BS 5930+A2 : 2010 : Code of practice for site investigations (Amendment 2). British Standards Institution.

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

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

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

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

GSI Geology of Kildare - Wicklow Sheet 16 : 1994. 1:100 000 geological map (solid). Geological Survey of Ireland

OSI Discovery Series Sheet 55: 1996 First Edition. 1:50 000 Ordnance Survey of Ireland.

TABLE 1 : EXPLORATORY HOLES LEVELS AND COORDINATES

Point ID	I.T.M. Easting (m)	I.T.M. Northing (m)	I.T.M. Level (mOD)	Irish National Grid Easting (m)	Irish National Grid Northing (m)	Irish National Grid Level (mOD)
BH-01	653730.67	692898.79	99.66	253791.82	192863.22	99.66
BH.02	653754.75	692921.31	98.45	253815.92	192885.74	98.45
BH.03	653774.70	692922.08	98.27	253835.87	192886.51	98.27
BH.04	653789.81	692940.62	98.17	253850.98	192905.06	98.17
BH-05	653712.52	692938.97	98.90	253773.68	192903.41	98.90
BH-06	653734.32	692954.80	98.58	253795.48	192919.24	98.58
BH-07	653759.87	692970.81	98.39	253821.03	192935.25	98.39
BH-08	653694.68	692966.94	98.92	253755.83	192931.38	98.92
BH-09	653718.84	692981.19	98.75	253780.00	192945.64	98.75
BH-10	653737.73	692998.07	98.55	253798.89	192962.52	98.55
SA-01	653735.74	692861.89	98.85	253796.90	192826.31	98.85
SA-02	653853.95	692943.02	97.52	253915.14	192907.46	97.52
SA-03	653831.91	692775.11	97.90	253893.09	192739.51	97.90
TP-01	653664.19	692955.15	99.13	253725.33	192919.59	99.13
TP-02	653745.33	693013.31	98.37	253806.49	192977.76	98.37
TP-03	653782.00	692963.62	98.31	253843.16	192928.06	98.31
TP-04	653700.19	692907.17	99.46	253761.34	192871.60	99.46
TP-05	653736.53	692945.56	98.53	253797.69	192910.00	98.53
TP-06	653658.96	692878.73	99.25	253720.10	192843.16	99.25
TP-07	653622.65	692851.93	99.63	253683.78	192816.35	99.63
TP-08	653591.84	692829.08	99.74	253652.97	192793.49	99.74
TP-09	653532.01	692795.09	100.80	253593.12	192759.49	100.80
TP-10	653482.02	692759.57	102.21	253543.12	192723.96	102.21
TP-11	653444.60	692722.42	104.21	253505.69	192686.80	104.21
TP-12	653171.09	692421.67	113.44	253232.12	192386.00	113.44
DCP/CBR-01	653249.82	692491.13	109.71	253310.87	192455.47	109.71
DCP/CBR-02	653274.99	692522.00	109.27	253336.05	192486.35	109.27
DCP/CBR-03	653294.66	692544.89	108.96	253355.72	192509.24	108.96
DCP/CBR-04	653313.31	692567.39	109.00	253374.38	192531.75	109.00
DCP/CBR-05	653332.53	692590.09	109.38	253393.60	192554.45	109.38
DCP/CBR-06	653350.49	692610.83	109.30	253411.56	192575.19	109.30
DCP/CBR-07	653368.55	692632.25	108.66	253429.63	192596.62	108.66
DCP/CBR-08	653385.39	692652.70	108.15	253446.47	192617.07	108.15
DCP/CBR-09	653403.26	692674.52	107.57	253464.34	192638.90	107.57
DCP/CBR-10	653421.10	692696.16	106.03	253482.19	192660.54	106.03

ENCLOSURE A

EXPLORATORY HOLE RECORDS

Key to Exploratory Hole Records	Key
Hammer Energy Report	Calibration certificate DP1
Borehole Logs	BH1 to 10
Trial Pit Logs	SA1 to SA3 and TP1 to 12

Key to Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample	nominally 100 mm diameter and full recovery unless otherwise stated
UT	Driven thin wall tube sample	
TW	Pushed thin wall tube sample	
P	Pushed piston sample	
L	Liner sample (from Windowless or similar sampler), full recovery unless otherwise stated	
CBR	CBR mould sample	
BLK	Block sample	
CS	Core sample (from rotary core) taken for laboratory testing	
AMAL	Amalgamated sample	

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample
	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was made to take a tube sample, however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C — Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 the total blow count beyond the seating drive is given (without the N = prefix).

IV	*in situ* Vane shear strength, peak (p) and remoulded (r)
HV	Hand vane shear strength, peak (p) and remoulded (r)
PP	Pocket penetrometer test, converted to shear strength
KFH, KRH, KPI	Permeability tests (KFH = falling head, KRH = rising head; KPI = packer inflow); results provided in Field Records column (one value per stage for packer tests)

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930+A2 (2010)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented. The term non-intact (NI) is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

Notes:
See report text for full references of standards

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Key

Key to Exploratory Hole Records

INSTALLATION

Standpipe/ piezometer

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:

SP	Standpipe
SPIE	Standpipe piezometer
PPIE	Pneumatic piezometer
EPIE	Electronic piezometer

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:

ICE	Biaxial inclinometer
ICM	Inclinometer tubing for use with probe
SLIP	Slip indicator

Settlement Points or Pressure Cells

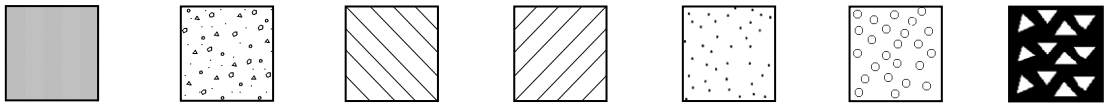
The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column:

ESET	Electronic settlement cell/gauge
ETM	Magnetic extensometer settlement point
EPCE	Electronic embedment pressure cell
PPCE	Electronic push in pressure cell

INSTALLATION LEGENDS

A legend describing the installation is shown in the rightmost column. Legends additional to BS5930 are used to describe the backfill materials as indicated below.



NOTES

1. Soils and rocks are described in accordance with BS EN ISO 14688-1 (2002) and 14689-1 (2003) respectively as amplified by BS 5930+A2 (2010).

2. For fine soils consistency determined in the field by the logger is reported for those strata where undisturbed samples are available. The consistency is qualified and given (in brackets) when, in the opinion of the logger, the sample is disturbed but the assessed consistency is reasonably representative of the in situ conditions; in these circumstances it will normally underestimate consistency in situ. No consistency is given where the samples available are too disturbed to allow a reasonable assessment.

3. Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.

4. The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.

5. The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures

6. Strata legends are in accordance with BS 5930+A2 (2010).

7. Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole (ref BS5930+A2:2010, Clause 47.2.7). In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.

8. The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (eg high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.

Updated March 2011

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

HOLEQUEST
• LIMITED •

Winston Road
Galashiels
Selkirkshire
TD1 2DA
01896 752295

SPT Hammer Ref:	DP1
Test Date:	20/12/2011
Report Date:	20/12/2011
File Name:	DP1.spt
Test Operator:	SMCD

Instrumented Rod Data

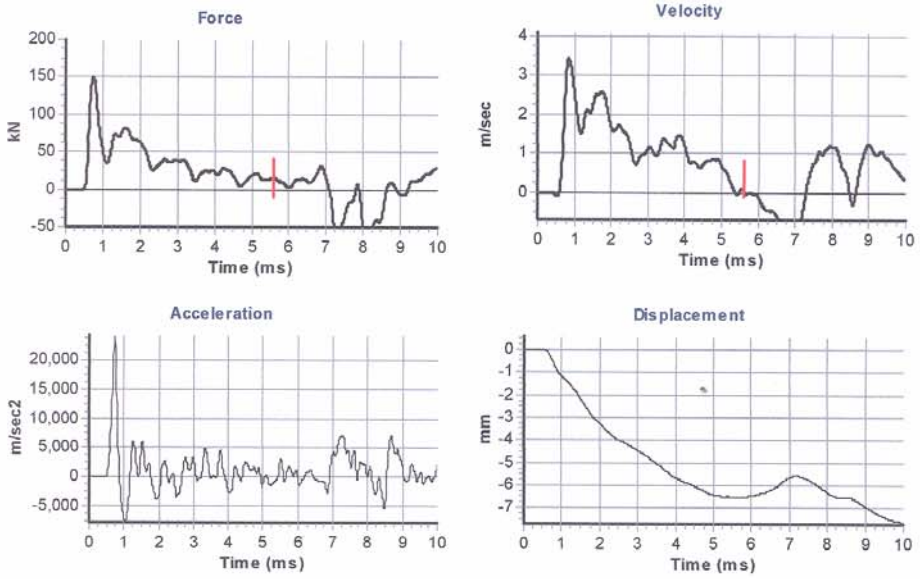
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6092
Accelerometer No.2:	6094

SPT Hammer Information

Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	15.8

Comments / Location

Tested in Holequest Ltd Test Facility



Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	352

Energy Ratio E_r (%): **74**

Signed: Stewart McDowall

Title: Engineer

The recommended calibration interval is 6 months

Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 14/03/2012 **End** 14/03/2012	**Equipment, Methods and Remarks** Dando 2000. Cable percussion boring.	**Depth from** 0.00m	**to** 6.50m	**Diameter** 150mm	**Casing Depth** 5.80m	**Ground Level** +99.66 mOD **Coordinates** E 653730.67 **National Grid** N 692898.79 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.80	B 4			
0.90	D 5			
0.90-1.20	B 6			
1.20-0.00	SPT C	N=16 (3,3/6,6,2,2)		dry
1.20-1.70	B 7			
1.70-2.15	U 8	85 blows 350 mm rec		
2.15	D 9			
2.30-2.75	SPT C	N=12 (1,3/3,4,2,3)		
2.30-2.80	B 10			
2.80-3.30	B 11			
2.80	U NR	150 blows No recovery	2.80	
3.30-3.75	SPT S	N=38 (8,15/11,8,9,10)	3.10	
3.30	D 12			
3.50	D 13			
3.80-4.30	B 14			
4.30-4.75	SPT C	N=28 (3,3/4,7,8,9)	4.30	
4.30-4.80	B 15			
4.50	D 16			
5.30-5.75	SPT C	N=32 (4,4/6,6,10,10)	5.10	
5.30-5.80	B 17			
5.50	D 18			
			14/03/2012	
			5.60	
6.50	SPT C	()	6.50	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL.	(0.30)		
	0.30 *+99.36*		
Brown slightly clayey slightly gravelly SAND with medium cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	(0.60)		
0.90-1.70 m with brown mottling	0.90 *+98.76*		
Stiff, becoming very stiff, grey sandy, becoming slightly sandy, gravelly, becoming slightly gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular to subrounded of limestone.			
2.80-3.30 m brown grey slightly sandy gravel	(5.60)		
EXPLORATORY HOLE ENDS AT 6.50 m	6.50 *+93.16*		

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
None observed (see Key Sheet)			

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
4.10 -4.10	30 mins	
4.90 -4.90	30 mins	
6.50 -6.50	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Borehole

BH1

Sheet 1 of 1

Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 15/03/2012 **End** 15/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring.	**Depth from** 0.00m	**to** 8.50m	**Diameter** 150mm	**Casing Depth** 8.50m	**Ground Level** +98.45 mOD **Coordinates** E 653754.75 **National Grid** N 692921.31 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00		0.00-1.20 m Hand excavated inspection pit.		
0.00-0.30	B 1			
0.10	D 2			
0.30	D 3			
0.30-0.80	B 4			
0.90	D 5			
0.90-1.20	B 6			
1.20-1.65	SPT S	N=18 (2,4/4,5,4,5)	1.20	1.10
1.20-1.65	D 7			
1.20	B 8			
1.70-2.15	U 9	85 blows		
2.15	D 10			
2.20-2.65	SPT C	N=30 (8,10/10,8,6,6)	2.20	
2.40	B 11			
2.40-2.80	B 12			
2.80	D 13			
3.10-3.46	SPT C	50 (4,10/14,18,18 for 60mm)	3.10	1.30
3.10-3.60	B 14			
3.80	D 15			
4.20-4.65	SPT C	N=40 (12,12/10,11,9,10)	4.20	dry
4.20-4.70	B 16			
4.80	D 17			
5.20-5.65	SPT C	N=36 (4,5/8,8,10,10)	5.00	dry
5.20	B 18			
5.80	D 19			
6.70-7.08	SPT C	50 (6,8/11,14,14,11 for 6mm)	6.60	
6.70-7.20	B 20			
6.80	D 21			
7.80	D 22			
8.20-8.37	SPT C	50 (4,10/50 for 15mm)	8.20	
			15/03/2012	1800
			8.50	dry
8.50	SPT C	(25 for 0mm/50 for 0mm)	8.50	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL	(0.30)		
	0.30 *+98.15*		
Light brown slightly clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies.	(0.60)		
	0.90 *+97.55*		
Stiff grey slightly sandy slightly gravelly CLAY with low cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone. (0.90-1.20 m brown mottling; 1.20-1.70 m brown sandy slightly gravelly CLAY)	(1.50)		1
	2.40 *+96.05*		
Dense grey slightly clayey slightly sandy GRAVEL with medium cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone.	(0.40)		
	2.80 *+95.65*		
Very stiff grey brown slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of limestone with low cobble content. Sand is fine to coarse. (3.10-3.60 m high cobble content)	(5.70)		
EXPLORATORY HOLE ENDS AT 8.50 m	8.50 *+89.95*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	1.20	No inflow	4.00

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
3.60 -3.80	30 mins	
8.40 -8.50	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Carried out for EirGrid

Borehole

BH2

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Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 15/03/2012 **End** 20/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 5.80m	**Diameter** 150mm	**Casing Depth** 5.80m	**Ground Level** +98.27 mOD **Coordinates** E 653774.70 **National Grid** N 692922.08 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.80	B 4			
0.80	D 5			
0.80-1.20	B 6			
1.20-1.65	SPT C	N=16 (3,3/3,3,5,5)	1.20	0.80
1.20-1.50	B 7			
1.50	D 8			
1.70-2.15	SPT S	N=18 (1,2/7,4,3,4)	1.70	1.10
1.70-2.20	B 10			
1.70-2.15	D 9			
2.20-2.65	U 11	100 blows	2.20	dry
2.65	D 12			
2.80-3.25	SPT C	N=18 (2,2/4,4,5,5)	2.80	1800
			15/03/2012	dry
3.00-3.50	B 13		2.80	
			20/03/2012	0800
			2.80	dry
3.50	D 14			
3.80-4.25	SPT C	N=31 (6,12/10,6,7,8)	3.50	dry
3.80-4.30	B 15			
4.30-4.60	U 16	150 blows	4.10	
4.60	D 17			
4.80-5.25	SPT C	N=39 (4,6/8,10,10,11)	4.70	
4.80-5.30	B 18			
5.50	D 19			
			20/03/2012	1800
			0.00	dry
5.80	SPT C	()	5.80	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL	(0.30)		
	0.30 *+97.97*		
Light brown slightly clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies.	(0.50)		
	0.80 *+97.47*		
Medium dense grey slightly clayey slightly gravelly to gravelly SAND with medium cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone.	(0.70)		
	1.50 *+96.77*		
Stiff becoming very stiff grey brown slightly sandy slightly gravelly CLAY with low cobble content of subangular limestone. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone.	(4.30)		
EXPLORATORY HOLE ENDS AT 5.80 m	5.80 *+92.47*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	0.80	No inflow	3.00

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
5.70 -5.80	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
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Borehole

BH3

Sheet 1 of 1

Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 13/03/2012 **End** / /	**Equipment, Methods and Remarks** Dando 2000. Cable percussion boring.	**Depth from** 0.00m	**to** 6.44m	**Diameter** 150mm	**Casing Depth** 6.20m	**Ground Level** +98.17 mOD **Coordinates** E 653789.81 **National Grid** N 692940.62 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.50	B 4			
0.50	D 5			
0.50-1.00	B 6			
1.10	W 18			
1.10	D 7			
1.20-1.65	SPT C	N=16 (1,2/4,3,4,5)	1.20	dry
1.20-1.70	B 8			
1.70-2.15	U 9	150 blows 400 mm rec		
2.15	D 10			
2.20-2.65	SPT C	N=19 (1,2/3,5,5,6)	2.10	dry
2.20-2.70	B 11			
2.70-3.15	U 12	150 blows		
3.15	D 13			
3.20-3.65	SPT C	N=29 (2,4/6,7,8,8)	3.10	dry
3.20-3.70	B 14			
4.00	D 15			
4.20-4.65	SPT C	N=36 (4,4/6,8,10,12)	4.20	dry
4.20-4.70	B 16			
5.00	D 17			
5.40-5.67	SPT C	50 (14,11 for 25mm/ 18,20,12 for 15mm)	5.20	dry
5.60-6.00	B 19			
6.00	D 20			
6.20-6.44	SPT C	50 (10,15 for 50mm/ 28,22 for 40mm)	6.20 13/03/2012 6.20	4.70 dry

Strata

Description	Depth, *Level* (Thickness)
TOPSOIL.	(0.30) 0.30 *+97.87*
Light brown clayey slightly gravelly SAND. Gravel is subrounded fine to coarse of various lithologies.	0.50 *+97.67*
Grey clayey gravelly SAND. Gravel is subrounded fine to coarse of various lithologies.	(0.60) 1.10 *+97.07*
1.10-2.20 m brown mottling	
Firm, becoming very stiff, grey slightly sandy slightly gravelly CLAY with low becoming high cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	(5.34)
5.60-6.00 m high cobble content of subrounded limestone	
EXPLORATORY HOLE ENDS AT 6.44 m	6.44 *+91.73*

Legend: 1

Backfill/ Instruments

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	1.10	-	1.20

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
5.40 -5.60	30 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
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Borehole

BH4

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Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 7.40m	**Diameter** 150mm	**Casing Depth** 7.40m	**Ground Level** +98.90 mOD **Coordinates** E 653712.52 **National Grid** N 692938.97 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.40	B 4			
0.40	D 5			
0.40-0.90	B 6			
1.00	D 7			
1.20-1.65	SPT S	N=20 (1,2/2,4,6,8)	1.20	1.20
1.20-1.65	D 8			
1.20-1.70	B 9			
2.00	D 10			
2.20-2.65	SPT C	N=33 (2,3/4,5,8,16)	2.10	
2.20-2.70	B 11			
3.00	D 12			
3.20-3.65	SPT C	N=25 (6,6/6,5,6,8)	3.20	dry
3.20-3.70	B 13			
3.70-4.15	U 14	150 blows		
4.15	D 15			
4.20-4.65	SPT C	N=36 (4,8/8,8,9,11)	4.00	
4.20-4.70	B 16			
5.00	D 17			
5.20-5.65	SPT C	N=50 (7,11/14,14,22,-)	5.10	dry
5.20-5.70	B 18			
6.00	D 19			
6.70-7.08	SPT C	50 (4,8/11,14,16,9 for 4mm)	6.50	
6.70-7.20	B 20			
7.00	D 21			
			21/03/2012	1800
7.40-7.85	SPT C	N=50 (9,12/14,17,19,-)	7.40	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL	(0.30)		
	0.30 *+98.60*		
Orange brown very sandy GRAVEL.	0.40 *+98.50*		
Stiff firm grey brown sandy CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse of limestone.	(1.60)		1
	2.00 *+96.90*		
Stiff becoming very stiff grey slightly sandy gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subangular to subrounded of limestone.	(3.00)		
	5.00 *+93.90*		
Very stiff grey brown, slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of limestone. Sand is fine to coarse.	(2.40)		
EXPLORATORY HOLE ENDS AT 7.40 m	7.40 *+91.50*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	1.20	No inflow	2.00

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
5.60 -5.80	30 mins	
7.10 -7.40	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Borehole

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Borehole Log

Soil Mechanics

Drilled DA **Logged** MMS **Checked** MH	**Start** 20/03/2012 **End** 20/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 5.90m	**Diameter** 150mm	**Casing Depth** 5.90m	**Ground Level** +98.58 mOD **Coordinates** E 653734.32 **National Grid** N 692954.80 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.60	B 4			
0.60	D 5			
0.60-1.10	B 6			
1.20-1.65	SPT S	N=30 (2,7/9,7,7,7)	1.20	1.00
1.20-1.70	B 7			
2.00	D 8			
2.30-2.75	SPT C	N=18 (14,8/6,3,4,5)	2.30	
2.30-2.80	B 9			
3.00	D 10			
3.50-3.94	SPT C	50 (4,7/8,7,14,21 for 60mm)	3.50	dry
3.50-4.00	B 11			
4.00-4.50	B 12			
4.00	D 13			
4.00	U NR	150 blows No recovery		
4.50-4.95	SPT C	N=40 (4,6/8,12,10,10)	4.50	
4.50-5.00	B 14			
5.00	D 15			
5.50	D 16			
			20/03/2012	
5.90	SPT C	()		5.90

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
Firm brown slightly sandy slightly gravelly CLAY with rootlets. Sand if fine to coarse. Gravel is fine to medium subrounded of various lithologies. (TOPSOIL)	(0.30) 0.30 *+98.28*		
Firm brownish grey very sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of various lithologies.	(0.90)		1
Very stiff light brownish grey slightly sandy to sandy slightly gravelly to very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of limestone.	1.20 *+97.38* (2.80)		
Very stiff light grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of limestone.	4.00 *+94.58* (1.90)		
EXPLORATORY HOLE ENDS AT 5.90 m	5.90 *+92.68*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	1.10	-	1.50

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
5.80 -5.80	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Borehole

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Borehole Log

Soil Mechanics

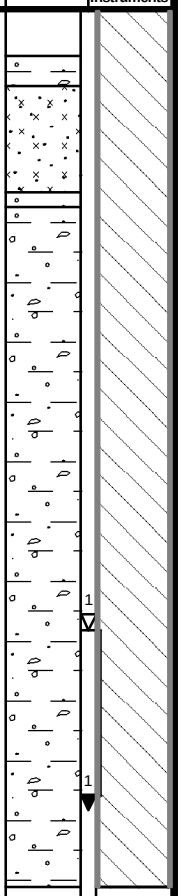
Drilled DA **Logged** MMS **Checked** MH	**Start** 20/03/2012 **End** 20/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 5.80m	**Diameter** 150mm	**Casing Depth** 5.80m	**Ground Level** +98.39 mOD **Coordinates** E 653759.87 **National Grid** N 692970.81 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.50	B 4			
0.50	D 5			
0.50-1.00	B 6			
1.20-1.65	SPT S	N=14 (1,2/2,3,4,5)	1.20	0.80
1.20-1.65	D 7			
1.30	D 8			
1.30-1.80	B 9			
1.80-2.20	B 10			
1.80	U NR	150 blows No recovery		
2.20-2.61	SPT C	N=30 (17,8 for 35mm/8,7,7,8)		
2.20-2.70	B 11			
2.50	D 12			
3.20-3.52	SPT C	50 (11,13/20,17,13 for 20mm)	3.10	dry
3.20-3.70	B 13			
3.50	D 14			
4.20-4.65	SPT C	N=43 (4,8/10,12,10,11)	4.20	
4.20-4.70	B 15			
4.50	D 16			
5.20-5.61	SPT C	63 (11,13/13,9,14,27 for 35mm)	5.20	
5.20	W 17			
5.20-5.70	B 18			
5.50	D 19		20/03/2012	
5.80-6.08	SPT C	50 (12,13 for 50mm/17,33)	5.80	

Strata

Description	Depth, *Level* (Thickness)
Firm light brown slightly sandy CLAY. Sand is fine to coarse with rootlets. (TOPSOIL)	(0.30) 0.30 *+98.09*
Firm light brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded sandstone.	0.50 *+97.89* (0.70)
Grey silty SAND. Sand is fine to coarse.	1.20 *+97.19*
Stiff purplish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of limestone and sandstone.	1.30 *+97.09*
Stiff becoming very stiff light grey sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular of sandstone and limestone.	(4.50)
EXPLORATORY HOLE ENDS AT 5.80 m	5.80 *+92.59*



Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.20	Rose to 4.10 m after 20 minutes.	5.50

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
3.80 -4.00	30 mins	
5.40 -5.80	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Carried out for EirGrid

Borehole

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Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 12/03/2012 **End** 12/03/2012	**Equipment, Methods and Remarks** Dando 2000. Cable percussion boring.	**Depth from** 0.00m	**to** 5.47m	**Diameter** 150mm	**Casing Depth** 5.20m	**Ground Level** +98.92 mOD **Coordinates** E 653694.68 **National Grid** N 692966.94 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.25	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.25	D 3			
0.60	D 4			
0.60	D 5			
0.60-1.10	B 6			
1.20-1.65	SPT C	N=22 (1,2/6,7,6,3)		dry
1.20-1.65	B 7			
1.70	D 8			
1.70-2.20	B 9			
1.70-2.15	U NR	150 blows No recovery	1.70	1.50
2.20-2.65	SPT C	N=25 (1,2/3,6,7,9)	2.20	2.10
2.20-2.70	B 10			
2.70	D 11			
3.20-3.65	SPT C	N=43 (4,6/10,10,11,12)	3.20	2.60
3.20-3.70	B 12			
4.00	D 13			
4.20-4.65	SPT C	N=37 (2,3/4,8,10,15)	4.20	3.10
4.20-4.70	B 14			
5.00	D 15			
5.20-5.47	SPT C	50 (5,10/28,22 for 40mm)	5.20	3.30
			12/03/2012 5.20	3.30

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL.	(0.30) 0.30 *+98.62*		
Light brown slightly silty slightly gravelly SAND. Gravel is subrounded fine to coarse of limestone.	(0.30) 0.60 *+98.32*		
Stiff, becoming very stiff, grey and brown slightly sandy slightly gravelly to gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	(4.87)		1
4.20-5.00 m gravelly			
EXPLORATORY HOLE ENDS AT 5.47 m	5.47 *+93.46*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	1.50	-	-

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
3.80 -4.00	30 mins	
4.80 -5.20	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Borehole

BH8

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Borehole Log

Soil Mechanics

Drilled DA **Logged** MMS **Checked** MH	**Start** 21/03/2012 **End** 22/03/2012	**Equipment, Methods and Remarks** Dando Cable percussion boring	**Depth from** 0.00m	**to** 7.60m	**Diameter** 150mm	**Casing Depth** 7.60m	**Ground Level** +98.75 mOD **Coordinates** E 653718.84 **National Grid** N 692981.19 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.60	B 4			
0.50	L 5			
0.60	D 6			
0.60-0.80	B 7			
0.80	D 8			
0.80-1.20	B 9			
1.20-1.65	SPT S	N=22 (1,1/3,5,6,8)		
1.20-1.65	D 10			
1.20	W 11			
1.20-1.70	B 12			
2.00	D 13			
2.20-2.65	SPT C	N=26 (4,4/6,8,7,5)	2.20	dry
2.20-2.70	B 14			
3.00	D 15			
3.20-3.65	SPT C	N=31 (4,4/6,7,8,10)	3.10	
3.20-3.70	B 16			
			21/03/2012	
4.00	D 17		22/03/2012	0800
4.30-4.75	SPT C	N=38 (5,7/8,10,10,10)	4.20	dry
4.30-4.80	B 18			
4.80-5.25	U 19	150 blows 300 mm rec		
5.25	D 20			
5.30-5.73	SPT C	50 (6,9/12,12,16,10 for 50mm)	5.10	
5.30-5.80	B 21			
6.00	D 22			
6.80-7.15	SPT C	50 (5,11/13,19,18 for 50mm)	6.80	
6.80-7.30	B 23			
7.00	D 24			
			22/03/2012	
7.50	D 25			
7.60	SPT C	()		

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
Brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded of various lithologies with rootlets. (TOPSOIL)	(0.30) 0.30 *+98.45*		
Light brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded of various lithologies.	(0.30) 0.60 *+98.15*		1
Stiff purplish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of limestone and sandstone.	(0.60) 1.20 *+97.55*		1
Stiff purplish grey becoming grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of limestone and sandstone.	(4.10)		
Very stiff light grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of sandstone.	5.30 *+93.45* (2.30)		
EXPLORATORY HOLE ENDS AT 7.60 m	7.60 *+91.15*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	1.20	Rose to 0.80 m after 20 minutes.	2.00

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
7.50 -7.50	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

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Borehole

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Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MH	**Start** 12/03/2012 **End** 12/03/2012	**Equipment, Methods and Remarks** Dando 2000. Cable percussion boring.	**Depth from** 0.00m	**to** 5.50m	**Diameter** 150mm	**Casing Depth** 5.50m	**Ground Level** +98.55 mOD **Coordinates** E 653737.73 **National Grid** N 692998.07 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.80	B 4			
0.90	D 5			
0.90-1.20	B 6			
1.20-1.65	SPT C	N=6 (3,3/1,2,1,2)	1.20	0.90
1.20-1.70	B 7			
2.00	D 8			
2.20-2.65	SPT C	N=19 (3,6/5,4,5,5)	2.20	1.20
2.20-2.70	B 9			
2.80	D 10			
3.00-3.33	SPT C	50 (4,8/11,11,28 for 30mm)	3.00	0.00
3.00-3.50	B 11			
3.50	D 12			
4.00-4.45	SPT C	N=39 (4,8/8,9,10,12)	4.00	dry
4.00-4.50	B 13			
4.50	D 14			
5.00-5.50	B 15			
			12/03/2012 5.50	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL.	(0.30) 0.30 *+98.25*		
Brown and grey clayey slightly gravelly SAND with medium cobble content. Gravel is subrounded fine to coarse of limestone. Cobble is subrounded of limestone.	(0.60) 0.90 *+97.65*		
Loose, becoming medium dense, grey slightly clayey gravelly SAND or very sandy GRAVEL with low to high cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	(1.90) 2.80 *+95.75*		
Very stiff grey slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	(2.70)		
EXPLORATORY HOLE ENDS AT 5.50 m	5.50 *+93.05*		

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
None observed (see Key Sheet)			

Depth Related Remarks *

From	to (m)

Chiselling

Depths (m)	Time	Tools used
3.40 -3.60	30 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Borehole

BH10

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** AO	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.35 m Length 2.00 m A B C D 100 (Deg)	**Ground Level** +98.85 mOD **Coordinates** E 653735.74 **National Grid** N 692861.89 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.90-1.00	B 1	
0.90-1.00	D 2	
1.40-1.50	B 3	
1.40-1.50	D 4	08/03/2012
		* 1.20

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Firm light brown sandy slightly gravelly SILT. Sand is fine to medium. Gravel is rounded fine to coarse of various lithologies.	0.30 *+98.55*		
3 Stiff grey slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded to rounded fine to coarse of limestone.	0.50 *+98.35*		
	(0.80)		
4 Grey and brown mottling sandy GRAVEL with low cobble and boulder content. Gravel is subrounded to rounded fine to coarse of various lithologies. Cobbles and boulders are subrounded to rounded of limestone up to 400mm in size.	1.30 *+97.55*		
	(0.30)		
EXPLORATORY HOLE ENDS AT 1.60 m	1.60 *+97.25*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.50	Rose to 1.20 m after 20 minutes.

Depth Related Remarks *

From	to (m)	
1.60		Trial pit terminated due to water inflow.

Stability Moderate

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY

Project No. Y2012-12A

Carried out for EirGrid

Trial Pit

TPS1

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** AO	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T tracked excavator, machine excavated.	**Dimensions and Orientation** Width 1.30 m Length 1.80 m A B C D 002 (Deg)	**Ground Level** +97.52 mOD **Coordinates** E 653853.95 **National Grid** N 692943.02 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.90-1.00	B 1	
0.90-1.00	D 2	
		08/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Firm light brown and grey mottled sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of various lithologies.	0.30 *+97.22*		
3 Soft to firm grey and brown mottling slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	0.50 *+97.02*		
	(1.20)		
EXPLORATORY HOLE ENDS AT 1.70 m	1.70 *+95.82*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
1.70		Trial pit terminated at required depth.

Stability Moderate

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit
TPS2
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** AO	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 60 13.5T tracked excavator, machine excavated.	**Dimensions and Orientation** Width 1.35 m Length -	**Ground Level** +97.90 mOD **Coordinates** E 653831.91 **National Grid** N 692775.11 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
1.00-1.10	B 1	
1.00-1.10	D 2	
		*
1.40-1.50	B 3	
1.40-1.50	D 4	08/03/2012
		1.30

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Firm brown sandy slightly gravelly SILT. Gravel is subrounded fine to coarse of various lithologies.	0.30 *+97.60* (0.60)		
3 Grey gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.90 *+97.00* (0.40)		
4 Firm brown and grey slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subrounded of limestone.	1.30 *+96.60* (0.30)		
EXPLORATORY HOLE ENDS AT 1.60 m	1.60 *+96.30*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.30	Steady inflow

Depth Related Remarks *

From	to (m)	
1.30		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit
TPS3
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi Machine excavated.	**Dimensions and Orientation** Width 1.40 m Length 3.90 m A B C D 040 (Deg)	**Ground Level** +99.13 mOD **Coordinates** E 653664.19 **National Grid** N 692955.15 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.60-0.70	B 1	
0.60-0.70	D 2	
1.10	HV	p 56kPa, r 5kPa
1.90-2.00	B 3	
1.90-2.00	D 4	
2.90-3.00	B 5	08/03/2012
2.90-3.00	D 6	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL	(0.30)		
2 Grey slightly gravelly SAND with low cobble content. Sand is fine and medium. Gravel is subrounded fine to coarse of various lithologies.Cobbles are subrounded of limestone. 0.30-0.50 m orange brown staining	0.30 *+98.83* (0.70)		
3 Firm becoming stiff grey slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded of limestone. Cobbles are subrounded of limestone.	1.00 *+98.13* (2.00)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+96.13*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.00	Slight seepage

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Moderate

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
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Carried out for EirGrid

Trial Pit
TP1
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.40 m Length 2.10 m A B C D → 000 (Deg)	**Ground Level** +98.37 mOD **Coordinates** E 653745.33 **National Grid** N 693013.31 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.40	D 1	
0.80-0.90	B 2	
0.80-0.90	D 3	
1.00	HV	p 94kPa, r 6kPa
1.50-1.60	B 4	
1.50-1.60	D 5	
2.50-2.60	B 6	
2.50-2.60	D 7	
		08/03/2012 * 1.00

Strata

Description	Depth, *Level* (Thickness)
1 TOPSOIL.	(0.30)
2 Firm light brown and grey mottling sandy slightly gravelly SILT. Gravel is subrounded fine to coarse of various lithologies.	0.30 *+98.07*
3 Grey very sandy clayey GRAVEL with low cobble content. Gravel is subrounded to rounded fine to coarse of various lithologies. Cobbles are subrounded of limestone.	0.55 *+97.82* (0.45)
4 Stiff grey slightly sandy slightly gravelly CLAY with low cobble and boulder content. Gravel is subrounded fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone up to 400mm in size. 1.00-1.20 m brown with grey mottling	1.00 *+97.37* (2.00)
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+95.37*

Legend: 1

Backfill/ Instruments

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.00	Steady inflow.

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP2

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.40 m Length 3.10 m A D B C 080 (Deg)	**Ground Level** +98.31 mOD **Coordinates** E 653782.00 **National Grid** N 692963.62 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.70-0.80	B 1	*
0.70-0.80	D 2	
1.10	HV	p 53kPa, r 4kPa
1.50-1.60	B 3	
1.50-1.60	D 4	
2.00	HV	p 47kPa, r 5kPa
2.50-2.60	B 5	
2.50-2.60	D 6	
		08/03/2012
		* 0.70

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Firm orange very sandy SILT. Sand is fine to medium.	0.30 *+98.01*		
3 Grey slightly gravelly SAND with low cobble content. Sand is fine to medium. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.50 *+97.81* (0.50)		
4 Firm becoming stiff, occasional stiff grey occasional brown mottling slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subrounded of limestone. Rare limestone boulder up to 300mm in size.	1.00 *+97.31* (2.00)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+95.31*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
0.70	1.00	Seepage
3.00		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY

Project No. Y2012-12A

Carried out for EirGrid

Trial Pit

TP3

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** AO	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.60 m Length 3.20 m A / D / B / C → 090 (Deg)	**Ground Level** +99.46 mOD **Coordinates** E 653700.19 **National Grid** N 692907.17 **Chainage**

Samples and Tests

Strata

Depth	Type & No.	Date Records	Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
			1 TOPSOIL.	(0.30)		
				0.30 *+99.16*		
0.50	D 1		2 Firm light brown and orange sandy slightly gravelly SILT. Gravel is subrounded fine to coarse of various lithologies	(0.40)		
				0.70 *+98.76*		
1.00	HV	p 57kPa, r 0kPa	3 Firm becoming soft grey and brown mottling sandy gravelly CLAY with medium cobble content and low boulder content. Gravel is subrounded fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone up to 300mm.			
1.20-1.30	B 2					
1.20-1.30	D 3			(1.30)		
2.00-2.10	B 4					
2.00-2.10	D 5			2.00 *+97.46*		
		*	4 Grey clayey SAND and GRAVEL with medium cobble and low boulder content. Gravel is subrounded fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone up to 400mm in size.	(1.00)		
2.90-3.00	B 6	08/03/2012				
2.90-3.00	D 7	* 2.50		3.00 *+96.46*		
			EXPLORATORY HOLE ENDS AT 3.00 m			

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
2.50	3.00	Seepage
3.00		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP4

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 08/03/2012 **End** 08/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.70 m Length 3.00 m A B C D 120 (Deg)	**Ground Level** +98.53 mOD **Coordinates** E 653736.53 **National Grid** N 692945.56 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.50-0.60	B 1	
0.50-0.60	D 2	
1.00	HV	p 112kPa, r 14kPa
1.50	D 3	
2.50-2.60	B 4	
2.50-2.60	D 5	
		08/03/2012
		* 1.60

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Firm light brown/orange and grey mottling slightly sandy slightly gravelly CLAY. Gravel is subrounded fine to coarse of various lithologies.	0.30 *+98.23* (0.40)		
3 Stiff grey and brown mottling slightly sandy slightly gravelly CLAY with low cobble and boulder content. Gravel is subrounded fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone up to 400mm in size.	0.70 *+97.83* (0.60)		
4 Grey gravelly SAND with low cobble content. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded of limestone.	1.30 *+97.23* (0.80)	1	
5 Firm to stiff grey slightly sandy slightly gravelly CLAY with low cobble and boulder content. Gravel is subrounded fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone up to 400mm in size.	2.10 *+96.43* (0.90)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+95.53*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.60	Steady inflow.

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP5

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.50 m Length 3.40 m A B C D 345 (Deg)	**Ground Level** +99.25 mOD **Coordinates** E 653658.96 **National Grid** N 692878.73 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.90-1.00	B 1	
0.90-1.00	D 2	
1.00	HV	* p 24kPa, r 1kPa
1.90-2.00	B 3	
1.90-2.00	D 4	
2.50	HV	p 118kPa, r 17kPa
2.90-3.00	B 5	07/03/2012
2.90-3.00	D 6	* 1.00

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Grey and brown mottling slightly silty slightly gravelly SAND. Sand is fine to medium. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.30 *+98.95*		
3 Grey slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.50 *+98.75* (1.00)		
4 Stiff grey slightly sandy slightly gravelly to gravelly CLAY with low cobble and boulder content. Gravel is subrounded fine to coarse of various lithologies. Cobbles and boulders are subrounded of limestone. Occasional lenses of grey sand.	1.50 *+97.75* (1.50)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+96.25*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
1.00	2.00	Numerous small inflows
3.00		Trial pit terminated at required depth.

Stability Moderate

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP6

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** AO	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.50 m Length 3.50 m A B C D 010 (Deg)	**Ground Level** +99.63 mOD **Coordinates** E 653622.65 **National Grid** N 692851.93 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.50-0.60	B 1	
0.50-0.60	D 2	
0.80	HV	p 48kPa, r 6kPa
1.10	HV	p 167kPa, r 12kPa
1.50-1.60	B 3	
1.50-1.60	D 4	
2.50-2.60	B 5	
2.50-2.60	D 6	
		07/03/2012
		* 2.30

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Grey slightly gravelly fine to medium SAND. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.30 *+99.33* (0.80)		
3 Stiff brown and grey mottling slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded to rounded fine to coarse of various lithologies. Cobbles are subrounded of limestone.	1.10 *+98.53* (1.00)		
4 Grey slightly clayey slightly sandy GRAVEL with high cobble content. Gravel is subangular to subrounded fine to coarse of various lithologies. Cobbles are subangular of limestone.	2.10 *+97.53* (0.90)	1	
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+96.63*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	2.30	-

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP7

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.50 m Length 3.50 m A B C D 350 (Deg)	**Ground Level** +99.74 mOD **Coordinates** E 653591.84 **National Grid** N 692829.08 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.50	D 1	
0.90-1.00	B 2	
0.90-1.00	D 3	
1.00	HV	p 31kPa, r 2kPa
1.90-2.00	B 4	
1.90-2.00	D 5	
2.00	HV	p 13kPa, r 1kPa
2.00	W 8	
2.90-3.00	B 6	07/03/2012
2.90-3.00	D 7	1.70

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.35)		
	0.35 *+99.39*		
2 White slightly gravelly silty fine to coarse SAND. Gravel is subrounded fine to coarse of various lithologies.			
	0.60 *+99.14*		
3 Grey slightly gravelly sandy SILT. Gravel is subrounded to rounded fine to coarse of various lithologies. Sand is fine to coarse.	(1.10)		
	1.70 *+98.04*		
4 Soft grey slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subrounded of limestone.	(1.30)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+96.74*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.70	-

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Poor

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

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Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.50 m Length 3.50 m A B C D 355 (Deg)	**Ground Level** +100.80 mOD **Coordinates** E 653532.01 **National Grid** N 692795.09 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.60-0.70	B 1	
0.60-0.70	D 2	
1.50-1.60	B 3	
1.50-1.60	D 4	
2.50-2.60	B 5	
2.50-2.60	D 6	
		07/03/2012
		1.80

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.40)		
	0.40 *+100.40*		
2 Grey fine to coarse SAND.	(0.80)		
	1.20 *+99.60*		
3 Stiff light brown slightly sandy slightly gravelly SILT. Gravel is subrounded fine to coarse of various lithologies. Occasional lens of sand.	(0.90)		1
	2.10 *+98.70*		
4 Stiff grey slightly sandy slightly gravelly CLAY with low cobble content. Gravel is subrounded fine to coarse of various lithologies. Cobbles are subrounded of limestone.	(0.90)		
	3.00 *+97.80*		
EXPLORATORY HOLE ENDS AT 3.00 m			

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.80	Slow trickle

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Good

Shoring None

Weather Sunny, rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

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Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.60 m Length 3.00 m A B C D 000 (Deg)	**Ground Level** +102.21 mOD **Coordinates** E 653482.02 **National Grid** N 692759.57 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.90-1.00	B 1	
0.90-1.00	D 2	
1.00	HV	p 44kPa, r 8kPa
1.90-2.00	B 3	
1.90-2.00	D 4	
2.20	W 5	
		07/03/2012
		2.00

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.40)		
	0.40 *+101.81*		
2 Light brown slightly gravelly SAND. Sand is fine to medium. Gravel is subrounded to rounded fine to coarse of various lithologies.	(1.30)		
	1.70 *+100.51*		
3 Brown slightly gravelly to very gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of various lithologies.	(1.10)		1
EXPLORATORY HOLE ENDS AT 2.80 m	2.80 *+99.41*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	2.00	Quick inflow

Depth Related Remarks *

From	to (m)	
2.80		Trial pit terminated due to instability.

Stability Poor

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP10

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** AO	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.50 m Length 3.50 m A B C D → 100 (Deg)	**Ground Level** +104.21 mOD **Coordinates** E 653444.60 **National Grid** N 692722.42 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.50-0.60	B 1	
0.50-0.60	D 2	
0.90	D 3	
1.00	HV	p 70kPa, r 12kPa
1.40-1.50	B 4	
1.40-1.50	D 5	
2.50-2.60	B 6	
2.50-2.60	D 7	
		07/03/2012
		3.00 *

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.30)		
2 Brown slightly gravelly fine to coarse SAND. Gravel is subrounded fine to medium of various lithologies.	0.30 *+103.91*		
	(0.50)		
3 Black slightly organic fine to coarse SAND.	0.80 *+103.41*		
4 Grey becoming light brown slightly gravelly SAND. Sand is fine to medium. Gravel is subrounded to rounded fine to medium of various lithologies. 1.00-1.20 m slightly silty. 1.80 m light brown	1.00 *+103.21*		
	(2.00)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+101.21*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	3.00	Base of pit filled

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Moderate to poor

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit
TP11
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MH	**Start** 07/03/2012 **End** 07/03/2012	**Equipment, Methods and Remarks** 13.5T Hitachi, machine excavated.	**Dimensions and Orientation** Width 1.50 m Length 4.10 m A B C D → 350 (Deg)	**Ground Level** +113.44 mOD **Coordinates** E 653171.09 **National Grid** N 692421.67 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
0.90-1.00	B 1	
0.90-1.00	D 2	
1.00	HV	p 23kPa, r 2kPa
1.90-2.00	B 3	
1.90-2.00	D 4	
2.90-3.00	B 5	07/03/2012
2.90-3.00	D 6	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL.	(0.40)		
2 Orange brown slightly gravelly sandy SILT. Sand is fine to medium. Gravel is rounded fine to medium of various lithologies.	0.40 *+113.04* (1.20)		
3 Grey slightly gravelly to gravelly fine to coarse SAND with low cobble content. Gravel is subrounded to rounded fine to coarse of various lithologies. Cobbles are rounded of limestone.	1.60 *+111.84* (1.40)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+110.44*		

Depth	Type & No.	Records Date

Groundwater Entries

No. Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth.

Stability Good

Shoring None

Weather Sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY
Project No. Y2012-12A
Carried out for EirGrid

Trial Pit

TP12

Sheet 1 of 1

ENCLOSURE B

IN SITU TESTING

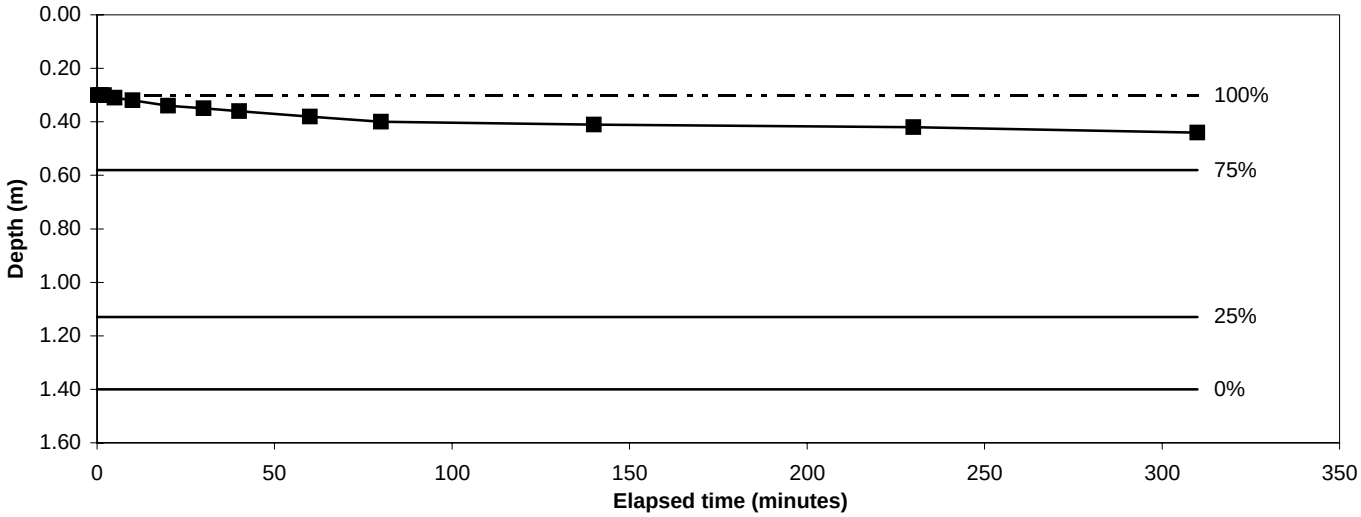
Dynamic Cone Penetrometer Tests with CBR values	CBR1 To 1
Soakaway Tests	SKWY/SA1/1 SKWY/SA2/1 SKWY/SA3/1

Soakaway Test

Soil Mechanics

Trial Pit No:	TPS1	Test No:	1	Date:	08/03/2012
Length (m):	1.70		Datum height:	0.00	m agl
Width (m):	1.30		Granular infill:	None	
Depth (m):	1.40				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.30		
1	0.30		
2	0.30		
5	0.31		
10	0.32		
20	0.34		
30	0.35		
40	0.36		
60	0.38		
80	0.40		
140	0.41		
230	0.42		
310	0.44		



Start water depth for analysis (mbgl):	0.30		
75% effective depth (mbgl):	0.58	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.85		
25% effective depth (mbgl):	1.13	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.40		

Volume outflow between 75% and 25% effective depth (m3):

Mean surface area of outflow (m^2): 5.51

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate**

Remarks Results processed following BRE 365 (2007).

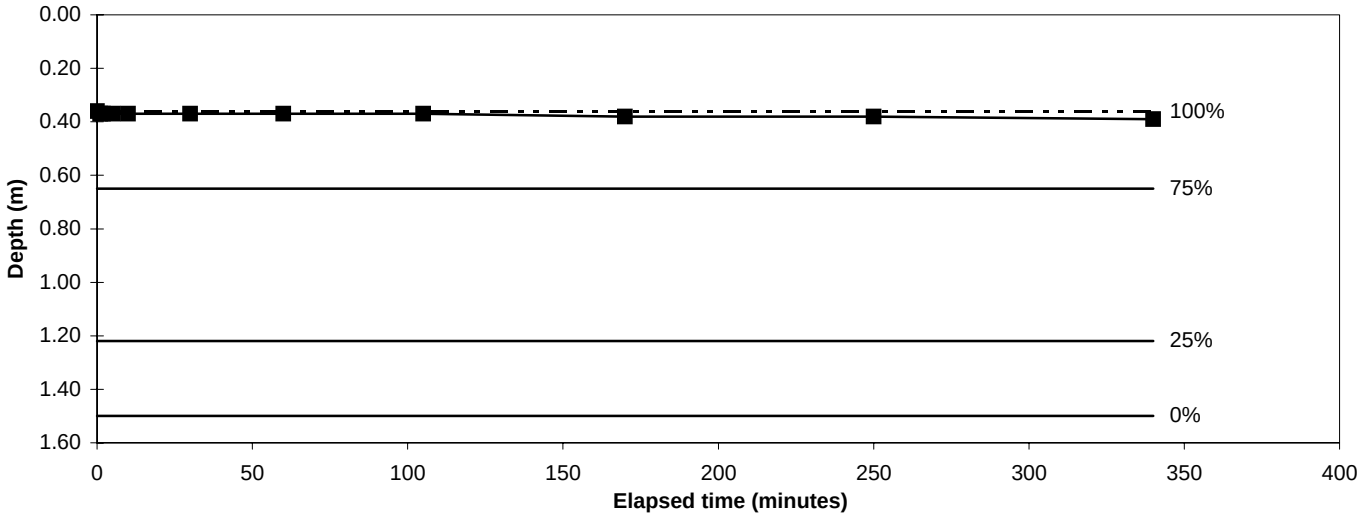
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT	Figure
	Project No.	Y2012-12A	**SKWY/TPS1/1**
	Carried out for	EirGrid	Sheet 1 of 1

Soakaway Test

Soil Mechanics

Trial Pit No:	TPS2	Test No:	1	Date:	08/03/2012
Length (m):	1.50		Datum height:	0.00	m agl
Width (m):	1.30		Granular infill:	None	
Depth (m):	1.50				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.36		
1	0.37		
2	0.37		
5	0.37		
10	0.37		
30	0.37		
60	0.37		
105	0.37		
170	0.38		
250	0.38		
340	0.39		



Start water depth for analysis (mbgl):	0.36		
75% effective depth (mbgl):	0.65	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.93		
25% effective depth (mbgl):	1.22	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.50		

Volume outflow between 75% and 25% effective depth (m3):

Mean surface area of outflow (m^2): 5.14

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate**

Remarks Results processed following BRE 365 (2007).

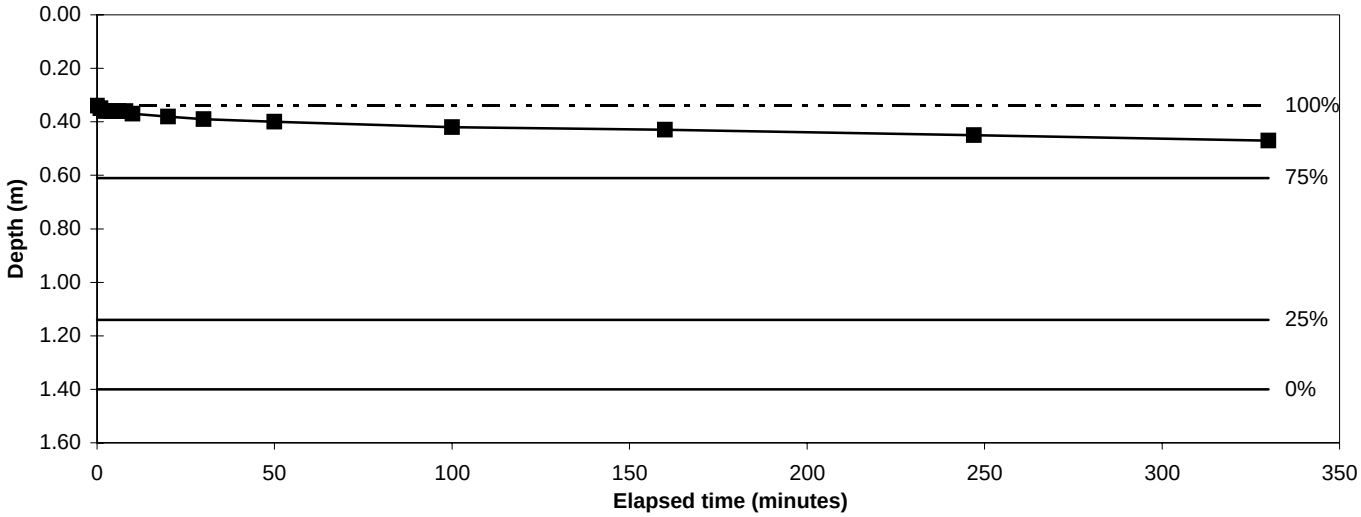
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT	Figure
	Project No.	Y2012-12A	**SKWY/TPS2/1**
	Carried out for	EirGrid	Sheet 1 of 1

Soakaway Test

Soil Mechanics

Trial Pit No:	TPS3	Test No:	1	Date:	08/03/2012
Length (m):	1.60		Datum height:	0.00	m agl
Width (m):	1.30		Granular infill:	None	
Depth (m):	1.40				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.34		
1	0.35		
2	0.36		
4	0.36		
6	0.36		
8	0.36		
10	0.37		
20	0.38		
30	0.39		
50	0.40		
100	0.42		
160	0.43		
247	0.45		
330	0.47		



Start water depth for analysis (mbgl):	0.34		
75% effective depth (mbgl):	0.61	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	0.87		
25% effective depth (mbgl):	1.14	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.40		

Volume outflow between 75% and 25% effective depth (m3):

Mean surface area of outflow (m^2): 5.15

(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate**

Remarks Results processed following BRE 365 (2007).

Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT	Figure
	Project No.	Y2012-12A	**SKWY/TPS3/1**
	Carried out for	EirGrid	Sheet 1 of 1

Dynamic Cone Penetrometer Test

Soil Mechanics

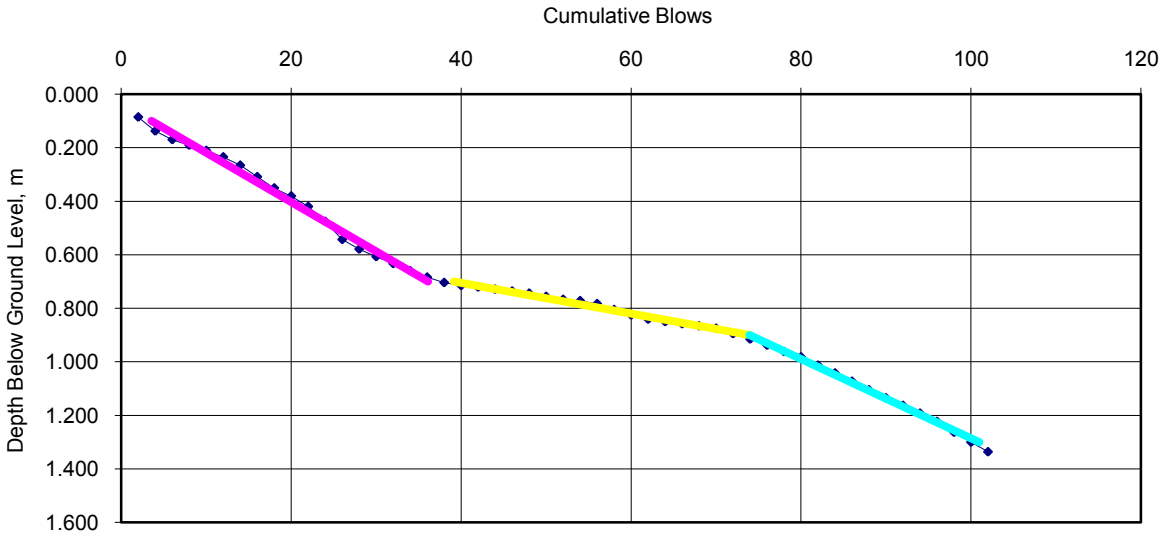
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653249.82 m E ; 692491.13 m N ; Ground level 109.71 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.086	2	0.772	54						
0.138	4	0.783	56						
0.170	6	0.805	58						
0.191	8	0.825	60						
0.211	10	0.841	62						
0.235	12	0.850	64						
0.266	14	0.858	66						
0.309	16	0.866	68						
0.351	18	0.875	70						
0.381	20	0.895	72						
0.420	22	0.915	74						
0.476	24	0.938	76						
0.543	26	0.962	78						
0.579	28	0.982	80						
0.607	30	1.013	82						
0.633	32	1.042	84						
0.660	34	1.073	86						
0.684	36	1.105	88						
0.704	38	1.135	90						
0.715	40	1.163	92						
0.721	42	1.192	94						
0.729	44	1.223	96						
0.736	46	1.263	98						
0.744	48	1.300	100						
0.756	50	1.336	102						
0.767	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.70	13
0.70	0.90	47
0.90	1.30	17

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR1

Dynamic Cone Penetrometer Test

Soil Mechanics

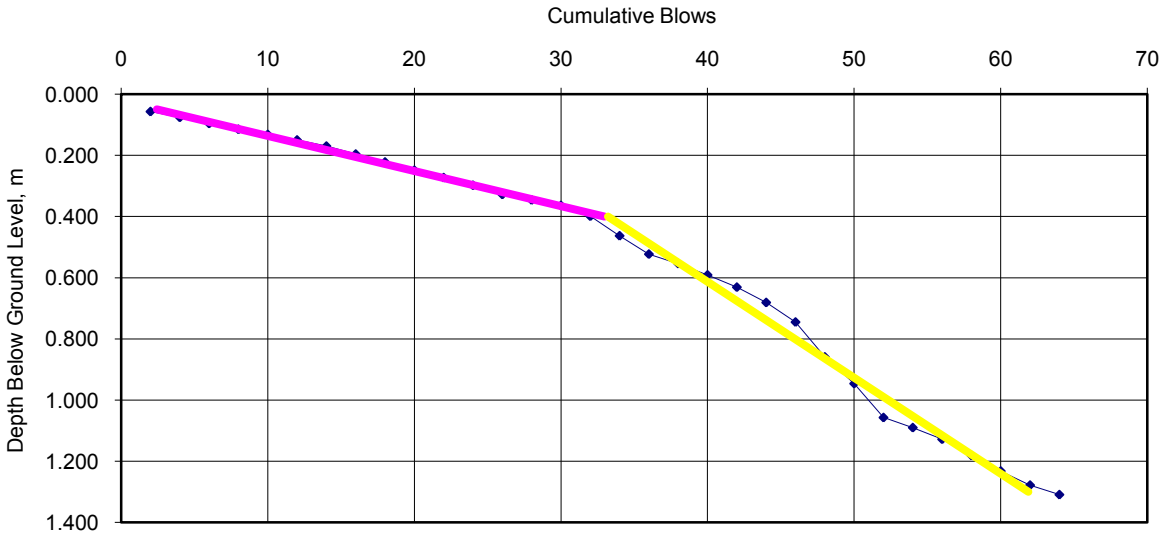
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653274.99 m E ; 692522.00 m N ; Ground level 109.27 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.057	2	1.090	54						
0.076	4	1.128	56						
0.096	6	1.181	58						
0.115	8	1.232	60						
0.132	10	1.278	62						
0.150	12	1.309	64						
0.170	14								
0.196	16								
0.222	18								
0.249	20								
0.273	22								
0.298	24								
0.328	26								
0.346	28								
0.364	30								
0.399	32								
0.463	34								
0.523	36								
0.554	38								
0.591	40								
0.631	42								
0.681	44								
0.745	46								
0.859	48								
0.946	50								
1.057	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.05	0.40	22
0.40	1.30	7.9

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole CBR2

Dynamic Cone Penetrometer Test

Soil Mechanics

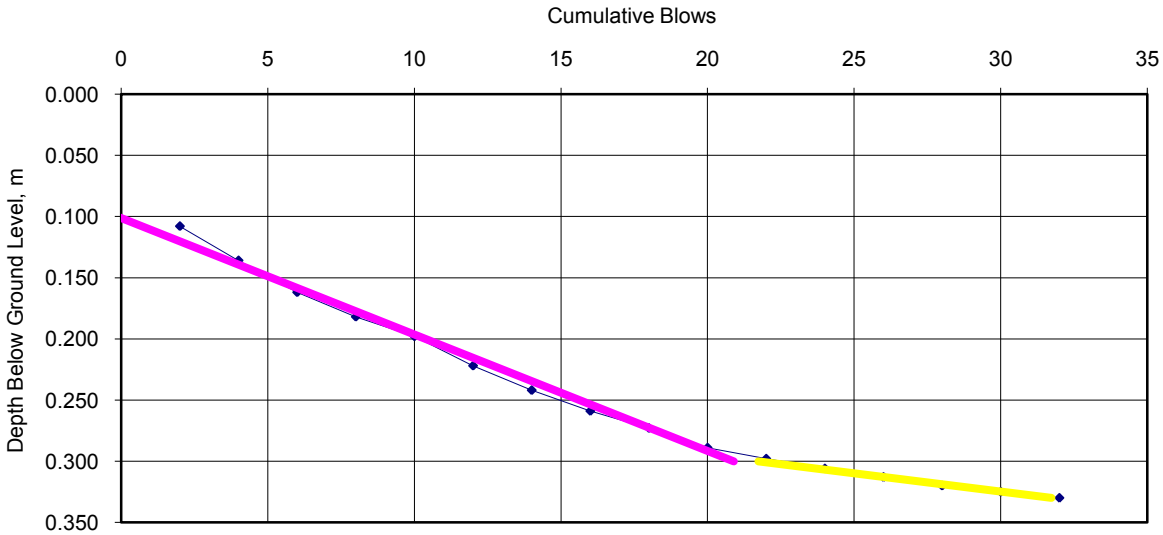
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653294.66 m E ; 692544.89 m N ; Ground level 108.96 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.108	2								
0.136	4								
0.162	6								
0.182	8								
0.198	10								
0.222	12								
0.242	14								
0.259	16								
0.273	18								
0.289	20								
0.298	22								
0.306	24								
0.313	26								
0.320	28								
0.325	30								
0.330	32								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.30	27
0.30	0.33	94

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR3

Dynamic Cone Penetrometer Test

Soil Mechanics

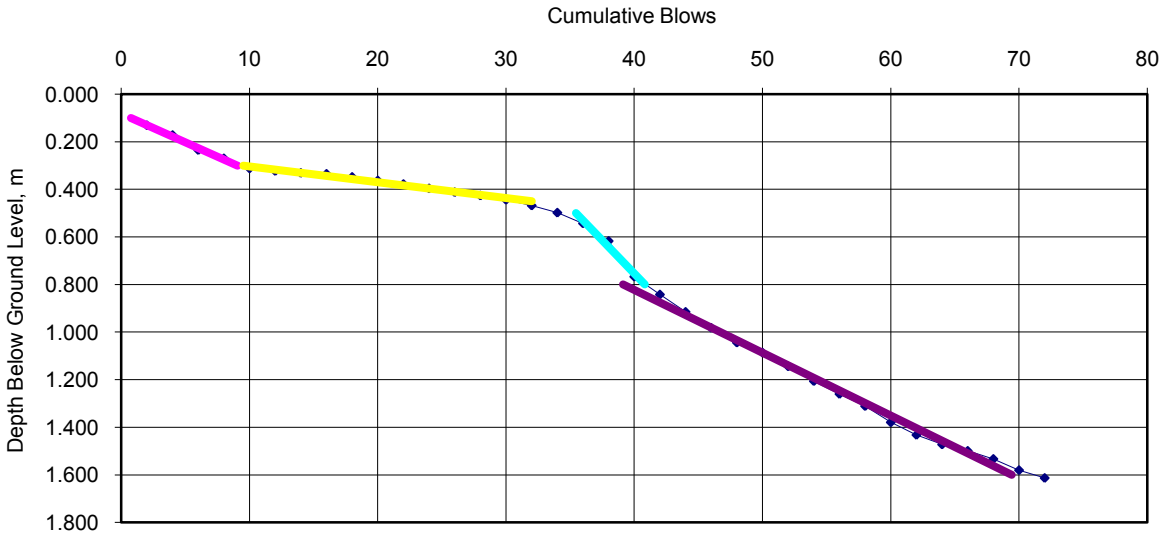
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653294.66 m E ; 692544.89 m N ; Ground level 108.96 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.131	2	1.206	54						
0.172	4	1.260	56						
0.235	6	1.311	58						
0.270	8	1.379	60						
0.312	10	1.432	62						
0.323	12	1.472	64						
0.331	14	1.499	66						
0.335	16	1.533	68						
0.348	18	1.580	70						
0.363	20	1.613	72						
0.378	22								
0.396	24								
0.412	26								
0.426	28								
0.444	30								
0.468	32								
0.498	34								
0.543	36								
0.617	38								
0.767	40								
0.842	42								
0.915	44								
0.982	46								
1.044	48								
1.086	50								
1.144	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.30	10
0.30	0.45	40
0.50	0.80	4.2
0.80	1.60	9.4

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR3A

Dynamic Cone Penetrometer Test

Soil Mechanics

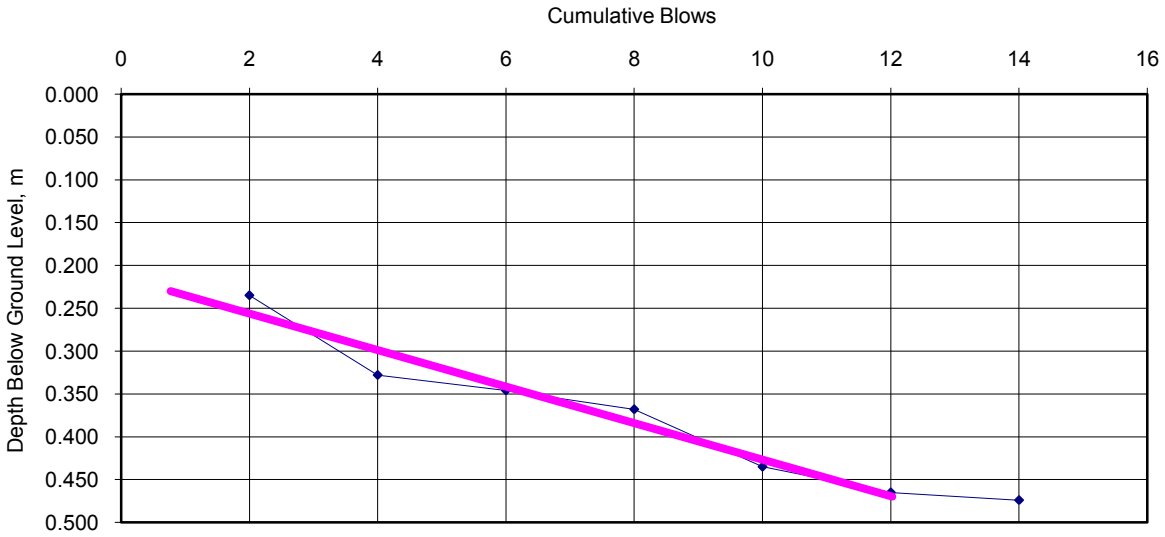
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653313.31 m E ; 692567.39 m N ; Ground level 109.00 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.235	2								
0.328	4								
0.346	6								
0.368	8								
0.435	10								
0.465	12								
0.474	14								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.23	0.47	11

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR4

Dynamic Cone Penetrometer Test

Soil Mechanics

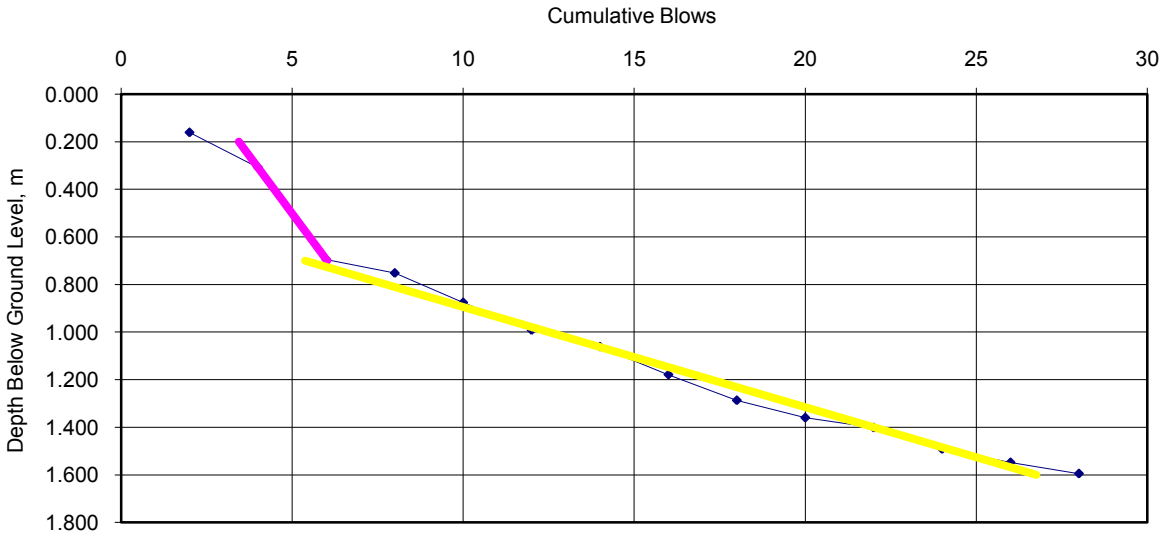
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653313.31 m E ; 692567.39 m N ; Ground level 109.00 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.161	2								
0.308	4								
0.696	6								
0.752	8								
0.876	10								
0.992	12								
1.062	14								
1.179	16								
1.287	18								
1.360	20								
1.402	22								
1.492	24								
1.548	26								
1.595	28								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.20	0.70	1.1
0.70	1.60	5.7

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR4A

Dynamic Cone Penetrometer Test

Soil Mechanics

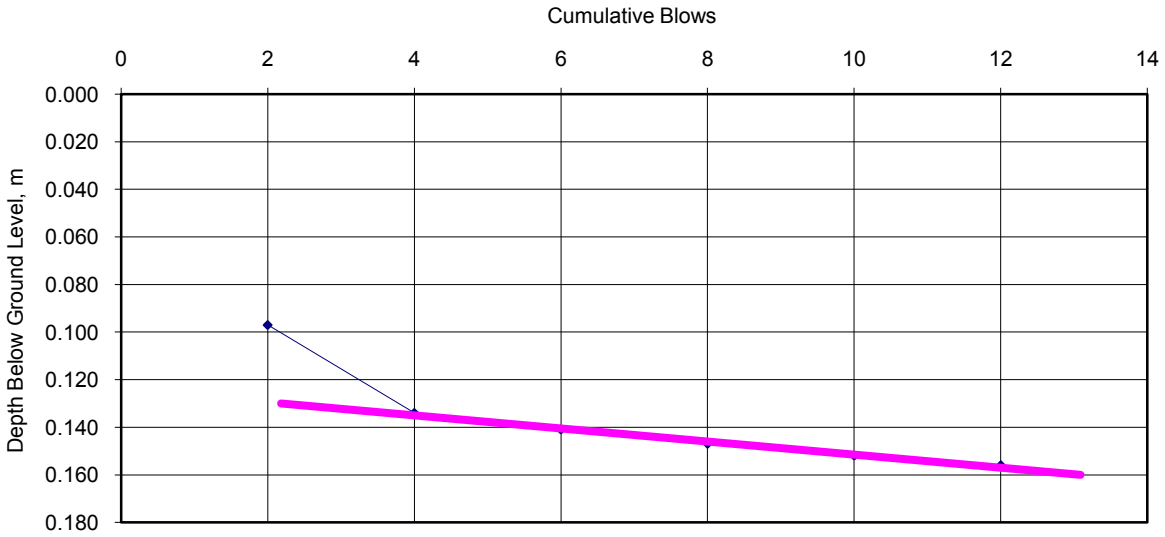
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653332.53 m E ; 692590.09 m N ; Ground level 109.38 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.097	2								
0.134	4								
0.141	6								
0.147	8								
0.152	10								
0.156	12								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.13	0.16	100

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR5

Dynamic Cone Penetrometer Test

Soil Mechanics

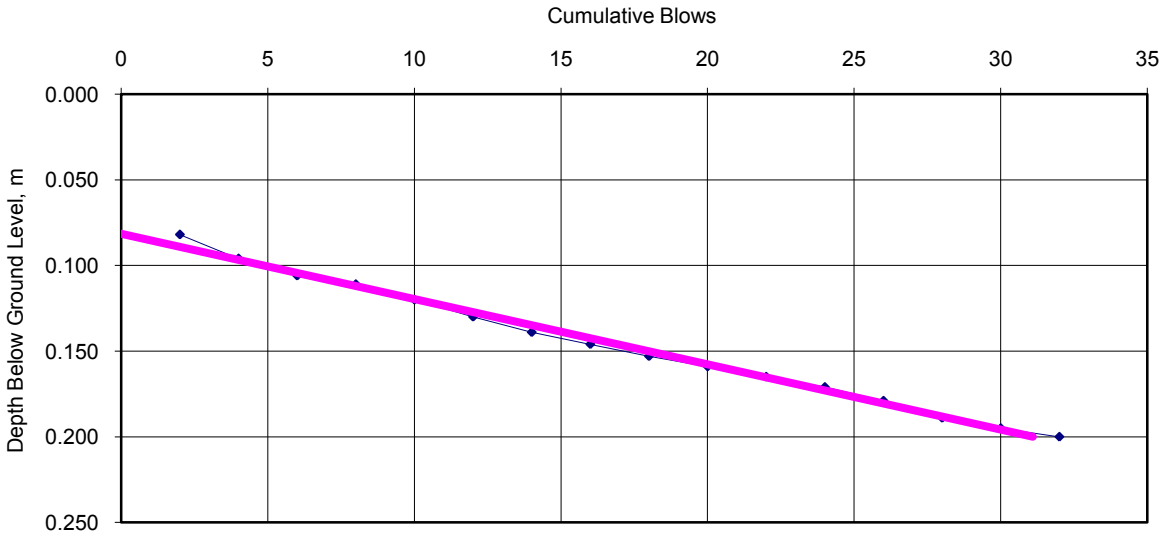
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653332.53 m E ; 692590.09 m N ; Ground level 109.38 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.082	2								
0.096	4								
0.106	6								
0.111	8								
0.120	10								
0.130	12								
0.139	14								
0.146	16								
0.153	18								
0.159	20								
0.165	22								
0.171	24								
0.179	26								
0.189	28								
0.195	30								
0.200	32								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.07	0.20	73

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR5A

Dynamic Cone Penetrometer Test

Soil Mechanics

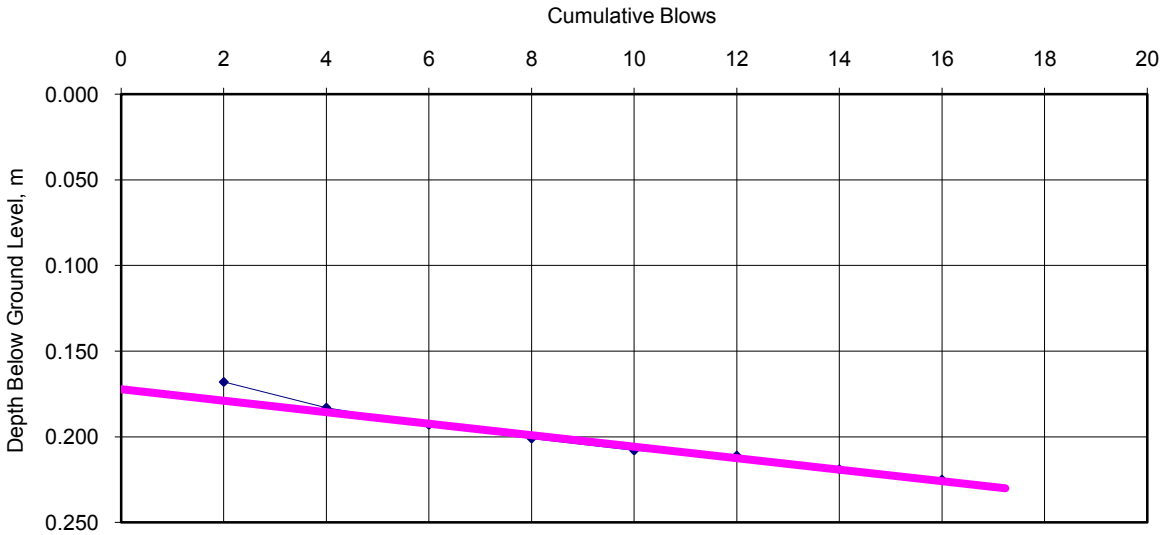
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653350.49 m E ; 692610.83 m N ; Ground level 109.30 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.168	2								
0.183	4								
0.193	6								
0.201	8								
0.208	10								
0.211	12								
0.219	14								
0.225	16								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.17	0.23	83

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole CBR6

Dynamic Cone Penetrometer Test

Soil Mechanics

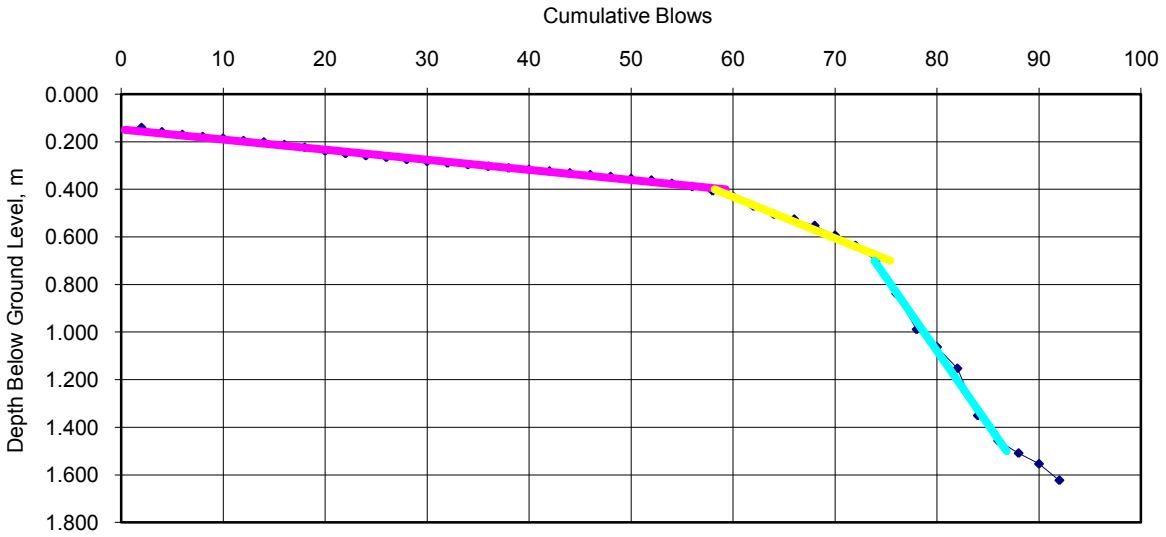
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653350.49 m E ; 692610.83 m N ; Ground level 109.30 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.141	2	0.376	54						
0.159	4	0.389	56						
0.170	6	0.407	58						
0.179	8	0.430	60						
0.186	10	0.471	62						
0.196	12	0.505	64						
0.202	14	0.526	66						
0.213	16	0.553	68						
0.224	18	0.594	70						
0.239	20	0.637	72						
0.250	22	0.700	74						
0.259	24	0.839	76						
0.266	26	0.989	78						
0.275	28	1.063	80						
0.283	30	1.153	82						
0.290	32	1.351	84						
0.297	34	1.457	86						
0.304	36	1.509	88						
0.311	38	1.554	90						
0.317	40	1.623	92						
0.324	42								
0.332	44								
0.339	46								
0.347	48								
0.355	50								
0.362	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.15	0.40	65
0.40	0.70	14
0.70	1.50	3.8

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR6A

Dynamic Cone Penetrometer Test

Soil Mechanics

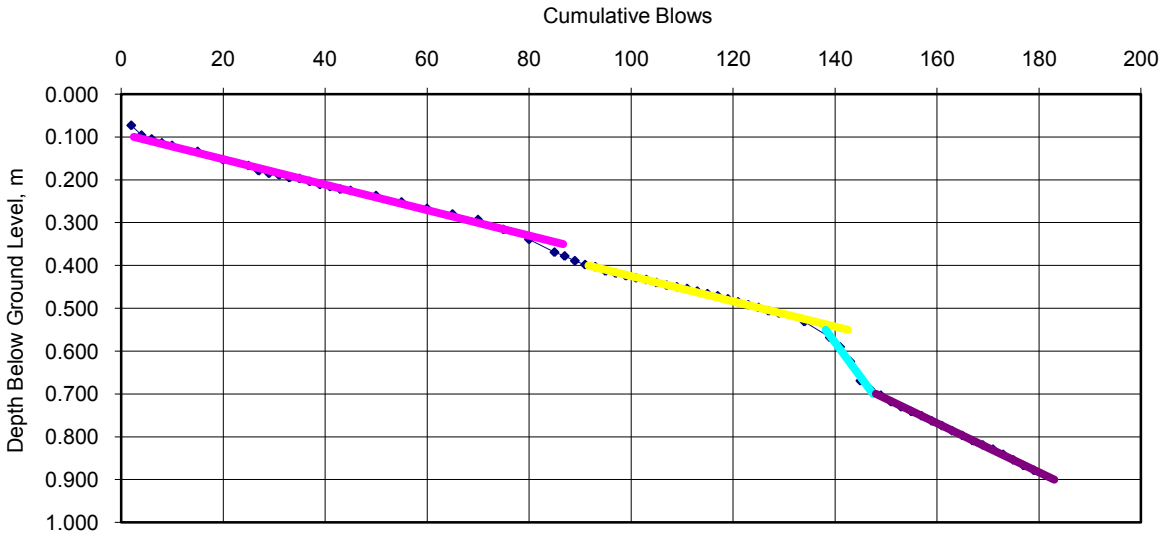
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653368.55 m E ; 692632.25 m N ; Ground level 108.66 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.073	2	0.378	87	0.669	145				
0.096	4	0.389	89	0.690	147				
0.105	6	0.398	91	0.703	149				
0.114	8	0.403	93	0.718	151				
0.120	10	0.413	95	0.730	153				
0.134	15	0.418	97	0.741	155				
0.153	20	0.424	99	0.751	157				
0.167	25	0.429	101	0.763	159				
0.179	27	0.433	103	0.774	161				
0.185	29	0.440	105	0.786	163				
0.189	31	0.446	107	0.797	165				
0.195	33	0.450	109	0.809	167				
0.197	35	0.454	111	0.819	169				
0.204	37	0.460	113	0.829	171				
0.211	39	0.466	115	0.841	173				
0.216	41	0.471	117	0.854	175				
0.222	43	0.478	119	0.867	177				
0.225	45	0.485	121	0.878	179				
0.237	50	0.492	123						
0.252	55	0.498	125						
0.267	60	0.506	127						
0.280	65	0.511	129						
0.293	70	0.531	134						
0.316	75	0.568	139						
0.339	80	0.590	141						
0.369	85	0.624	143						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.35	95
0.40	0.55	96
0.55	0.70	15
0.70	0.90	47

Prepared: 14/03/2012 17:13

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project •

Project No. •

Carried out for •

Hole

CBR7

Dynamic Cone Penetrometer Test

Soil Mechanics

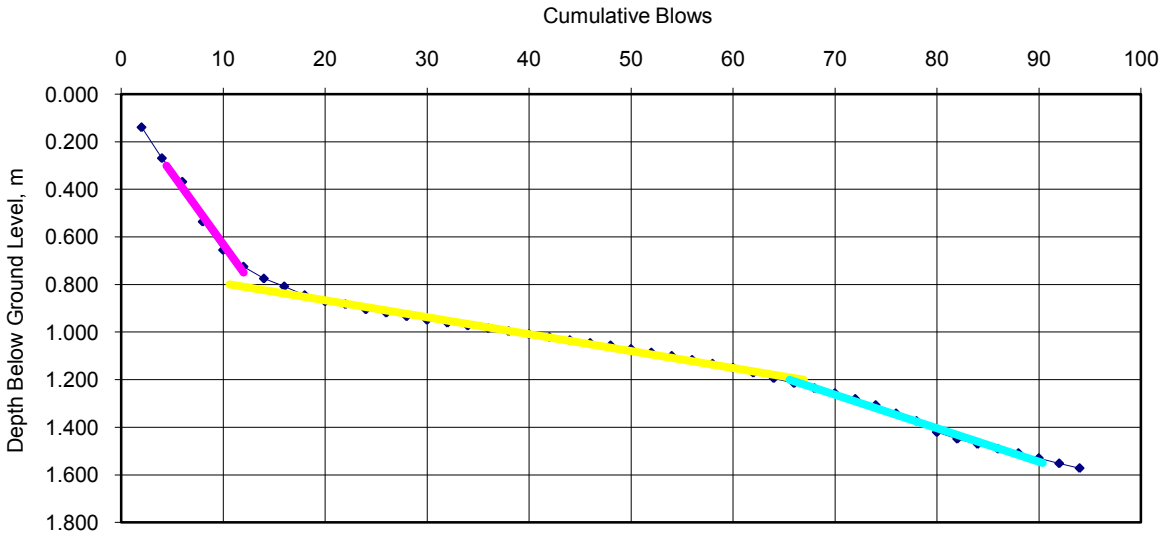
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653385.39 m E ; 692652.70 m N ; Ground level 108.15 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.139	2	1.100	54						
0.269	4	1.117	56						
0.368	6	1.133	58						
0.536	8	1.150	60						
0.655	10	1.171	62						
0.725	12	1.194	64						
0.775	14	1.215	66						
0.808	16	1.236	68						
0.845	18	1.257	70						
0.871	20	1.281	72						
0.883	22	1.307	74						
0.905	24	1.342	76						
0.919	26	1.374	78						
0.934	28	1.421	80						
0.949	30	1.449	82						
0.961	32	1.471	84						
0.973	34	1.491	86						
0.984	36	1.509	88						
0.996	38	1.530	90						
1.009	40	1.552	92						
1.021	42	1.572	94						
1.034	44								
1.046	46								
1.056	48								
1.071	50								
1.086	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.30	0.75	4
0.80	1.20	38
1.20	1.55	18

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR8

Dynamic Cone Penetrometer Test

Soil Mechanics

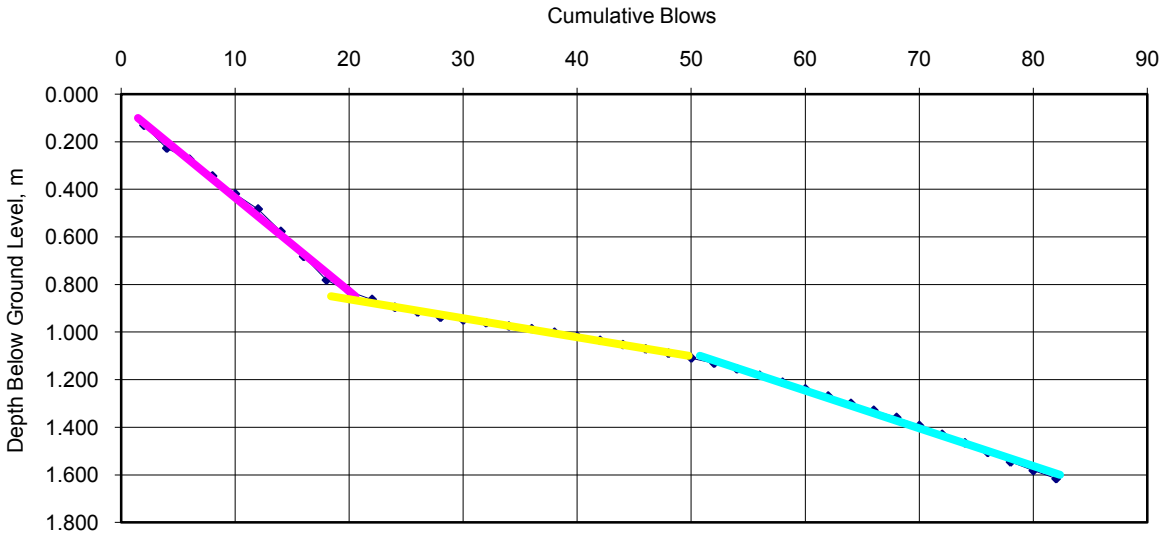
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653403.26 m E ; 692674.52 m N ; Ground level 107.57 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.131	2	1.155	54						
0.227	4	1.182	56						
0.274	6	1.211	58						
0.344	8	1.239	60						
0.419	10	1.269	62						
0.483	12	1.300	64						
0.577	14	1.329	66						
0.682	16	1.359	68						
0.781	18	1.393	70						
0.829	20	1.430	72						
0.863	22	1.466	74						
0.896	24	1.506	76						
0.916	26	1.546	78						
0.938	28	1.582	80						
0.949	30	1.616	82						
0.961	32								
0.975	34								
0.986	36								
1.001	38								
1.018	40								
1.035	42								
1.053	44								
1.071	46								
1.089	48								
1.109	50								
1.131	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.10	0.85	6.2
0.85	1.10	33
1.10	1.60	16

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR9

Dynamic Cone Penetrometer Test

Soil Mechanics

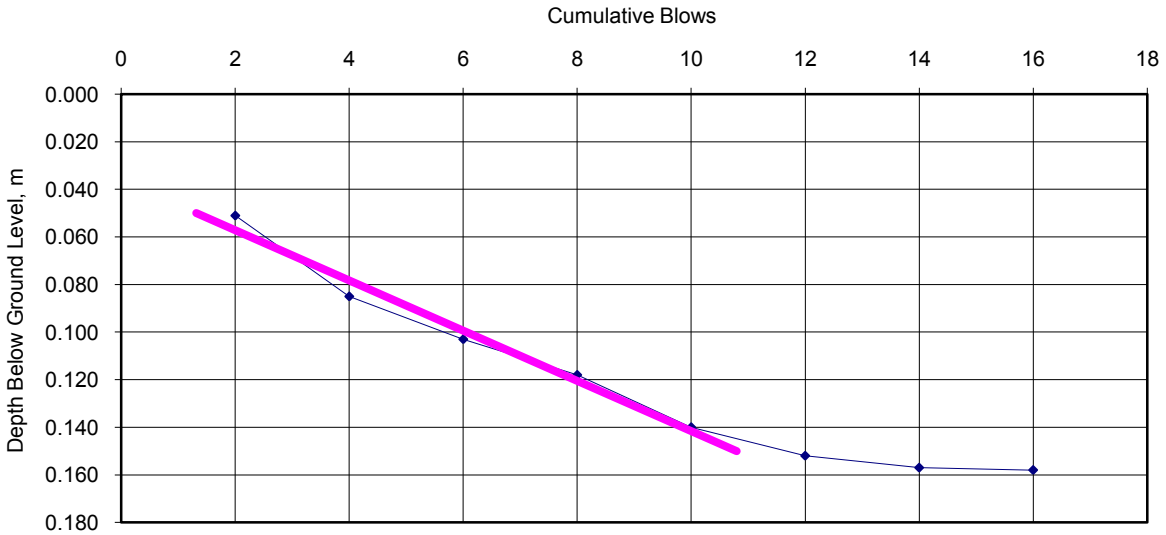
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653421.10 m E ; 692696.16 m N ; Ground level 106.03 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.051	2								
0.085	4								
0.103	6								
0.118	8								
0.140	10								
0.152	12								
0.157	14								
0.158	16								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.05	0.15	25

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole

CBR10

Dynamic Cone Penetrometer Test

Soil Mechanics

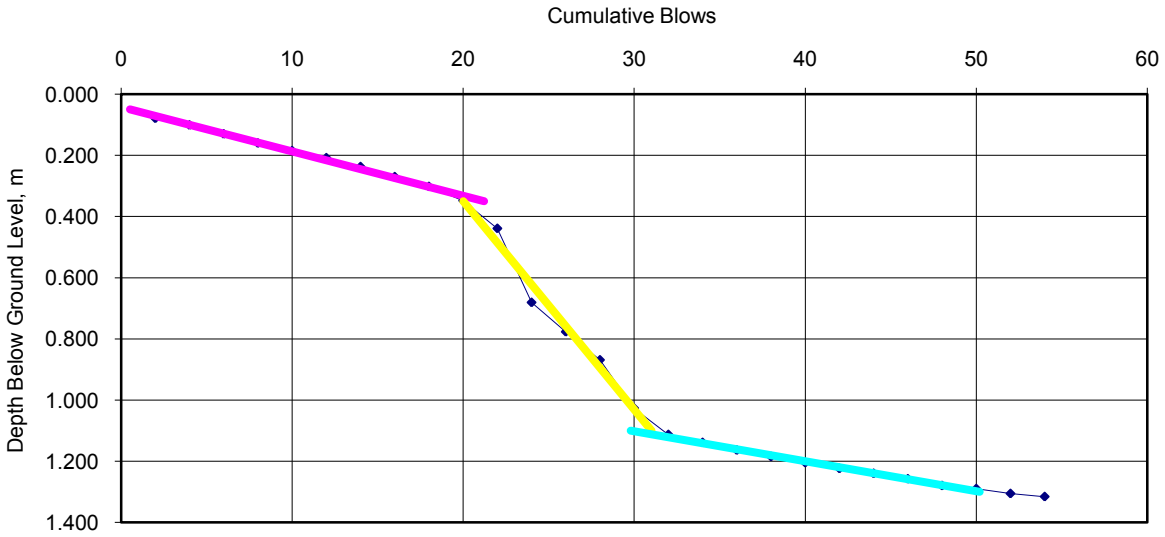
Date of Test: 12/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates. 653421.10 m E ; 692696.16 m N ; Ground level 106.03 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.079	2	1.316	54						
0.101	4								
0.130	6								
0.160	8								
0.185	10								
0.208	12								
0.237	14								
0.270	16								
0.302	18								
0.348	20								
0.439	22								
0.681	24								
0.777	26								
0.869	28								
1.027	30								
1.113	32								
1.139	34								
1.164	36								
1.185	38								
1.205	40								
1.224	42								
1.240	44								
1.258	46								
1.280	48								
1.290	50								
1.306	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.05	0.35	17
0.35	1.10	3.4
1.10	1.30	27

Prepared: 14/03/2012 16:52

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT

Project No. Y2012-12A

Carried out for EirGrid

Hole CBR10A

ENCLOSURE C

GEOTECHNICAL LABORATORY TEST RESULTS

Project Name

LAOIS KILKENNY

Project No.

Y2012-12A

Details of Report Contents

*Tests in the following list marked * are not UKAS accredited*

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SOIL TESTS

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UU triaxial compression test - Summary of Results	UUSUM	1	to 1	
Particle Size Distribution Analyses	PSD	1	to 13	
END OF REPORT			.	

ESG Environmental Scientifics Group

Total number of pages in this report 18

CHEMICAL TESTS - SUMMARY OF RESULTS

Project No	Project Name
Y2012-12A	LAOIS KILKENNY REINFORCEMENT PROJECT

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	Org %	LOI %	pH	Sulphate as SO_4 Preparation/test *	Sulphate as SO_4 2:1 water sol. g/L	Sulphate as SO_4 ground water g/L	Sulphate as SO_4 acid sol. %	SD1 options TS %	SD1 options Mg mg/L NO_3 mg/L NH_4	CO_2 %	Chloride, Cl water sol. %	Chloride, Cl acid sol. %	<2 mm %	Remarks
BH1	6	0.90	1.20	B	Brownish grey slightly sandy slightly gravelly CLAY.			8.2	1+3	0.07								54	
BH3	13	3.00	3.50	B	Dark grey slightly sandy slightly gravelly CLAY.			8.2	1+3	0.26								65	
BH4	18	1.10		W				7.0	2+3		0.06								
BH4	14	3.20	3.70	B	Dark grey slightly sandy slightly gravelly CLAY.			8.2	1+3	0.26								69	
BH6	11	3.50	4.00	B	Brownish grey slightly sandy slightly gravelly CLAY.			8.1	1+3	0.05								81	
BH8	6	0.60	1.10	B	Greyish brown slightly sandy slightly gravelly CLAY.			8.2	1+3	0.11								73	
BH10	9	2.20	2.70	B	Grey gravelly slightly clayey SAND with one cobble.			8.4	1+3	0.21								50	
TP3	3	1.50	1.60	B	Brownish grey slightly sandy slightly gravelly CLAY with 1 cobble.			8.1	1+3	0.07								65	
TP4	4	2.00	2.10	B	Brown silty very gravelly SAND.			8.3	1+3	0.08								39	
TP5	4	2.50	2.60	B	Dark grey slightly gravelly sandy CLAY.			8.2	1+3	0.07								69	
TP6	3	1.90	2.00	B	Grey slightly sandy gravelly CLAY with 1 cobble.			8.1	1+3	0.24								53	

BS 1377 : definitive method unless stated :

Org Organic matter content (s-sulphides, c-chlorides identified)

LOI Mass loss on ignition at 440°C

CO_2 Carbonate content (rapid titration)

Cl Chloride content

* Sulphate tests preparation / test methods :

1. BS 1377:Part 3:1990:clause 5.3
2. BS 1377:Part 3:1990:clause 5.4
3. BS 1377:Part 3:1990:clause 5.5
4. TRL447 - 1 water soluble sulphate
5. TRL447 - 2 acid soluble sulphate
6. BR279 - groundwater sulphate

< 2mm material passing 2mm sieve

BRE Special Digest SD1, dependent options :

TS Total Sulphur to BR279 / EN ISO15178

Mg Soluble Magnesium to BR279, colorimetric

NO3 Soluble Nitrate to BR279, colorimetric

NH_4 qualitative

INDEX PROPERTIES - SUMMARY OF RESULTS

Project No	Project Name
Y2012-12A	LAOIS KILKENNY REINFORCEMENT PROJECT

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	p Mg/m^3	p_d Mg/m^3	w %	< 425 µm sieve %	W_L %	W_P %	I_P	p_s Mg/m^3	Remarks
BH1	12	3.30		D	Dark grey slightly gravelly slightly clayey SAND.			6.7						
BH1	14	3.80	4.30	B	Brownish grey slightly sandy slightly gravelly CLAY.				57 s	23 a	13	10		
BH2	8	1.20	1.20	B	Brown gravelly slightly clayey SAND.			14	71 s	20 b	NP			
BH2	15	3.80		D	Grey slightly sandy slightly gravelly CLAY.			13						
BH2	16	4.20	4.70	B	Dark grey slightly gravelly sandy CLAY.				64 s	20 a	12	8		
BH3	12	2.65		D	Grey slightly sandy gravelly CLAY.			9.2						
BH4	10	2.15		D	Greyish brown slightly sandy gravelly CLAY.			6.4						
BH4	11	2.20	2.70	B	Grey slightly sandy slightly gravelly CLAY.				64 s	21 a	12	9		
BH4	15	4.00		D	Brownish grey slightly sandy slightly gravelly CLAY.			10						
BH4	19	5.60	6.00	B	Brownish grey sandy gravelly very clayey COBBLES.				18 s	24 a	14	10		
BH4	20	6.00		D	Dark grey slightly gravelly sandy CLAY.			12						
BH5	9	1.20	1.70	B	Brownish grey slightly sandy gravelly CLAY with occasional rootlets and 1 cobble.				44 s	21 a	13	8		
BH5	8	1.20	1.65	D	Dark brownish grey slightly sandy slightly gravelly CLAY.			6.7						
BH5	15	4.15		D	Dark grey slightly sandy slightly gravelly CLAY.			10						
BH5	16	4.20	4.70	B	Grey slightly sandy slightly gravelly CLAY.				73 s	25 a	14	11		
BH6	6	0.60	1.10	B	Greyish brown slightly sandy gravelly CLAY.			9.6						
BH6	7	1.20	1.70	B	Greyish brown slightly sandy slightly gravelly CLAY.			9.3	48 s	22 a	13	9		
BH7	10	1.80	2.20	B	Greyish brown slightly sandy slightly gravelly CLAY.			13	62 s	23 a	14	9		
BH8	7	1.20	1.65	B	Greyish brown slightly sandy slightly gravelly CLAY.				59 s	24 a	14	10		
BH8	8	1.70		D	Brownish grey slightly sandy slightly gravelly CLAY.			7.8						
BH8	14	4.20	4.70	B	Dark grey slightly sandy gravelly CLAY.			10	43 s	23 a	13	10		
BH9	8	0.80		D	Dark brownish grey slightly gravelly sandy CLAY.			8.4	60 s	22 a	12	10		
BH9	16	3.20	3.70	B	Brownish grey slightly sandy slightly gravelly CLAY.			11	60 s	23 a	14	9		
BH10	11	3.00	3.50	B	Grey slightly sandy slightly gravelly SILT with occasional rootlets.			9.5	66 s	20 a	15	5		
TP5	2	0.50	0.60	D	Brown slightly gravelly sandy CLAY.			9.3	63 s	23 a	14	9		
TP9	4	1.50	1.60	D	Light brown slightly gravelly slightly clayey SAND.			9.7	57 s	18 a	12	6		

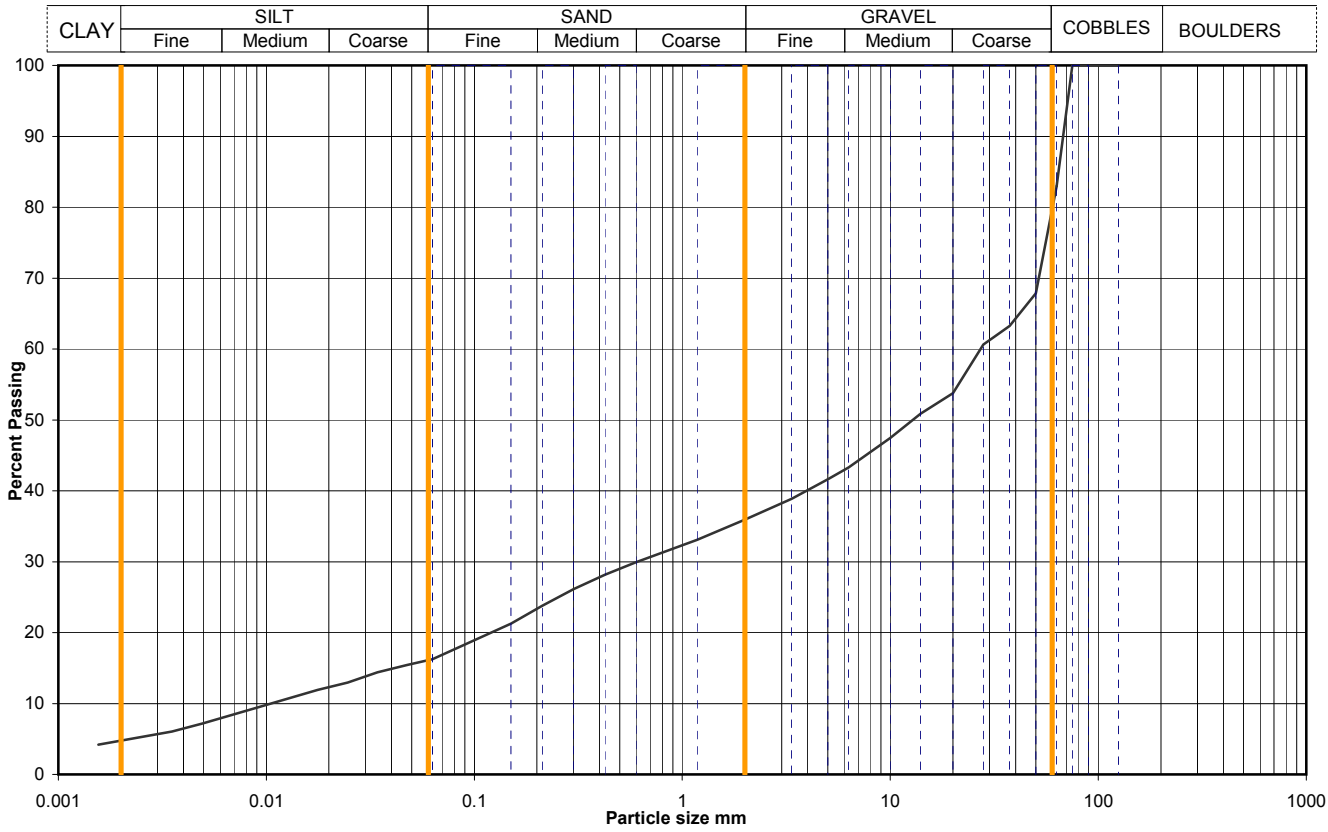
General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See individual test reports for further details.

Key :

p	bulk density, linear	W_L Liquid limit	W_P	Plastic limit	<425um preparation	p_s	particle density
p_d	dry density	a 4 point cone test	NP	non - plastic	n from natural soil	-g =	gas jar
w	moisture content	b 1 point cone test	I_P	Plasticity Index	s sieved specimen	-p =	small pyknometer

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH1		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	2.30		
			Samp No	10	Type	B
			ID	ESGY2012-12A201203150000000095		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	16
90	100	0.0476	15
75	100	0.0342	14
63	83	0.0246	13
50	68	0.0176	12
37.5	63	0.0094	10
28	61	0.0049	7
20	54	0.0035	6
14	51	0.0016	4
10	47		
6.3	43		
5.0	42		
3.35	39		
2.00	36		
1.18	33	Particle density, Mg/m3	
0.600	30		
0.425	28	2.65 assumed	
0.300	26	Dry mass of sample, kg	
0.212	24		
0.150	21	4.0	
0.063	16		

Soil description	Greyish brown slightly sandy gravelly CLAY with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	20	0
	Gravel	44	55
	Sand	20	25
	Silt	11	14
	Clay	5	6

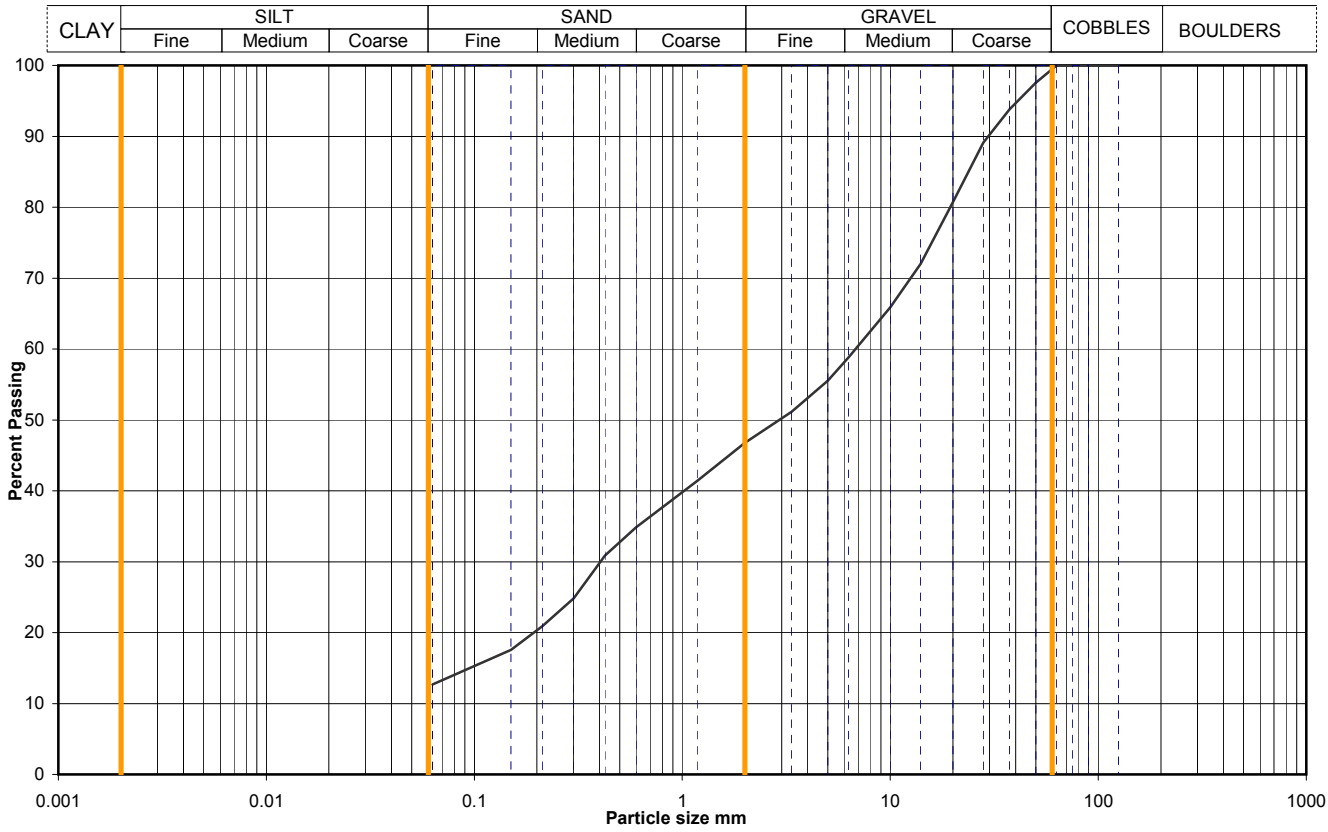
Uniformity Coefficient	D_{60} / D_{10}	2575

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:22	**Figure** **PSD 1**

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.20		
			Samp No	7	Type	B
			ID	ESGY2012-12A201203270000000185		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	98		
37.5	94		
28	89		
20	81		
14	72		
10	66		
6.3	59		
5.0	56		
3.35	51		
2.00	47		
1.18	41		
0.600	35		
0.425	31		
0.300	25	Dry mass of sample, kg	
0.212	21		
0.150	18	9.7	
0.063	13		

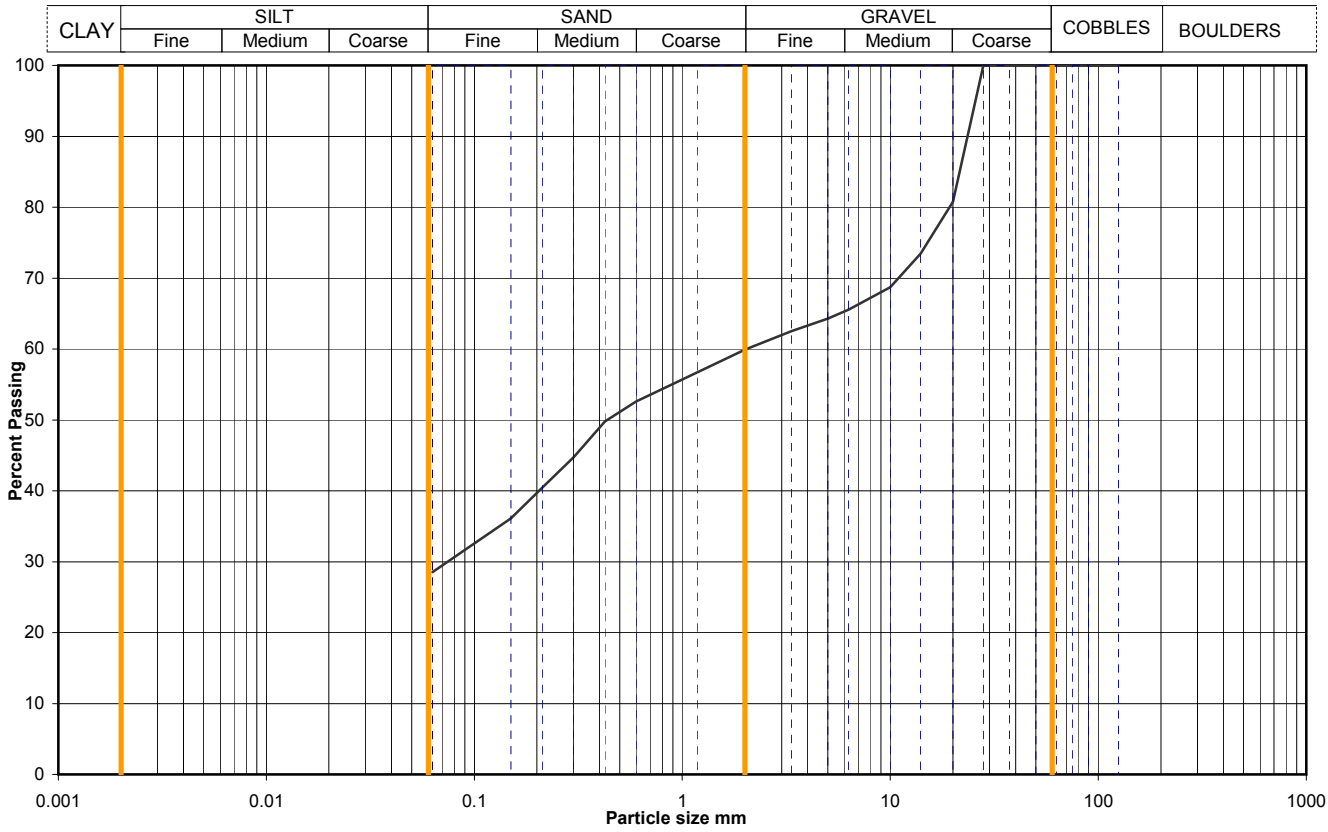
Soil description	Greyish brown very sandy clayey GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	1	0
	Gravel	52	53
	Sand	34	34
	Silt	silt+clay =	
	Clay	13	13

Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.70		
			Samp No	9	Type	D
			ID	ESGY2012-12A201203270000000188		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	81		
14	73		
10	69		
6.3	66		
5.0	64		
3.35	63		
2.00	60		
1.18	57		
0.600	53		
0.425	50		
0.300	45	Dry mass of sample, kg	
0.212	40		
0.150	36	0.2	
0.063	29		

Soil description	Brownish grey slightly sandy gravelly CLAY.		
Preparation / Pretreatment	Sieve: pre dried,		
Remarks	Sieve: Insufficient material for sedimentation		
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	40	40
	Sand	31	31
	Silt	silt+clay =	
	Clay	29	29

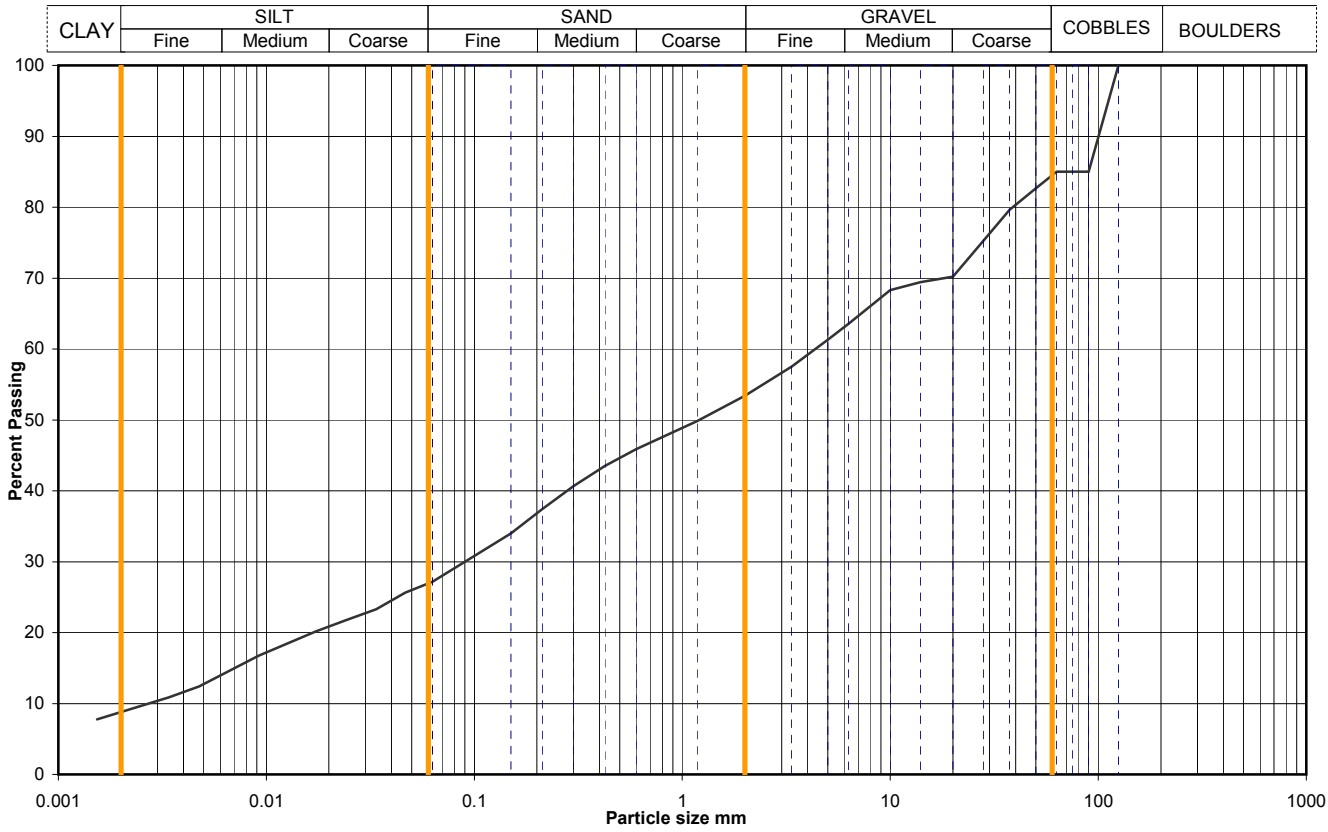
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:22	**Figure** **PSD 3**

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH5		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.20		
			Samp No	9	Type	B
			ID	ESGY2012-12A201203270000000207		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	27
90	85	0.0466	26
75	85	0.0337	23
63	85	0.0242	22
50	83	0.0173	20
37.5	80	0.0092	17
28	75	0.0048	12
20	70	0.0034	11
14	69	0.0015	8
10	68		
6.3	64		
5.0	61		
3.35	58		
2.00	53		
1.18	50	Particle density, Mg/m3	
0.600	46		
0.425	44	2.65 assumed	
0.300	41	Dry mass of sample, kg	
0.212	37		
0.150	34	8.8	
0.063	27		

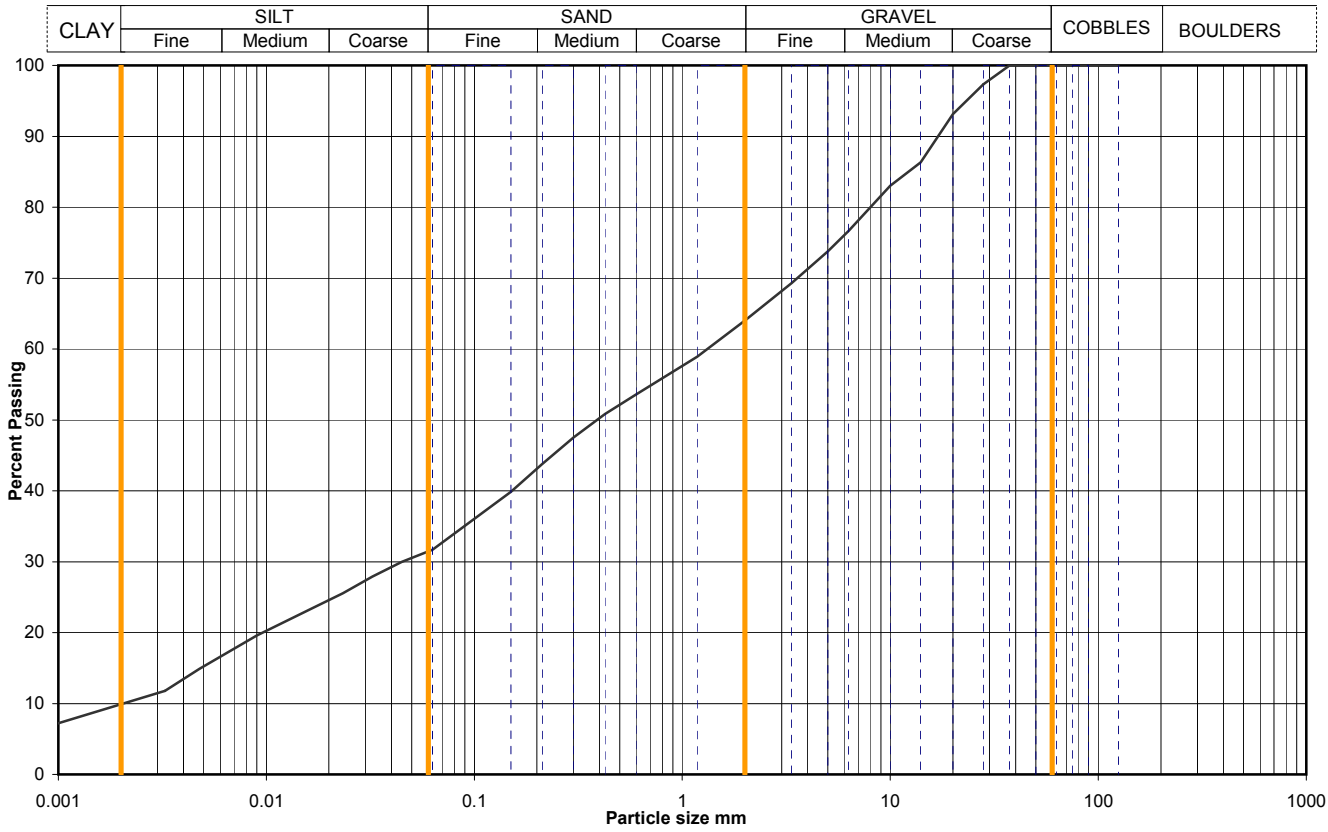
Soil description	Brownish grey slightly sandy gravelly CLAY with occasional rootlets and 1 cobble.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	15	0
	Gravel	32	38
	Sand	26	31
	Silt	18	21
	Clay	9	11

Uniformity Coefficient	D_{60} / D_{10}	1596

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH6		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	2.30		
			Samp No	9	Type	B
			ID	ESGY2012-12A201203270000000229		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	32
90	100	0.0448	30
75	100	0.0323	28
63	100	0.0234	26
50	100	0.0168	24
37.5	100	0.0090	20
28	97	0.0048	15
20	93	0.0033	12
14	86	0.0008	7
10	83		
6.3	77		
5.0	74		
3.35	69		
2.00	64		
1.18	59	Particle density, Mg/m3	
0.600	54		
0.425	51	2.65 assumed	
0.300	48	Dry mass of sample, kg	
0.212	44		
0.150	40	11.0	
0.063	32		

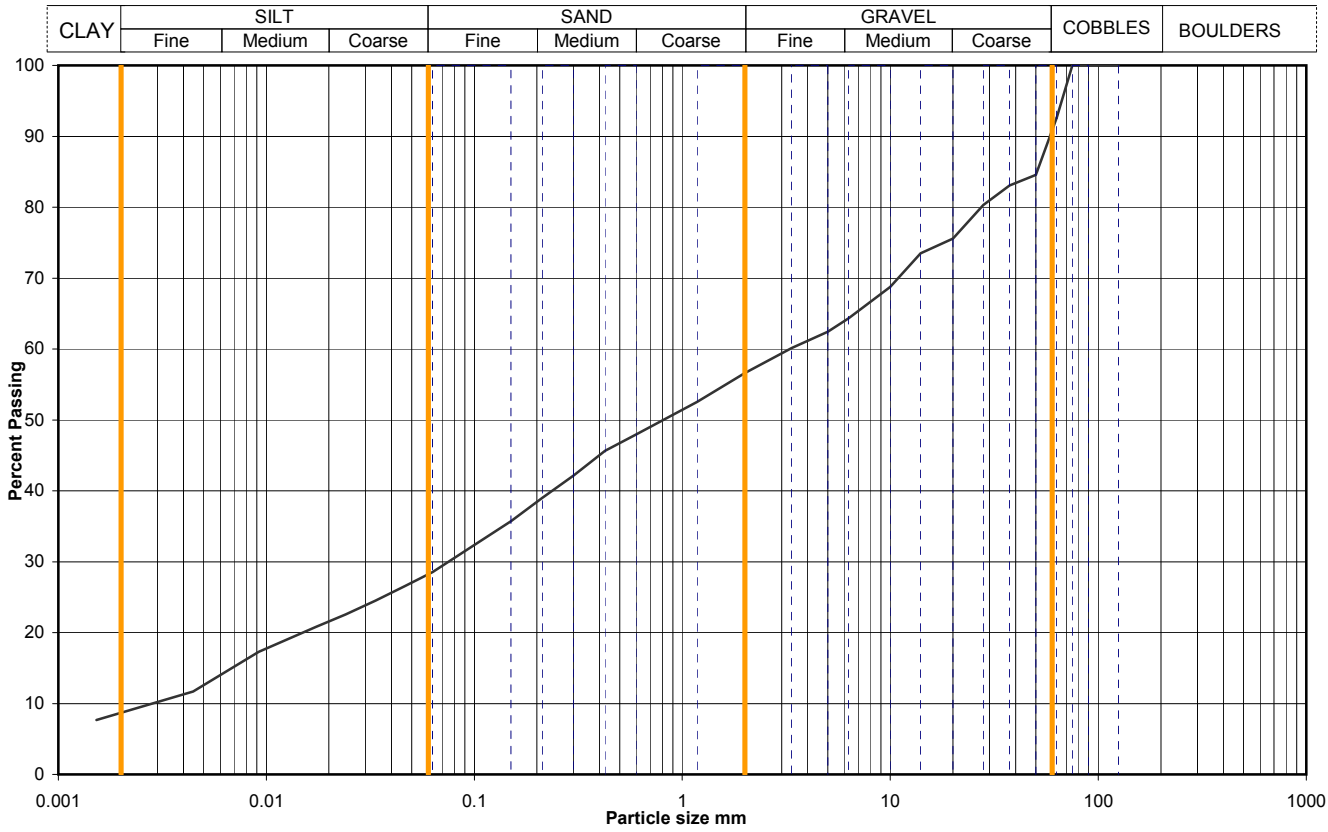
Soil description	Dark brown slightly sandy gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	36	36
	Sand	33	33
	Silt	21	21
	Clay	10	10

Uniformity Coefficient	D_{60} / D_{10}	641

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH8		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	2.20		
			Samp No	10	Type	B
			ID	ESGY2012-12A201203150000000148		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	29
90	100	0.0465	27
75	100	0.0335	25
63	93	0.0241	23
50	85	0.0173	21
37.5	83	0.0092	17
28	80	0.0044	12
20	76	0.0032	10
14	73	0.0015	8
10	69		
6.3	64		
5.0	62		
3.35	60		
2.00	57		
1.18	53	Particle density, Mg/m3	
0.600	48		
0.425	46	2.65 assumed	
0.300	42	Dry mass of sample, kg	
0.212	39		
0.150	36	8.2	
0.063	29		

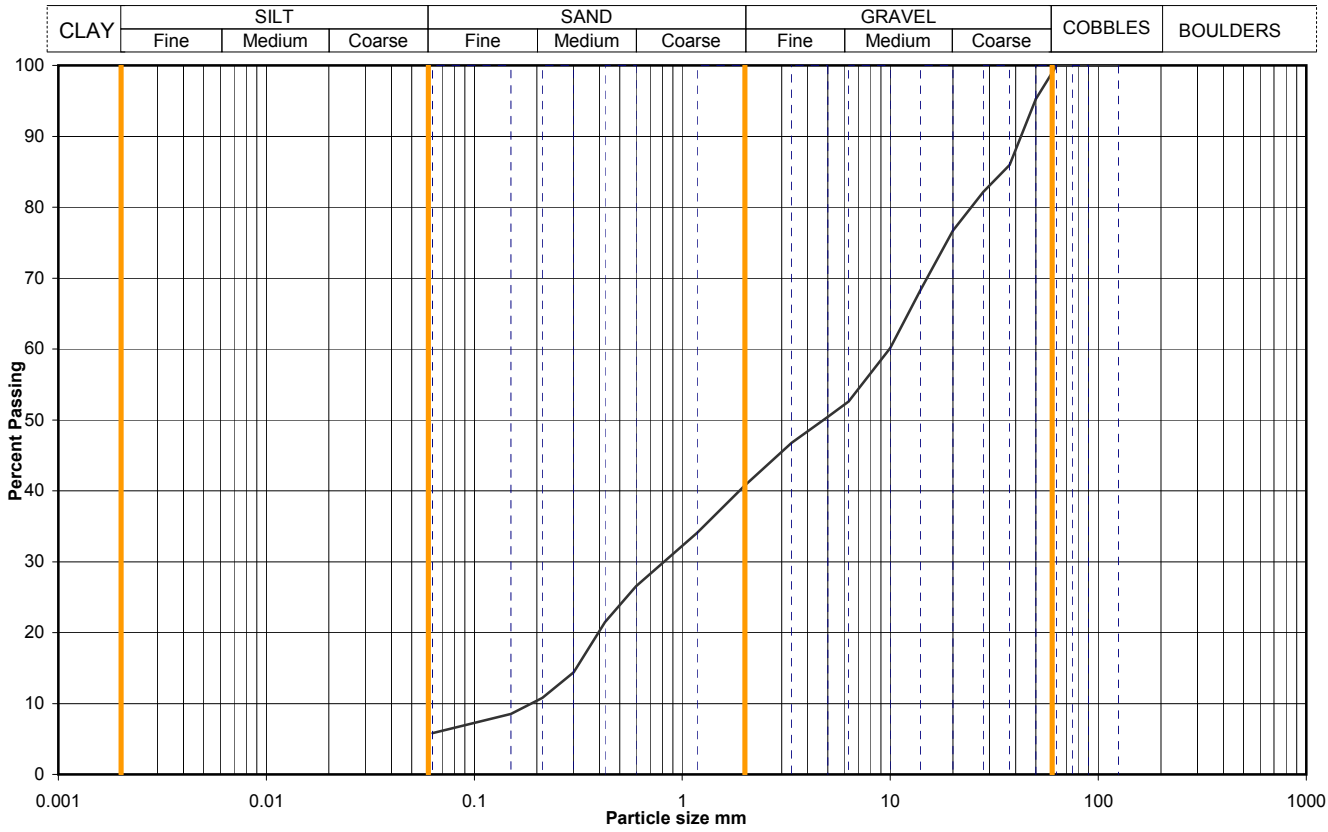
Soil description	Brownish grey slightly sandy gravelly CLAY with one cobble.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	9	0
	Gravel	34	37
	Sand	28	31
	Silt	20	22
	Clay	9	10

Uniformity Coefficient	D_{60} / D_{10}	1158

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	BH10		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.20		
			Samp No	7	Type	B
			ID	ESGY2012-12A201203150000000110		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	86		
28	82		
20	77		
14	68		
10	60		
6.3	53		
5.0	50		
3.35	47		
2.00	41		
1.18	34		
0.600	27		
0.425	21		
0.300	14	Dry mass of sample, kg	
0.212	11		
0.150	9	8.6	
0.063	6		

Soil description	Brownish grey very sandy clayey GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	1	0
	Gravel	58	59
	Sand	35	35
	Silt	silt+clay =	
	Clay	6	6

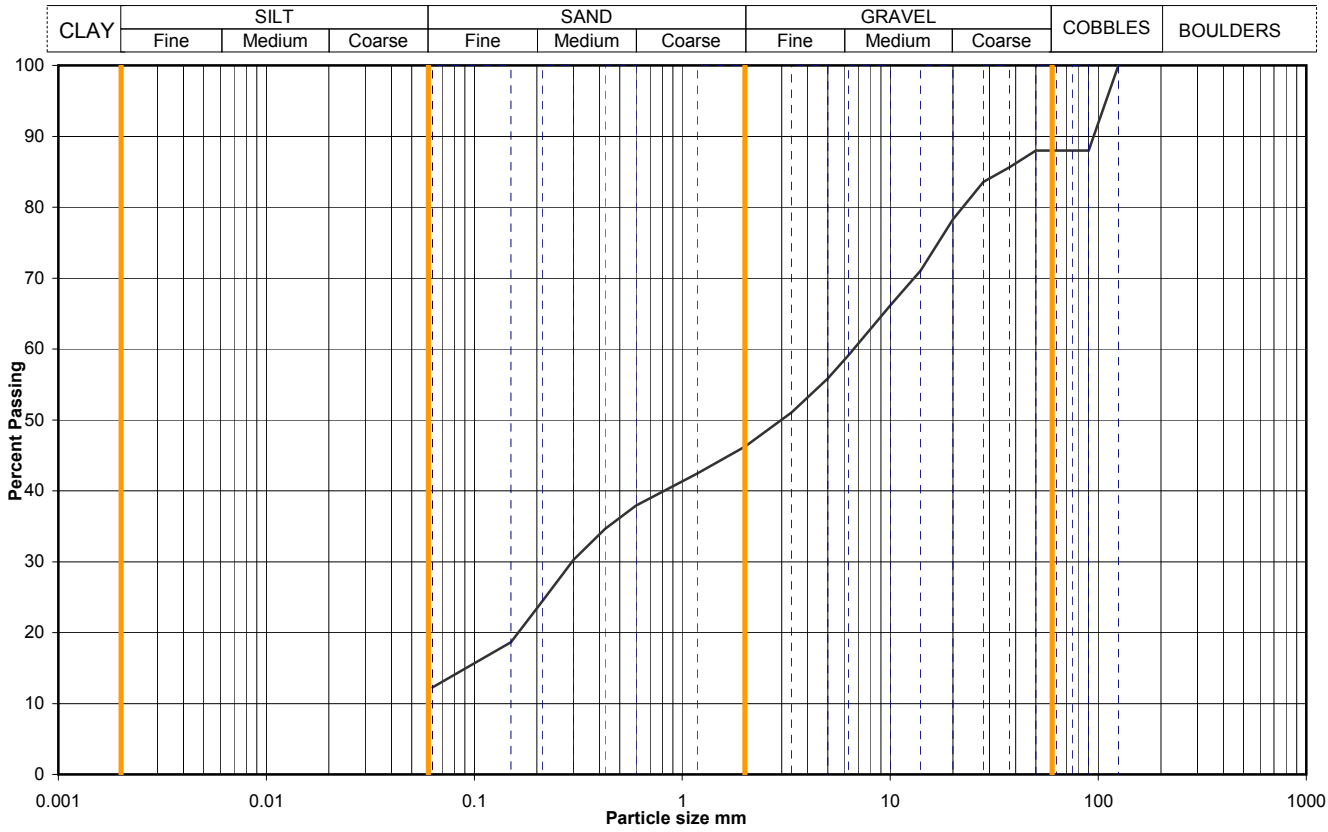
Uniformity Coefficient	D_{60} / D_{10}	53

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:22	**Figure** **PSD 7**

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	TP2		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	0.80		
			Samp No	2	Type	B
			ID	ESGY2012-12A201203130000000020		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	88		
75	88		
63	88		
50	88		
37.5	86		
28	84		
20	78		
14	71		
10	66		
6.3	59		
5.0	56		
3.35	51		
2.00	46		
1.18	42		
0.600	38		
0.425	35		
0.300	30	Dry mass of sample, kg	
0.212	24		
0.150	19	13.8	
0.063	12		

Soil description	Dark grey very sandy clayey GRAVEL with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	12	0
	Gravel	42	48
	Sand	34	39
	Silt	silt+clay =	
	Clay	12	14

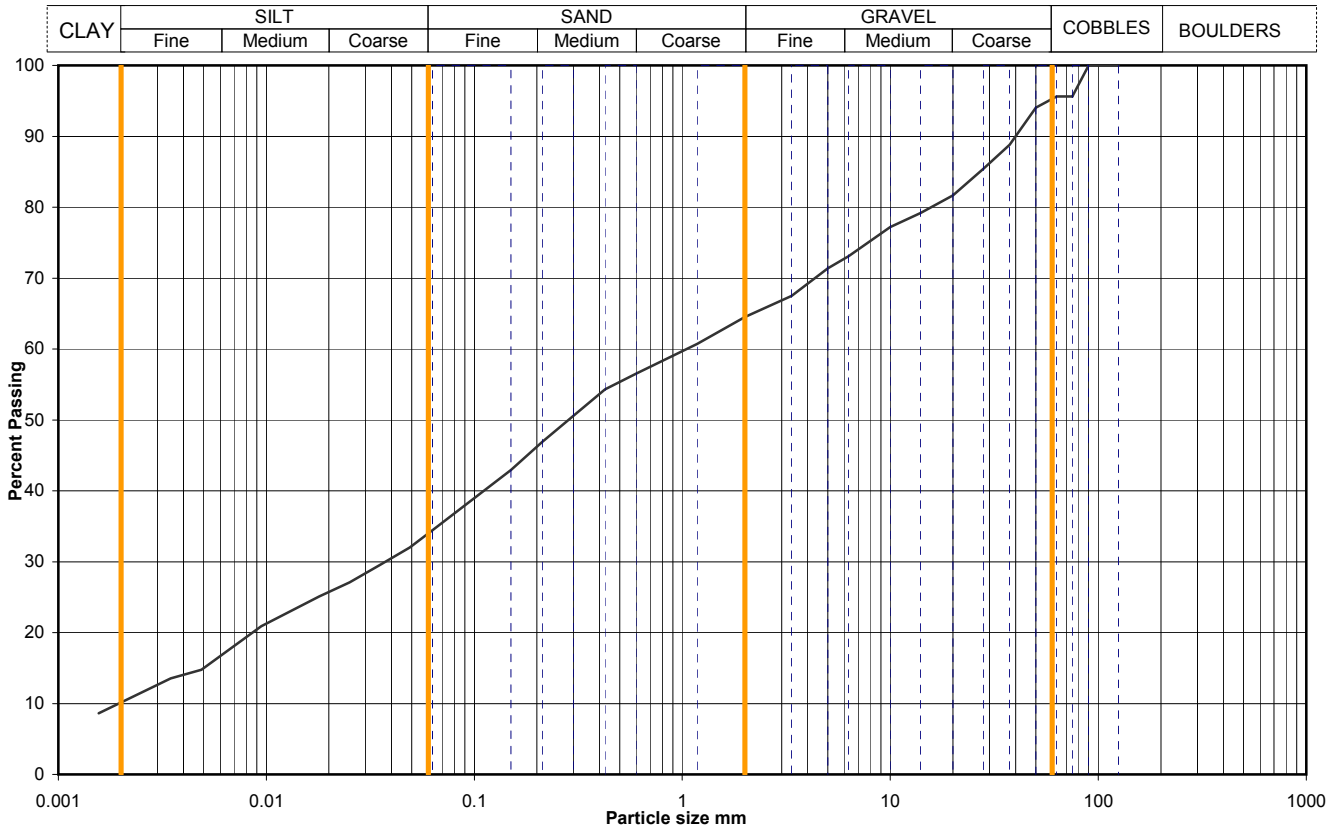
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:22	**Figure** **PSD 8**

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	TP3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.50		
			Samp No	3	Type	B
			ID	ESGY2012-12A201203130000000028		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	34
90	100	0.0490	32
75	96	0.0351	30
63	96	0.0251	27
50	94	0.0180	25
37.5	89	0.0095	21
28	85	0.0049	15
20	82	0.0035	14
14	79	0.0016	9
10	77		
6.3	73		
5.0	71		
3.35	68		
2.00	65		
1.18	61	Particle density, Mg/m3	
0.600	57		
0.425	54	2.65 assumed	
0.300	51	Dry mass of sample, kg	
0.212	47		
0.150	43	17.3	
0.063	34		

Soil description	Brownish grey slightly sandy slightly gravelly CLAY with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	5	0
	Gravel	30	32
	Sand	31	33
	Silt	24	25
	Clay	10	11

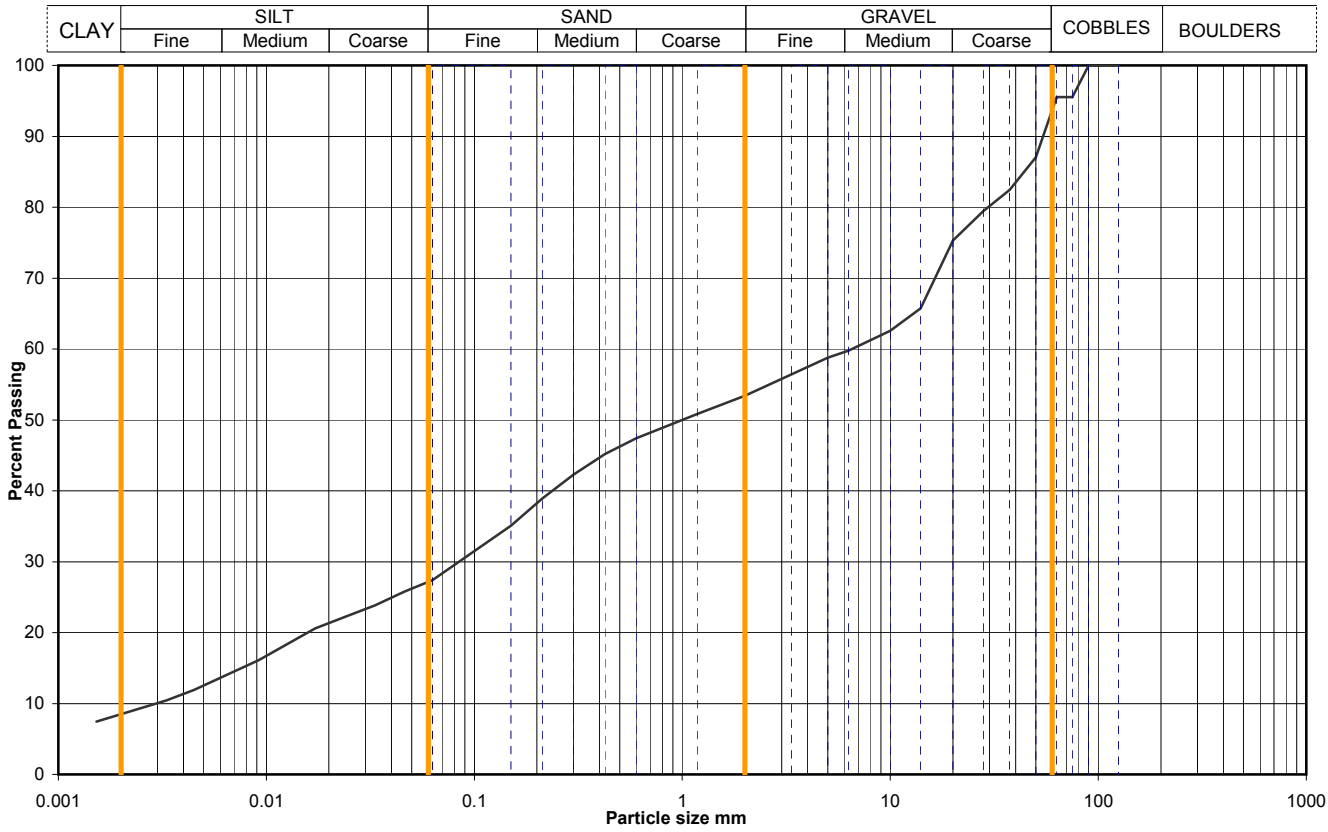
Uniformity Coefficient	D_{60} / D_{10}	536

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:22	**Figure** **PSD 9**

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	TP6		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.90		
			Samp No	3	Type	B
			ID	ESGY2012-12A201203130000000046		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	27
90	100	0.0461	26
75	96	0.0332	24
63	96	0.0239	22
50	87	0.0171	21
37.5	82	0.0092	16
28	79	0.0045	12
20	75	0.0033	10
14	66	0.0015	7
10	63		
6.3	60		
5.0	59		
3.35	56		
2.00	53		
1.18	51	Particle density, Mg/m3	
0.600	47		
0.425	45	2.65 assumed	
0.300	42	Dry mass of sample, kg	
0.212	39		
0.150	35	15.7	
0.063	27		

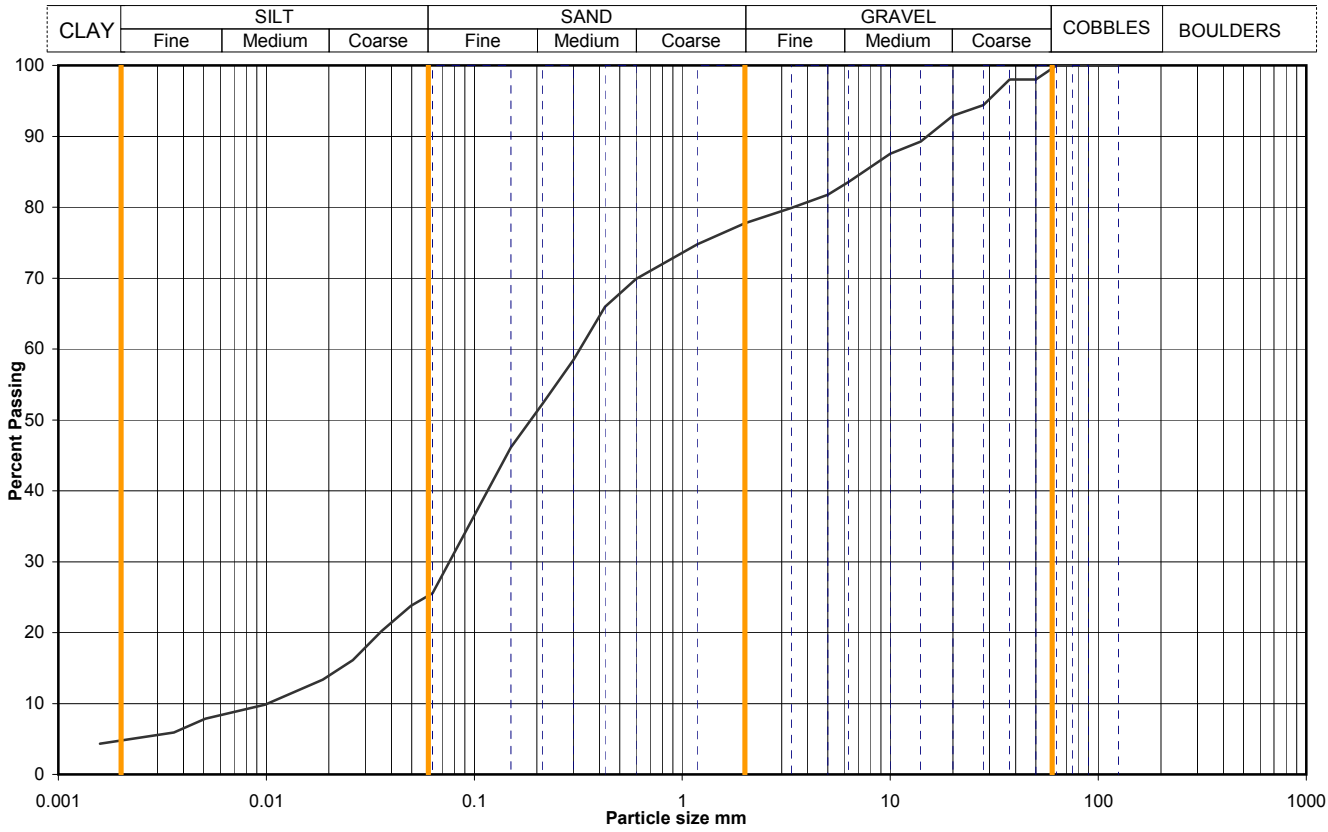
Soil description	Grey slightly sandy gravelly CLAY with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	6	0
	Gravel	41	44
	Sand	26	28
	Silt	19	20
	Clay	8	9

Uniformity Coefficient	D_{60} / D_{10}	2213

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	TP8		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	0.90		
			Samp No	2	Type	B
			ID	ESGY2012-12A201203130000000057		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	26
90	100	0.0496	24
75	100	0.0359	20
63	100	0.0260	16
50	98	0.0187	13
37.5	98	0.0099	10
28	94	0.0051	8
20	93	0.0036	6
14	89	0.0016	4
10	88		
6.3	84		
5.0	82		
3.35	80		
2.00	78		
1.18	75	Particle density, Mg/m3	
0.600	70		
0.425	66	2.65 assumed	
0.300	59	Dry mass of sample, kg	
0.212	52		
0.150	46	15.0	
0.063	26		

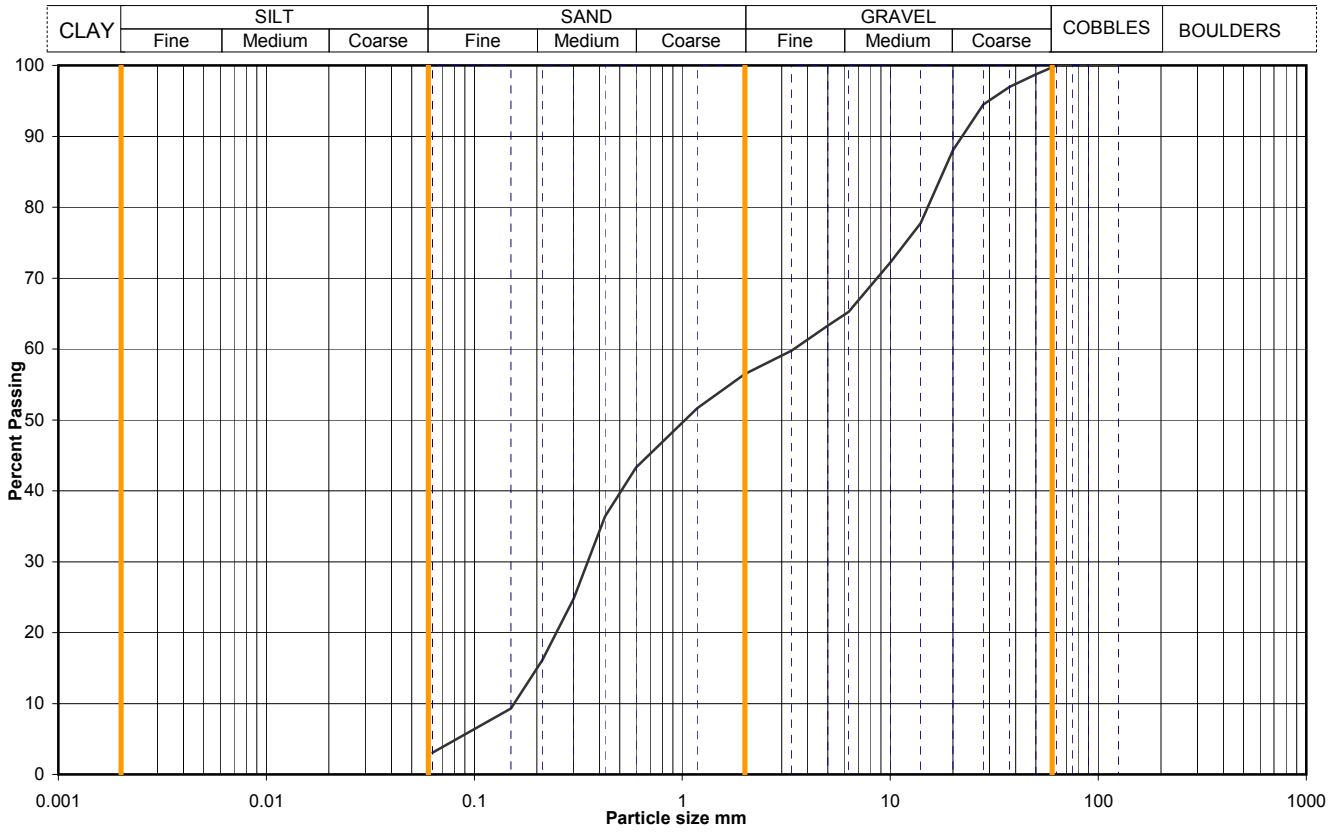
Soil description	Grey slightly gravelly sandy SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	22	22
	Sand	53	53
	Silt	20	20
	Clay	5	5

Uniformity Coefficient	D_{60} / D_{10}	32

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	TP10		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	1.90		
			Samp No	3	Type	B
			ID	ESGY2012-12A201203130000000003		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	99		
37.5	97		
28	94		
20	88		
14	78		
10	72		
6.3	65		
5.0	63		
3.35	60		
2.00	56		
1.18	52		
0.600	43		
0.425	36		
0.300	25	Dry mass of sample, kg	
0.212	16		
0.150	9	18.3	
0.063	3		

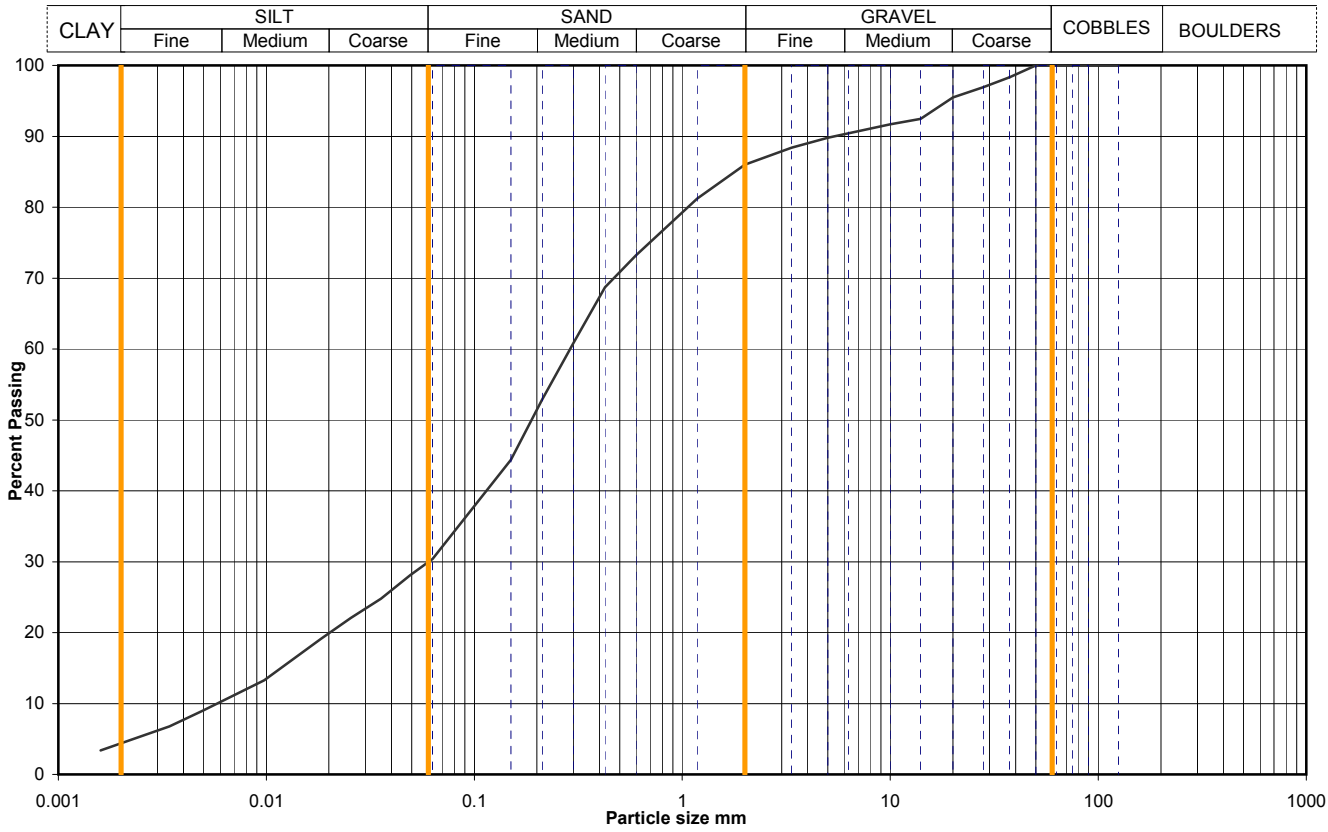
Soil description	Greyish brown very gravelly SAND.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	44	44
	Sand	53	53
	Silt	silt+clay =	
	Clay	3	3

Uniformity Coefficient	D_{60} / D_{10}	22

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

Particle Size Distribution Analysis

Project No	Y2012-12A	Sample Details:	Hole No	TP12		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT		Depth (m BGL)	0.90		
			Samp No	1	Type	B
			ID	ESGY2012-12A201203130000000013		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	30
90	100	0.0493	28
75	100	0.0355	25
63	100	0.0255	22
50	100	0.0183	19
37.5	98	0.0098	13
28	97	0.0050	9
20	95	0.0034	7
14	92	0.0016	3
10	92		
6.3	90		
5.0	90		
3.35	88		
2.00	86		
1.18	81	Particle density, Mg/m3	
0.600	73		
0.425	69	2.65 assumed	
0.300	61	Dry mass of sample, kg	
0.212	53		
0.150	44	14.0	
0.063	30		

Soil description	Brown slightly gravelly sandy SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	14	14
	Sand	56	56
	Silt	26	26
	Clay	4	4

Uniformity Coefficient	D_{60} / D_{10}	50

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS WITHOUT MEASUREMENT OF PORE PRESSURE - SUMMARY OF RESULTS

Project No	Project Name
Y2012-12A	LAOIS KILKENNY REINFORCEMENT PROJECT

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	Density bulk Mg/m³	Density dry Mg/m³	*w* %	Test type	Dia. mm	$ó_3$ kPa	At failure / end of stage: Axial strain %	$ó_1 - ó_3$ kPa	c_u kPa	MODE	Remarks
BH4	9	1.70	2.15	U	Firm to stiff brownish grey sandy gravelly CLAY.	2.39	2.21	8.0	UUM	103.6	20	3.0	123	62		
										103.6	40	5.0	171	85	P	
										103.6	80	19.8	304	152		

General notes: Tests carried out in accordance with BS1377: Part 7: 1990, clause 8 for single stage, clause 9 for multistage tests. Specimens nominally 2:1 height diameter ratio and tested at a rate of strain of 2%/minute, unless annotated otherwise. See individual test reports for further details.

Legend

UU - single stage test (may be in sets of specimens)	$ó_3$	cell pressure	Mode of failure	P	plastic
UUM - multistage test on a single specimen	$ó_1 - ó_3$	deviator stress		B	brittle
suffix R - remoulded or recompacted	c_u	undrained shear strength		C	compound

ENCLOSURE D

GEOENVIRONMENTAL LABORATORY TEST RESULTS

ESG Scientifics Report

Scientifics Report No
EFS/123380

TEST REPORT
SOIL SAMPLE ANALYSIS

1252

Report No. EFS/123380 (Ver. 1)

ESG Geoenvironmental Consulting
Carowswood
Castlemartyr
Co Cork
Ireland

Site: Laois Kilkenny Reinforcement Project

The 2 samples described in this report were registered for analysis by ESG on 11-Apr-2012. This report supersedes any versions previously issued by the laboratory.
The analysis was completed by: 24-Apr-2012

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited
Any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by ESG.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of PAH (MS-SIM) (80) Results
Table of PCB Congener Results
GC-FID Chromatograms
Table of WAC Analysis Results
Analytical and Deviating Sample Overview
Table of Method Descriptions
Table of Report Notes

On behalf of
ESG :
Andrew Timms Operations Manager

Date of Issue: 24-Apr-2012

Tests marked '^' have been subcontracted to another laboratory.

ESG accepts no responsibility for any sampling not carried out by our personnel.

Units :		%	mg/kg	mg/kg	mg/kg	% M/M	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg			
Method Codes :		TMSS	TPHFIDUS	TPHFIDUS	PCBUSECDAR	WSLM59	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	PAHMSUS			
Method Reporting Limits :		0.2	10	10		0.01	10	10	10	20	20	10	10				
UKAS Accredited :		Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
LAB ID Number CL/	**Client Sample Description**	**Tot.Moisture @ 105C**	**MRO by GCFID (AR)**	**TPH by GCFID (AR)**	**PCB-7 Congeners Analysis**	**Total Organic Carbon**	**Benzene**	**Toluene**	**Ethyl Benzene**	**MTBE**	**Xylenes**	**m/p Xylenes**	**o Xylene**	**PAH (16) by GCMS**			
1260665	Y2012-12A Coolnabacky BH9	14.5	<10	12	Req	0.25	<10	<10	<10	<20	<20	<10	<10	Req			
0																	

ESG Environmental Scientifics Group

Bretby Business Park, Ashby Road

Burton-on-Trent, Staffordshire, DE15 0YZ

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Client Name	**ESG Geoenvironmental Consulting**
Contact	Mr A Jaworski

Laois Reinforcement r

Soil Sample Analysis

Date Printed	**24-Apr-2012**
Report Number	**EFS/123380**
Table Number	**1**

here individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Geoenvironmental Consulting: il enn L ois ein. ro ect		
Sample Details:	Y2012-12A	**Number**	s12_3380
LIMS ID Number:	CL1260665	**Date Booked in:**	11-Apr-12
QC Batch Number:	120363	**Date Extracted:**	19-Apr-12
Quantitation File:	Initial Calibration	**Date Analysed:**	20-Apr-12
Directory:	1912MS5.PAH\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	-	< 0.08	-
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.28	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	108
Acenaphthene-d10	115
Phenanthrene-d10	121
Chrysene-d12	135
Perylene-d12	143

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	95
Terphenyl-d14	103

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Polychlorinated Biphenyls (congeners)

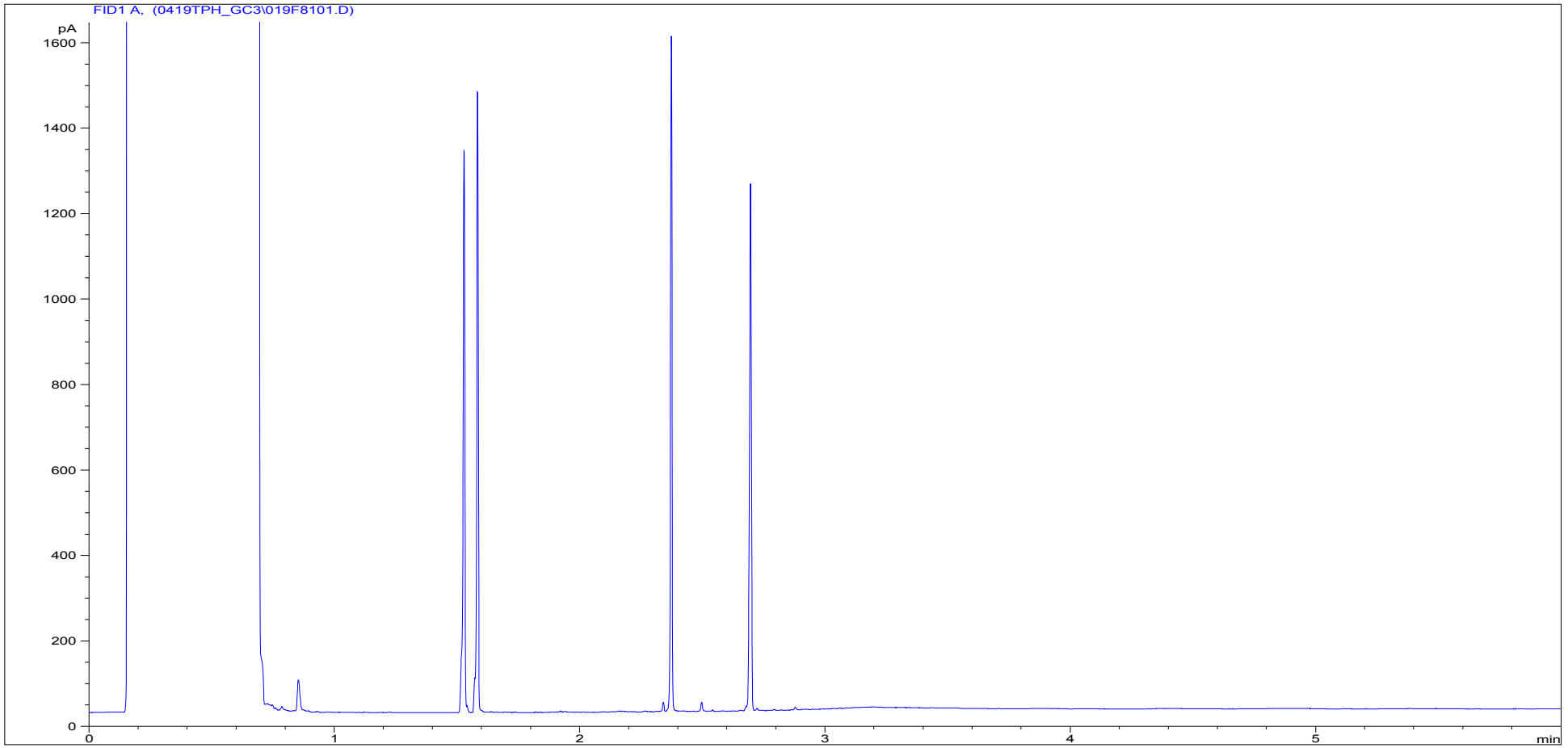
Customer and Site Details:	ESG Geoenvironmental Consulting: L ois il enn Reinforcement ro ect	M**atrix:**	**S**OIL
Job Number:	S12_3380	**Date Booked in:**	11-Apr-12
QC Batch Number:	120106	**Date Extracted:**	19-Apr-12
Directory:	0419BPCB.GC8	**Date Analysed:**	20-Apr-12
Method:	Ultrasonic		

*** This sample data is not UKAS accredited.**

		Concentration, (µg/kg)						
Sample ID	**Customer ID**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB153**	**PCB138**	**PCB180**
* CL1260665	Y2012-12A Coolna cky BH9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
<								

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1260665	**Job Number:**	S12_3380
Multiplier:	8	**Client:**	ESG Geoenvironmental Consulting
Dilution:	1	**Site:**	Laois Kilkenny Reinforcement Project
Acquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	Y2012-12A BH9
Acquisition Date/Time:	20-Apr-12		
Datafile:	D:\TES\DATA\Y2012\04\0419TPH_GC3\019F8101.D		

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/2

					Leaching Data	
Client	ESG Geoenvironmental Consulting				Weight of sample (kg)	0.090
Contact	Mr A Jaworski				Moisture content @ 105℃ (%)	14.5
					Equivalent Weight based on drying at 105℃ (kg)	0.106
Site	Laois Kilkenny Reinforcement Project				Volume of water required to carry out 10:1 stage (litres)	0.884
Sample Description		**Report No**	**Sample No**	**Issue Date**		
Y2012-12A BH9		s12_3380	CL/1260665	24-Apr-12		

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.25	3	5	6
	LOI450	Loss on Ignition (%)				10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.05	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	14	500		
	PAHMSUS	PAH Sum of 17 (mg/kg)		100		
	PHSOIL	pH (pH units)			>6	
	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7			To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	10:1 Single Stage Leachate	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/2 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº	mg/kg (dry weight)			
U	WSLM3	pH (pH units) ºº	11.4	Calculated data not UKAS Accredited			
U	WSLM2	Conductivity (µs/cm) ºº	888				
U	ICPMSW	Arsenic	<0.001	<0.01	0.5	2	25
N	ICPWATVAR	Barium	0.24	2.4	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.03	0.3	0.5	10	70
U	ICPMSW	Copper	0.02	0.2	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.013	0.13	0.5	10	30
U	ICPMSW	Nickel	0.003	0.03	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.003	0.03	0.06	0.7	5
U	ICPMSW	Selenium	0.003	0.03	0.1	0.5	7
U	ICPMSW	Zinc	0.008	0.08	4	50	200
U	KONENS	Chloride	21	210	800	15000	25000
U	ISEF	Fluoride	0.9	9	10	150	500
U	ICPWATVAR	Sulphate as SO4	18	180	1000	20000	50000
	WSLM27	Total Dissolved Solids			4000	60000	100000
	SFAPI	Phenol Index			1		
N	WSLM13	Dissolved Organic Carbon	8.1	81	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Where individual results are flagged see report notes for status.

SOIL Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

S123380

Customer ESG Geoenvironmental Consulting
Site Laois Kilkenny Reinforcement Project
Report No S123380

Consignment No S28307
Date Logged 11-Apr-2012
Report Due 23-Apr-2012

ID Number	Description	MethodID	BTEXHSA		CEN Leachate	CustServ	PAHMSUS	PCBUSECDAR	TMSS	TPHFIDUS		WSLM59
		Sampled	BTEX-HSA + MTBE analysis	MTBE (µg/kg)	CEN Leac(P)C	Report B	PAH (16) by GCMS	PCB-7 Congeners Analysis	Tot.Moisture @ 105C	MRO by GCFID (AR)	TPH by GCFID (AR)	Total Organic Carbon
		Accredited to ISO17025	✓	✓			✓		✓	✓	✓	
CL/1260665	Y2012-12A Coolna cky BH9	D										
CL/1260666												

Note: For analysis where the Report Due date is greater than 7 days (PAH, Pesticides, PCB, Phenols, Herbicides) or 2 days (BOD) after the sampling date, although we will do our utmost to prioritise your samples, they may become deviant whilst being processed in the Laboratory.

In this instance, please contact the Laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key	
A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time

Requested Analysis Key	
	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBUSECDAR	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	TMSS	As Received	Determination of the Total Moisture content at 105ºC by loss on oven drying gravimetric analysis
Soil	TPHFIDUS	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection.
Soil	WSLM59	Air Dried	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	ISEF	As Received	Determination of Fluoride in water samples by Ion Selective Electrode (ISE)
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	WSLM13	As Received	Instrumental analysis using acid/persulphate digestion and dispersive IR detection
Water	WSLM2	As Received	Determination of the Electrical Conductivity (µS/cm) by electrical conductivity probe.
Water	WSLM27	As Received	Gravimetric Determination
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on an air dried basis
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols. This may have resulted in deterioration of the sample(s) during transit to the laboratory. Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

END OF REPORT

Where individual results are flagged see report notes for status.

ENCLOSURE E

PHOTOGRAPHS

Trial Pits	SA1 to SA3 and TP1 to 12

Trial Pit Photographs - TPS1

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **S1** Sheet 1 of 1

Trial Pit Photographs - TPS2

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **S2** Sheet 1 of 1

Trial Pit Photographs - TPS3

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **S3** Sheet 1 of 1

Trial Pit Photographs - TP1

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP1** Sheet 1 of 1

Trial Pit Photographs - TP2

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP2** Sheet 1 of 1

Trial Pit Photographs - TP3

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP3** Sheet 1 of 1

Trial Pit Photographs - TP4

Soil Mechanics

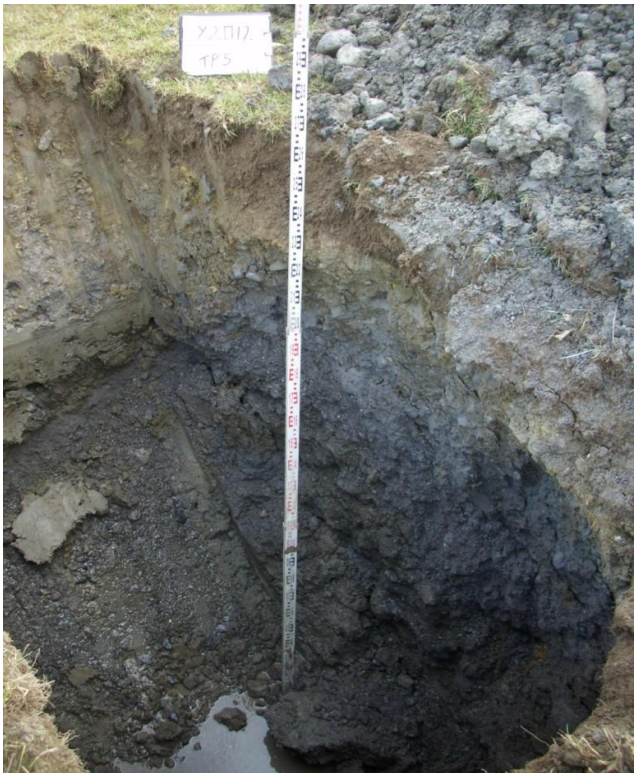
Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP4** Sheet 1 of 1

Trial Pit Photographs - TP5

Soil Mechanics



Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP5** Sheet 1 of 1

Trial Pit Photographs - TP6

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP6** Sheet 1 of 1

Trial Pit Photographs - TP7

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP7** Sheet 1 of 1

Trial Pit Photographs - TP8

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP8** Sheet 1 of 1

Trial Pit Photographs - TP9

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP9** Sheet 1 of 1

Trial Pit Photographs - TP10

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP10** Sheet 1 of 1

Trial Pit Photographs - TP11

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP11** Sheet 1 of 1

Trial Pit Photographs - TP12

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY Y2012-12A EirGrid	**Trial pit** **TP12** Sheet 1 of 1

ENCLOSURE F

SOIL CHARACTERISATION AND SITE SUITABILITY ASSESSMENT REPORT

Traynor Environmental Ltd – Report No 12.050 TE

SOIL CHARACTERISATION AND SITE SUITABILITY ASSESSMENT REPORT
TE REF: 12/050TE

9ÅNJDNJÅŘ

LAOIS-KILKENNY REINFORCEMENT PROJECT
COOLNABACKY 400KV STATION
COOLNABACKY
TIMAHOE
CO. LAOIS

IN ACCORDANCE WITH
EPA CODE OF PRACTICE
WASTEWATER TREATMENT AND DISPOSAL
SYSTEMS SERVING SINGLE HOUSES 2009

Traynor Environmental Ltd
Belturbet Business Park, Creeny, Belturbet
Co. Cavan
Tel: +353 49 9522236
Fax: +353 49 9522808
Web: www.traynorenvironmental.com

SITE CHARACTERISATION FORM FOR AN ON-SITE WASTEWATER TREATMENT SYSTEM

CONTENTS

1.0 GENERAL DETAILS (From planning application)

Company	*EirGrid*

Address	**Site Location and Townland**
EirGrid *c/o Geotech Specialists Ltd part of* *Environmental Scientifics Group* *Carewswood,* *Castlemartyr,* *County Cork,* *Ireland*	*EirGrid* *Laois-Kilkenny Reinforcement Project* *Coolnabacky 400kv Station* *Coolnabacky* *Timahoe* *Co. Laois*

Telephone Number	*N/A*	**Fax Number**	*N/A*
Email	*N/A*		

Maximum No. of Employees	*6*	No. of double bedrooms	*N/A*	No. of Single Bedrooms	*N/A*		
Proposed Water Supply	Mains		Private Well/Borehole	✓	Group Well/Borehole		

2.0 DESK STUDY

Soil Type	***Soil Association - 39*** *Greys 90% Grey brown Podzolics 10%*

Aquifer Category:	Regionally Important	*Rkd*	Locally Important		Poor				
Vulnerability	Extr		Hg	✓	Moderate		Low		High to Low		Unknown	

Bedrock Type	*DPBL - Dinantian Pure Unbedded Limestone*
Name of Public/Group Scheme Water Supply within 1km	*Local Group Water Scheme*

Groundwater Protection Scheme (Y/N)	*No*	**Source Protection Area**	SI		SO
Groundwater Protection Response:	*R2*[1]				
Presence of Significant sites (Archaeological, natural and historical):	*None identified or evident on the site.*				
Past experience in the area:	*Variable percolation characteristics in the locality.*				

Comments *(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).*

R2[1]*: Acceptable subject to normal good practice (i.e. System selection, construction, operation and maintenance in accordance with EPA (2009). Site may be suitable for discharge to ground, if the minimum depths are met on the site and if there exists suitable percolation. As the soil type in the area is Gleys (75% of the land area), and as the area is mapped as High Vulnerability, surface water may be at risk around the site. Groundwater as a resource will be at risk if the minimum depths required are not achieved on the site, or if the percolation rate is too rapid. Older wells in the area may also be at risk, if the minimum separation distances are not adhered to. Groundwater and wells are therefore the main targets, following the desk study. Given the response and the aquifer type, the site is potentially suitable for a conventional septic tank system if the minimum depths required are met on the site, if the minimum separation distances can be met, and if the percolation rate is adequate. A regionally important bedrock aquifer will generally have a high permeability, rapid flow velocities and will provide little attenuation.*

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position	*Relatively Flat*

Slope	*Steep <1:5*		*Shallow 1.5 to 1.20*		*Relatively Flat*	✓

Surface features within a minimum of 250 metres (Distances to features should be noted in metres)

Houses	*There are no houses located within 100m of the proposed percolation area (ppa).*
Existing Land Uses	*Agricultural grazing.*
Vegetation Indicators	*Grass is the pre-dominant vegetation in the ppa. The absence of rushes in the ppa could indicate adequate percolation characteristics of the subsoil.*
Groundwater Flow Directions	*Northeastern direction.*
Ground Condition	*Ground conditions are best described as firm in the ppa and throughout the site.*
Site Boundaries	*Hedge and trees with drains located on all boundaries (North, East, West and South)*
Roads	*Agricultural laneway located >20m Southwest of the ppa.*
Outcrops (Bedrock and/or subsoil)	*None identified or evident in the vicinity.*
Surface water ponding	*No evidence of surface water ponding when examined on 21.03.12. It must be noted that weather conditions prior to the site assessment taking place was generally dry.*
Drainage Ditches	*Drainage ditches located along all boundaries. Drain levels at approximately 1m below ground level and approximately 1.20m wide.*

Beaches/Shellfish	*None identified or evident in the vicinity.*	**Areas/Wetlands**	*None identified or evident in the vicinity.*
Karst Features	*None identified or evident in the vicinity.*	**Watercourse/ streams**	*Drainage ditches as above.*
Lakes	*None identified or evident in the vicinity.*	**Springs/ Wells**	*None identified or evident in the vicinity.*

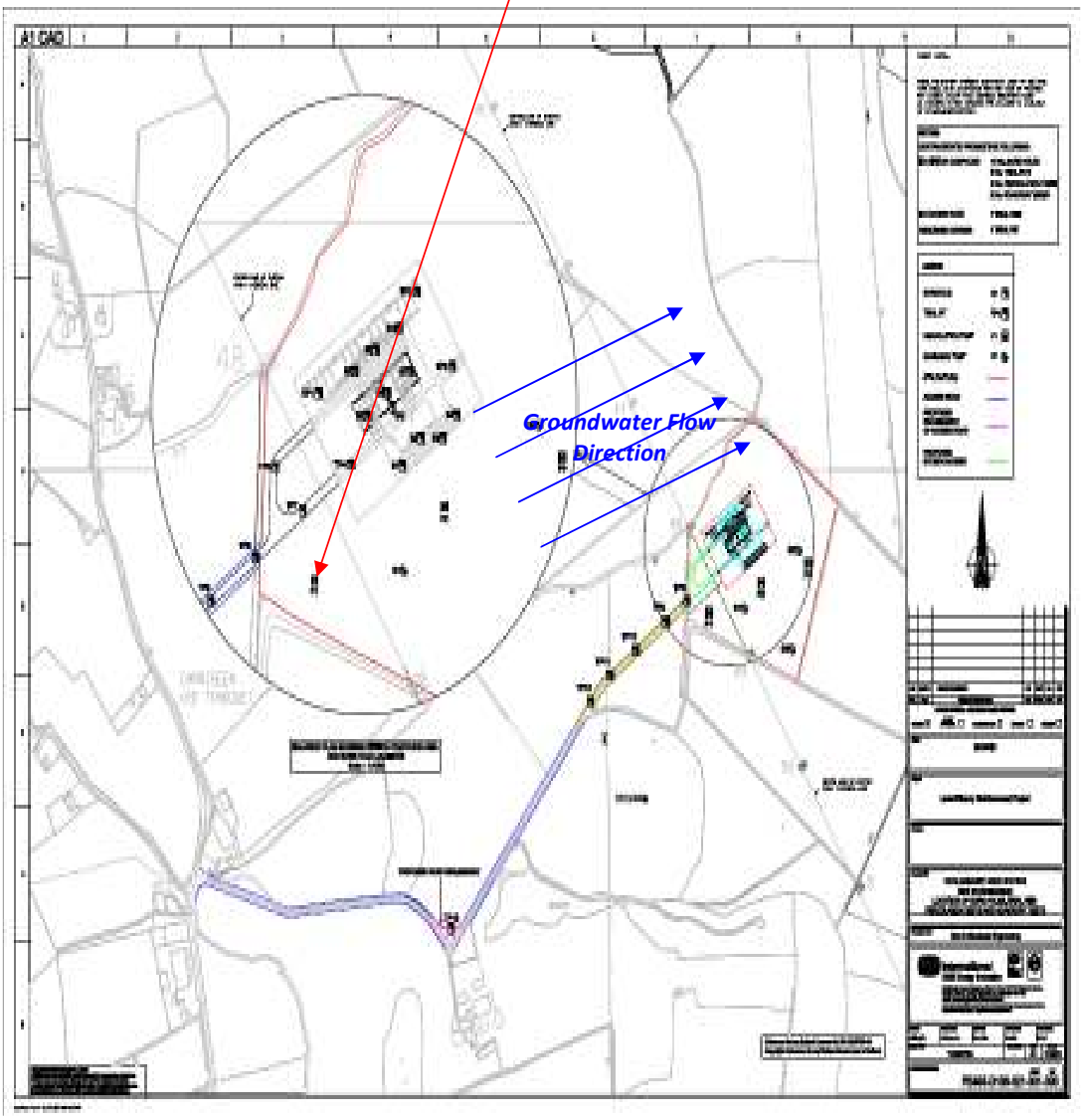
Comments *(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed treatment system on the site.*

Following the desk study surface water was not thought not to be at risk. During the visual assessment the land here seems to be generally average drained in the location of the tested area. From this, the surface water does not seem to be a potential target, unless the soil in the proposed percolation area is saturated. Groundwater is still a target following the visual assessment, unless the minimum depths required are met on the site and there exists adequate percolation. Wells in use in the area are not considered to be at risk, as they are all well outside the minimum separation distances (Groundwater Protection Responses of GSI/EPA/DoELG).

Sketch of site showing measurement to Trial Hole location and Percolation test Hole locations, wells and direction of ground water flow, proposed house (incl. distances from boundaries) adjacent houses, watercourses, significant sites and other features. North point should always be included.

SITE LAYOUT DRAWING SHOWING TEST HOLE LOCATIONS

Approximate Location of Trial Hole & Percolation Test Holes 1. Examined on 21.03.12



3.2 Trial Hole

Should be a minimum 3m deep

Depth of Trial Hole	*3.00m*		
Depth from Ground Surface to bedrock (m) if Present	*None encountered*	**Depth from Ground Surface to Water Table (m) if Present**	*1.00m*
Depth of water ingress	*1.00m*	**Rock Type if Present**	*None encountered*
Date and Time of Excavation	*19.03.12* *08.00*	**Date and Time of Examination**	*21.03.12* *09.00*

	Depth of P & T Test	Soil/Subsoil Texture Classification	Plasticity and Dilatancy	Soil Structure	Density Compactness	Colour	Preferential Flowpaths
0.1m		*Silt/Clay*	*Ribbons 75mm 3 Threads*	*Blocky*	*Medium*	*Brown*	*None*
0.2m	*Depth of P Test*						
0.3m							
0.4m			*Ribbons 115mm 8 Threads*			*Brown - Orange*	
0.5m	*Depth of T Test*	*CLAY*		*Sticky*	*High*		
0.6m							
0.7m							
0.8m		*Gravels/Clay*	*Ribbons 10mm 2 Threads*	*Blocky*	*Low*	*Grey Orange*	
0.9m							
1.0m							
1.1m							
1.2m							
1.3m		***Winter GWL***	***Winter GWL***	***Winter GWL***	***Winter GWL***	***Winter GWL***	***Winter GWL***
1.4m							
1.5m							
1.6m							
1.7m							
1.8m							
1.9m							
2.0m							
2.1m							
2.2m							
2.3m							
2.4m							
2.5m							
2.6m							
2.7m							
2.8m							
2.9m							
3.0m							

Evaluation: *According To The Flowchart For Describing Subsoil's based on BS5930:1999, the subsoil is best described as a Gravel/Clay. Good percolation characteristics of the subsoil exhibited in the trial hole (above the Winter Water Table Level of 1.00m)*

Likely T Value *<20.00 min /25mm*

*Note: Depth of percolation test holes should be indicated on log above (Enter P & T Depths as appropriate)
* See Appendix E for BS5930 Classification
** 3 samples to be tested on each horizon and results should be entered above for each horizon.
*** All signs of mottling should be recorded.

3.3a Percolation ("T" Test for Deep Subsoils and Water Table)

Step 1 Test Hole Preparation

Percolation Test Hole	***1***	***2***	***3***
Depth from ground surface to top of hole (mm) (A):	*200*	*200*	*200*
Depth from ground surface to base of hole (mm) (B):	*600*	*600*	*600*
Depth of hole (mm) (B-A):	*400*	*400*	*400*
Dimensions of hole [length x breadth (mm)]:	*300 x 300*	*300 x 300*	*300 x 300*

Step 2 Pre-Soaking Test Holes

Date and Time Pre-soaking Started	*20.03.12*	*16.40*	*20.03.12*	*16.45*	*20.03.12*	*16.48*

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3 Measuring T_{100}

Percolation Test Hole	***1***	***2***	***3***
Date of Test	*21.03.12*	*21.03.12*	*21.03.12*
Time Filled to 400mm	*09.00*	*09.05*	*09.10*
Time Water Level at 300mm	*09.33*	*09.40*	*09.50*
Time to drop 100mm (T_{100})	*33.00*	*35.00*	*40.00*
Average T_{100}			*36.00*

If T_{100} >300mins then T Value >90 – site unsuitable for discharge to ground
If $T_{100} \leq$ 210mins then go to Step 4
If $T_{100} \geq$ 210mins then go to Step 5

Step 4 Standard Method (where $T_{100} \leq 210$min)

Percolation Test Hole	1			2			3		
Fill No.	**Start Time at 300mm**	**Finish Time at 200mm**	**Δt (min)**	**Start Time at 300mm**	**Finish Time at 200mm**	**Δt (min)**	**Start Time at 300mm**	**Finish Time at 200mm**	**Δt (min)**
1	*09.34*	*10.15*	*41.00*	*09.41*	*10.29*	*48.00*	*09.51*	*10.41*	*50.00*
2	*10.16*	*11.08*	*52.00*	*10.30*	*11.31*	*61.00*	*10.42*	*11.48*	*66.00*
3	*11.09*	*12.17*	*68.00*	*11.32*	*12.51*	*79.00*	*11.49*	*13.24*	*95.00*
Average Δt			*53.67*			*62.67*			*70.33*
	Average Δt/4 = [Hole No. 1]		*13.42*	Average Δt/4 = [Hole No. 2]		*15.67*	Average Δt/4 = [Hole No. 2]		*17.58*

Result of Test : T *15.56* min/25mm

Comments
Excellent percolation characteristics of the subsoil

3.3b Percolation ("P" Test for Shallow Subsoils and Water Table)

Step 1 Test Hole Preparation

Percolation Test Hole	***1***	***2***	***3***
Depth from ground surface to top of hole (mm) (A):	*0*	*0*	*0*
Depth from ground surface to base of hole (mm) (B):	*400*	*400*	*400*
Depth of hole (mm) (B-A):	*400*	*400*	*400*
Dimensions of hole [length x breadth (mm)]:	*300 x 300*	*300 x 300*	*300 x 300*

Step 2 Pre-Soaking Test Holes

Date and Time Pre-soaking Started	*20.03.12*	*16.50*	*20.03.12*	*16.55*	*20.03.12*	*16.58*

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3 Measuring P_{100}

Percolation Test Hole	***1***	***2***	***3***
Date of Test	*21.03.12*	*21.03.12*	*21.03.12*
Time Filled to 400mm	*09.15*	*09.20*	*09.25*
Time Water Level at 300mm	*10.39*	*10.48*	*10.59*
Time to drop 100mm (P_{100})	*84.00*	*88.00*	*94.00*
Average P_{100}			*88.66*

If P_{100} >300mins then P Value >90 – site unsuitable for discharge to ground
If $P_{100} \leq$ 210mins then go to Step 4
If $P_{100} \geq$ 210mins then go to Step 5

Step 4 Standard Method (where $P_{100} \leq 210$min)

Percolation Test Hole	1			2			3		
Fill No.	Start Time at 300mm	Finish Time at 200mm	Δt (min)	Start Time at 300mm	Finish Time at 200mm	Δt (min)	Start Time at 300mm	Finish Time at 200mm	Δt (min)
1	*10.40*	*12.14*	*94.00*	*10.49*	*12.26*	*97.00*	*11.00*	*12.42*	*102.00*
2	*12.15*	*14.03*	*108.00*	*12.27*	*14.17*	*110.00*	*12.43*	*14.39*	*116.00*
3	*14.04*	*16.10*	*126.00*	*14.18*	*16.27*	*129.00*	*14.40*	*16.54*	*134.00*
Average Δt			*109.33*			*112.00*			*117.33*
	Average Δt/4 = [Hole No. 1]		*27.33*	Average Δt/4 = [Hole No. 2]		*28.00*	Average Δt/4 = [Hole No. 3		*29.33*

Result of Test : P *28.22* min/25mm

Comments
Good percolation characteristics of the topsoil.

4.0 CONCLUSIONS of SITE CHARACTERISATION:

Not suitable for Development	

Suitable for		**Discharge Route**
1. Septic tank System (Septic tank and soil percolation system)		*Groundwater*
2. Secondary Treatment System		
a. Septic tank and intermittent filter system and polishing unit	✓	
b. Package Wastewater Treatment system and polishing unit	✓	

5.0 RECOMMENDATION:

Propose to install	*The site is not suitable for a conventional septic tank and percolation area. Traynor Environmental recommends that an O' Reilly Oakstown package sewage treatment system or similar approved treatment system and a raised soil polishing filter constructed in accordance with EPA Guidelines 2009 is installed.*

And discharge to	*Groundwater*

Trench Invert Level (m)	*0.30m Above Ground Level (AGL)*

Site Specific Conditions (if any) e.g. special works, Site Improvement Works, Testing etc.
The tests showed that the site has a "T" value rating of 15.56min/25mm indicating excellent percolation characteristics of the subsoil. A "P" value rating of 28.22min/25mm was attained indicating excellent percolation characteristics of the topsoil. Bedrock level was not encountered in the trial hole; Groundwater was encountered in the trial hole at a depth of 1.00 BGL. *A purpose built soil polishing filter should be constructed to ensure that there is a minimum of 0.90m of suitable percolating material between the base of the lowest part of the soil polishing filter and groundwater level (1.00m) at all times. The distribution pipes used in this system will be smooth walled, have a diameter of 32mm, have 6mm holes drilled in them 300mm apart, and each pipe should be spaced parallel and 600mm apart. The distribution pipes will be bedded on 250mm depth of crushed stone (20 - 30 mm in size). Once the distribution pipes are in place they should be surrounded and covered to a depth of 150mm of crushed stone which should extend the full width of the soil polishing filter. Before the distribution pipes are backfilled with the topsoil the crushed stone should be covered with geotextile or similar permeable or durable materials. This is to prevent the stone being silted up with topsoil.* *Traynor Environmental Ltd also recommends that the soil polishing filter construction and the installation of the O' Reilly Oakstown Treatment System is overseen by a suitable qualified and accredited person*

6.0 TREATMENT SYSTEM DESIGN DETAILS

SYSTEM TYPE: Septic Tank System

Tank Capacity (m^2)	*N/A*	***Percolation Area***		***Mound Percolation Area***	
		No. of Trenches	*N/A*	*No. of Trenches*	*N/A*
		Length of Trenches (m)	*N/A*	*Length of Trenches (m)*	*N/A*
		Invert Level (m)	*N/A*	*Invert Level (m)*	*N/A*

SYSTEM TYPE: *O' Reilly Oakstown Treatment System*

Filter Systems

Media Type	**Area (m^2)**	**Deep of Filter (m)**	**Invert Level (m)**
Sand/Soil	*N/A*	*N/A*	*N/A*
Soil	*72m^2*	*0.25m*	*0.30m AGL*
Constructed Wetland	*N/A*	*N/A*	*N/A*
Other	*N/A*	*N/A*	*N/A*

Package Treatment Systems

Type	*O' Reilly Oakstown Treatment System*	
Capacity PE	*10*	
Sizing of Primary Compartment		
	4	**m^2**

SYSTEM TYPE: *O' Reilly Oakstown Treatment System*

Polishing Filter: *Surface Area (m^2)*	*N/A*	**Package Treatment Systems:** Capacity (PE)	*10*
or Gravity Fed:		**Constructed Wetland:** *Surface Area (m^2)*	*N/A*
No. of Trenches	*N/A*		
Length of Trenches (m)	*N/A*		
Invert Level (m)	*N/A*		

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate ($l/m^2.d$)	*210l/d*
Surface Water		Discharge Rate	*0.024l/s*

TREATMENT STANDARDS:

Treatment System Performance Standards (mg/l)	**BOD**	**SS**	**NH_3**	**Total N**	**Total P**
O'Reilly Oakstown Treatment System	*<20*	*<30*	*<10*	*5 - 10*	*12.5*

QUALITY ASSURANCE:

Installation & Commissioning	**On-going Maintenance**
Recommend to be overseen by plant supplier.	*Maintain and de-sludge annually*

7.0 SITE ASSESSOR DETAILS

Company:	*Traynor Environmental Ltd*				
Prefix:	*Mr.*	**First Name:**	*Nevin*	**Surname:**	*Traynor*
Address:	*Belturbet Business Park, Creeny, Belturbet, Co. Cavan.*				
Qualifications/Experience:	*BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.*				
Date of Report:	*28.03.12*				
Phone:	*049 9522236*	**Fax:**	*049 9522808*	**E-mail:**	*nevin@traynorenvironmental.com*
Indemnity Insurance Number:	*AGD/11/109*				

Signed: 

Nevin Traynor

BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.

For Traynor Environmental Ltd

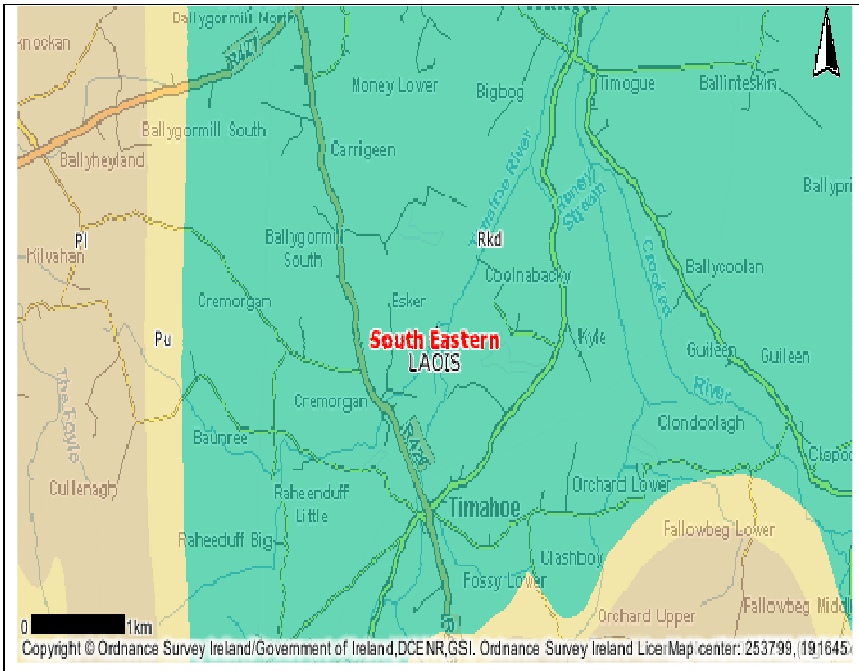
8.0 SITE PHOTOGRAPHS

Facing East From the Proposed Percolation Area	*Facing West From the Proposed Percolation Area*
	
Facing South From the Proposed Percolation Area	***Facing North From the Proposed Percolation Area***
	
Trial Hole Front View	***Trial Hole Side View***
	

Percolation ("T") Test 1	*Percolation ("T") Test 2*
	
Percolation ("T") Test 3	***Percolation ("P") Test 1***
	
Percolation ("P") Test 2	***Percolation ("P") Test 3***
	

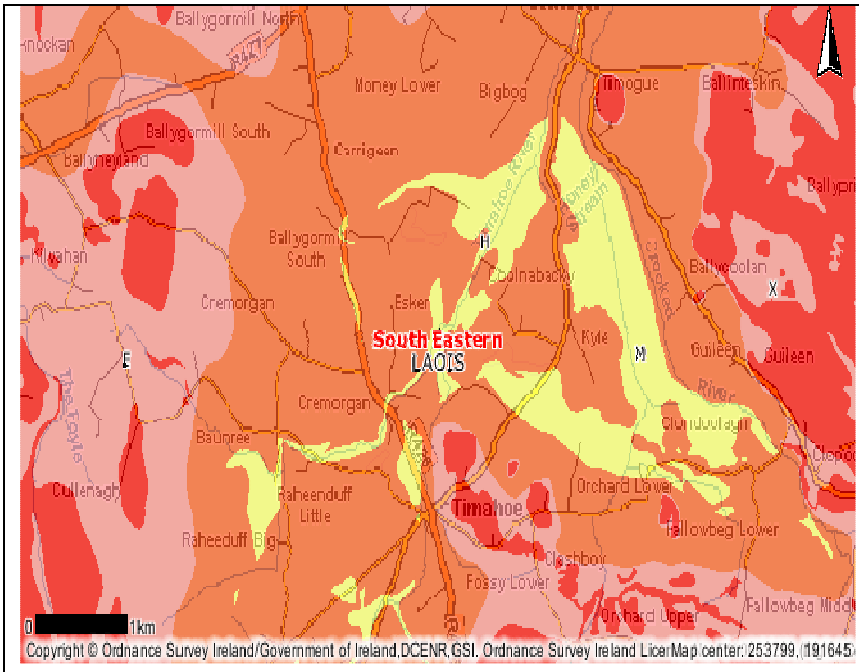
Maps Used As Part of the EPA Site Suitability Assessment

Groundwater/Aquifer Map



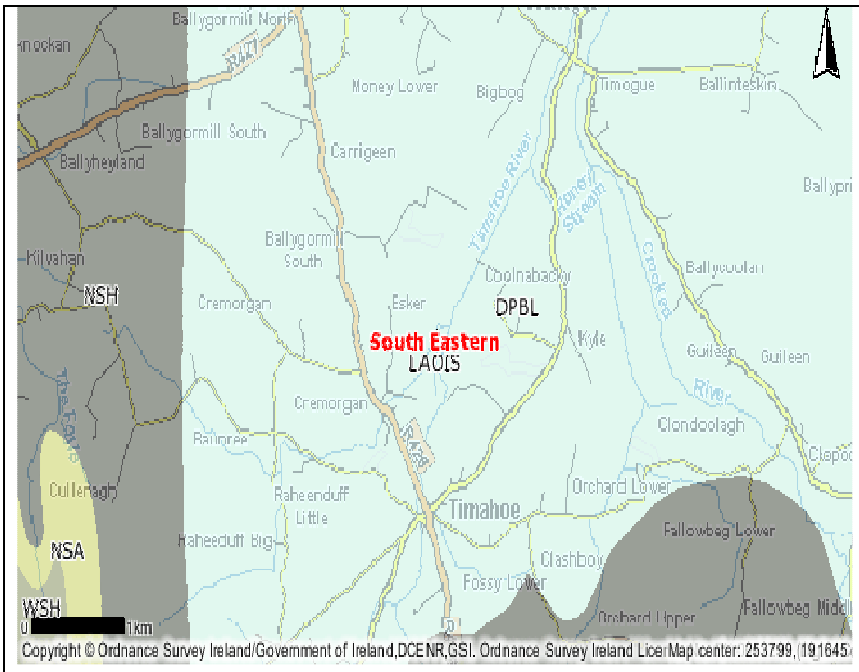
From the GSI Groundwater Aquifer Map Site is classified as Rkd Regionally important aquifer - .karstified (diffuse)

Vulnerability Map



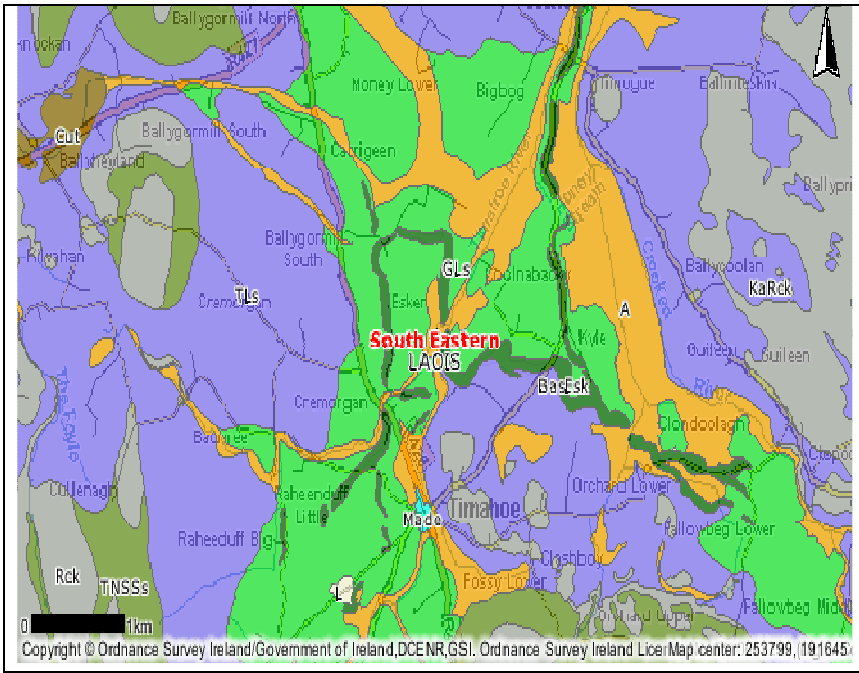
From the GSI Vulnerability Map Site is classified as High.

Bedrock Map



From the GSI Bedrock Map Site is classified as DPBL Dinantian Pure Unbedded Limestone

Teagasc Subsoil Map



From the Teagasc Subsoil GSI Map Site is classified as GLs Glacial Sands and gravels.

9.0 EPA/FAS CERTIFICATE

FETAC
Further Education and Training Awards Council
Comhairle na dTeastas Breisoideachais agus Oiliúna

National Skills Certificate
(FÁS)

Awarded to
Bronnta ar

Nevin Traynor

who has achieved the National Standards for
a bhain Caighdeáin Náisiúnta amach maidir le

Site Suitability Assessment for On-Site

Wastewater Treatment Systems

Chair, FETAC

Chief Executive, FETAC

F/NSC 003535

Griffiths & Armour

ENGINEERS IRELAND
VERIFICATION OF PROFESSIONAL INDEMNITY INSURANCE

Insured:	**Traynor Environmental Ltd**
Address:	**Belturbet Business Park Creeny Belturbet Co. Cavan**
Description of Business:	**Consulting Engineers**
Policy Number and Name/Address of Lead Insurer:	**A G Doré Syndicate 2526 at Lloyd's 4th Floor, 70 Gracechurch Street London EC3V 0XL United Kingdom Policy No: AGD/11/109**
Period of Insurance:	**12 July 2011 to 11 July 2012**
Renewal Date:	**12 July 2012**
Retroactive Date:	**None**
Limit of Indemnity any one claim:	**A sum not less than €1,000,000 (separate aggregate limits of indemnity for all claims in the period relating to** • **pollution or contamination** • **asbestos)**
Excess applying to each and every claim:	**€5,000**
Total amount of Excess amounts payable for all claims during any one period of insurance:	**€15,00**
Does cover include Joint Venture Projects?	**Yes**
Does cover include Sub-Consultants?	**Yes - Insured's liability**
Is there a Sub-Consultant's Warranty?	**None**
Are there any Restrictions/Limitations/Warranties in relation to the Policy connected with the Project or Brief presented by the Local Authority, Health Board, Vocational Educational Committee, Regional Technical College or other Public Body? If so, could you provide details:	**None other than those which are standard to this class of insurance protection**
Signed:	**For and on behalf of Griffiths & Armour Professional Risks** GROUP OFFICES Liverpool London Manchester Glasgow Dublin Guernsey
Date:	**13 July 2011**

The policy is subject to the insuring agreements, exclusions, conditions and declarations contained therein. The above is accurate at the date of signature. No obligation is imposed herein on the signatory to advise of any alteration.

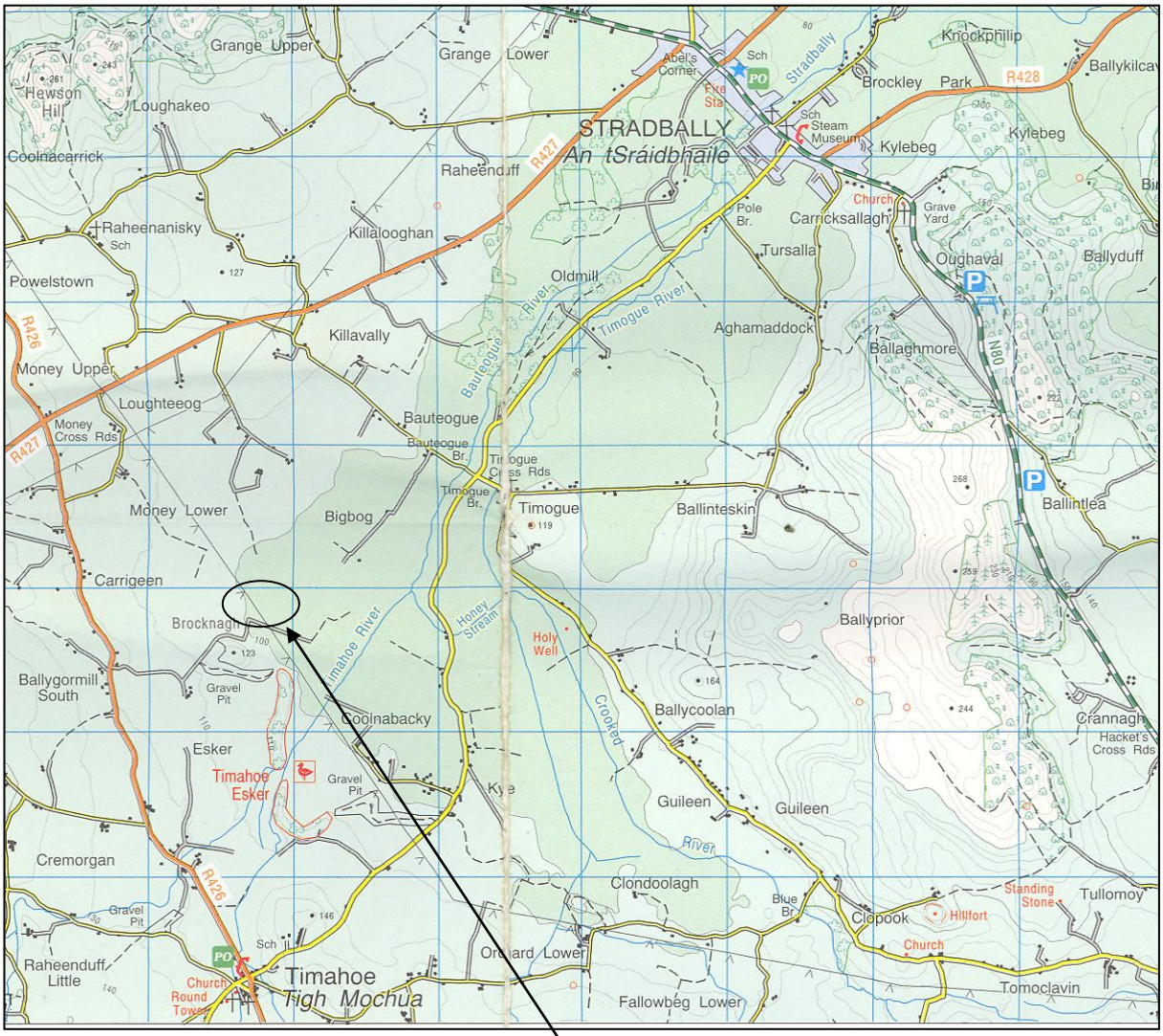
ENCLOSURE G

DRAWINGS

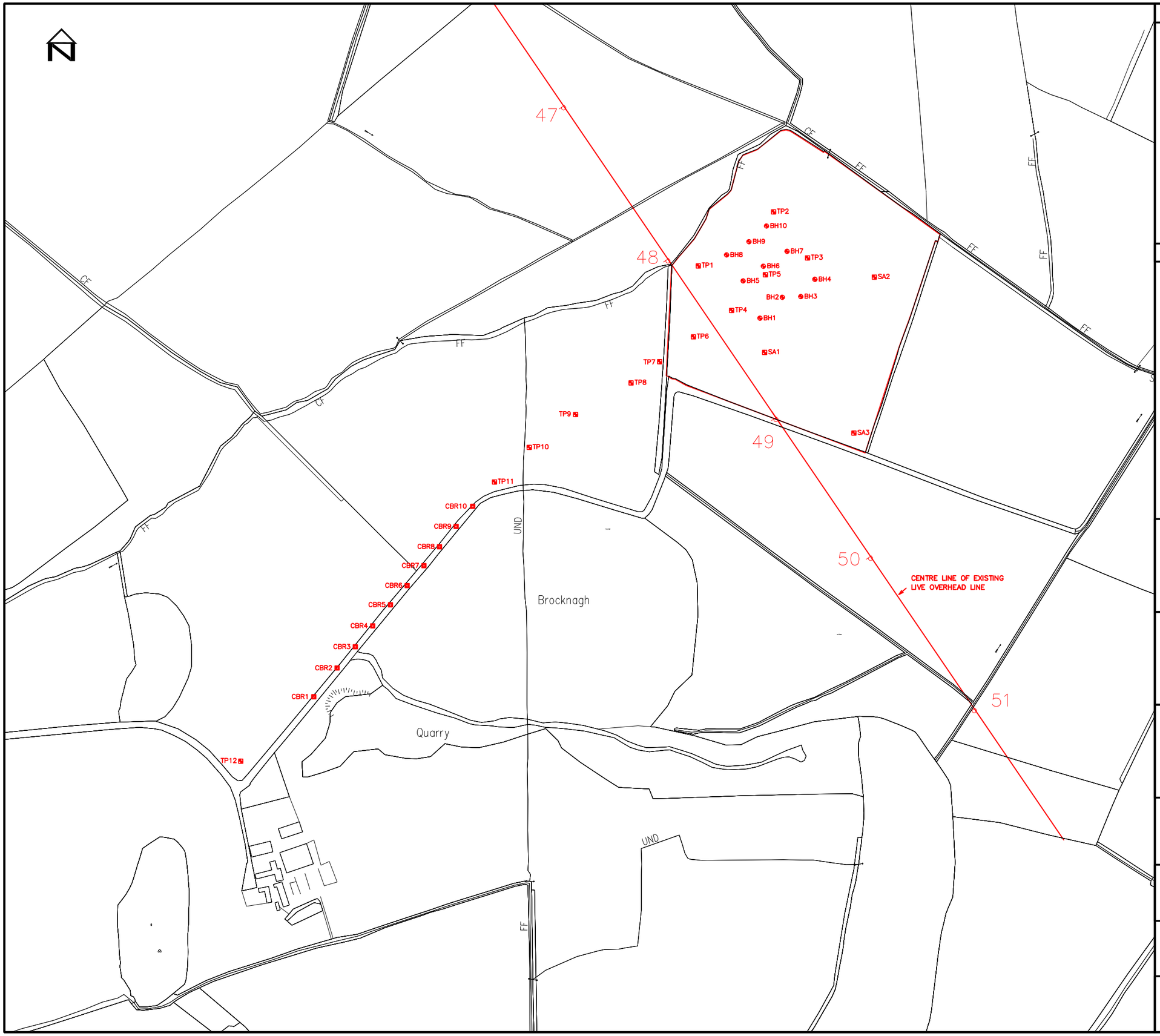
Site Location Plan

Soil Mechanics

N



Notes: Not to scale	Project Project No. Carried out for	Laois Kilkenny Reinforcement Project – Coolnabacky 400kV: Ground Investigation Y2012-12A EirGrid	Figure 1



GENERAL NOTES

LEGEND TO SYMBOLS

Denotes Borehole Location

Denotes CBR Test Location

Denotes Trial Pit Location

Scale: 1:4000

0 40m 80 120 160 200

Title

SITE PLAN

Project

LAOIS KILKENNY REINFORCEMENT PROJECT - COOLNABACKY

Client

EirGrid

Soil Mechanics

Date	Drawn By	Approv. By
14/06/12	AW	AJ

Sheet Size	Scale	Project No
A3	1:4000	Y2012-12A

Figure No	Rev
D2	0

Report No Y2012-12B

LAOIS KILKENNY REINFORCEMENT PROJECT – BALLYRAGGET 110KV SUBSTATION

FACTUAL REPORT ON GROUND INVESTIGATION

Carried out for:
EirGrid

Engineer:
ESB International

July 2012

Soil Mechanics
Geotech Specialists Ltd
Carewswood
Castlemartyr
County Cork
Tel: +353 (0) 21 466 7164 Fax: +353 (0) 21 466 7630
email: cork@geotech.ie

Soil Mechanics part of Environmental Scientifics Group

LAOIS KILKENNY REINFORCEMENT PROJECT – BALLYRAGGET 110KV SUBSTATION:

FACTUAL REPORT ON GROUND INVESTIGATION

Report No: Y2012-12B

Date: July 2012

Employer:

EirGrid
The Oval
160 Shelbourne Road
Ballsbridge
Dublin 4

Engineer:

ESB International
Stephen Court
18/21 St Stephen's Green
Dublin 2

Issue No	Date	Details
1	July 2012	Report as submitted

CONTENTS

1 INTRODUCTION

In February 2012 Soil Mechanics (SM) was commissioned by ESB International (ESBI), on behalf of EirGrid, to carry out a ground investigation at Ballyragget, County Kilkenny. The investigation was required to obtain geotechnical and geoenvironmental information for a proposed replace to an existing 38kv substation.

The scope of the investigation, which was specified by ESBI, comprised cable percussion boreholes, trial pits, in situ testing and laboratory testing. The investigation was carried out in accordance with the contract specification, Eurocode 7 and relevant related standards identified below (see also References). The fieldwork was carried out between 21 March 2012 and 27 March 2012.

This report presents the factual records of the fieldwork and laboratory testing.

A soil characterisation and Soil Suitability Assessment Report was carried out by Traynor Environmental Ltd (Ref 12.050 TE, dated 30 March 2012) and is presented in Enclosure F.

2 THE SITE AND GEOLOGY

2.1 The Site

Ballyragget 38kV Substation is situated approximately 1.25 km north of Ballyragget, County Kilkenny, see Site Location Plan in Enclosure H. The site is at National Grid reference S 445 727.

The site consists of a large roughly rectangular field where the proposed substation is planned to be constructed and an adjacent field through which the proposed access route is planned. The area is level and is presently being used as agricultural land. The existing 38kv Substation bounds the site to the East with the northern boundary being located adjacent to an existing graveyard. To the west and south of the proposed station is currently agricultural land.

2.2 Published Geology

The published geological map covering the site, GSI Sheet 18, shows the bedrock in the area to be the Ballyadams Formation comprising crinoidal wackestone and packstone limestone.

3 FIELDWORK

3.1 General

The fieldwork was carried out in general accordance with BS 5930+A2 (2010), BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006).

The exploratory hole and in situ test locations were selected by ESBI. The locations were set out by SM approximately to the supplied co-ordinates. The co-ordinates and reduced levels were subsequently resurveyed by SM to Irish National Grid and Ordnance Datum. Table 1 presents a summary of the levels and coordinates of the exploratory positions both to ITM and Irish National Grid. ITM coordinates are presented on the exploratory hole and insitu test locations only.

The exploratory hole and in situ test locations are shown on the Site Plan in Enclosure H.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

SUMMARY OF EXPLORATORY HOLES

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Cable Percussion Boring	5	9.74	Designated 1 to 5
Trial Pits	13	3.00	Machine dug. Designated SA1 to SA3 and TP1 to 10

The exploratory hole records are presented in Enclosure A and should be read in conjunction with the Key which is included in that enclosure. The records provide descriptions of the materials encountered in accordance with BS 5930 (1999) without amendment. BS EN ISO 14688-1 (2002) and 14689-1 (2003), for soils and rocks respectively, as amplified by BS 5930+A2 (2010). The records also give details of the samples taken together with observations made during boring and pitting. Photographs of the trial pits are presented in Enclosure F.

On completion of the fieldwork the samples were placed in sealed containers and transported to the Cork office of Soil Mechanics for temporary retention in secure frostproof premises. Samples required for geotechnical testing were subsequently transferred to the in-house laboratory on

receipt of the Client's testing instructions. Geoenvironmental samples were transported from site directly to the ESG Scientifics laboratory.

3.3 Instrumentation and Monitoring (Observations not included in this draft report)

The instruments installed in the exploratory holes are shown on the logs and detailed in Enclosure B. No groundwater monitoring has been carried out.

3.4 In Situ Testing

In situ testing was carried out in accordance with the relevant standards as tabulated below. The testing is summarised in the following table and the results are presented in Enclosure C unless noted otherwise. A calibration certificates of the SPT hammer is included with the results of the SPTs in Enclosure A.

SUMMARY OF IN SITU TESTING

TYPE	QUANTITY	REMARKS
Standard Penetration Test	38	BS EN ISO 22476-3 (2005). Results presented on logs in Enclosure A
Dynamic Cone Penetration Test (DCP's)	11	Completed by Dynamic Cone Penetration Test BS 1377 (1990) with calculated CBR values
EPA Percolation Test		Completed by Traynor Environmental presented in Enclosure F
Soakaway	3	BRE Digest 365 (2007)

4 LABORATORY TESTING

4.1 Geotechnical Testing

The testing was scheduled by ESBI and was carried out in accordance with BS 1377 (1990). The testing is summarised below and the results are presented in Enclosure D.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

TYPE	REMARKS
Moisture Content Determination	2 no
Atterberg Limit Determination	2 no
Particle Size Distribution Analysis	18 no
pH and Water Soluble Sulphate Content of Soils	7 no. Test methods are BS 1377 or others recognised in BRE Special Digest 1 (2005); they are indicated on the results report sheets in Enclosure <<D>>.

4.2 Geoenvironmental Testing

The testing was scheduled by ESBI and was carried out by ESG Scientifics. The results are presented in Enclosure E.

Prepared By	**Alex Orrell BSc**
Reviewed By	**M N Harris BSc MSc DIC MICE CEng FGS**
Approved for Issue By	

REFERENCES

BRE Digest 365 : 2007 : Soakaway design. Building Research Establishment, Garston, Watford.

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

BS 5930 : 1999 : Code of practice for site investigations. British Standards Institution.

BS 5930+A2 : 2010 : Code of practice for site investigations (Amendment 2). British Standards Institution.

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

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

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

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

GSI Geology of Tipperary Sheet 18 : 1994. 1:100 000 geological map (solid). Geological Survey of Ireland

OSI Discovery Series Sheet 60 Kilkenny Laois Tipperary: 1996 First Edition. 1:50 000 Ordnance Survey of Ireland.

TABLE 1 : EXPLORATORY HOLES LEVELS AND COORDINATES

Point ID	I.T.M. Easting(m)	I.T.M. Northing(m)	I.T.M. Level (mOD)	Irish National Grid Easting(m)	Irish National Grid Northing(m)	Irish National Grid Level (mOD)
BH-01	644345.81	672189.97	69.34	244404.96	172149.85	69.34
BH-02	644350.34	672169.87	69.24	244409.50	172129.76	69.24
BH-03	644320.22	672187.02	68.54	244379.37	172146.91	68.54
BH-04	644332.23	672166.57	68.88	244391.39	172126.46	68.88
BH-05	644312.72	672173.68	68.19	244371.87	172133.56	68.19
SA-01	644354.18	672181.08	69.47	244413.34	172140.96	69.47
SA-02	644288.49	672141.09	69.02	244347.64	172100.97	69.02
SA-03	644300.85	672212.60	68.55	244359.99	172172.49	68.55
TP-01	644376.32	672228.07	69.81	244435.49	172187.97	69.81
TP-02	644334.54	672201.57	69.29	244393.69	172161.46	69.29
TP-03	644299.35	672190.02	68.12	244358.49	172149.91	68.12
TP-04	644333.05	672183.75	69.04	244392.21	172143.64	69.04
TP-05	644345.48	672169.75	69.18	244404.63	172129.64	69.18
TP-06	644335.73	672155.02	68.41	244394.89	172114.90	68.41
TP-07	644310.51	672152.14	68.62	244369.66	172112.02	68.62
TP-08	644280.49	672153.85	69.14	244339.63	172113.73	69.14
TP-09	644272.98	672179.59	69.25	244332.12	172139.47	69.25
TP-10	644264.64	672205.33	69.05	244323.78	172165.22	69.05
DCP-01	644392.07	672233.54	70.01	244451.24	172193.44	70.01
DCP-02	644365.68	672224.27	69.65	244424.84	172184.16	69.65
DCP-03	644338.38	672212.86	69.41	244397.54	172172.76	69.41
DCP-04	644330.97	672199.11	69.17	244390.12	172159.00	69.17
DCP-05	644297.84	672191.80	68.13	244356.99	172151.69	68.13
DCP-06	644302.98	672174.91	68.29	244362.12	172134.80	68.29
DCP-07	644335.64	672181.92	69.09	244394.79	172141.81	69.09
DCP-08	644339.81	672163.15	68.76	244398.97	172123.04	68.76
DCP-09	644310.32	672185.98	68.13	244369.47	172145.87	68.13
DCP-10	644315.70	672165.84	68.32	244374.85	172125.73	68.32
DCP-11	644307.55	672158.95	68.49	244366.70	172118.83	68.49

ENCLOSURE A

EXPLORATORY HOLE RECORDS

Key to Exploratory Hole Records	Key
Hammer Energy Report	Calibration certificate DP1
Borehole Logs	BH1 to 5
Trial Pit Logs	SA1 to SA3 and TP1 to 10

Key to Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample
UT	Driven thin wall tube sample
TW	Pushed thin wall tube sample
P	Pushed piston sample

} nominally 100 mm diameter and full recovery unless otherwise stated

L	Liner sample (from Windowless or similar sampler), full recovery unless otherwise stated
CBR	CBR mould sample
BLK	Block sample
CS	Core sample (from rotary core) taken for laboratory testing
AMAL	Amalgamated sample

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample
	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was made to take a tube sample, however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 the total blow count beyond the seating drive is given (without the N = prefix).

IV	*in situ* Vane shear strength, peak (p) and remoulded (r)
HV	Hand vane shear strength, peak (p) and remoulded (r)
PP	Pocket penetrometer test, converted to shear strength
KFH, KRH, KPI	Permeability tests (KFH = falling head, KRH = rising head; KPI = packer inflow); results provided in Field Records column (one value per stage for packer tests)

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930+A2 (2010)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented. The term non-intact (NI) is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

Notes:
See report text for full references of standards

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
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Carried out for EirGrid

Key

Key to Exploratory Hole Records

INSTALLATION

Standpipe/ piezometer

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:

SP Standpipe
SPIE Standpipe piezometer
PPIE Pneumatic piezometer
EPIE Electronic piezometer

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:

ICE Biaxial inclinometer
ICM Inclinometer tubing for use with probe
SLIP Slip indicator

Settlement Points or Pressure Cells

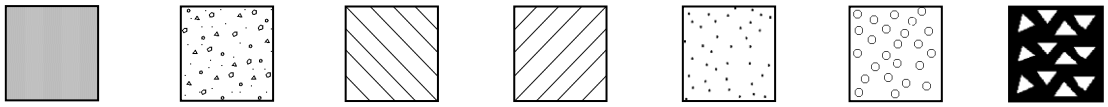
The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column:

ESET Electronic settlement cell/gauge
ETM Magnetic extensometer settlement point
EPCE Electronic embedment pressure cell
PPCE Electronic push in pressure cell

INSTALLATION LEGENDS

A legend describing the installation is shown in the rightmost column. Legends additional to BS5930 are used to describe the backfill materials as indicated below.



NOTES

1 Soils and rocks are described in accordance with BS EN ISO 14688-1 (2002) and 14689-1 (2003) respectively as amplified by BS 5930+A2 (2010).

2 For fine soils consistency determined in the field by the logger is reported for those strata where undisturbed samples are available. The consistency is qualified and given (in brackets) when, in the opinion of the logger, the sample is disturbed but the assessed consistency is reasonably representative of the in situ conditions; in these circumstances it will normally underestimate consistency in situ. No consistency is given where the samples available are too disturbed to allow a reasonable assessment.

3 Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.

4 The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.

5 The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures

6 Strata legends are in accordance with BS 5930+A2 (2010).

7 Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole (ref BS5930+A2:2010, Clause 47.2.7). In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.

8 The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (eg high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.

Updated March 2011

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

HOLEQUEST
• LIMITED •

Winston Road
Galashiels
Selkirkshire
TD1 2DA
01896 752295

SPT Hammer Ref:	DP1
Test Date:	20/12/2011
Report Date:	20/12/2011
File Name:	DP1.spt
Test Operator:	SMCD

Instrumented Rod Data

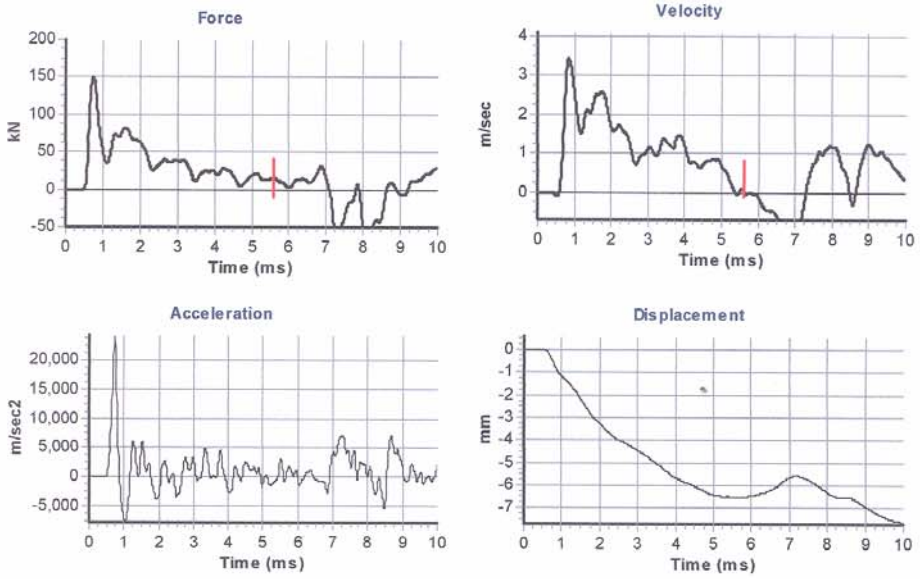
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6092
Accelerometer No.2:	6094

SPT Hammer Information

Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	15.8

Comments / Location

Tested in Holequest Ltd Test Facility



Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	352

Energy Ratio E_r (%): **74**

Signed: Stewart McDowall

Title: Engineer

The recommended calibration interval is 6 months

Borehole Log

Soil Mechanics

Drilled DA **Logged** MMS **Checked** MNH	**Start** 26/03/2012 **End** 27/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 9.74m	**Diameter** 150mm	**Casing Depth** 9.40m	**Ground Level** +69.34 mOD **Coordinates** E 644345.81 **National Grid** N 672189.97 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-9.50 m Hand excavated inspection pit		
0.20	D 2			
0.30	D 3			
0.30-0.60	B 4			
0.60	D 5			
0.60-1.10	B 6			
1.20-1.65	SPT C	* N=47 (2,8/11,11,12,13)	1.20	dry
1.20-1.70	B 7			
2.00	D 8			
2.20-2.65	SPT C	N=43 (4,8/10,10,12,11)	2.20	1.10
2.20-2.70	B 9			
3.00	D 10		26/03/2012	
3.30-3.75	SPT C	N=21 (4,6/6,5,5,5)	3.30	2.70
3.30-3.80	B 11		3.30	2.20
4.00	D 12			
4.30-4.75	SPT C	N=26 (3,5/5,6,7,8)	4.30	2.10
4.30-4.80	B 13			
5.00	D 14			
5.30-5.75	SPT C	N=27 (4,3/5,6,7,9)	5.30	
5.30-5.80	B 15			
6.00	D 16			
6.80-7.25	SPT C	N=37 (4,6/8,10,9,10)	6.80	3.10
6.80-7.25	B 17			
7.00	D 18			
8.00	D 19			
8.30-8.73	SPT C	50 (5,8/10,10,14,16 for 50mm)	8.30	3.60
8.30-8.60	B 20			
8.80	D 21			
9.40-9.68	SPT S	50 (7,15/24,26 for 55mm)	9.40	4.10
9.40	D 22		27/03/2012	
9.60-9.74	SPT C	50 (25 for 70mm/50 for 65mm)	9.40	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
Brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies with some rootlets. (TOPSOIL)	(0.60) 0.60 *+68.74*		
Brown very clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies.	(0.60) 1.20 *+68.14*		
Dense dark grey slightly silty very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone.	(2.10) 3.30 *+66.04*		
Medium dense to dense dark grey slightly silty very gravelly SAND with rare subrounded cobbles of sandstone. Sand is fine to coarse. Gravel is subangular to subrounded of various lithologies.	(5.50) 8.80 *+60.54*		
Stiff to very stiff greyish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone.	(0.94) 9.74 *+59.60*		
EXPLORATORY HOLE ENDS AT 9.74 m			SP

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
None observed (see Key Sheet)			

Depth Related Remarks *

From	to (m)	
1.20	9.60	Water added.

Chiselling

Depths (m)	Time	Tools used
1.80 -1.80	30 mins	
2.60 -2.80	30 mins	
9.40 -9.60	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Borehole BH1

Sheet 1 of 1

Borehole Log

Soil Mechanics

Drilled DA **Logged** MMS **Checked** MNH	**Start** 26/03/2012 **End** 26/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring.	**Depth from** 0.00m	**to** 8.70m	**Diameter** 150mm	**Casing Depth** 8.70m	**Ground Level** +69.24 mOD **Coordinates** E 644350.34 **National Grid** N 672169.87 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m		
0.10	D 2			
0.30	D 3			
0.30-0.60	B 4			
0.60	D 5			
0.60-1.10	B 6			
1.20-1.65	SPT C	* N=33 (2,4/6,8,9,10)	1.20	dry
1.20-1.70	B 7			
2.00	D 8			
2.20-2.65	SPT C	N=27 (4,4/6,8,6,7)	2.20	1.20
2.20-2.70	B 9			
3.00	D 10			
3.20-3.65	SPT C	N=36 (2,5/7,9,10,10)	3.20	2.10
3.20-3.70	B 11			
4.00	D 12			
4.30-4.75	SPT C	N=21 (3,5/6,5,5,5)	4.20	2.20
4.30-4.80	B 13			
5.00	D 14			
5.30-5.75	SPT C	N=28 (3,5/8,7,6,7)	5.30	3.20
5.30-5.80	B 15			
6.00	D 16			
6.80-7.25	SPT C	N=39 (4,6/8,10,11,10)	6.80	3.20
6.80-7.30	B 17			
7.00	D 18			
8.00	D 19			
8.30	SPT C	()	8.30	
8.30-8.70	B 20		26/03/2012 8.70	
~~8.70~~	~~SPT C~~	~~()~~	~~8.70~~	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
Firm brown sandy slightly gravelly CLAY with rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of various lithologies. (TOPSOIL)	(0.60) 0.60 *+68.64*		
Brown clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of various lithologies.	(0.60) 1.20 *+68.04*		
Medium dense to dense mottled grey brown slightly silty very gravelly SAND. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of various lithologies.	(2.00) 3.20 *+66.04*		
Medium dense to dense grey and brown sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to sounded fine to coarse of various lithologies.	(2.80) 6.00 *+63.24*		
Dense to very dense grey to dark grey and brown silty SAND and GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of various lithologies.	(2.70) 8.70 *+60.54*		
EXPLORATORY HOLE ENDS AT 8.70 m			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
None observed (see Key Sheet)			

Depth Related Remarks *

From	to (m)	
1.20	8.70	Water added

Chiselling

Depths (m)	Time	Tools used
8.30 -8.30	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Borehole

BH2

Sheet 1 of 1

Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MNH	**Start** 22/03/2012 **End** 22/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 9.02m	**Diameter** 150mm	**Casing Depth** 8.80m	**Ground Level** +68.54 mOD **Coordinates** E 644320.22 **National Grid** N 672187.02 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.80	B 4			
0.80	D 5			
0.80-1.20	B 6			
1.20-1.65	SPT C	* N=15 (1,2/3,3,4,5)	1.20	dry
1.20-1.70	B 7			
2.00	D 8			
2.20-2.65	SPT C	N=34 (4,6/6,7,9,12)	2.20	1.10
2.20-2.70	B 9			
3.00	D 10			
3.20-3.65	SPT C	N=46 (6,8/9,11,12,14)	3.20	1.30
3.20-3.70	B 11			
4.00	D 12			
4.20-4.65	SPT C	N=12 (2,5/4,2,3,3)	4.20	1.10
4.20-4.70	B 13			
5.00	D 14			
5.20-5.65	SPT C	N=31 (10,12/12,8,7,4)	5.20	1.50
5.20-5.70	B 15			
6.00	D 16			
6.80-7.25	SPT C	N=25 (4,4/4,6,8,7)	6.80	0.90
6.80-7.30	B 17			
7.00	D 18			
8.00	D 19			
8.30-8.52	SPT C	50 (15,10 for 25mm/ 27,23 for 40mm)	8.30	0.00
8.30-8.80	B 20			
8.80-9.02	SPT C	50 (12,13 for 30mm/ 29,21 for 40mm)	8.80 22/03/2012	

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL	(0.30)		
	0.30 *+68.24*		
Brown clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is subrounded fine to coarse predominantly of limestone.	(0.50)		
0.80-1.20 m slightly clayey	0.80 *+67.74*		
Dense locally medium dense grey brown sandy to very sandy GRAVEL locally clayey with low cobble content. Gravel is subrounded to subangular of limestone. Sand is fine to coarse.			
4.00-4.70 m recovered as grey brown sandy GRAVEL with high cobble content	(8.00)		
EXPLORATORY HOLE ENDS AT 9.02 m	8.80 *+59.74*		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
None observed (see Key Sheet)			

Depth Related Remarks *

From	to (m)	
1.20	8.80	Water added

Chiselling

Depths (m)	Time	Tools used
7.60 -7.60	30 mins	
8.40 -8.80	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Borehole

BH3

Sheet 1 of 1

Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MNH	**Start** 23/03/2012 **End** 26/03/2012	**Equipment, Methods and Remarks** Dando 2000 Cable percussion boring	**Depth from** 0.00m	**to** 7.90m	**Diameter** 150mm	**Casing Depth** 7.90m	**Ground Level** +68.88 mOD **Coordinates** E 644332.23 **National Grid** N 672166.57 **Chainage**

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.50	B 4			
0.50	D 5			
0.50-1.00	B 6			
1.20-1.65	SPT C	* N=38 (4,7/8,9,10,11)	1.20	dry
1.20-1.70	B 7			
2.00	D 8			
2.20-2.65	SPT C	N=38 (5,7/7,9,10,12)	2.20	1.10
2.20-2.70	B 9			
3.00	D 10			
3.20-3.65	SPT C	N=42 (4,6/8,10,12,12)	3.20	1.90
3.20-3.70	B 11			
4.00	D 12			
4.20-4.65	SPT C	N=30 (4,4/6,8,8,8)	4.20	1.20
4.20-4.70	B 13			
5.00	D 14			
5.20-5.65	SPT C	N=27 (4,20/5,8,7,7)	5.20	1.80
5.20-5.70	B 15			
6.00	D 16			
6.50-6.95	SPT C	N=35 (4,6/8,8,10,9)	6.50	2.10
6.50-7.00	B 17			
			26/03/2012	0800
6.95-7.31	SPT C	50 (10,12/16,18,16 for 60mm)	7.90	5.10
7.00	D 18		23/03/2012	
7.50	D 19			
			26/03/2012	
			7.90	5.10

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
TOPSOIL	(0.30)		
	0.30 *+68.58*		
Brown slightly clayey slightly gravelly SAND with low cobble content subrounded of various lithologies. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone. 0.50-1.00 m brown gravelly SAND with high cobble content	0.50 *+68.38*		
Dense locally medium dense grey brown sandy slightly clayey GRAVEL with high cobble content subangular to rounded predominantly of limestone. Gravel is fine to coarse subrounded. to subangular Sand is fine to coarse.			
5.20-7.00 m recovered as grey slightly sandy gravelly COBBLES	(7.40)		
EXPLORATORY HOLE ENDS AT 7.90 m	7.90 *+60.98*		

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
1.20	7.90	Water added

Chiselling

Depths (m)	Time	Tools used
2.80 -2.80	30 mins	
7.50 -7.90	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Borehole

BH4

Sheet 1 of 1

Borehole Log

Soil Mechanics

Drilled DA **Logged** AO **Checked** MNH	**Start** 23/03/2012 **End** 23/03/2012	**Equipment, Methods and Remarks** Dando2000 Cable percussion boring	**Depth from** 0.00m	**to** 8.10m	**Diameter** 150mm	**Casing Depth** 6.70m	**Ground Level** +68.19 mOD **Coordinates** E 644312.72 **National Grid** N 672173.68 **Chainage**

Samples and Tests

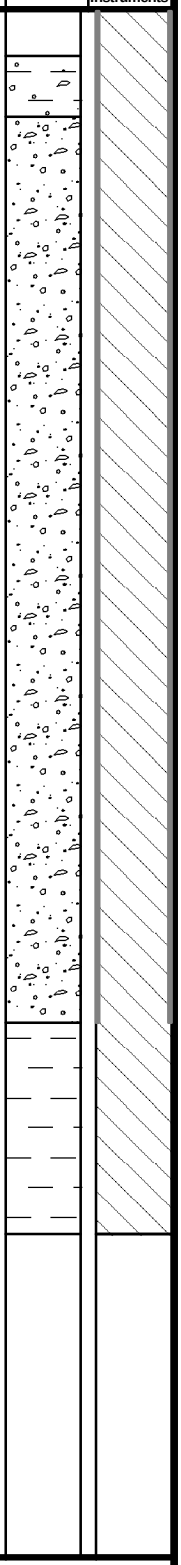
Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	B 1	0.00-1.20 m Hand excavated inspection pit.		
0.10	D 2			
0.30	D 3			
0.30-0.70	B 4			
0.70	D 5			
0.70-1.20	B 6			
1.20-1.65	SPT C	* N=11 (1,1/2,3,2,4)	1.20	dry
1.20-1.70	B 7			
2.00	D 8			
2.20-2.65	SPT C	N=16 (2,4/4,5,4,3)	2.20	1.10
2.20-2.70	B 9			
3.00	D 10			
3.20-3.65	SPT C	N=12 (2,3/4,3,2,3)	3.10	1.70
3.20-3.70	B 11			
4.00	D 12			
4.20-4.65	SPT C	N=16 (2,3/3,5,4,4)	4.20	2.10
4.20-4.70	B 13			
5.00	D 14			
5.30-5.71	SPT C	50 (8,16/18,22,10 for 35mm)	5.20	1.90
5.30-5.80	B 15			
6.00	D 16			
6.70	D 17			
6.90-7.13	SPT S	76 (14,11 for 25mm/ 24,26 for 50mm)	6.90	dry
6.90-7.20	D 18		6.90	dry
6.90-7.40	B 19			
7.80-8.08	SPT S	50 (10,15 for 70mm/ 25,25 for 60mm)		
7.80-8.10	D 20		23/03/2012	

Strata

Description	Depth, *Level* (Thickness)
TOPSOIL	(0.30)
	0.30 *+67.89*
Brown very sandy slightly gravelly CLAY with low cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone.	(0.40)
	0.70 *+67.49*
Medium dense becoming very dense grey brown sandy GRAVEL with low to high cobble content. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse predominantly of limestone. Cobbles are subrounded to rounded of limestone.	(6.00)
	6.70 *+61.49*
Very stiff grey brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse of limestone.	(1.40)
EXPLORATORY HOLE ENDS AT 8.10 m	8.10 *+60.09*

Legend

Backfill/ Instruments



Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
None observed (see Key Sheet)			

Depth Related Remarks *

From	to (m)	
1.20	6.70	Water added

Chiselling

Depths (m)	Time	Tools used
5.70 -5.70	30 mins	
7.40 -7.40	60 mins	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:50

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
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Borehole

BH5

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged MMS **Checked** MNH	**Start** 22/03/2012 **End** 22/03/2012	**Equipment, Methods and Remarks** 5 tonne track excavator	**Dimensions and Orientation** Width 1.00 m Length 2.50 m	**Ground Level** +69.47 mOD **Coordinates** E 644354.18 **National Grid** N 672181.08 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
1.00	B 1	
1.00	D 2	
2.00	B 3	
2.00	D 4	
2.70	B 5	
2.70	D 6	
		22/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 Firm greyish brown slightly sandy CLAY. Sand is fine to coarse. (TOPSOIL)	(0.30)		
2 Firm brown CLAY.	0.30 *+69.17* (0.40)		
3 Very sandy GRAVEL with many subrounded to rounded cobbles. Sand is fine to coarse. Gravel is fine to coarse subrounded to rounded of various lithologies	0.70 *+68.77* (1.10)		
4 Light greyish brown very gravelly SAND. Sand is fine to medium. Gravel is fine to coarse subrounded to rounded of various lithologies.	1.80 *+67.67* (0.70)		
5 Grey SAND and GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subrounded to rounded of various lithologies.	2.50 *+66.97* (0.50)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.47*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From to (m)

Stability Ok to poor

Shoring None

Weather Dry, overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit
SA1
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged MMS **Checked** MNH	**Start** 22/03/2012 **End** 22/03/2012	**Equipment, Methods and Remarks** 5 tonne track excavator	**Dimensions and Orientation** Width - Length -  180 (Deg)	**Ground Level** +69.02 mOD **Coordinates** E 644288.49 **National Grid** N 672141.09 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
1.00 1.00	B 1 D 2	
2.00 2.00	B 3 D 4	* 22/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 Firm greyish brown slightly sandy CLAY with rootlets. (TOPSOIL)	(0.40)		
2 Brown very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subrounded to rounded of various lithologies. 1.80-2.80 m occasional subrounded to rounded cobble of various lithologies and rare subrounded to rounded boulders (0.3m) of various lithologies.	0.40 *+68.62* (2.40)		
EXPLORATORY HOLE ENDS AT 2.80 m	2.80 *+66.22*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
2.00	2.80	Pit terminated due to walls collapsing.

Stability Poor

Shoring None

Weather Dry, bright

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit
SA2
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged MMS **Checked** MNH	**Start** 22/03/2012 **End** 22/03/2012	**Equipment, Methods and Remarks** 5 tonne track excavator	**Dimensions and Orientation** Width 2.00 m Length 7.00 m A B C D 020 (Deg)	**Ground Level** +68.55 mOD **Coordinates** E 644300.85 **National Grid** N 672212.60 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
1.60 1.60	B 1 D 2	
2.60 2.60	B 3 D 4	22/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 Firm slightly sandy gravelly CLAY. Sand is fine to coarse.	(0.40)		
2 Firm orangish brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to rounded of various lithologies.	0.40 *+68.15* (0.90)		
3 Brownish grey SAND and GRAVEL. Sand if fine to coarse subrounded to rounded of various lithologies with occasional subrounded to rounded cobbles of various lithologies.	1.30 *+67.25* (1.70)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+65.55*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From to (m)

Stability Poor

Shoring None

Weather Dry, sunny

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

SA3

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.50 m A B C D 180 (Deg)	**Ground Level** +69.81 mOD **Coordinates** E 644376.32 **National Grid** N 672228.07 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.50-0.60	B 1	
0.50-0.60	D 2	
1.40-1.50	B 3	
1.40-1.50	D 4	
2.50-2.60	B 5	
2.50-2.60	D 6	
		21/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL	(0.30)		
2 Red brown slightly clayey very sandy silty GRAVEL. Gravel is fine to coarse subrounded of various lithologies. Sand is fine to coarse.	0.30 *+69.51* (0.60)		
3 Grey brown gravelly SAND with high cobble content subrounded to rounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded of limestone.	0.90 *+68.91* (1.40)		
4 Grey gravelly SAND with low cobble content subrounded to sounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone.	2.30 *+67.51* (0.70)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.81*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Moderate

Shoring None

Weather Overcast

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit
TP1
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.10 m Length 2.20 m A B C D 020 (Deg)	**Ground Level** +69.29 mOD **Coordinates** E 644334.54 **National Grid** N 672201.57 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.50-0.60	B 1	
0.50-0.60	D 2	
1.00-1.10	B 3	
1.00-1.10	D 4	
1.90-2.00	B 5	
1.90-2.00	D 6	
2.90-3.00	B 7	21/03/2012
2.90-3.00	D 8	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOP SOIL	(0.30)		
2 Firm brown very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone.	0.30 *+68.99* (0.40)		
3 Grey gravelly SAND. Sand is fine to coarse with high cobble content of subrounded to rounded limestone. Gravel is subrounded to rounded fine to coarse of limestone.	0.70 *+68.59* (0.80)		
4 Brown slightly gravelly to very gravelly SAND locally a very sandy gravel with low cobble content of subrounded to rounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone. Gravel and cobbles decrease with depth.	1.50 *+67.79* (1.50)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.29*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Moderate

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
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Carried out for EirGrid

Trial Pit

TP2

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.40 m A B C D 220 (Deg)	**Ground Level** +68.12 mOD **Coordinates** E 644299.35 **National Grid** N 672190.02 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.90-1.00	B 1	
0.90-1.00	D 2	
1.90-2.00	B 3	
1.90-2.00	D 4	
2.90-3.00	B 5	21/03/2012
2.90-3.00	D 6	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOP SOIL	(0.30)		
2 Soft brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.30 +67.82 (0.40)		
3 Firm orange brown sandy gravelly CLAY with low cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subrounded fine to coarse of various lithologies.	0.70 +67.42 (0.70)		
4 Brown gravelly SAND/sandy GRAVEL with medium cobble content of subrounded to rounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone. Becoming high cobble content with depth, occasional lense of brown fine to coarse sand.	1.40 +66.72 (1.60)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 +65.12		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Moderate

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

TP3

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.50 m A B C D 100 (Deg)	**Ground Level** +69.04 mOD **Coordinates** E 644333.05 **National Grid** N 672183.75 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.90-1.00	B 1	
0.90-1.00	D 2	
1.90-2.00	B 3	
1.90-2.00	D 4	
2.90-3.00	B 5	21/03/2012
2.90-3.00	D 6	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOP SOIL	(0.40)		
2 Grey brown gravelly SAND with high cobble content of subrounded to rounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone.	0.40 *+68.64* (1.00)		
3 Brown fine to coarse SAND with rare rounded gravel of various lithologies.	1.40 *+67.64* (1.60)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.04*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Moderate

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

TP4

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.40 m A B C D 120 (Deg)	**Ground Level** +69.18 mOD **Coordinates** E 644345.48 **National Grid** N 672169.75 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.90-1.00	B 1	
0.90-1.00	D 2	
1.00	HV	p 37kPa, r 4kPa
1.90-2.00	B 3	
1.90-2.00	D 4	
2.90-3.00	B 5	21/03/2012
2.90-3.00	D 6	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL	(0.40)		
2 Firm orange brown sandy gravelly CLAY with low cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone.	0.40 *+68.78* 0.60 *+68.58*		
3 Grey brown very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone. Occasional lense of brown fine to medium sand.	(1.10)		
4 Light brown slightly gravelly SAND with low cobble content of subrounded to rounded limestone. Sand is fine to medium. Gravel is subrounded to rounded fine to coarse of limestone.	1.70 *+67.48*		
	(1.30)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.18*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *
From to (m)

Stability Good
Shoring None
Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit
TP5
Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.50 m A B C D 190 (Deg)	**Ground Level** +68.41 mOD **Coordinates** E 644335.73 **National Grid** N 672155.02 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.50-0.60	B 1	
0.50-0.60	D 2	
0.90	HV	p 31kPa, r 5kPa
1.50-1.60	B 3	
1.50-1.60	D 4	
2.50-2.60	B 5	
2.50-2.60	D 6	
		21/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL	(0.30)		
2 Soft orange brown very sandy slightly gravelly CLAY with low cobble content of subrounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone.	0.30 *+68.11* (0.90)		
3 Grey brown gravelly fine to coarse SAND with high cobble content of subrounded to rounded limestone. Gravel is subrounded to rounded fine to coarse of limestone.	1.20 *+67.21* (1.80)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+65.41*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)		

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Moderate

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

TP6

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 0.30 m Length 2.50 m A B C D 230 (Deg)	**Ground Level** +68.62 mOD **Coordinates** E 644310.51 **National Grid** N 672152.14 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.50-0.60	B 1	
0.50-0.60	D 2	
1.50-1.60	B 3	
1.50-1.60	D 4	
2.50-2.60	B 5	
2.50-2.60	D 6	
		21/03/2012 dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL	(0.30)		
2 Brown clayey slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.30 *+68.32* (0.40)		
3 Grey brown gravelly fine to coarse SAND locally sandy GRAVEL with high cobble content of subrounded to rounded limestone. Gravel is subrounded to rounded fine to coarse of limestone.	0.70 *+67.92* (1.70)		
4 Brown slightly gravelly fine to coarse SAND with low cobble content of subrounded to rounded limestone.	2.40 *+66.22* (0.60)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+65.62*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
3.00		Trial pit terminated at required depth

Stability Good

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

TP7

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.40 m A B C D 240 (Deg)	**Ground Level** +69.14 mOD **Coordinates** E 644280.49 **National Grid** N 672153.85 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.90-1.00	B 1	
0.90-1.00	D 2	
1.90-2.00	B 3	
1.90-2.00	D 4	
2.90-3.00	B 5	21/03/2012
2.90-3.00	D 6	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOP SOIL	(0.30)		
2 Brown clayey slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of limestone.	0.30 *+68.84*		
3 Grey brown gravelly fine to coarse SAND locally sandy GRAVEL with high cobble content of subrounded to rounded limestone. Gravel is subrounded to rounded fine to coarse of limestone.	0.50 *+68.64*		
	(2.50)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.14*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Good

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

TP8

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.40 m A B C D 020 (Deg)	**Ground Level** +69.25 mOD **Coordinates** E 644272.98 **National Grid** N 672179.59 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.70-0.80	B 1	
0.70-0.80	D 2	
0.90	HV	p 14kPa, r 4kPa
1.70-1.80	B 3	
1.70-1.80	D 4	
2.70-2.80	B 5	21/03/2012
2.70-2.80	D 6	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOP SOIL	(0.40)		
2 Grey brown sandy GRAVEL with high cobble content of subrounded to rounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone.	0.40 *+68.85*		
2.50 m 1 large limestone boulder (800mm)	(2.40)		
EXPLORATORY HOLE ENDS AT 2.80 m	2.80 *+66.45*		

Depth	Type & No.	Records Date

Groundwater Entries

No. Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From (m)	to (m)	
2.80		Pit terminated due to instability

Stability Poor

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit

TP9

Sheet 1 of 1

Trial Pit Log

Soil Mechanics

Logged AO **Checked** MNH	**Start** 21/03/2012 **End** 21/03/2012	**Equipment, Methods and Remarks** Caterpillar 6 Tonne Excavator	**Dimensions and Orientation** Width 1.40 m Length 2.50 m A B C D 350 (Deg)	**Ground Level** +69.05 mOD **Coordinates** E 644264.64 **National Grid** N 672205.33 **Chainage**

Samples and Tests

Depth	Type & No.	Date Records
		0.00-1.20 m Hand excavated inspection pit
0.50-0.60	B 1	
0.50-0.60	D 2	
0.90	D 3	
1.50-1.60	B 4	
1.50-1.60	D 5	
2.90-3.00	B 6	21/03/2012
2.90-3.00	D 7	dry

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
1 TOPSOIL	(0.30)		
2 Firm orange brown very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of various lithologies.	0.30 *+68.75* (0.40)		
3 Grey brown fine to coarse SAND.	0.70 *+68.35* (0.30)		
4 Grey brown slightly gravelly to very gravelly SAND locally a sandy GRAVEL with medium cobble content of subrounded to rounded limestone. Sand is fine to coarse. Gravel is subrounded to rounded fine to coarse of limestone. Becoming gravelly with high cobble content.	1.00 *+68.05* (2.00)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00 *+66.05*		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour

None observed (see Key Sheet)

Depth Related Remarks *

From	to (m)	
3.00		Pit terminated at required depth

Stability Poor

Shoring None

Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale 1:25

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET
Project No. Y2012-12B
Carried out for EirGrid

Trial Pit
TP10
Sheet 1 of 1

ENCLOSURE B
INSTRUMENTATION AND MONITORING

Groundwater Installation Details

Hole No	Instrument ID	Installation Type	Date of Installation	Reference depth (mBGL)	Piezometer Diameter (mm)	Top of response zone (mBGL)	Base of response zone (mBGL)	Tubing Completion Details	Headworks	Remarks
BH1		SP	27 Mar 2012	0.00	50	1.00	9.74	Gas tap	Stop cock cover	

Notes: Type: SP - Standpipe, SPIE - Standpipe Piezometer, HPIE - Hydraulic Piezometer, PPIE - Pneumatic Piezometer, EPIE - Electronic Piezometer Prepared: 05/07/2012 14:19

AGS

Project	**LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET**
Project No.	**Y2012-12B**
Carried out for	**EirGrid**

Table

B1

ENCLOSURE C

IN SITU TESTING

Dynamic Cone Penetrometer Tests with CBR values	CBR1 To 11
Soakaway Tests	SKWY/SA1/1 to 3, SKWY/SA2/1 to 3 SKWY/SA3/

Dynamic Cone Penetrometer Test

Soil Mechanics

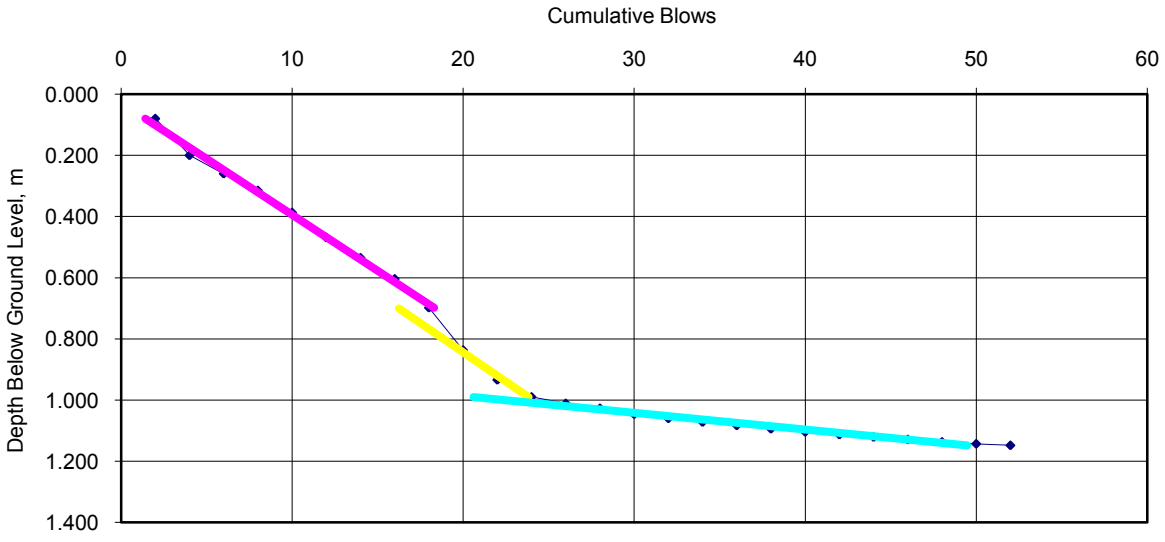
Date of Test: 21/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates : 644392.07 m E; 672233.54 m N; Ground level 70.01 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.080	2								
0.200	4								
0.260	6								
0.315	8								
0.387	10								
0.469	12								
0.535	14								
0.604	16								
0.698	18								
0.837	20								
0.934	22								
0.990	24								
1.011	26								
1.027	28								
1.046	30								
1.060	32								
1.072	34								
1.083	36								
1.094	38								
1.104	40								
1.113	42								
1.121	44								
1.129	46								
1.137	48								
1.143	50								
1.148	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.08	0.70	6.7
0.70	0.99	6.4
0.99	1.15	50

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR1

Dynamic Cone Penetrometer Test

Soil Mechanics

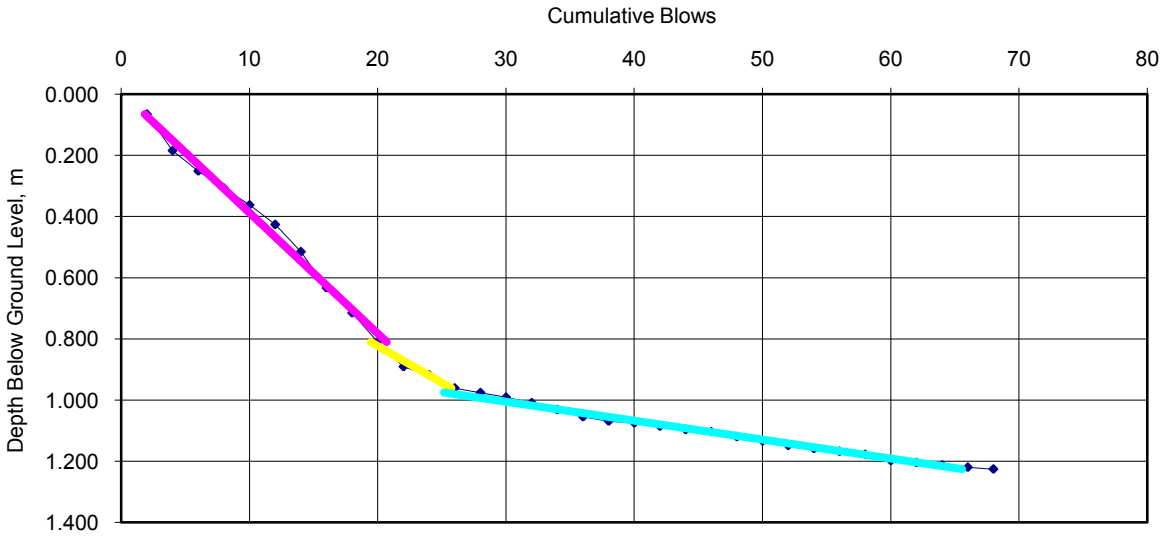
Date of Test: 21/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates : 644365.68 m E; 672224.27 m N; Ground level 69.65 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.065	2	1.159	54						
0.184	4	1.168	56						
0.251	6	1.178	58						
0.307	8	1.198	60						
0.362	10	1.205	62						
0.426	12	1.213	64						
0.515	14	1.220	66						
0.633	16	1.226	68						
0.715	18								
0.810	20								
0.891	22								
0.918	24								
0.961	26								
0.976	28								
0.991	30								
1.009	32								
1.032	34								
1.055	36								
1.069	38								
1.075	40								
1.086	42								
1.097	44								
1.104	46								
1.120	48								
1.134	50								
1.149	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.07	0.81	6.2
0.81	0.96	10
0.98	1.23	43

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR2

Dynamic Cone Penetrometer Test

Soil Mechanics

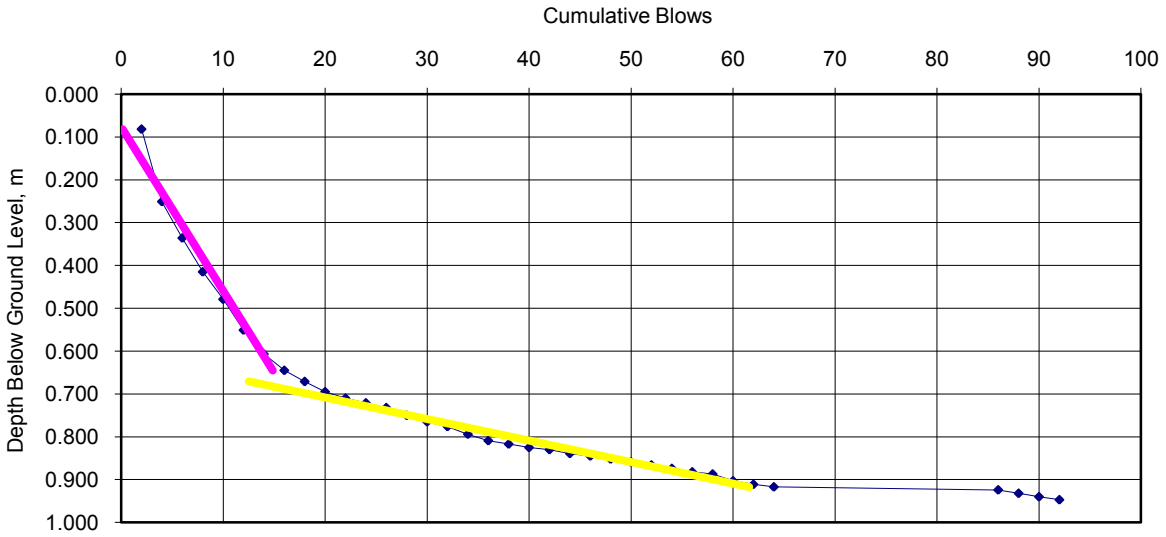
Date of Test: 21/03/2012 Test Depth: 0.00 mBGL

Tested By: AO Method: DCP

Remarks:

Coordinates : 644338.38 m E; 672212.86 m N; Ground level 69.41 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.082	2	0.874	54						
0.251	4	0.882	56						
0.336	6	0.887	58						
0.415	8	0.903	60						
0.479	10	0.911	62						
0.551	12	0.917	64						
0.607	14	0.924	86						
0.645	16	0.932	88						
0.671	18	0.940	90						
0.695	20	0.947	92						
0.710	22								
0.721	24								
0.732	26								
0.750	28								
0.765	30								
0.776	32								
0.794	34								
0.809	36								
0.817	38								
0.825	40								
0.830	42								
0.839	44								
0.845	46								
0.852	48								
0.859	50								
0.866	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.08	0.65	6.4
0.67	0.92	54

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR3

Dynamic Cone Penetrometer Test

Soil Mechanics

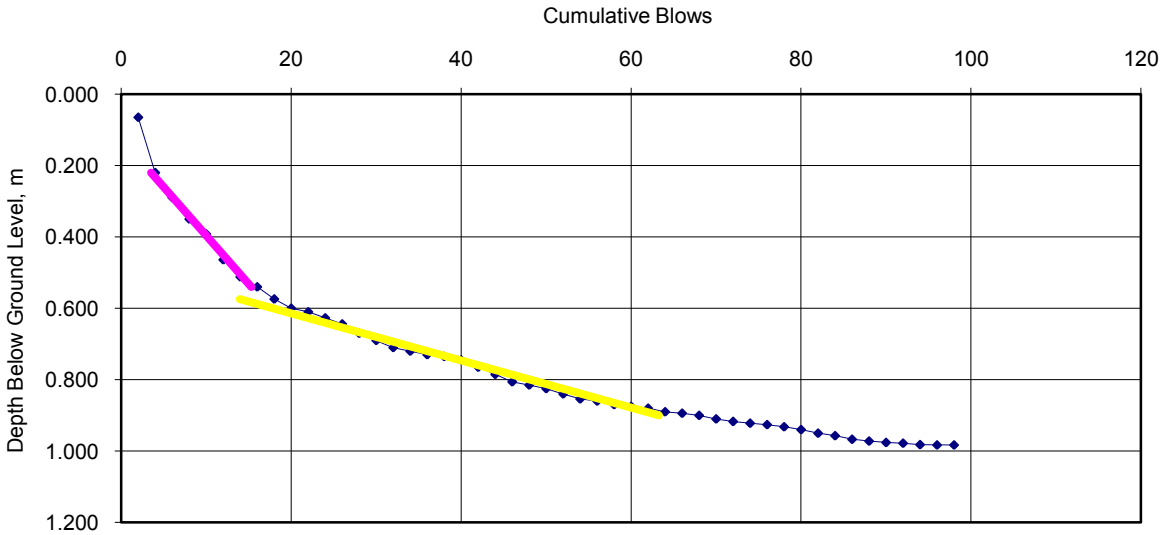
Date of Test: 16/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644330.97 m E; 672199.11 m N; Ground level 69.17 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.065	2	0.854	54						
0.220	4	0.860	56						
0.290	6	0.870	58						
0.350	8	0.875	60						
0.392	10	0.880	62						
0.464	12	0.890	64						
0.512	14	0.894	66						
0.540	16	0.900	68						
0.574	18	0.910	70						
0.600	20	0.917	72						
0.610	22	0.922	74						
0.627	24	0.926	76						
0.644	26	0.932	78						
0.670	28	0.940	80						
0.690	30	0.950	82						
0.710	32	0.957	84						
0.720	34	0.967	86						
0.730	36	0.972	88						
0.735	38	0.976	90						
0.745	40	0.978	92						
0.765	42	0.982	94						
0.785	44	0.983	96						
0.806	46	0.983	98						
0.815	48								
0.825	50								
0.840	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.22	0.54	9.2
0.57	0.90	41

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR4

Dynamic Cone Penetrometer Test

Soil Mechanics

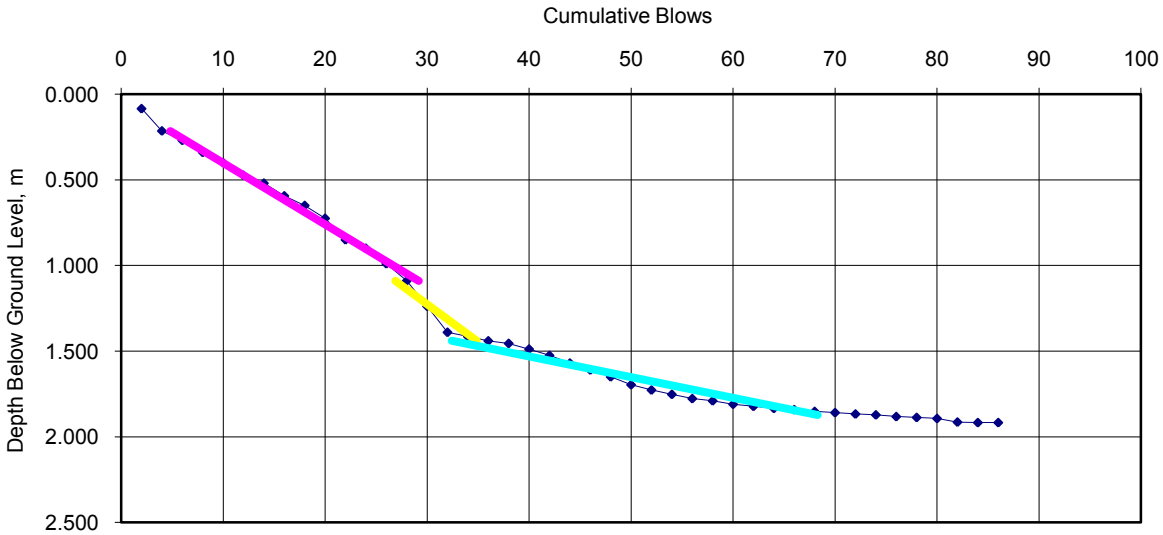
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644297.84 m E; 672191.80 m N; Ground level 68.13 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.085	2	1.752	54						
0.215	4	1.777	56						
0.270	6	1.790	58						
0.340	8	1.810	60						
0.400	10	1.822	62						
0.474	12	1.834	64						
0.520	14	1.842	66						
0.594	16	1.852	68						
0.650	18	1.859	70						
0.725	20	1.867	72						
0.850	22	1.872	74						
0.900	24	1.882	76						
0.990	26	1.887	78						
1.090	28	1.893	80						
1.238	30	1.914	82						
1.390	32	1.917	84						
1.415	34	1.917	86						
1.440	36								
1.455	38								
1.488	40								
1.525	42								
1.570	44								
1.610	46								
1.650	48								
1.696	50								
1.727	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.22	1.09	6.8
1.09	1.44	5.5
1.44	1.87	21

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR5

Dynamic Cone Penetrometer Test

Soil Mechanics

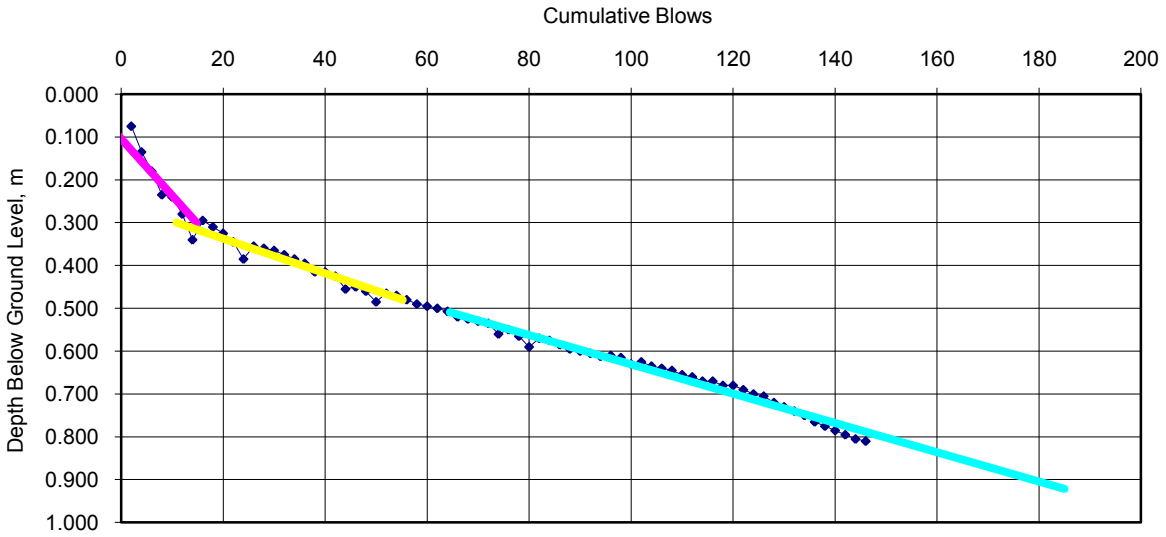
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644302.98 m E; 672174.91 m N; Ground level 68.29 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.075	2	0.470	54	0.640	106				
0.135	4	0.480	56	0.645	108				
0.180	6	0.490	58	0.655	110				
0.235	8	0.495	60	0.660	112				
0.240	10	0.500	62	0.670	114				
0.280	12	0.507	64	0.670	116				
0.340	14	0.520	66	0.680	118				
0.295	16	0.525	68	0.680	120				
0.310	18	0.530	70	0.690	122				
0.325	20	0.535	72	0.700	124				
0.345	22	0.560	74	0.705	126				
0.385	24	0.550	76	0.720	128				
0.355	26	0.565	78	0.730	130				
0.360	28	0.590	80	0.740	132				
0.365	30	0.570	82	0.750	134				
0.375	32	0.575	84	0.765	136				
0.385	34	0.585	86	0.775	138				
0.395	36	0.595	88	0.785	140				
0.415	38	0.600	90	0.795	142				
0.415	40	0.605	92	0.805	144				
0.425	42	0.612	94	0.810	146				
0.455	44	0.610	96						
0.450	46	0.615	98						
0.460	48	0.630	100						
0.485	50	0.625	102						
0.465	52	0.635	104						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.08	0.30	19
0.30	0.48	68
0.51	0.92	82

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR6

Dynamic Cone Penetrometer Test

Soil Mechanics

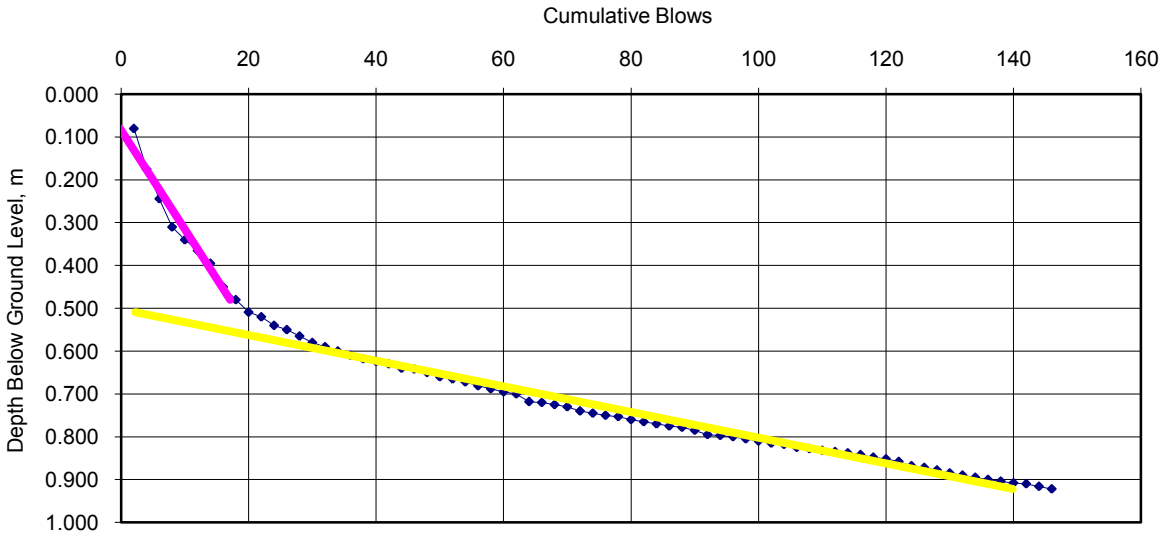
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644335.64 m E; 672181.92 m N; Ground level 69.09 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.080	2	0.672	54	0.825	106				
0.175	4	0.681	56	0.828	108				
0.244	6	0.688	58	0.832	110				
0.310	8	0.695	60	0.835	112				
0.340	10	0.700	62	0.838	114				
0.365	12	0.718	64	0.842	116				
0.395	14	0.720	66	0.848	118				
0.450	16	0.725	68	0.852	120				
0.480	18	0.730	70	0.858	122				
0.509	20	0.740	72	0.868	124				
0.520	22	0.745	74	0.872	126				
0.540	24	0.750	76	0.878	128				
0.550	26	0.753	78	0.885	130				
0.565	28	0.760	80	0.890	132				
0.580	30	0.765	82	0.895	134				
0.590	32	0.770	84	0.900	136				
0.600	34	0.775	86	0.904	138				
0.610	36	0.778	88	0.908	140				
0.618	38	0.785	90	0.910	142				
0.624	40	0.795	92	0.916	144				
0.630	42	0.797	94	0.922	146				
0.640	44	0.800	96						
0.642	46	0.805	98						
0.650	48	0.810	100						
0.660	50	0.815	102						
0.665	52	0.818	104						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.08	0.48	10
0.51	0.92	94

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project: LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No.: Y2012-12B

Carried out for: EirGrid

Hole: CBR7

Dynamic Cone Penetrometer Test

Soil Mechanics

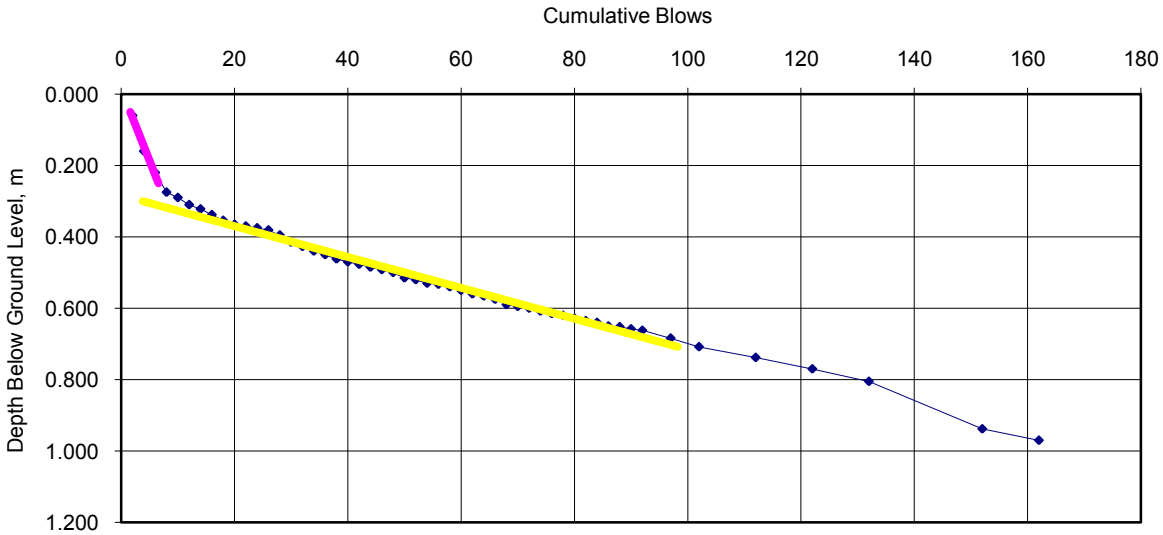
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644339.81 m E; 672163.15 m N; Ground level 68.76 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.060	2	0.530	54	0.970	162				
0.160	4	0.533	56						
0.220	6	0.540	58						
0.275	8	0.550	60						
0.290	10	0.560	62						
0.310	12	0.566	64						
0.322	14	0.575	66						
0.338	16	0.590	68						
0.354	18	0.595	70						
0.365	20	0.600	72						
0.370	22	0.608	74						
0.375	24	0.615	76						
0.381	26	0.620	78						
0.395	28	0.628	80						
0.415	30	0.635	82						
0.427	32	0.640	84						
0.440	34	0.650	86						
0.450	36	0.652	88						
0.462	38	0.658	90						
0.470	40	0.662	92						
0.477	42	0.684	97						
0.485	44	0.708	102						
0.492	46	0.738	112						
0.500	48	0.770	122						
0.515	50	0.805	132						
0.520	52	0.938	152						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.05	0.25	6.1
0.30	0.71	64

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR8

Dynamic Cone Penetrometer Test

Soil Mechanics

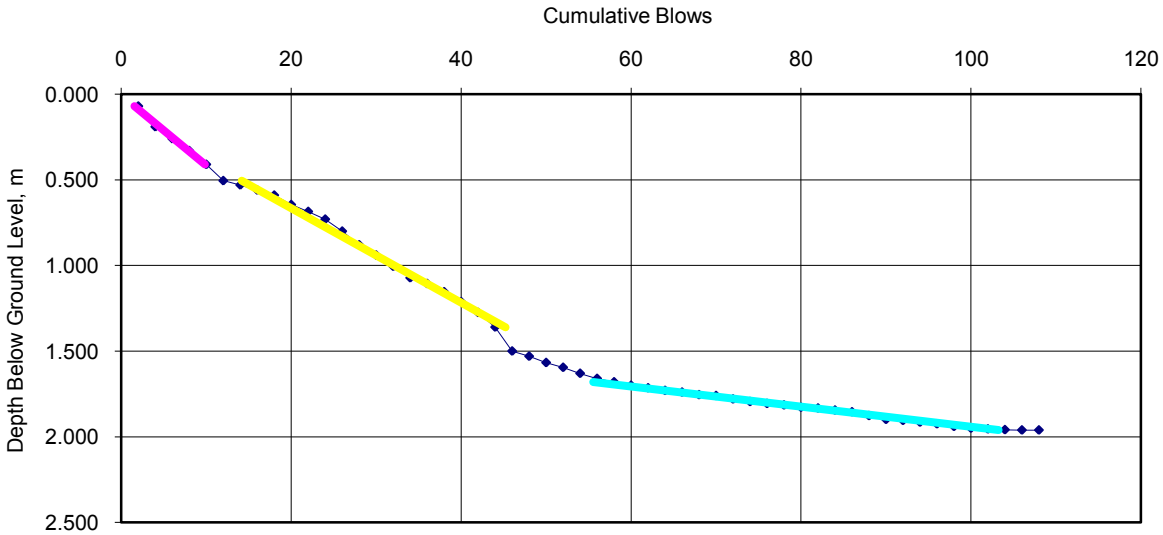
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644310.32 m E; 672185.98 m N; Ground level 68.13 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.070	2	1.630	54	1.961	106				
0.190	4	1.660	56	1.961	108				
0.260	6	1.680	58						
0.330	8	1.700	60						
0.410	10	1.715	62						
0.505	12	1.730	64						
0.530	14	1.740	66						
0.560	16	1.755	68						
0.590	18	1.760	70						
0.645	20	1.780	72						
0.685	22	1.795	74						
0.730	24	1.806	76						
0.800	26	1.815	78						
0.880	28	1.828	80						
0.940	30	1.833	82						
1.005	32	1.845	84						
1.072	34	1.855	86						
1.106	36	1.877	88						
1.154	38	1.899	90						
1.212	40	1.905	92						
1.275	42	1.915	94						
1.360	44	1.925	96						
1.500	46	1.940	98						
1.530	48	1.950	100						
1.567	50	1.955	102						
1.595	52	1.959	104						



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.07	0.41	5.9
0.51	1.36	9
1.68	1.96	46

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR9

Dynamic Cone Penetrometer Test

Soil Mechanics

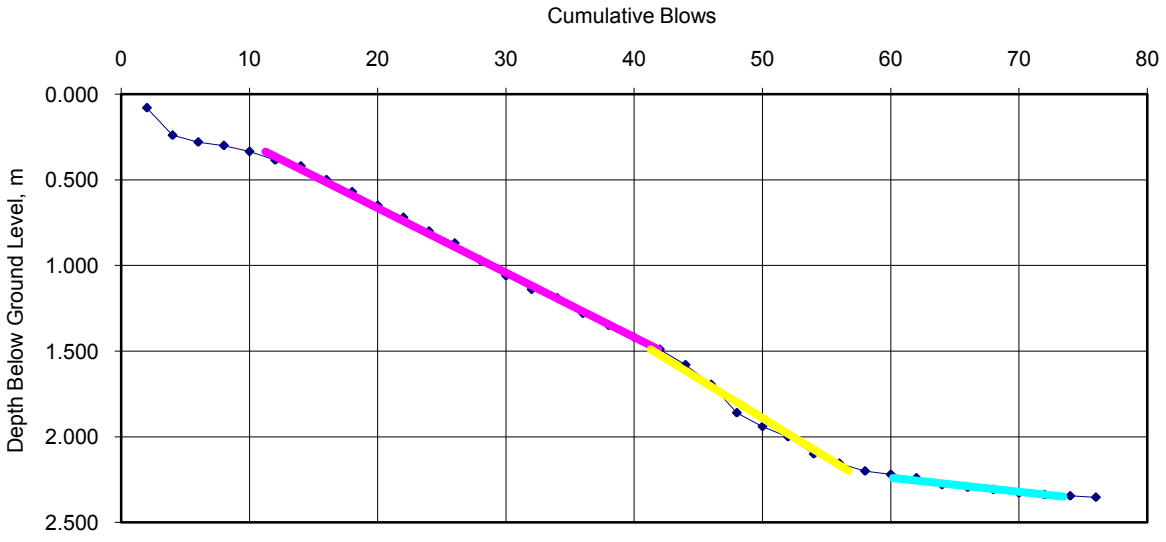
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644315.70 m E; 672165.84 m N; Ground level 68.32 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.080	2	2.100	54						
0.240	4	2.155	56						
0.280	6	2.200	58						
0.300	8	2.220	60						
0.335	10	2.240	62						
0.385	12	2.280	64						
0.420	14	2.295	66						
0.500	16	2.308	68						
0.570	18	2.328	70						
0.650	20	2.338	72						
0.720	22	2.345	74						
0.800	24	2.353	76						
0.870	26								
0.970	28								
1.060	30								
1.140	32								
1.190	34								
1.280	36								
1.350	38								
1.420	40								
1.490	42								
1.580	44								
1.695	46								
1.860	48								
1.940	50								
2.000	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.34	1.49	6.5
1.49	2.20	5.2
2.24	2.35	32

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

Hole CBR10

Dynamic Cone Penetrometer Test

Soil Mechanics

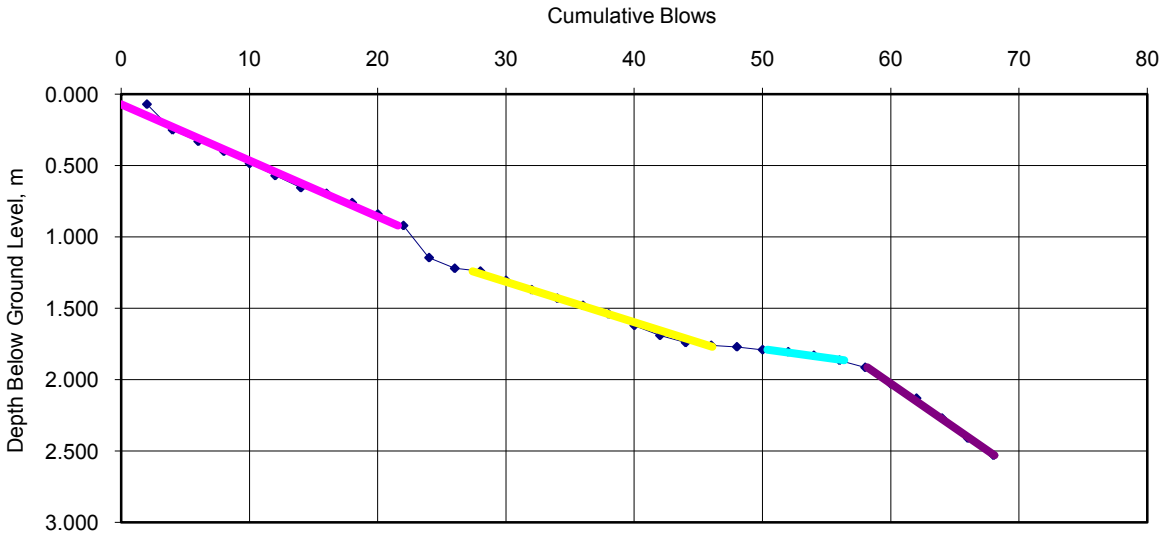
Date of Test: 26/03/2012 Test Depth: 0.00 mBGL

Tested By: MMS Method: DCP

Remarks:

Coordinates : 644307.55 m E; 672158.95 m N; Ground level 68.49 m OD

Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows	Depth, mBGL	Cumulative Blows
0.070	2	1.830	54						
0.250	4	1.864	56						
0.330	6	1.914	58						
0.400	8	2.030	60						
0.485	10	2.130	62						
0.570	12	2.270	64						
0.655	14	2.410	66						
0.695	16	2.530	68						
0.760	18								
0.840	20								
0.920	22								
1.145	24								
1.220	26								
1.240	28								
1.305	30								
1.370	32								
1.430	34								
1.480	36								
1.540	38								
1.620	40								
1.690	42								
1.740	44								
1.760	46								
1.770	48								
1.790	50								
1.805	52								



CBR Values

Top, mBGL	Base, mBGL	CBR, %[1]
0.07	0.92	6.2
1.24	1.77	8.7
1.79	1.86	21
1.91	2.53	3.8

Prepared: 12/04/2012 15:48

Notes:

Calculated using TRRL Overseas Road Note 8, 1990

Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Project No. Y2012-12B

Carried out for EirGrid

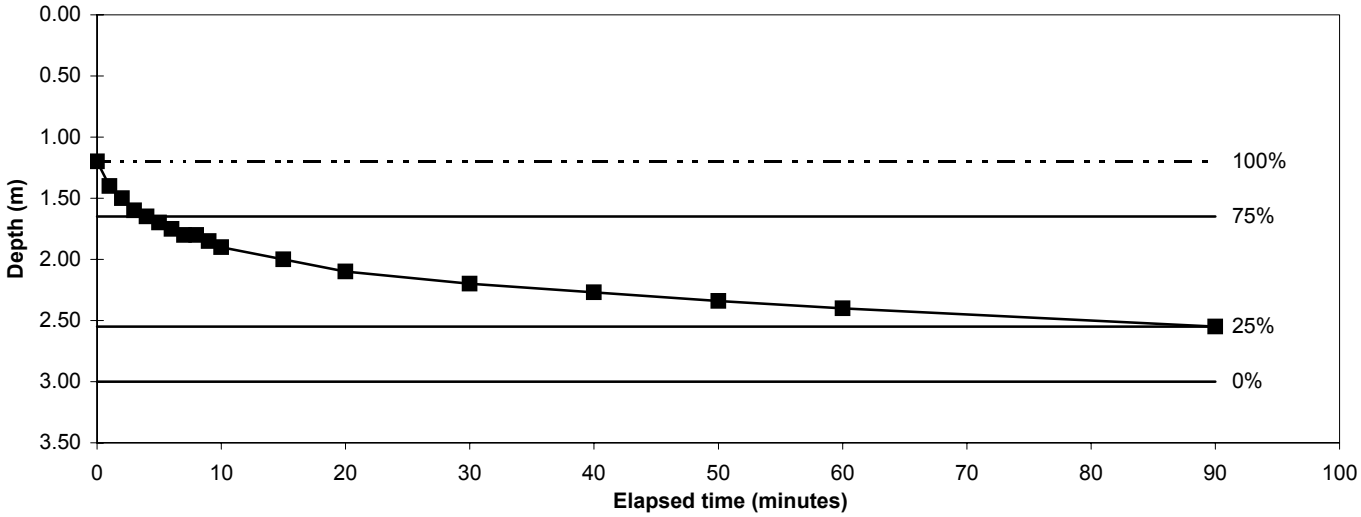
Hole CBR11

Soakaway Test

Soil Mechanics

Trial Pit No:	SA1	Test No:	1	Date:	22/03/2012
Length (m):	1.60		Datum height:	0.00	m agl
Width (m):	0.90		Granular infill:	None	
Depth (m):	3.00				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.20	40	2.27
1	1.40	50	2.34
2	1.50	60	2.40
3	1.60	90	2.55
4	1.65		
5	1.70		
6	1.75		
7	1.80		
8	1.80		
9	1.85		
10	1.90		
15	2.00		
20	2.10		
30	2.20		



Start water depth for analysis (mbgl):	1.20		
75% effective depth (mbgl):	1.65	Elapsed time (mins):	4.0
50% effective depth (mbgl):	2.10		
25% effective depth (mbgl):	2.55	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	3.00		

Volume outflow between 75% and 25% effective depth (m3):
Mean surface area of outflow (m^2): 5.94
(side area at 50% effective depth + base area)
Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate

Remarks	Results processed following BRE 365 (2007). 2.27

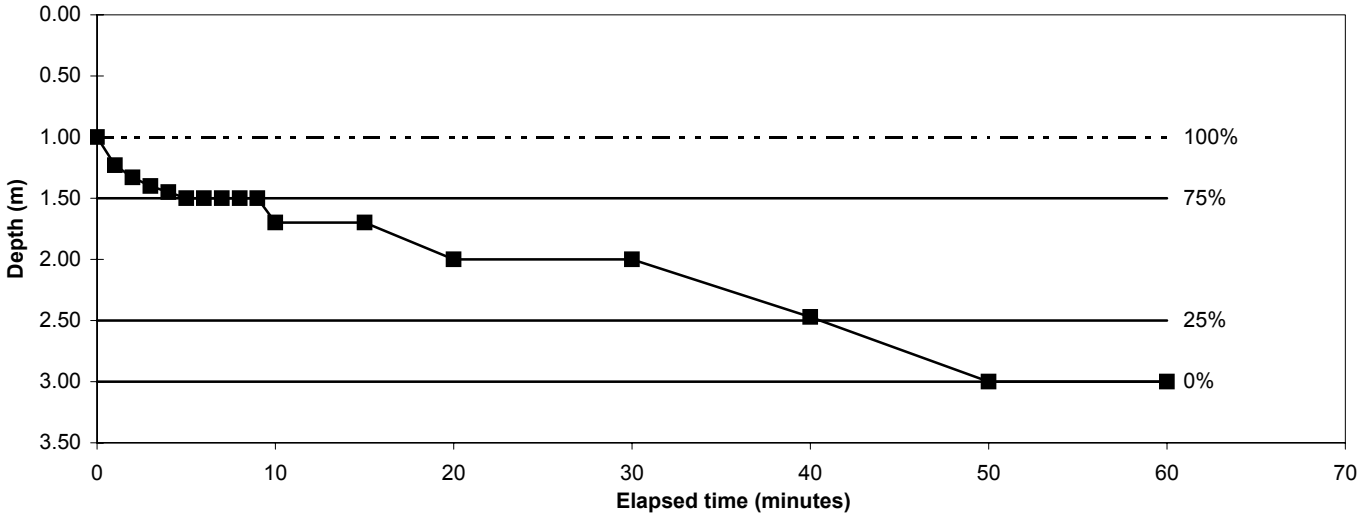
Notes:			Figure
	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	**SKWY/SA1/1**
	Project No.	Y2012-12B	Sheet 1 of 1
	Carried out for	EirGrid	

Soakaway Test

Soil Mechanics

Trial Pit No:	SA1	Test No:	2	Date:	22/03/2012
Length (m):	1.60		Datum height:	0.00	m agl
Width (m):	0.90		Granular infill:	None	
Depth (m):	3.00				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.00	40	2.47
1	1.23	50	3.00
2	1.33	60	3.00
3	1.40		
4	1.45		
5	1.50		
6	1.50		
7	1.50		
8	1.50		
9	1.50		
10	1.70		
15	1.70		
20	2.00		
30	2.00		



Start water depth for analysis (mbgl):	1.00		
75% effective depth (mbgl):	1.50	Elapsed time (mins):	9.0
50% effective depth (mbgl):	2.00		
25% effective depth (mbgl):	2.50	Elapsed time (mins):	40.6
Base of soakage zone (mbgl):	3.00		

Volume outflow between 75% and 25% effective depth (m3):	1.440
Mean surface area of outflow (m^2): (side area at 50% effective depth + base area)	6.44
Time for outflow between 75% and 25% effective depth (mins):	31.6

Soil infiltration rate (m/s):	**1.2E-4**

Remarks Results processed following BRE 365 (2007).

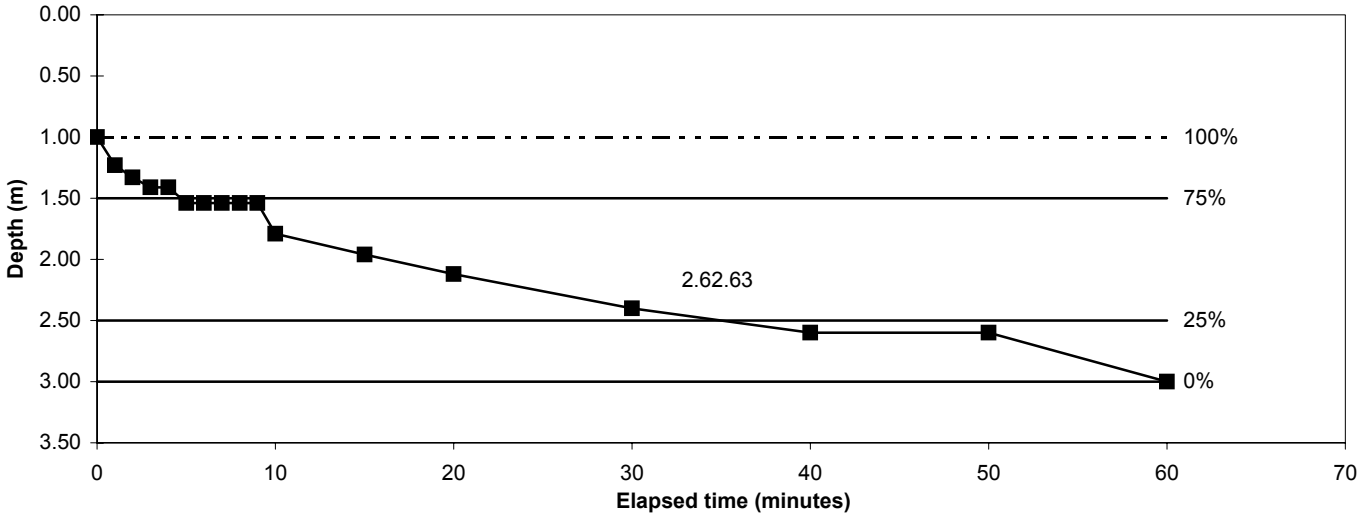
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	Figure **SKWY/SA1/2**
	Project No.	Y2012-12B	Sheet 1 of 1
	Carried out for	EirGrid	

Soakaway Test

Soil Mechanics

Trial Pit No:	SA1	Test No:	3	Date:	22/03/2012
Length (m):	1.60		Datum height:	0.00	m agl
Width (m):	0.90		Granular infill:	None	
Depth (m):	3.00				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.00	40	2.60
1	1.23	50	2.60
2	1.33	60	3.00
3	1.41		
4	1.41		
5	1.54		
6	1.54		
7	1.54		
8	1.54		
9	1.54		
10	1.79		
15	1.96		
20	2.12		
30	2.40		



Start water depth for analysis (mbgl):	1.00		
75% effective depth (mbgl):	1.50	Elapsed time (mins):	4.7
50% effective depth (mbgl):	2.00		
25% effective depth (mbgl):	2.50	Elapsed time (mins):	35.0
Base of soakage zone (mbgl):	3.00		

Volume outflow between 75% and 25% effective depth (m3):	1.440
Mean surface area of outflow (m^2): (side area at 50% effective depth + base area)	6.44
Time for outflow between 75% and 25% effective depth (mins):	30.3

Soil infiltration rate (m/s):	**1.2E-4**

Remarks Results processed following BRE 365 (2007).

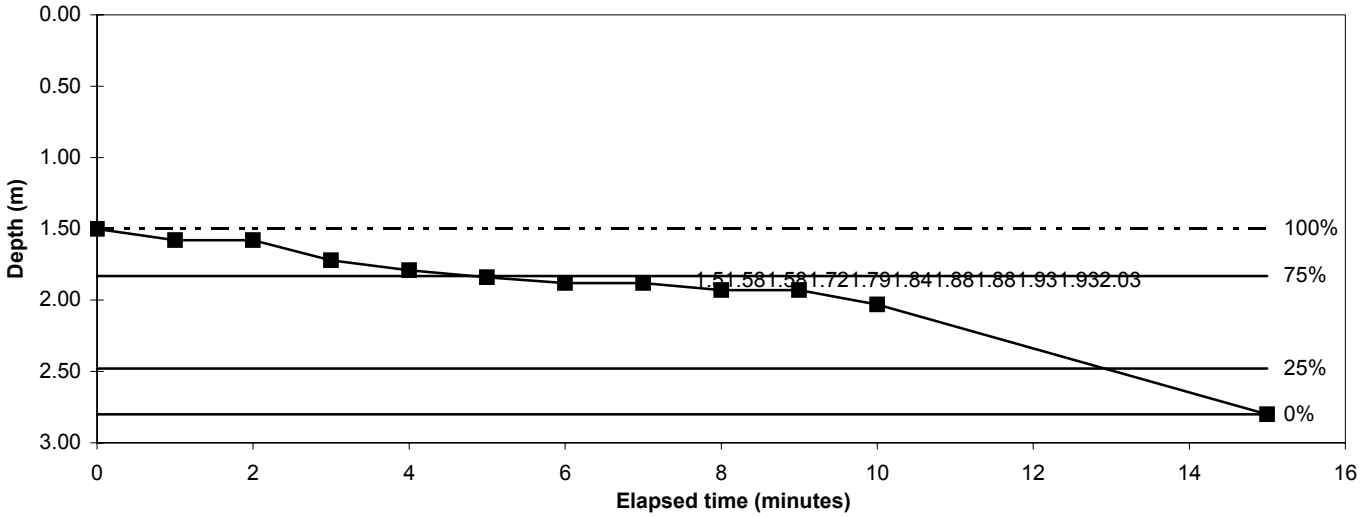
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	Figure
	Project No.	Y2012-12B	**SKWY/SA1/3**
	Carried out for	EirGrid	Sheet 1 of 1

Soakaway Test

Soil Mechanics

Trial Pit No:	SA2	Test No:	1	Date:	22/03/2012
Length (m):	1.80		Datum height:		m agl
Width (m):	1.40		Granular infill:	None	
Depth (m):	2.80				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.50		
1	1.58		
2	1.58		
3	1.72		
4	1.79		
5	1.84		
6	1.88		
7	1.88		
8	1.93		
9	1.93		
10	2.03		
15	2.80		



Start water depth for analysis (mbgl):	1.50		
75% effective depth (mbgl):	1.83	Elapsed time (mins):	4.8
50% effective depth (mbgl):	2.15		
25% effective depth (mbgl):	2.48	Elapsed time (mins):	12.9
Base of soakage zone (mbgl):	2.80		

Volume outflow between 75% and 25% effective depth (m3):	1.638
Mean surface area of outflow (m^2): (side area at 50% effective depth + base area)	6.68
Time for outflow between 75% and 25% effective depth (mins):	8.1

Soil infiltration rate (m/s):	**5.0E-4**

Remarks Results processed following BRE 365 (2007).

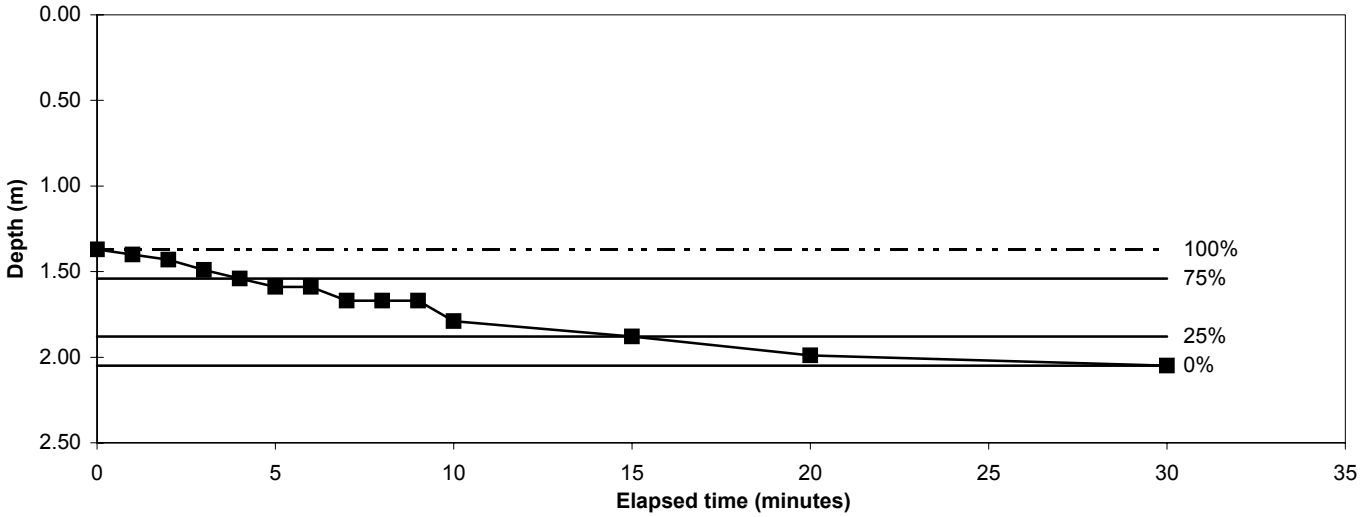
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	Figure
	Project No.	Y2012-12B	**SKWY/SA2/1**
	Carried out for	EirGrid	Sheet 1 of 1

Soakaway Test

Soil Mechanics

Trial Pit No:	SA2	Test No:	2	Date:	22/03/2012
Length (m):	1.80		Datum height:	0.00	m agl
Width (m):	1.40		Granular infill:	None	
Depth (m):	2.05				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.37		
1	1.40		
2	1.43		
3	1.49		
4	1.54		
5	1.59		
6	1.59		
7	1.67		
8	1.67		
9	1.67		
10	1.79		
15	1.88		
20	1.99		
30	2.05		



Start water depth for analysis (mbgl):	1.37		
75% effective depth (mbgl):	1.54	Elapsed time (mins):	4.0
50% effective depth (mbgl):	1.71		
25% effective depth (mbgl):	1.88	Elapsed time (mins):	15.0
Base of soakage zone (mbgl):	2.05		

Volume outflow between 75% and 25% effective depth (m3):	0.857
Mean surface area of outflow (m^2): (side area at 50% effective depth + base area)	4.70
Time for outflow between 75% and 25% effective depth (mins):	11.0

Soil infiltration rate (m/s):	**2.8E-4**

Remarks Results processed following BRE 365 (2007).

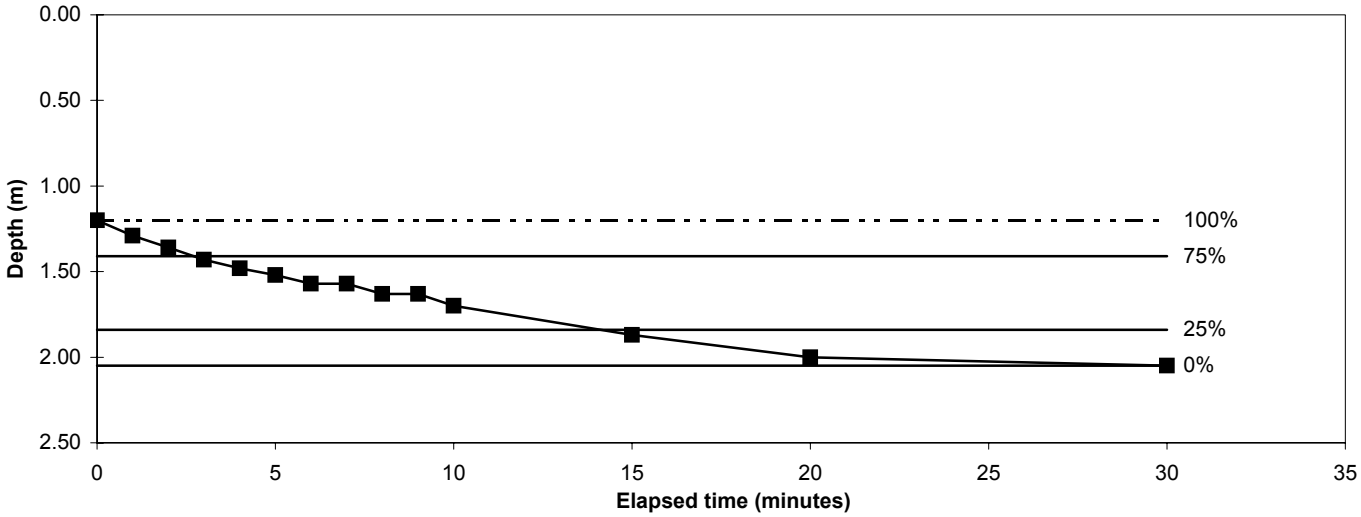
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	Figure **SKWY/SA2/2**
	Project No.	Y2012-12B	Sheet 1 of 1
	Carried out for	EirGrid	

Soakaway Test

Soil Mechanics

Trial Pit No:	SA2	Test No:	3	Date:	22/03/2012
Length (m):	1.80		Datum height:	0.00	m agl
Width (m):	1.40		Granular infill:	None	
Depth (m):	2.05				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.20		
1	1.29		
2	1.36		
3	1.43		
4	1.48		
5	1.52		
6	1.57		
7	1.57		
8	1.63		
9	1.63		
10	1.70		
15	1.87		
20	2.00		
30	2.05		



Start water depth for analysis (mbgl):	1.20		
75% effective depth (mbgl):	1.41	Elapsed time (mins):	2.7
50% effective depth (mbgl):	1.63		
25% effective depth (mbgl):	1.84	Elapsed time (mins):	14.1
Base of soakage zone (mbgl):	2.05		

Volume outflow between 75% and 25% effective depth (m3):	1.084
Mean surface area of outflow (m^2): (side area at 50% effective depth + base area)	5.21
Time for outflow between 75% and 25% effective depth (mins):	11.4

Soil infiltration rate (m/s):	**3.0E-4**

Remarks Results processed following BRE 365 (2007).

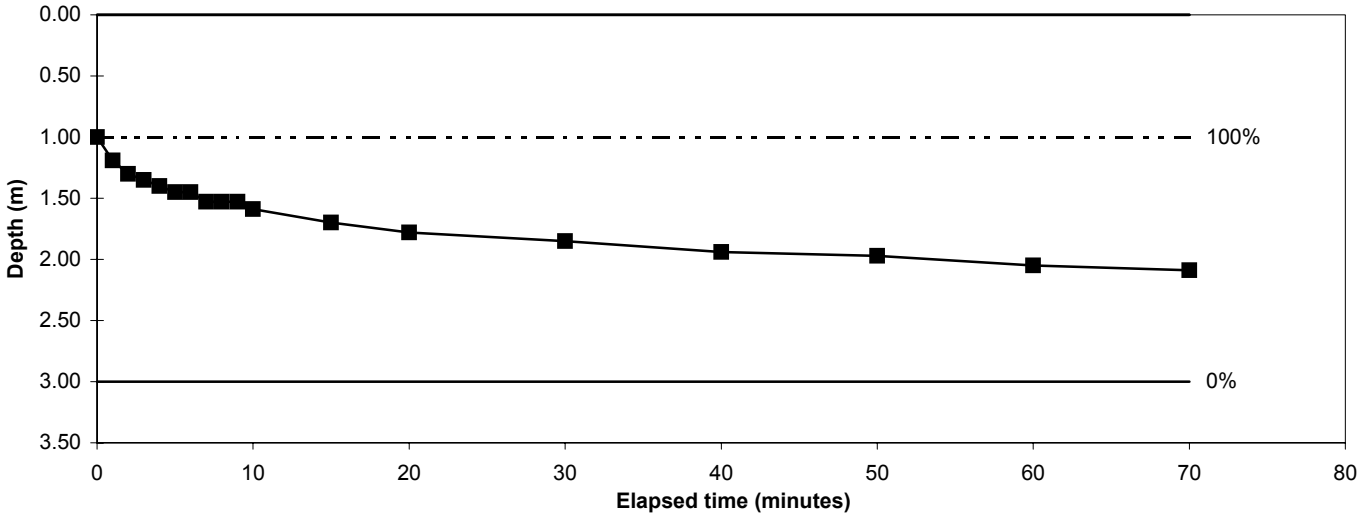
Notes:	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	Figure
	Project No.	Y2012-12B	**SKWY/SA2/3**
	Carried out for	EirGrid	Sheet 1 of 1

Soakaway Test

Soil Mechanics

Borehole No:	SA3	Test No:	1	Date:	23/03/2012
Diameter (m)	2.00		Datum height:	0.00	m agl
	1.00			None	
Depth (m):	3.00				

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.00	40	1.94
1	1.19	50	1.97
2	1.30	60	2.05
3	1.35	70	2.09
4	1.40		
5	1.45		
6	1.45		
7	1.53		
8	1.53		
9	1.53		
10	1.59		
15	1.70		
20	1.78		
30	1.85		



Start water depth for analysis (mbgl): 1.00

Base of soakage zone (mbgl): 3.00

Volume outflow between start and end water depths (m3): #VALUE!

Mean surface area of outflow (m^2): #VALUE!

(side area at 50% effective depth + base area)

Time of outflow between start and end water depths (mins): 70.0

Soil infiltration rate (m/s):	**#VALUE!**

Remarks	Soil infiltration rate calculated by in-house method 1.94

Notes:			Figure
	Project	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET	**SKWY/SA3/1**
	Project No.	Y2012-12B	Sheet 1 of 1
	Carried out for	EirGrid	

ENCLOSURE D

GEOTECHNICAL LABORATORY TEST RESULTS

Project Name

LAOIS KILKENNY

Project No.

Y2012-12B

Details of Report Contents

*Tests in the following list marked * are not UKAS accredited*

ITEM	Sheet Nos			Comments
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SOIL TESTS

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Chemical Tests - Summary of Results	CHEM	1	to 1	
Particle Size Distribution Analyses	PSD	1	to 18	
END OF REPORT				

Total number of pages in this report 22

CHEMICAL TESTS - SUMMARY OF RESULTS

Project No	Project Name
Y2012-12B	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	Org %	LOI %	pH	Sulphate as SO_4 Preparation/test *	Sulphate as SO_4 2:1 water sol. g/L	Sulphate as SO_4 ground water g/L	Sulphate as SO_4 acid sol. %	SD1 options TS %	SD1 options Mg mg/L NO_3 mg/L NH_4	CO_2 %	Chloride, Cl water sol. %	Chloride, Cl acid sol. %	<2 mm %	Remarks
BH3	6	0.80	1.20	B	Brown slightly sandy gravelly CLAY.			7.7	1+3	0.02								41	
BH4	7	1.20	1.70	B	Brownish grey sandy slightly clayey GRAVEL.			8.5	1+3	0.18								14	
BH5	6	0.70	1.20	B	Greyish brown slightly sandy gravelly CLAY with one cobble.			7.9	1+3	0.33								46	
TP2	5	1.90	2.00	B	Brown very sandy slightly clayey GRAVEL.			8.2	1+3	0.03								50	
TP3	3	1.90	2.00	B	Brown gravelly SAND with one cobble.			8.1	1+3	0.02								33	
TP4	4	1.90	2.00	D	Brownish grey slightly gravelly slightly clayey SAND.			8.2	1+3	0.06								89	
TP7	3	1.50	1.60	B	Greyish brown very sandy slightly organic GRAVEL with 2 cobbles.			8.2	1+3	0.07								35	

BS 1377 : definitive method unless stated :

Org Organic matter content (s-sulphides, c-chlorides identified)

LOI Mass loss on ignition at 440°C

CO_2 Carbonate content (rapid titration)

Cl Chloride content

* Sulphate tests preparation / test methods :

1. BS 1377:Part 3:1990:clause 5.3
2. BS 1377:Part 3:1990:clause 5.4
3. BS 1377:Part 3:1990:clause 5.5
4. TRL447 - 1 water soluble sulphate
5. TRL447 - 2 acid soluble sulphate
6. BR279 - groundwater sulphate

< 2mm material passing 2mm sieve

BRE Special Digest SD1, dependent options :

TS Total Sulphur to BR279 / EN ISO15178

Mg Soluble Magnesium to BR279, colorimetric

NO3 Soluble Nitrate to BR279, colorimetric

NH_4 qualitative

INDEX PROPERTIES - SUMMARY OF RESULTS

Project No	Project Name
Y2012-12B	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET

Hole No.	Sample No.	Depth (m) from	Depth (m) to	type	Soil Description	p Mg/m^3	p_d Mg/m^3	w %	< 425 µm sieve %	W_L %	W_P %	I_P	p_s Mg/m^3	Remarks
TP2	2	0.50	0.60	D	Brown slightly sandy slightly gravelly CLAY.			11	56 s	27 a	17	10		
TP6	2	0.50	0.60	D	Brown slightly sandy slightly gravelly CLAY.			12	59 s	26 a	17	9		

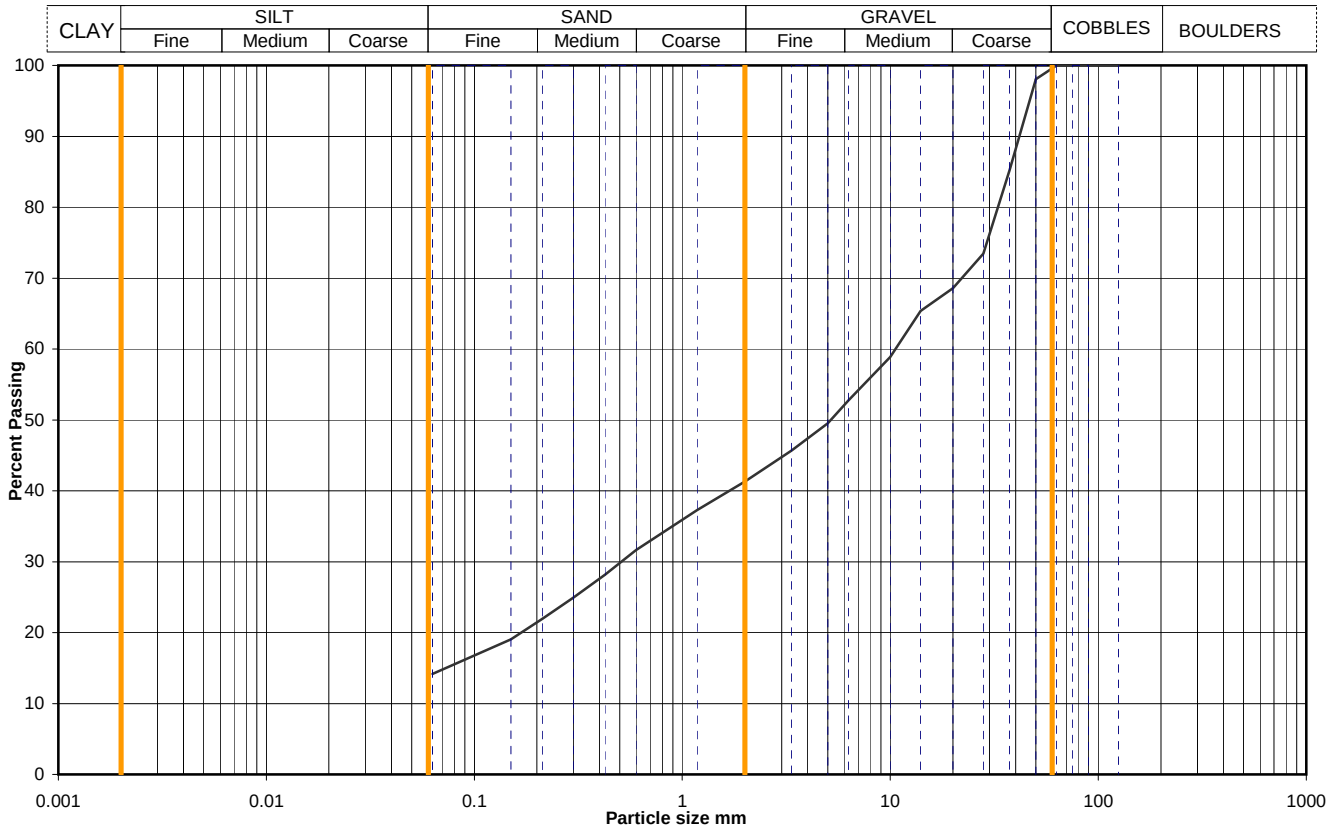
General notes: All above tests carried out to BS1377 : 1990 unless annotated otherwise. See individual test reports for further details.

Key :

p	bulk density, linear	W_L Liquid limit	W_P	Plastic limit	<425um preparation	p_s	particle density
p_d	dry density	a 4 point cone test	NP	non - plastic	n from natural soil	-g = gas jar	
w	moisture content	b 1 point cone test	I_P	Plasticity Index	s sieved specimen	-p = small pyknometer	

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	0.80		
			Samp No	6	Type	B
			ID	ESGY2012-12B201203290000000006		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	98		
37.5	85		
28	73		
20	69		
14	65		
10	59		
6.3	53		
5.0	50		
3.35	46		
2.00	41		
1.18	37		
0.600	32		
0.425	28		
0.300	25	Dry mass of sample, kg	
0.212	22		
0.150	19	13.0	
0.063	14		

Soil description	Brown slightly sandy gravelly CLAY.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	59	59
	Sand	27	27
	Silt	silt+clay =	
	Clay	14	14

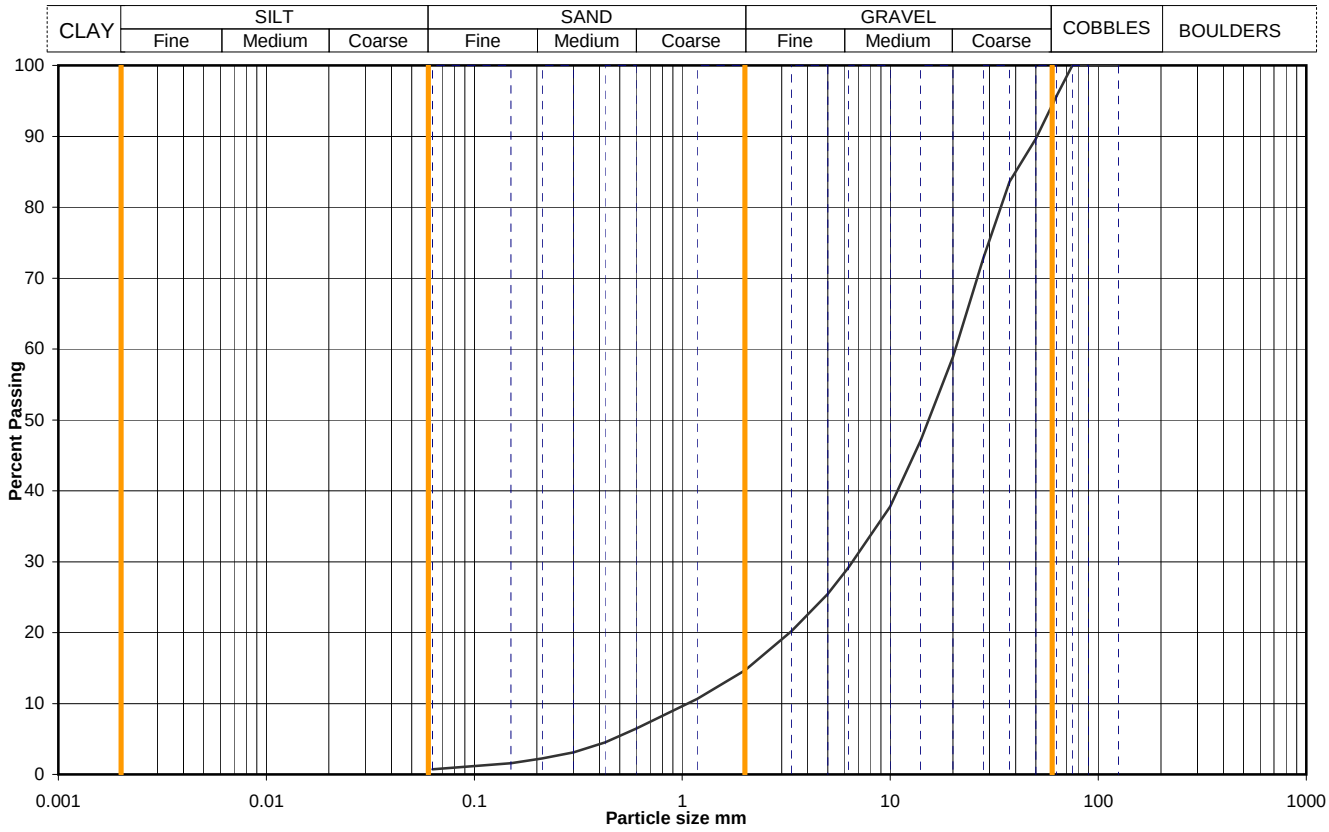
Uniformity Coefficient	D_{60} / D_{10}	Not applicable

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 1**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	3.20		
			Samp No	11	Type	B
			ID	ESGY2012-12B201203290000000011		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	96		
50	90		
37.5	84		
28	73		
20	59		
14	47		
10	38		
6.3	29		
5.0	25		
3.35	20		
2.00	15		
1.18	11		
0.600	6		
0.425	5		
0.300	3	Dry mass of sample, kg	
0.212	2		
0.150	2	18.5	
0.063	1		

Soil description	Grey sandy GRAVEL with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	6	0
	Gravel	79	84
	Sand	14	15
	Silt	silt+clay =	
	Clay	1	1

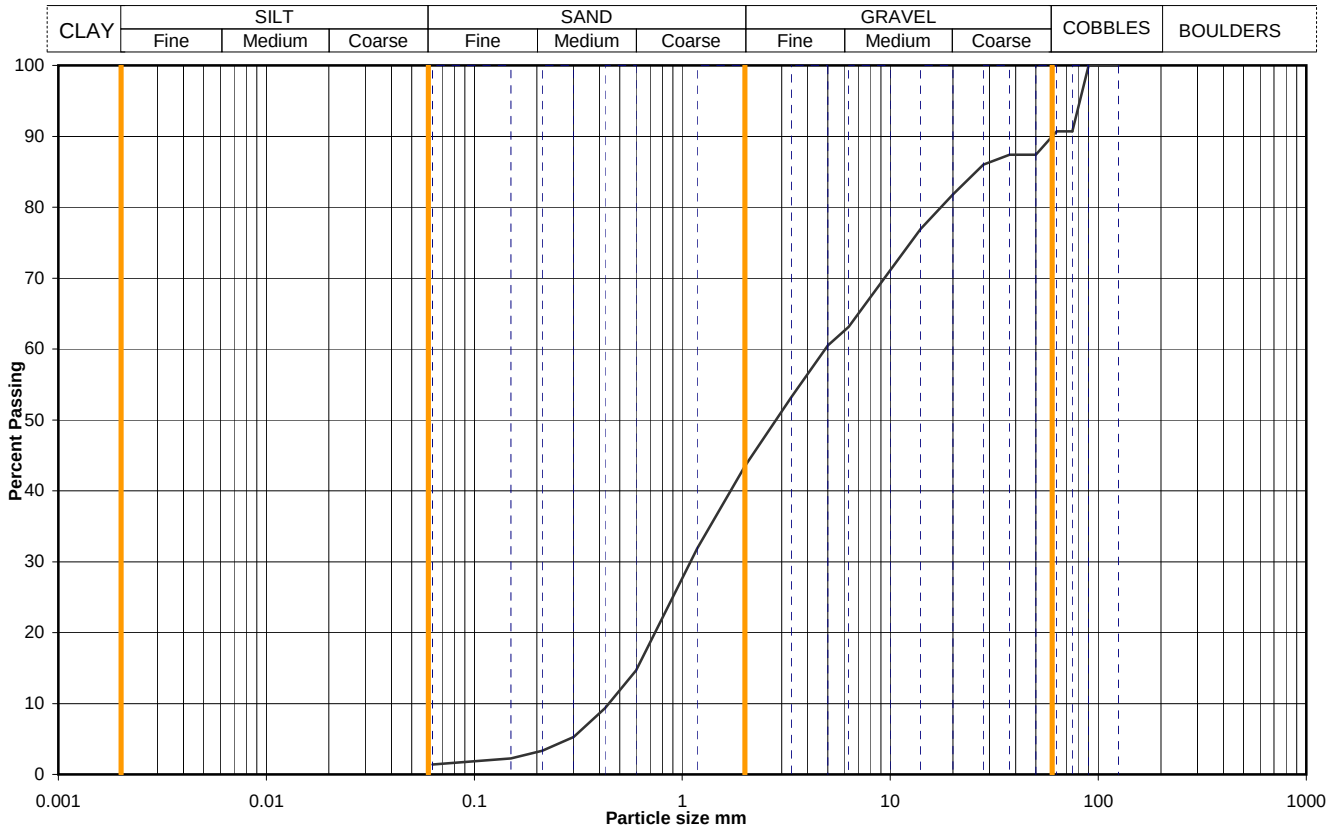
Uniformity Coefficient	D_{60} / D_{10}	19

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 2**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	5.20		
			Samp No	15	Type	B
			ID	ESGY2012-12B201203290000000015		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	91		
63	91		
50	87		
37.5	87		
28	86		
20	82		
14	77		
10	71		
6.3	63		
5.0	61		
3.35	53		
2.00	43		
1.18	32		
0.600	15		
0.425	9		
0.300	5	Dry mass of sample, kg	
0.212	3		
0.150	2	11.7	
0.063	1		

Soil description	Grey very sandy GRAVEL with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	10	0
	Gravel	47	52
	Sand	42	47
	Silt	silt+clay =	
	Clay	1	1

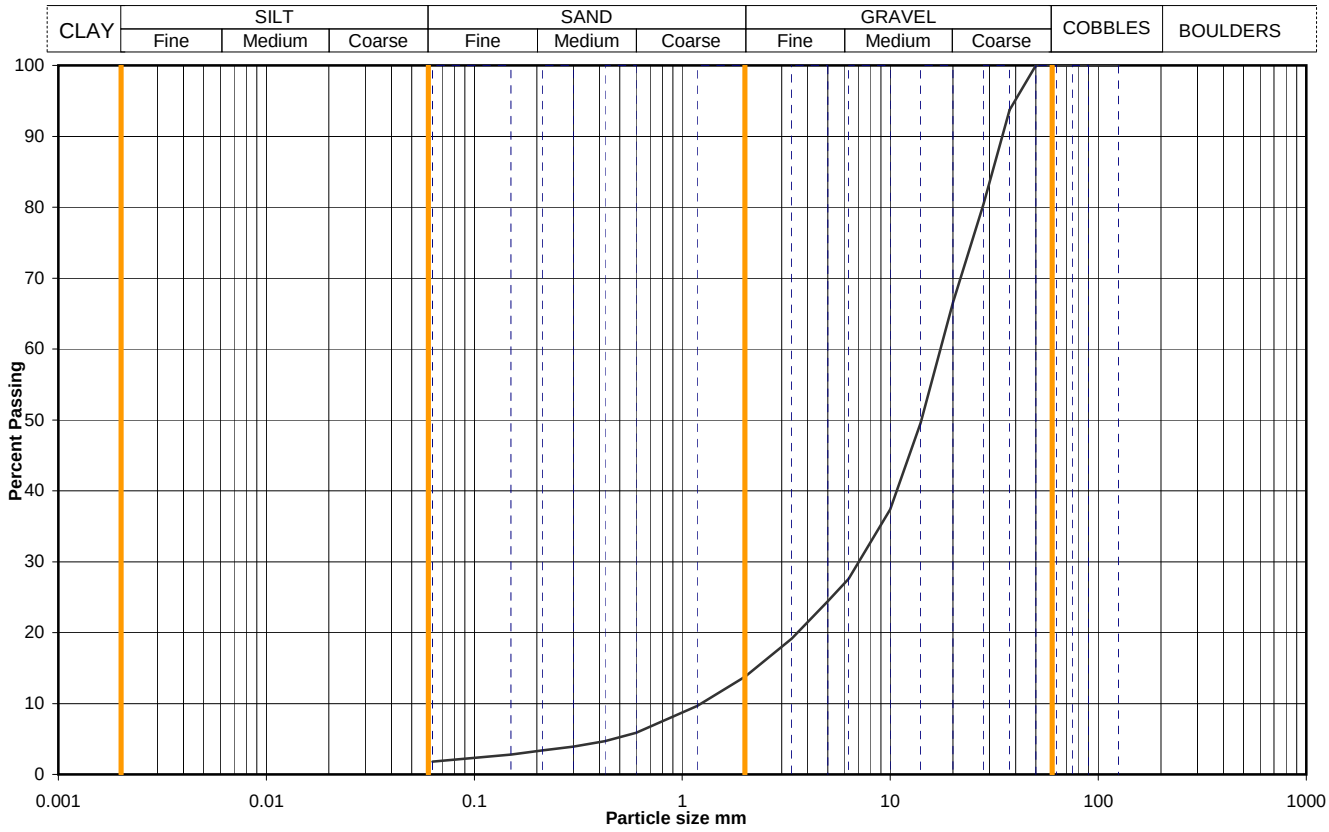
Uniformity Coefficient	D_{60} / D_{10}	11

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 3**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH4		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	1.20		
			Samp No	7	Type	B
			ID	ESGY2012-12B201203290000000027		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	94		
28	80		
20	67		
14	50		
10	37		
6.3	28		
5.0	24		
3.35	19		
2.00	14		
1.18	10		
0.600	6		
0.425	5		
0.300	4	Dry mass of sample, kg	
0.212	3		
0.150	3	11.6	
0.063	2		

Soil description	Brownish grey sandy slightly clayey GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	86	86
	Sand	12	12
	Silt	silt+clay =	
	Clay	2	2

Uniformity Coefficient	D_{60} / D_{10}	14

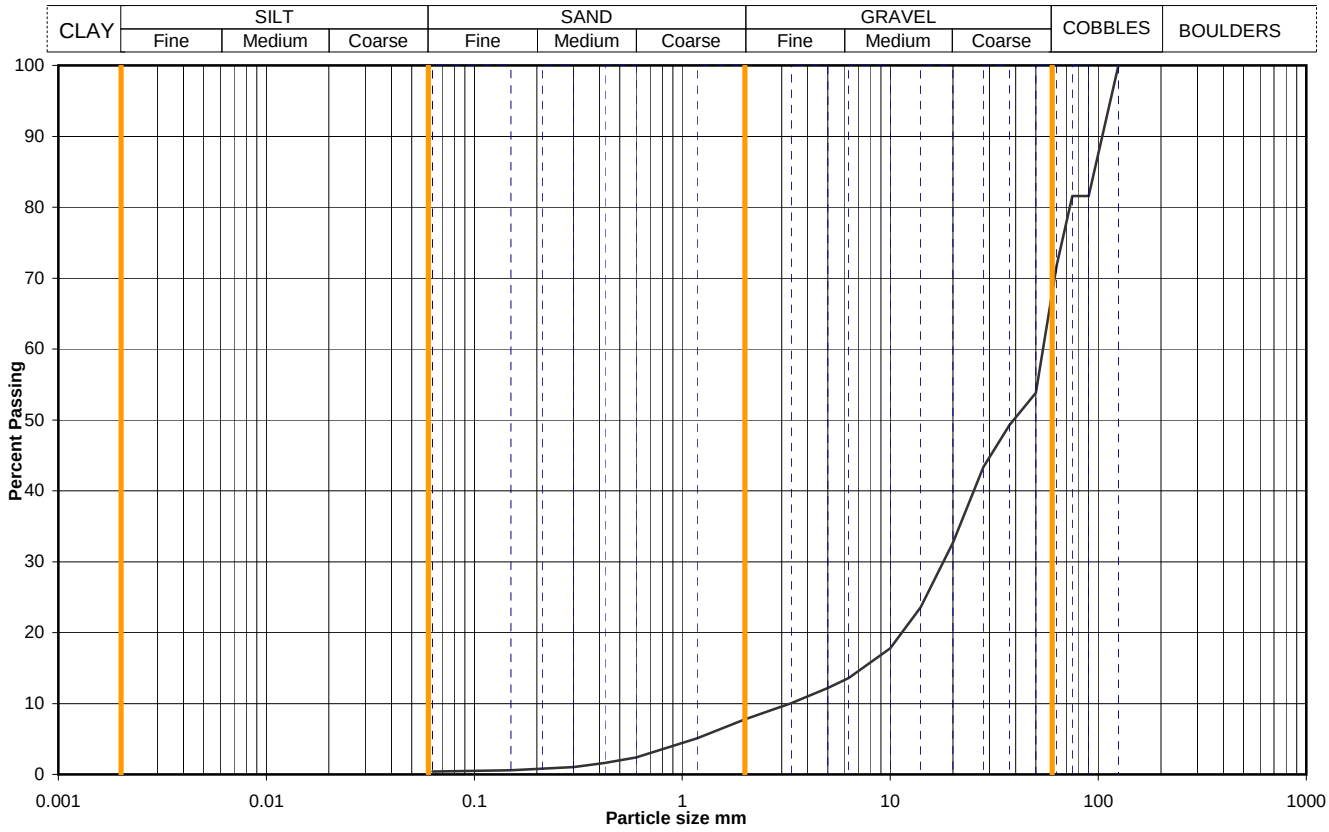
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57

Figure **PSD 4**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH4		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	6.50		
			Samp No	17	Type	B
			ID	ESGY2012-12B201203290000000037		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	82		
75	82		
63	72		
50	54		
37.5	49		
28	43		
20	33		
14	24		
10	18		
6.3	14		
5.0	12		
3.35	10		
2.00	8		
1.18	5		
0.600	2		
0.425	2		
0.300	1	Dry mass of sample, kg	
0.212	1	10.3	
0.150	1		
0.063	0		

Soil description	Grey sandy GRAVEL with 2 cobbles.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	32	0
	Gravel	60	88
	Sand	7	10
	Silt	silt+clay =	
	Clay	1	1

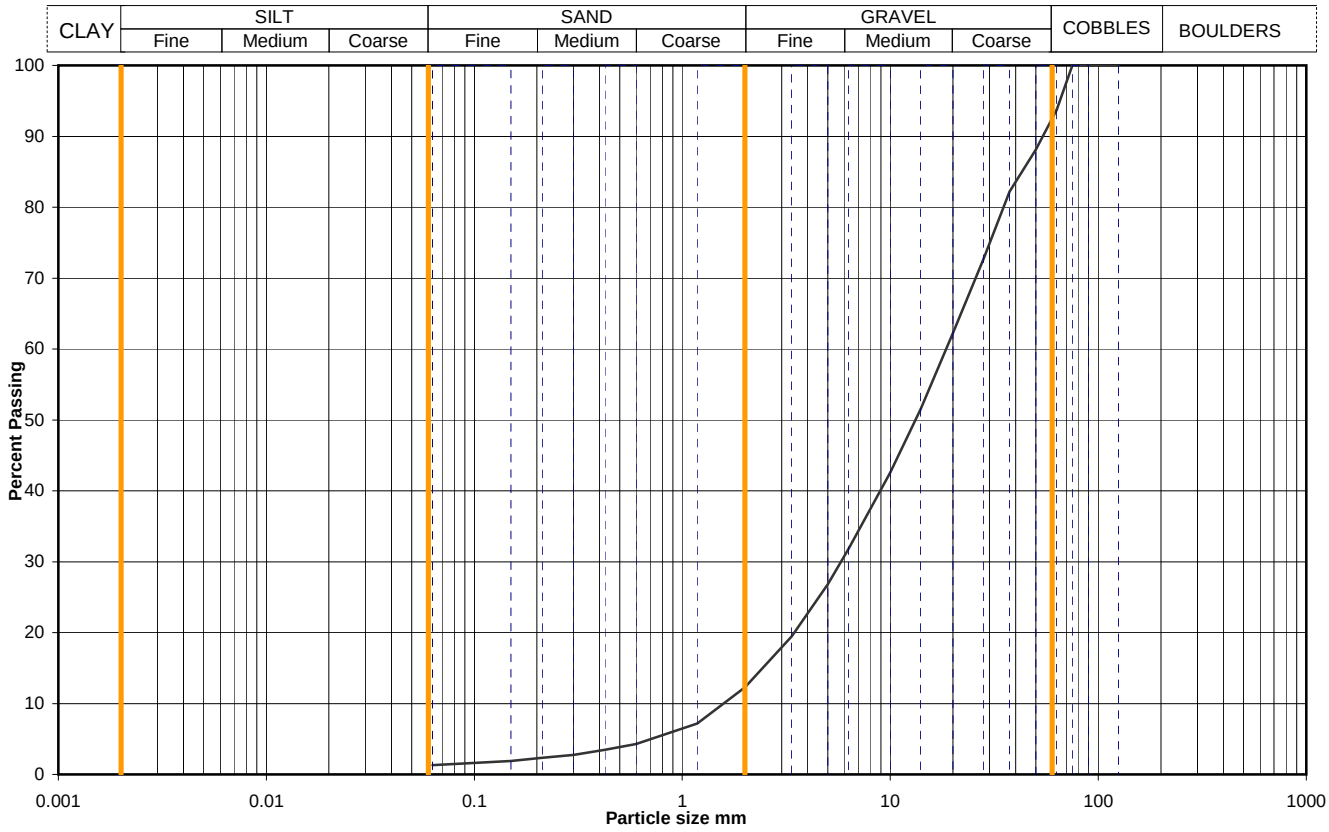
Uniformity Coefficient	D_{60} / D_{10}	16

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 5**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH5		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	2.20		
			Samp No	9	Type	B
			ID	ESGY2012-12B201203290000000047		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	94		
50	88		
37.5	82		
28	73		
20	62		
14	52		
10	43		
6.3	32		
5.0	27		
3.35	19		
2.00	12		
1.18	7		
0.600	4		
0.425	3		
0.300	3	Dry mass of sample, kg	
0.212	2		
0.150	2	14.1	
0.063	1		

Soil description	Greyish brown sandy GRAVEL with 2 cobbles.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	7	0
	Gravel	81	87
	Sand	11	12
	Silt	silt+clay =	
	Clay	1	1

Uniformity Coefficient	D_{60} / D_{10}	12

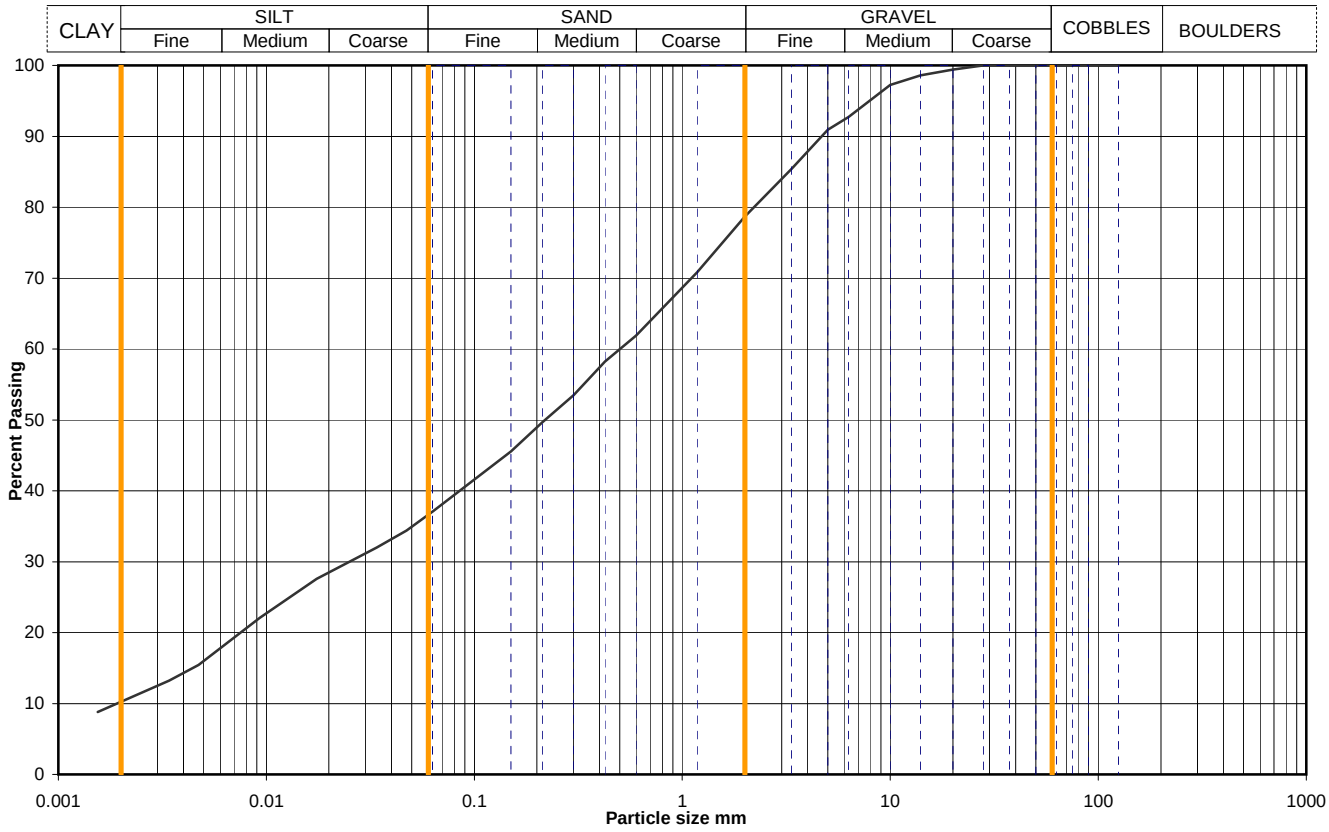
Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57

Figure **PSD 6**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	BH5		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	6.90		
			Samp No	19	Type	B
			ID	ESGY2012-12B201203290000000057		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	37
90	100	0.0472	34
75	100	0.0339	32
63	100	0.0243	30
50	100	0.0174	28
37.5	100	0.0093	22
28	100	0.0047	15
20	99	0.0034	13
14	99	0.0015	9
10	97		
6.3	93		
5.0	91		
3.35	85		
2.00	79		
1.18	71	Particle density, Mg/m3	
0.600	62		
0.425	58	2.65 assumed	
0.300	54	Dry mass of sample, kg	
0.212	50		
0.150	46	11.5	
0.063	37		

Soil description	Brownish grey slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	21	21
	Sand	42	42
	Silt	27	27
	Clay	10	10

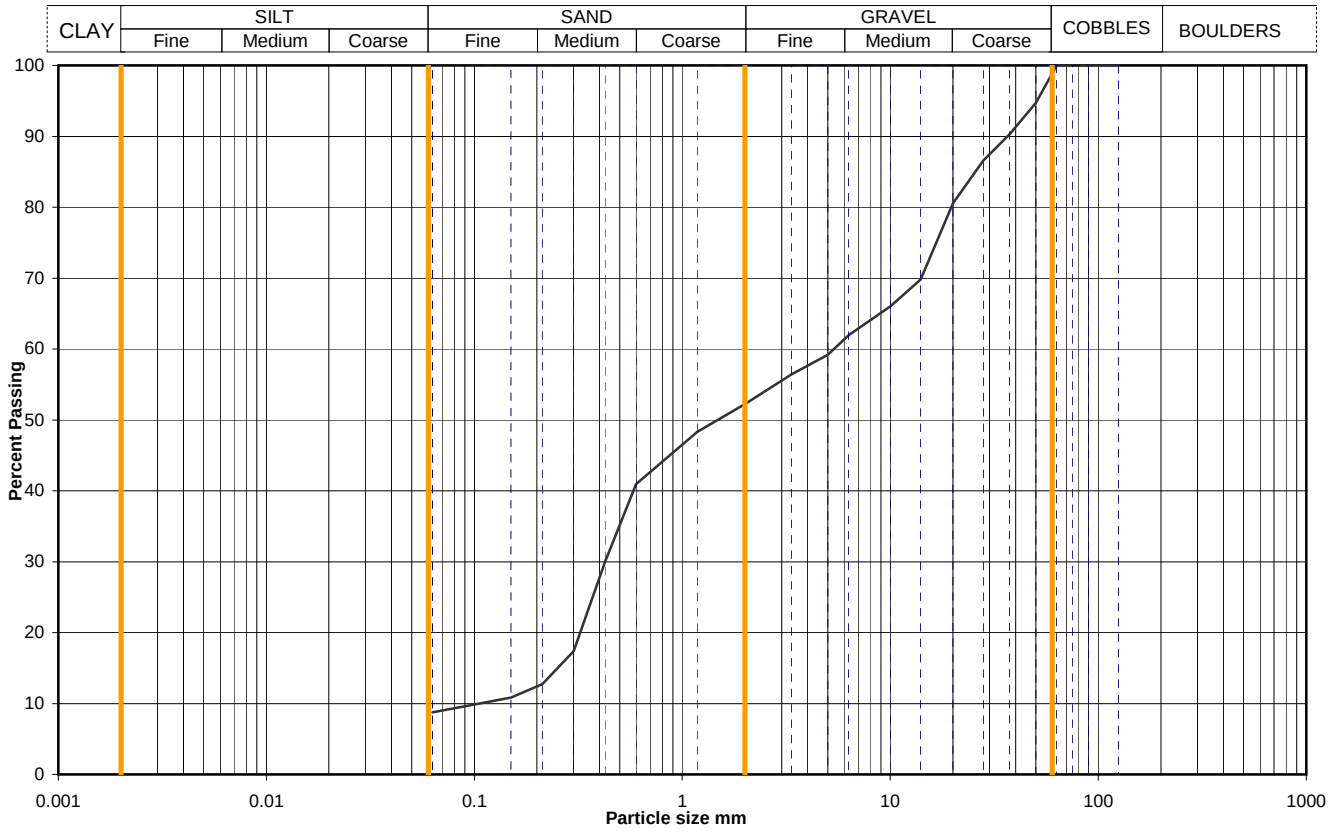
Uniformity Coefficient	D_{60} / D_{10}	263

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref			Figure
SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	Printed:21/05/2012 16:57	**PSD 7**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP1		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	0.50		
			Samp No	1	Type	B
			ID	ESGY2012-12B201203290000000079		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	90		
28	87		
20	81		
14	70		
10	66		
6.3	62		
5.0	59		
3.35	56		
2.00	52		
1.18	48		
0.600	41		
0.425	30		
0.300	17	Dry mass of sample, kg	
0.212	13		
0.150	11	13.4	
0.063	9		

Soil description	Greyish brown very sandy silty GRAVEL with rare rootlets.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	1	0
	Gravel	47	47
	Sand	43	43
	Silt	silt+clay =	
	Clay	9	9

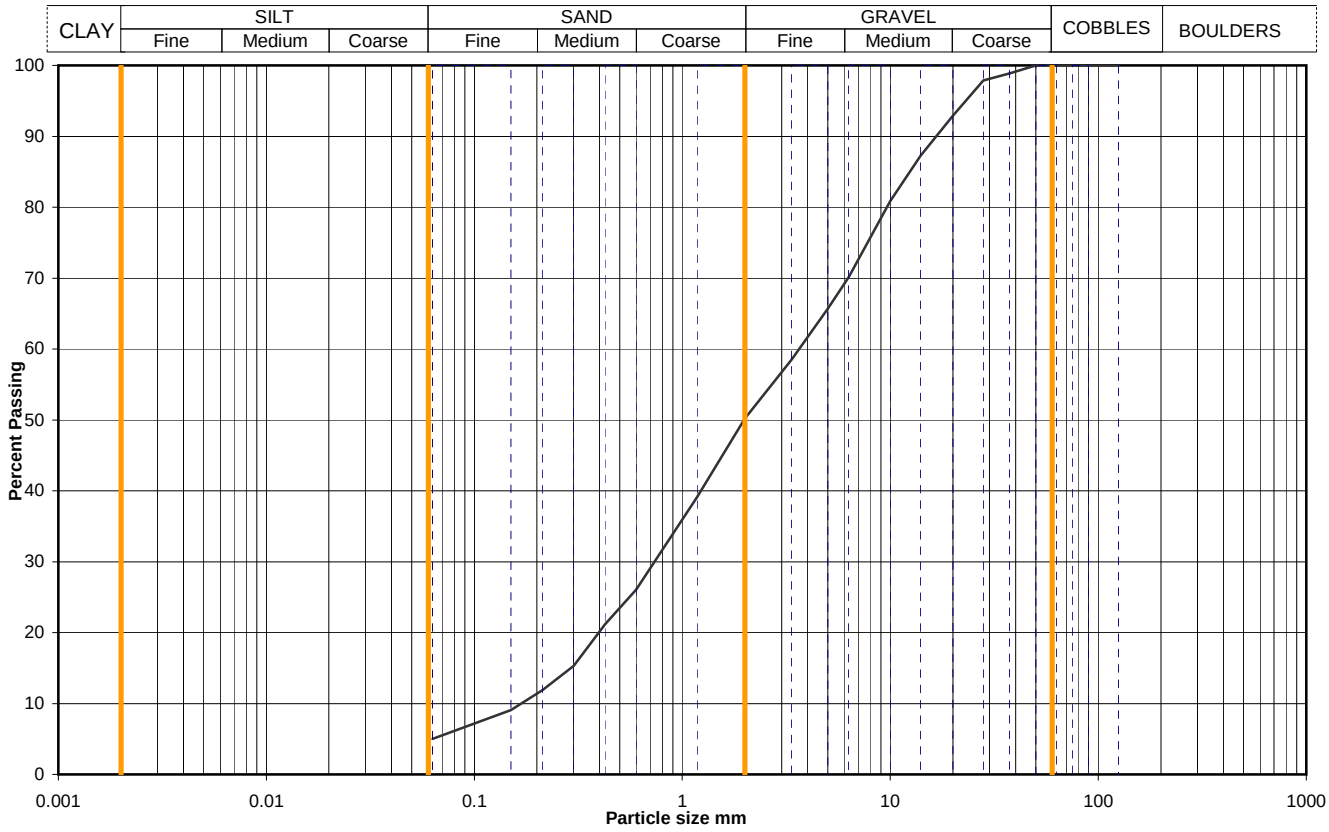
Uniformity Coefficient	D_{60} / D_{10}	51

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 8**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP2		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	1.90		
			Samp No	5	Type	B
			ID	ESGY2012-12B201203290000000089		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	98		
20	93		
14	87		
10	81		
6.3	70		
5.0	66		
3.35	59		
2.00	50		
1.18	39		
0.600	26		
0.425	21		
0.300	15	Dry mass of sample, kg	
0.212	12		
0.150	9	14.8	
0.063	5		

Soil description	Brown very sandy slightly clayey GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	50	50
	Sand	45	45
	Silt	silt+clay =	
	Clay	5	5

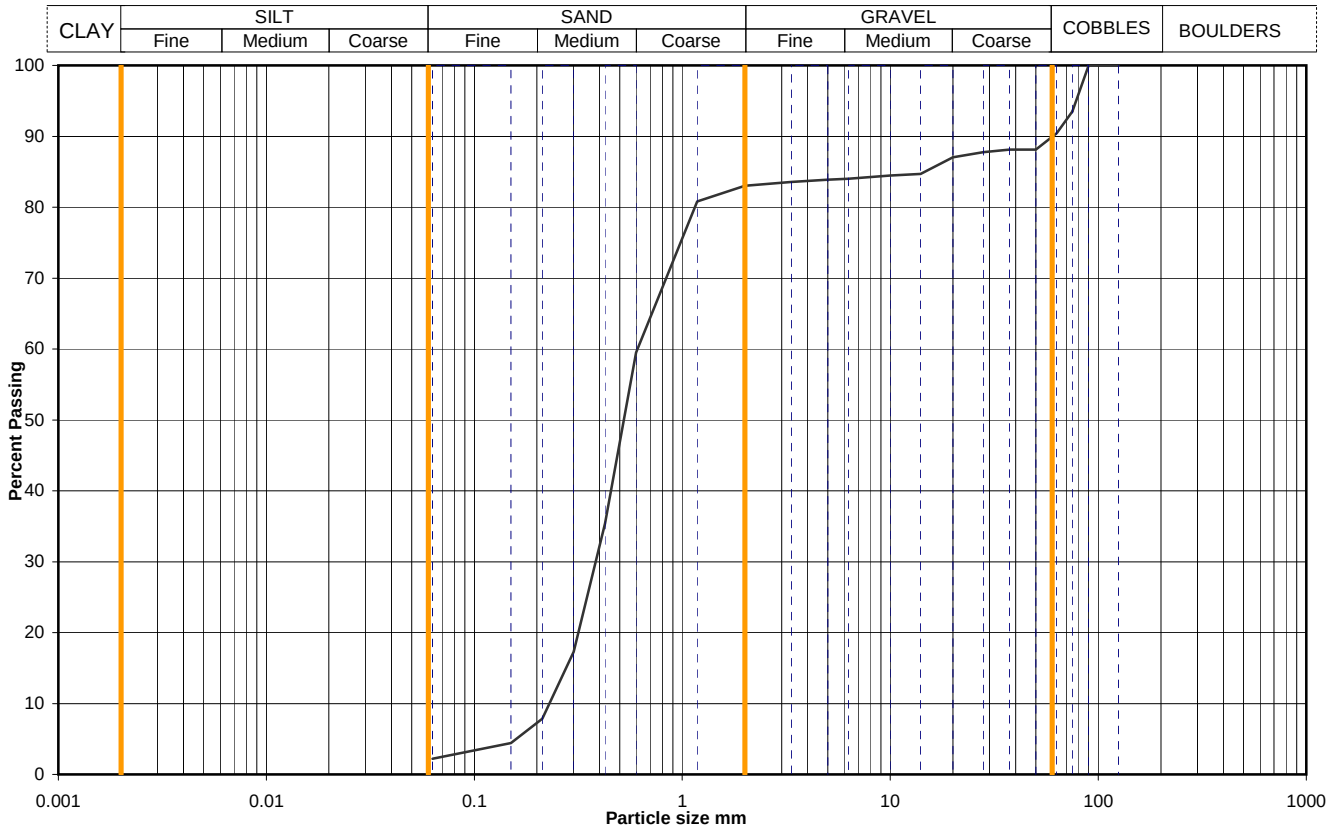
Uniformity Coefficient	D_{60} / D_{10}	22

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 9**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP2		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	2.90		
			Samp No	7	Type	B
			ID	ESGY2012-12B201203290000000091		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	93		
63	90		
50	88		
37.5	88		
28	88		
20	87		
14	85		
10	84		
6.3	84		
5.0	84		
3.35	84		
2.00	83		
1.18	81		
0.600	60		
0.425	35		
0.300	17	Dry mass of sample, kg	
0.212	8		
0.150	4	14.1	
0.063	2		

Soil description	Brown and grey gravelly SAND with 2 cobbles.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	10	0
	Gravel	7	8
	Sand	81	90
	Silt	silt+clay =	
	Clay	2	2

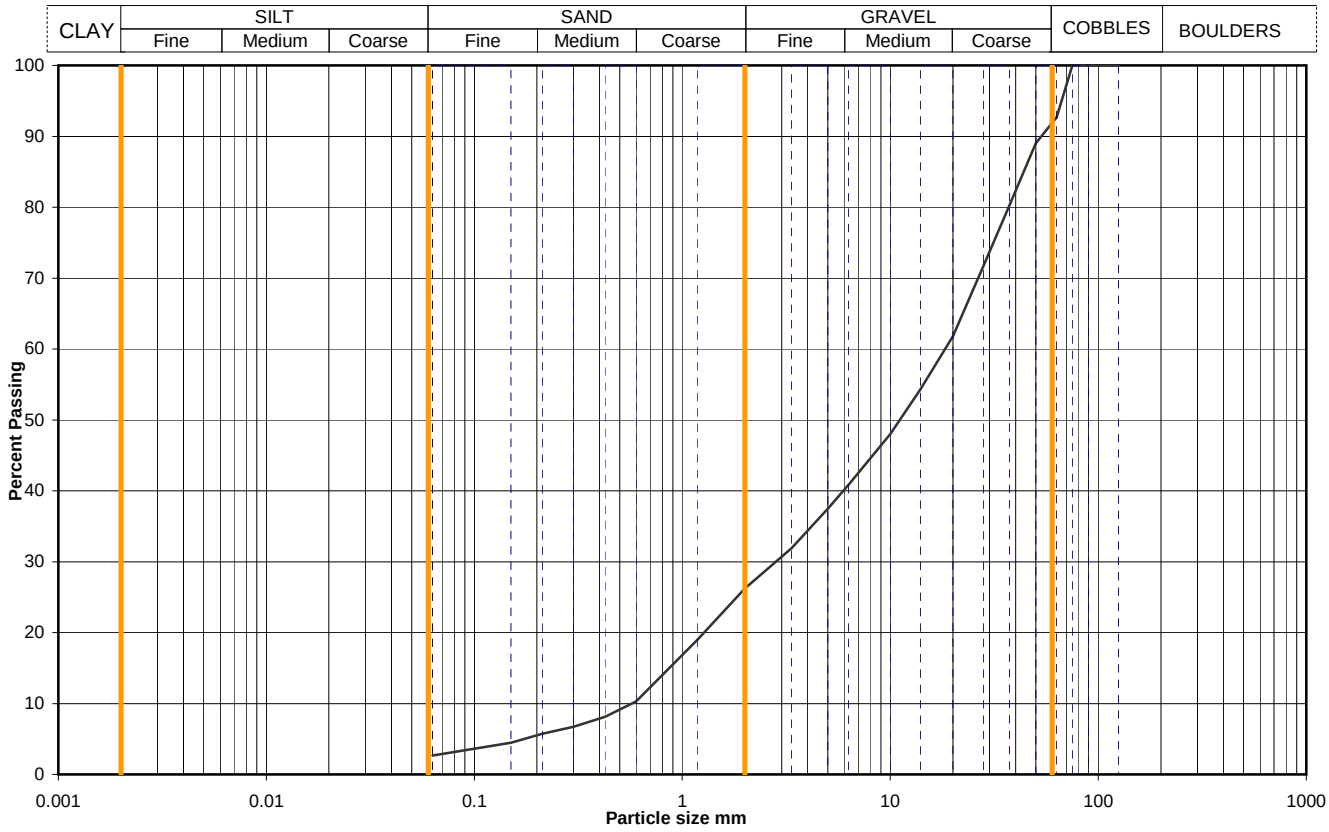
Uniformity Coefficient	D_{60} / D_{10}	3

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 10**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP3		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	2.90		
			Samp No	5	Type	B
			ID	ESGY2012-12B201203290000000097		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	93		
50	89		
37.5	80		
28	72		
20	62		
14	54		
10	48		
6.3	41		
5.0	37		
3.35	32		
2.00	26		
1.18	19		
0.600	10		
0.425	8		
0.300	7	Dry mass of sample, kg	
0.212	6		
0.150	4	15.9	
0.063	3		

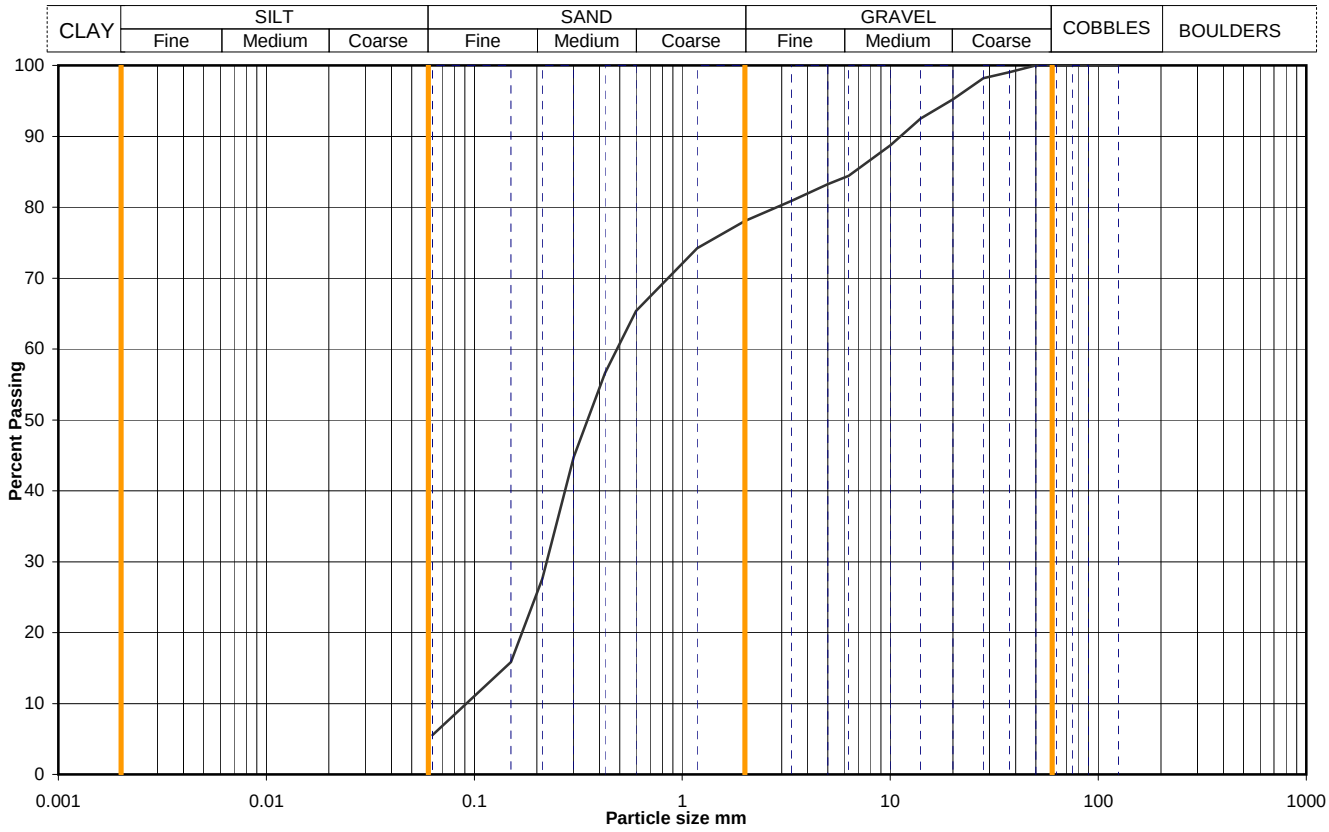
Soil description	Brown slightly clayey very sandy GRAVEL with 2 cobbles.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	8	0
	Gravel	66	72
	Sand	24	26
	Silt	silt+clay =	
	Clay	2	2

Uniformity Coefficient	D_{60} / D_{10}	32

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP4		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	2.90		
			Samp No	5	Type	B
			ID	ESGY2012-12B201203290000000103		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	98		
20	95		
14	93		
10	89		
6.3	84		
5.0	83		
3.35	81		
2.00	78		
1.18	74		
0.600	65		
0.425	57		
0.300	45	Dry mass of sample, kg	
0.212	28		
0.150	16	13.7	
0.063	6		

Soil description	Greyish brown very gravelly SAND.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	0	0
	Gravel	22	22
	Sand	72	72
	Silt	silt+clay =	
	Clay	6	6

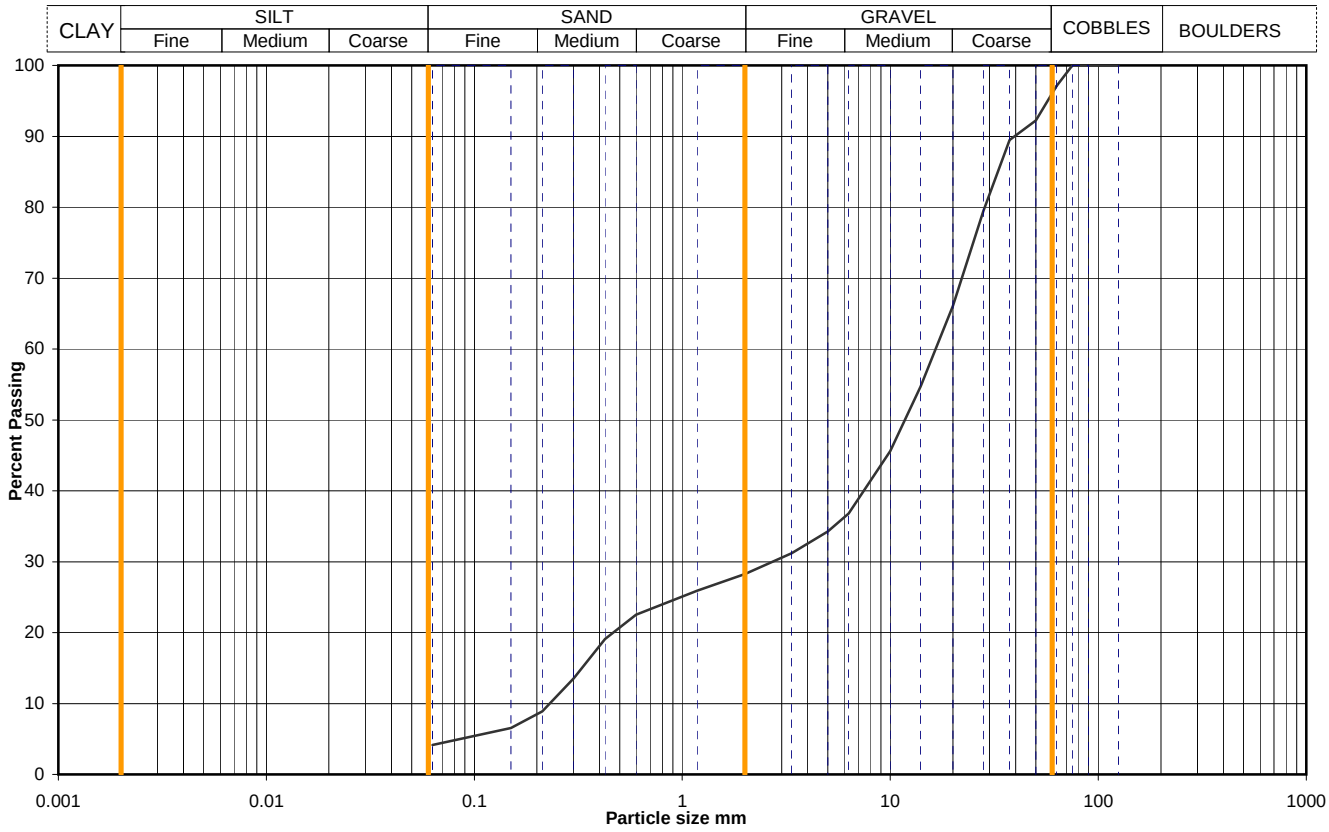
Uniformity Coefficient	D_{60} / D_{10}	5

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 12**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP5		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	0.90		
			Samp No	1	Type	B
			ID	ESGY2012-12B201203290000000105		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	97		
50	92		
37.5	89		
28	79		
20	66		
14	55		
10	46		
6.3	37		
5.0	34		
3.35	31		
2.00	28		
1.18	26		
0.600	23		
0.425	19		
0.300	14	Dry mass of sample, kg	
0.212	9	15.9	
0.150	7		
0.063	4		

Soil description	Brown very sandy slightly silty GRAVEL with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	4	0
	Gravel	68	71
	Sand	24	25
	Silt	silt+clay =	
	Clay	4	4

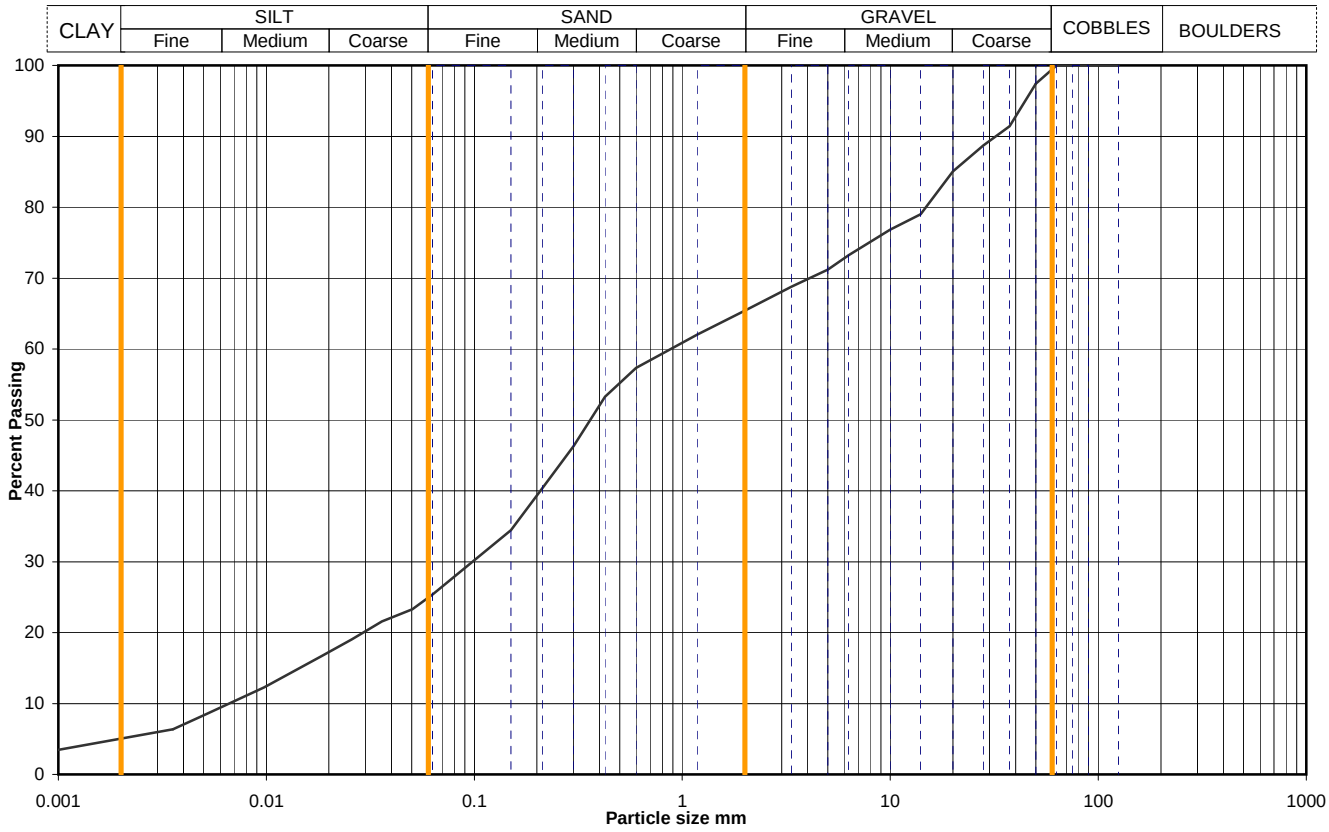
Uniformity Coefficient	D_{60} / D_{10}	72

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 13**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP6		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	0.50		
			Samp No	1	Type	B
			ID	ESGY2012-12B201203290000000111		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	25
90	100	0.0503	23
75	100	0.0359	22
63	100	0.0258	19
50	97	0.0185	17
37.5	91	0.0098	12
28	89	0.0051	8
20	85	0.0036	6
14	79	0.0009	3
10	77		
6.3	73		
5.0	71		
3.35	69		
2.00	65		
1.18	62	Particle density, Mg/m3	
0.600	57		
0.425	53	2.65 assumed	
0.300	46	Dry mass of sample, kg	
0.212	40		
0.150	34	12.3	
0.063	25		

Soil description	Brown slightly gravelly sandy clayey SILT.		
Preparation / Pretreatment	Sieve: natural material Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	1	0
	Gravel	34	34
	Sand	41	41
	Silt	19	19
	Clay	5	5

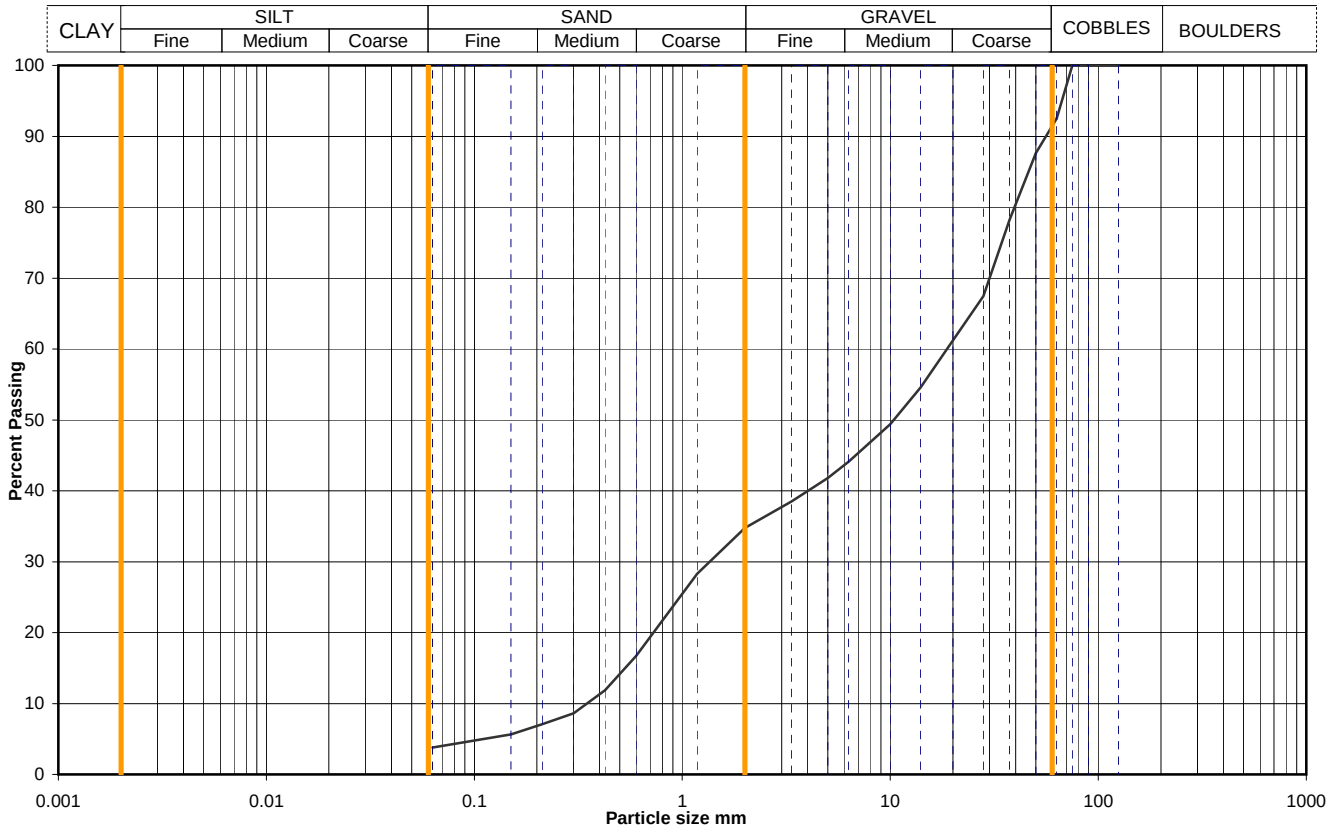
Uniformity Coefficient	D_{60} / D_{10}	133

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.5 hydrometer

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 14**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP7		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	1.50		
			Samp No	3	Type	B
			ID	ESGY2012-12B201203290000000075		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	92		
50	88		
37.5	78		
28	67		
20	61		
14	55		
10	49		
6.3	44		
5.0	42		
3.35	39		
2.00	35		
1.18	28		
0.600	17		
0.425	12		
0.300	9	Dry mass of sample, kg	
0.212	7		
0.150	6	14.3	
0.063	4		

Soil description	Greyish brown very sandy slightly organic GRAVEL with 2 cobbles.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	9	0
	Gravel	56	62
	Sand	31	34
	Silt	silt+clay =	
	Clay	4	4

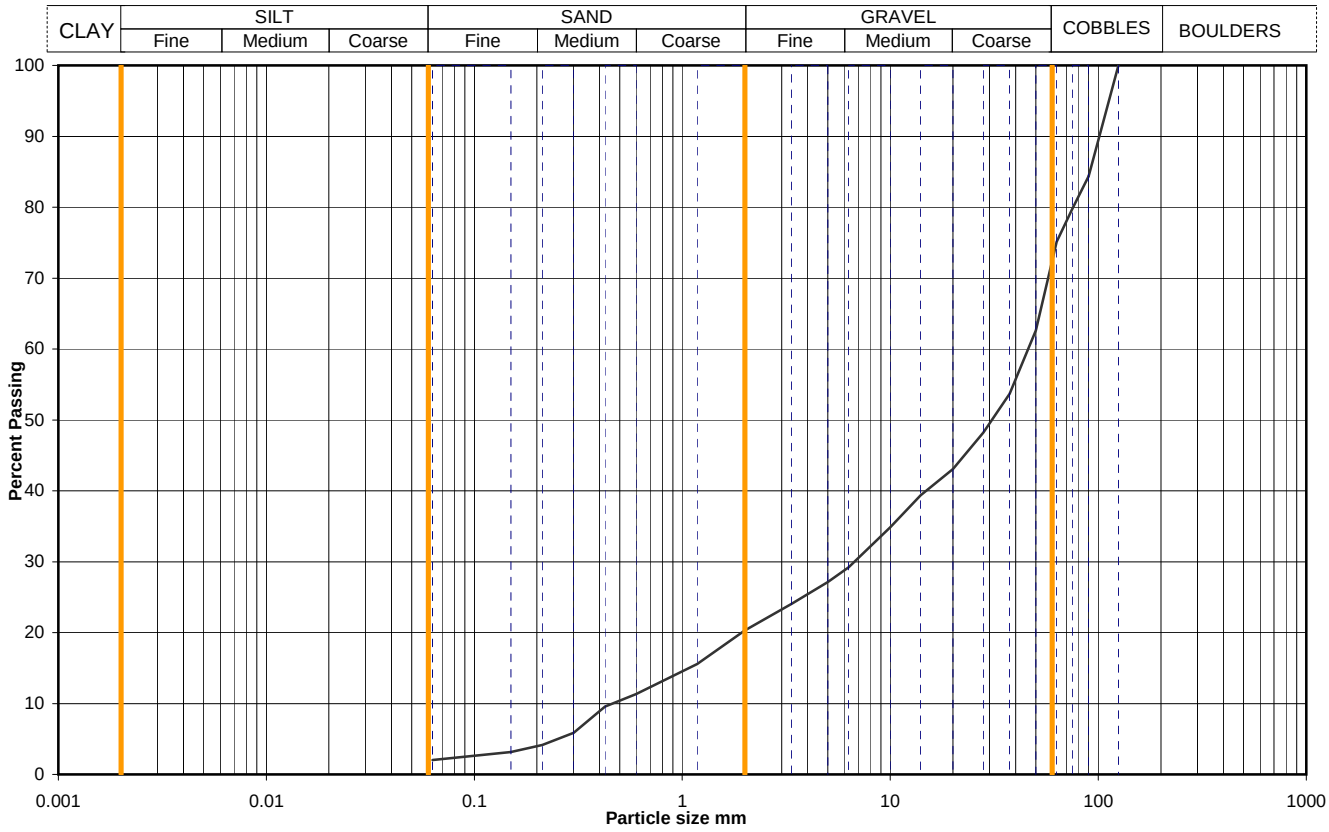
Uniformity Coefficient	D_{60} / D_{10}	54

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 15**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP8		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	1.90		
			Samp No	3	Type	B
			ID	ESGY2012-12B201203290000000126		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	84		
75	80		
63	75		
50	63		
37.5	54		
28	48		
20	43		
14	39		
10	35		
6.3	29		
5.0	27		
3.35	24		
2.00	20		
1.18	16		
0.600	11		
0.425	10		
0.300	6	Dry mass of sample, kg	
0.212	4		
0.150	3	17.0	
0.063	2		

Soil description	Grey very sandy GRAVEL with 3 cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	28	0
	Gravel	52	72
	Sand	18	25
	Silt	silt+clay =	
	Clay	2	3

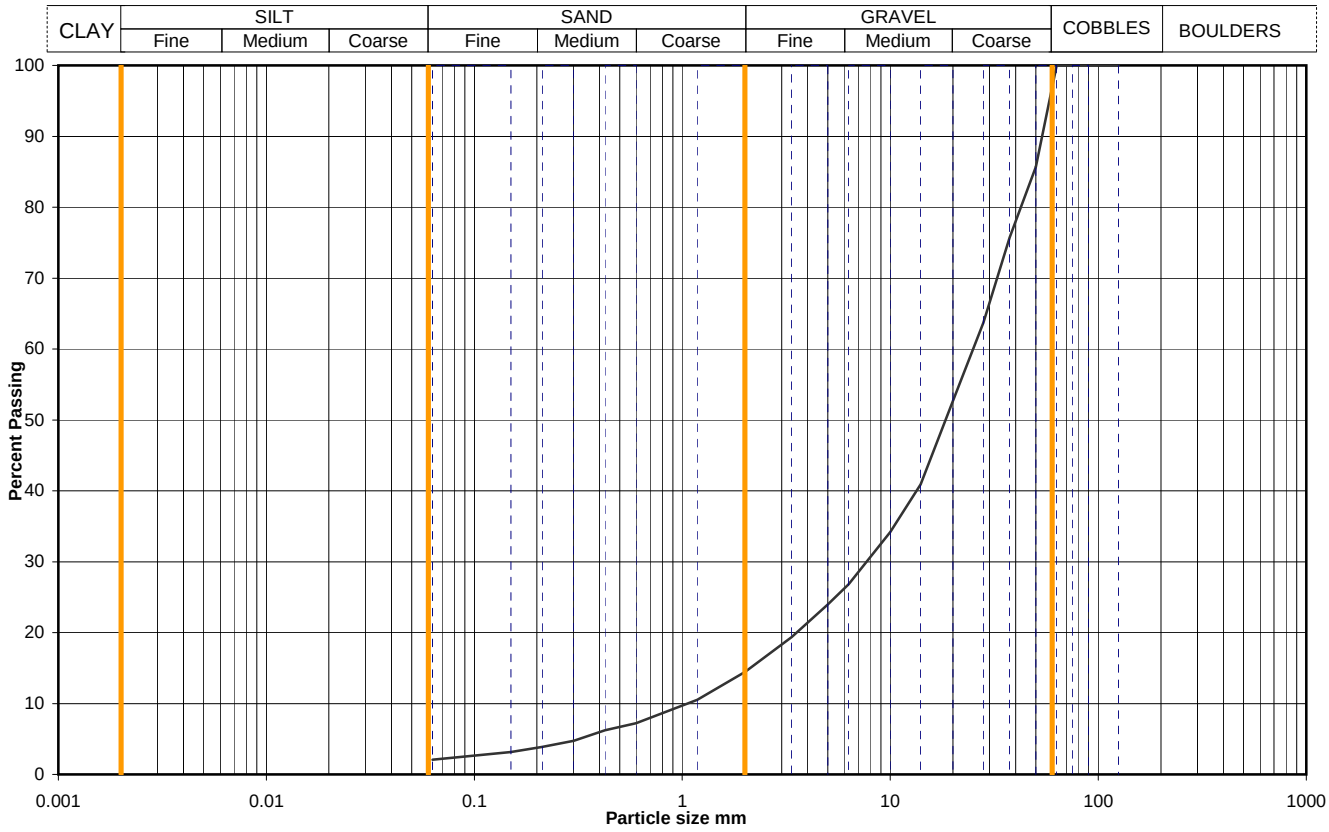
Uniformity Coefficient	D_{60} / D_{10}	100

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:57	**Figure** **PSD 16**

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP9		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	2.70		
			Samp No	5	Type	B
			ID	ESGY2012-12B201203290000000134		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	86		
37.5	76		
28	64		
20	53		
14	41		
10	34		
6.3	27		
5.0	24		
3.35	19		
2.00	14		
1.18	11		
0.600	7		
0.425	6		
0.300	5	Dry mass of sample, kg	
0.212	4		
0.150	3	15.5	
0.063	2		

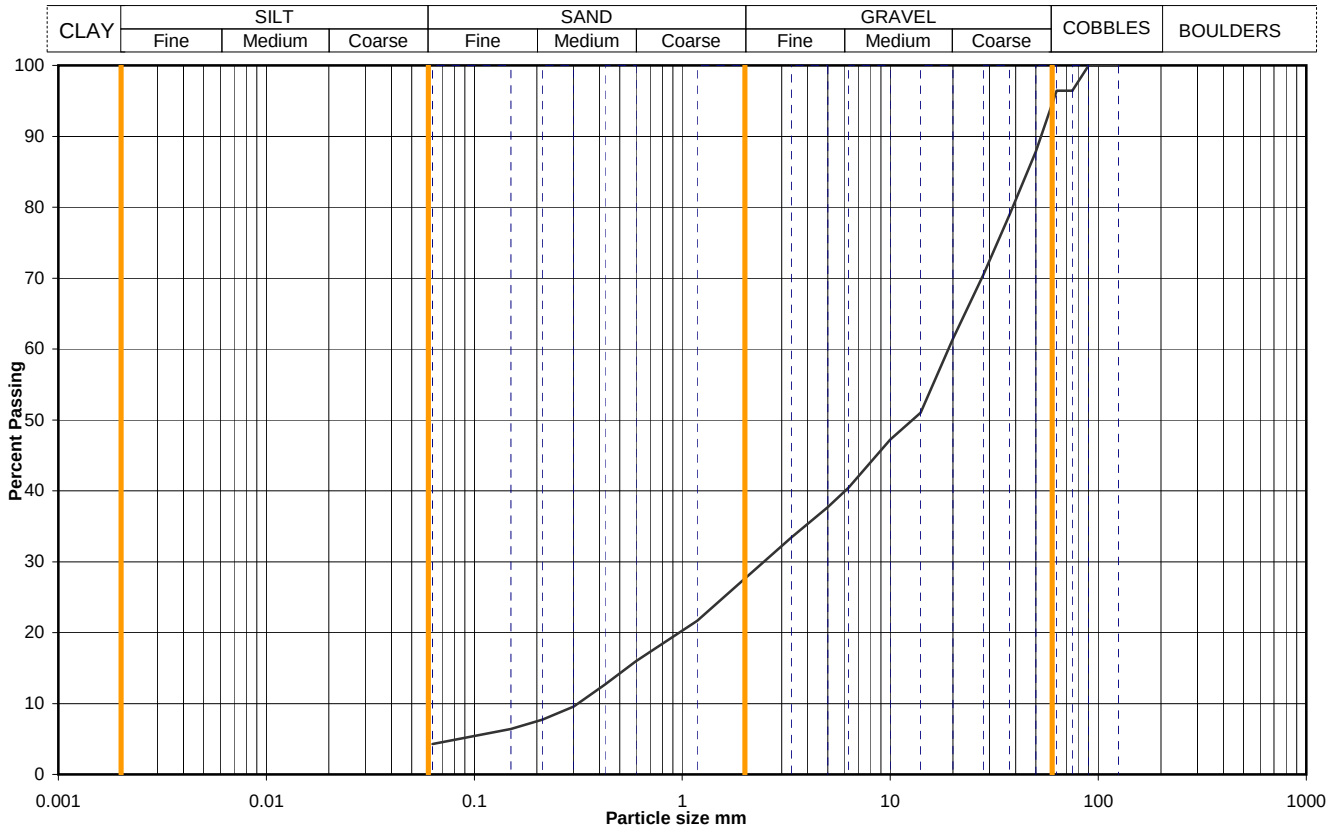
Soil description	Greyish brown sandy GRAVEL.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	3	0
	Gravel	83	86
	Sand	12	12
	Silt	silt+clay =	
	Clay	2	2

Uniformity Coefficient	D_{60} / D_{10}	24

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

Particle Size Distribution Analysis

Project No	Y2012-12B	Sample Details:	Hole No	TP10		
Project Name	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET		Depth (m BGL)	2.90		
			Samp No	6	Type	B
			ID	ESGY2012-12B201203290000000122		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	96		
63	96		
50	88		
37.5	79		
28	70		
20	61		
14	51		
10	47		
6.3	40		
5.0	38		
3.35	33		
2.00	28		
1.18	22		
0.600	16		
0.425	13		
0.300	10	Dry mass of sample, kg	
0.212	8		
0.150	6	14.7	
0.063	4		

Soil description	Brown very sandy GRAVEL with 1 cobble.		
Preparation / Pretreatment	Sieve: natural material		
Remarks			
Sample Proportions *<60mm values to aid description only		Whole	*<60mm
	Cobbles / boulders	5	0
	Gravel	67	71
	Sand	23	24
	Silt	silt+clay =	
	Clay	5	5

Uniformity Coefficient	D_{60} / D_{10}	61

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	none

QA Ref SLR 2,9 Rev 88 Aug 11	ESG Environmental Scientifics Group	UKAS TESTING 1157	Printed:21/05/2012 16:58	**Figure** **PSD 18**

ENCLOSURE E

GEOENVIRONMENTAL LABORATORY TEST RESULTS

ESG Scientifics Report

Scientifics Report No
EFS/123380

TEST REPORT
SOIL SAMPLE ANALYSIS

1252

Report No. EFS/123380 (Ver. 1)

ESG Geoenvironmental Consulting
Carowswood
Castlemartyr
Co Cork
Ireland

Site: Laois Reinforcement Eirgrid

The 2 samples described in this report were registered for analysis by ESG on 11-Apr-2012. This report supersedes any versions previously issued by the laboratory.
The analysis was completed by: 24-Apr-2012

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited
Any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by ESG.

The following tables are contained in this report:

On behalf of
ESG :
Andrew Timms Operations Manager

Date of Issue: 24-Apr-2012

Tests marked '^' have been subcontracted to another laboratory.

ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

Units :		%	mg/kg	mg/kg	mg/kg	% M/M	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	mg/kg			
Method Codes :		TMSS	TPHFIDUS	TPHFIDUS	PCBUSECDAR	WSLM59	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	PAHMSUS			
Method Reporting Limits :		0.2	10	10		0.01	10	10	10	20	20	10	10				
UKAS Accredited :		Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
LAB ID Number CL/	**Client Sample Description**	**Tot.Moisture @ 105C**	**MRO by GCFID (AR)**	**TPH by GCFID (AR)**	**PCB-7 Congeners Analysis**	**Total Organic Carbon**	**Benzene**	**Toluene**	**Ethyl Benzene**	**MTBE**	**Xylenes**	**m/p Xylenes**	**o Xylene**	**PAH (16) by GCMS**			
1																	
1260666	Y2012-12B Ballyragget TP1	10.9	<10	10	Req	0.68	<10	<10	<10	<20	<20	<10	<10	Req			

Environmental Scientifics Group

il Sample Analysis

Contact Mr A Jaworski

Date Printed	
Report Number	**EFS/123380**
Table Number	**1**

Where individual results are flagged see report notes for status.

Polycyclic Aromatic Hydrocarbons
GC/MS (SIM)

Customer and Site Details:	ESG Geoenvironmental Consulting: Laois Kilkenney Reinf. Project		
Sample Details:	Y2012-12B Ballyragget TP1 **Job Number:**		S12_3380
LIMS ID Number:	CL1260666	**Date Booked in:**	11-Apr-12
QC Batch Number:	120363	**Date Extracted:**	19-Apr-12
Quantitation File:	Initial Calibration	**Date Analysed:**	20-Apr-12
Directory:	1912MS5.PAH\	**Matrix:**	Soil
Dilution:	1.0	**Ext Method:**	Ultrasonic

UKAS accredited?: Yes

Target Compounds	CAS #	R.T. (min)	Concentration mg/kg	% Fit
Naphthalene	91-20-3	-	< 0.08	-
Acenaphthylene	208-96-8	-	< 0.08	-
Acenaphthene	83-32-9	-	< 0.08	-
Fluorene	86-73-7	-	< 0.08	-
Phenanthrene	85-01-8	-	< 0.08	-
Anthracene	120-12-7	-	< 0.08	-
Fluoranthene	206-44-0	-	< 0.08	-
Pyrene	129-00-0	-	< 0.08	-
Benzo[a]anthracene	56-55-3	-	< 0.08	-
Chrysene	218-01-9	-	< 0.08	-
Benzo[b]fluoranthene	205-99-2	-	< 0.08	-
Benzo[k]fluoranthene	207-08-9	-	< 0.08	-
Benzo[a]pyrene	50-32-8	-	< 0.08	-
Indeno[1,2,3-cd]pyrene	193-39-5	-	< 0.08	-
Dibenzo[a,h]anthracene	53-70-3	-	< 0.08	-
Benzo[g,h,i]perylene	191-24-2	-	< 0.08	-
Total (USEPA16) PAHs	-	-	< 1.28	-

"M" denotes that % fit has been manually interpreted

Internal Standards	% Area
1,4-Dichlorobenzene-d4	NA
Naphthalene-d8	99
Acenaphthene-d10	105
Phenanthrene-d10	106
Chrysene-d12	114
Perylene-d12	119

Surrogates	% Rec
Nitrobenzene-d5	NA
2-Fluorobiphenyl	97
Terphenyl-d14	102

Concentrations are reported on a wet weight basis.

The Total PAH result is the sum of non-rounded individual PAH results and therefore may differ to the sum of the rounded individual PAH results printed above. By convention, where any one or more result is a "less than", the total is expressed as a "less than" and includes the "less than" concentration within the total.

Polychlorinated Biphenyls (congeners)

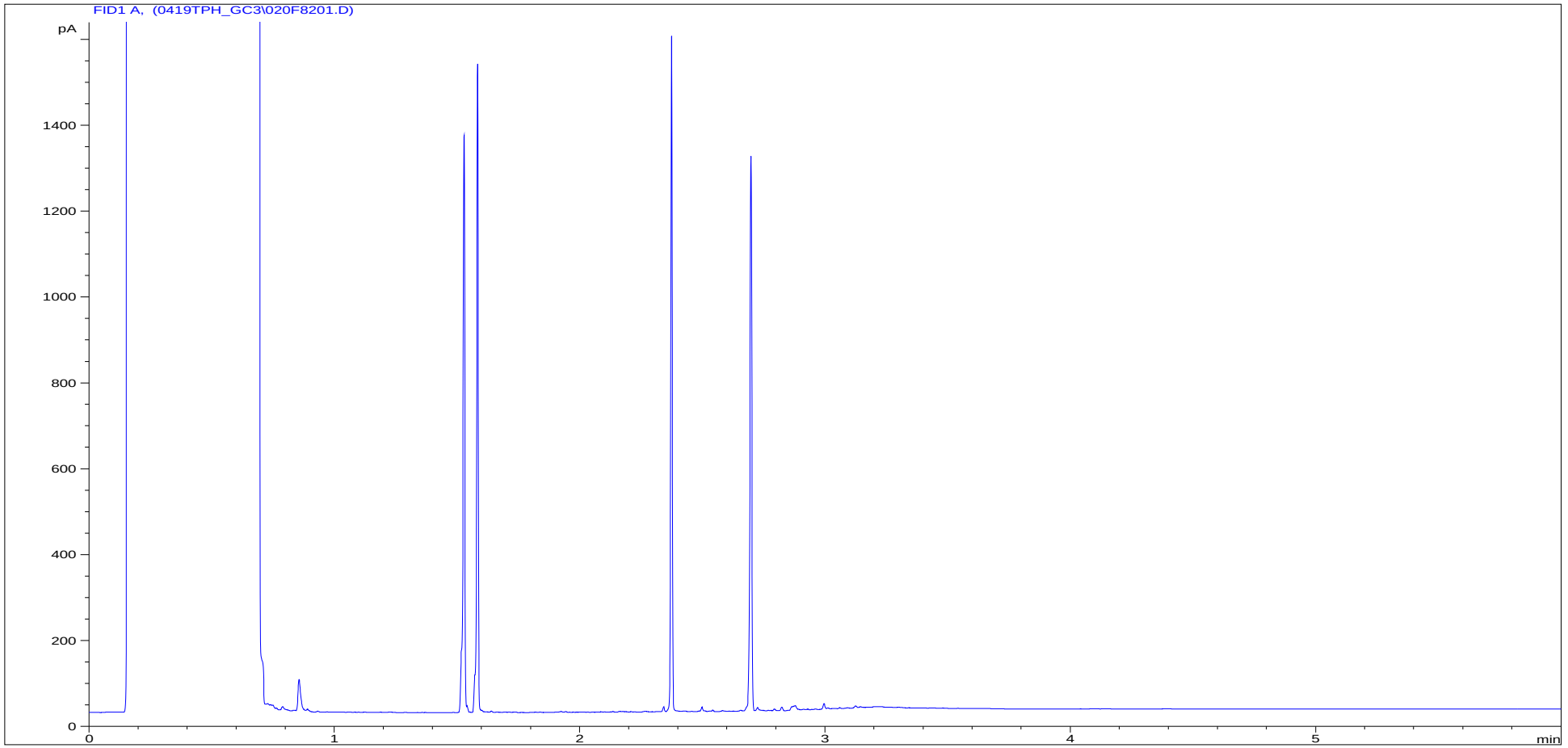
Customer and Site Details:	ESG Geoenvironmental Consulting: Laois Kilkenny Reinfo. Project	**Matrix:**	SOIL
Job Number:	S12_3380	**Date Booked in:**	11-Apr-12
QC Batch Number:	120106	**Date Extracted:**	19-Apr-12
Directory:	0419BPCB.GC8	**Date Analysed:**	20-Apr-12
Method:	Ultrasonic		

*** This sample data is not UKAS accredited.**

			Concentration, (µg/kg)						
	Sample ID	**Customer ID**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB153**	**PCB138**	**PCB180**
*	C								
*	CL1260666	Y2012-12B Ballyragget TP1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Where individual results are flagged see report notes for status.

Petroleum Hydrocarbons (C8 to C40) by GC/FID



Sample ID:	CL1260666	**Job Number:**	S12_3380
Multiplier:	8	**Client:**	ESG Geoenvironmental Consulting
Dilution:	1	**Site:**	Laois Kilkenny Reinforcement Project
cquisition Method:	5UL_RUNF.M	**Client Sample Ref:**	Y2012-12B Ballyragget TP1
Acquisition Date/Time:	20-Apr-12		
Datafile:	D:\TES\DATA\Y2012\04\0419TPH_GC3\020F8201.D		

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/2

					Leaching Data	
Client	ESG Geoenvironmental Consulting				Weight of sample (kg)	0.090
Contact	Mr A Jaworski				Moisture content @ 105℃ (%)	10.9
					Equivalent Weight based on drying at 105℃ (kg)	0.101
Site	Laois Kilkenny Reinforcement Project				Volume of water required to carry out 10:1 stage (litres)	0.889
Sample Description		**Report No**	**Sample No**	**Issue Date**		
Y2012-12B Ballyragget TP1		s12_3380	CL/1260666	24-Apr-12		

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.68	3	5	6
	LOI450	Loss on Ignition (%)				10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.05	6		
N	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.035	1		
U	TPHFIDUS	Mineral Oil (mg/kg)	11	500		
	PAHMSUS	PAH Sum of 17 (mg/kg)		100		
	PHSOIL	pH (pH units)			>6	
	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7			To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	10:1 Single Stage Leachate	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/2 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº	mg/kg (dry weight)			
U	WSLM3	pH (pH units) ºº	9.5	Calculated data not UKAS Accredited			
U	WSLM2	Conductivity (µs/cm) ºº	176				
U	ICPMSW	Arsenic	0.003	0.03	0.5	2	25
N	ICPWATVAR	Barium	0.37	3.7	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.011	0.11	0.5	10	70
U	ICPMSW	Copper	0.017	0.17	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.005	0.05	0.5	10	30
U	ICPMSW	Nickel	<0.001	<0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.009	0.09	0.06	0.7	5
U	ICPMSW	Selenium	0.003	0.03	0.1	0.5	7
U	ICPMSW	Zinc	0.052	0.52	4	50	200
U	KONENS	Chloride	12	120	800	15000	25000
U	ISEF	Fluoride	0.6	6	10	150	500
U	ICPWATVAR	Sulphate as SO4	19	190	1000	20000	50000
	WSLM27	Total Dissolved Solids			4000	60000	100000
	SFAPI	Phenol Index			1		
N	WSLM13	Dissolved Organic Carbon	12	120	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Where individual results are flagged see report notes for status.

SOIL Analysis

ESG Environmental Chemistry
Analytical and Deviating Sample Overview

S123380

Customer ESG Geoenvironmental Consulting
Site Laois Kilkenny Reinforcement Project
Report No S123380

Consignment No S28307
Date Logged 11-Apr-2012
Report Due 23-Apr-2012

ID Number	Description	MethodID	BTEXHSA		CEN Leac(P)C	CustServ	PAHMSUS	PCBUSECDAR	TMSS	TPHFIDUS		WSLM59
		Sampled	BTEX-HSA + MTBE analysis	MTBE (µg/kg)	CEN Leac(P)C	Report B	PAH (16) by GCMS	PCB-7 Congeners Analysis	Tot.Moisture @ 105C	MRO by GCFID (AR)	TPH by GCFID (AR)	Total Organic Carbon
	Accredited to ISO17025		✓	✓			✓		✓	✓	✓	
CL/1260666	Y2012-12B Ballyragget TP1	D										

Note: For analysis where the Report Due date is greater than 7 days (PAH, Pesticides, PCB, Phenols, Herbicides) or 2 days (BOD) after the sampling date, although we will do our utmost to prioritise your samples, they may become deviant whilst being processed in the Laboratory.

In this instance, please contact the Laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key

A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time

Requested Analysis Key

	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted

Where individual results are flagged see report notes for status.

The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBUSECDAR	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	TMSS	As Received	Determination of the Total Moisture content at 105ºC by loss on oven drying gravimetric analysis
Soil	TPHFIDUS	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection.
Soil	WSLM59	Air Dried	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	ISEF	As Received	Determination of Fluoride in water samples by Ion Selective Electrode (ISE)
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	WSLM13	As Received	Instrumental analysis using acid/persulphate digestion and dispersive IR detection
Water	WSLM2	As Received	Determination of the Electrical Conductivity (µS/cm) by electrical conductivity probe.
Water	WSLM27	As Received	Gravimetric Determination
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on an air dried basis
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile
CR Denotes Crocidolite
AM Denotes Amosite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols. This may have resulted in deterioration of the sample(s) during transit to the laboratory. Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined
N.Det Not detected
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

END OF REPORT

Where individual results are flagged see report notes for status.

ENCLOSURE F

PHOTOGRAPHS

Trial Pits	TP1 to 10

Trial Pit Photographs - TP1

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP1** Sheet 1 of 1

Trial Pit Photographs - TP2

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP2** Sheet 1 of 1

Trial Pit Photographs - TP3

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP3** Sheet 1 of 1

Trial Pit Photographs - TP4

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Project No Y2012-12B Carried out for EirGrid	**Trial pit** **TP4** Sheet 1 of 1

Trial Pit Photographs - TP5

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP5** Sheet 1 of 1

Trial Pit Photographs - TP6

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP6** Sheet 1 of 1

Trial Pit Photographs - TP7

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP7** Sheet 1 of 1

Trial Pit Photographs - TP8

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP8** Sheet 1 of 1

Trial Pit Photographs - TP9

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP9** Sheet 1 of 1

Trial Pit Photographs - TP10

Soil Mechanics

Trial Pit Side/Base

Trial Pit Spoil

Notes Scale 1 : 50 000	Project Project No Carried out for	LAOIS KILKENNY REINFORCEMENT PROJECT - BALLYRAGGET Y2012-12B EirGrid	**Trial pit** **TP10** Sheet 1 of 1

ENCLOSURE G

SOIL CHARACTERISATION AND SITE SUITABILITY ASSESSMENT REPORT

Traynor Environmental Ltd – Report No 12.050 TE

SOIL CHARACTERISATION AND
SITE SUITABILITY ASSESSMENT REPORT
TE REF: 12.050 TE

EIRGRID
LAOIS-KILKENNY REINFORCEMENT PROJECT
BALLYRAGGET 110KV STATION
BALLYRAGGET
CO KILKENNY

IN ACCORDANCE WITH
EPA CODE OF PRACTICE
WASTEWATER TREATMENT AND DISPOSAL SYSTEMS SERVING SINGLE HOUSES 2009

Traynor Environmental Ltd
Belturbet Business Park, Creeny, Belturbet
Co. Cavan
Tel: +353 49 9522236
Fax: +353 49 9522808
Web: www.traynorenvironmental.com

SITE CHARACTERISATION FORM FOR AN ON-SITE WASTEWATER TREATMENT SYSTEM

CONTENTS

1.0 GENERAL DETAILS (From planning application)

Company	*EirGrid*

Address	**Site Location and Townland**
EirGrid *c/o Geotech Specialists Ltd part of* *Environmental Scientifics Group* *Carewswood,* *Castlemartyr,* *County Cork,* *Ireland*	*EirGrid* *Laois-Kilkenny Reinforcement Project* *Ballyragget 110KV Station* *Ballyragget* *Co Kilkenny*

Telephone Number	*N/A*	**Fax Number**	*N/A*
Email	*N/A*		

Maximum No. of Employees	*6*	**No. of Double Bedrooms**	*N/A*	**No. of Single Bedrooms**	*N/A*

Proposed Water Supply	Mains	✓	Private Well/Borehole		Group Well/Borehole	

2.0 DESK STUDY

Soil Type	***Soil Association 34.*** *Minimal Grey Brown Podzolics - 70%* *Gleys - 20% Brown Earth - 10%*

Aquifer Category:	Regionally Important	*Rkd*	Locally Important		Poor			
Vulnerability	Extr		Hg	✓	Moderate		Low		High to Low		Unknown	

Bedrock Type	*DPBL – Dinantian Pure Bedded Limestones*

Name of Public/Group Scheme Water Supply within 1km	*Group Water Scheme*			
Groundwater Protection Scheme (Y/N)	*No*	**Source Protection Area**	SI N/A	SO N/A
Groundwater Protection Response:	*R2*[1]			
Presence of Significant sites (Archaeological, natural and historical):	*None identified or evident on the site.*			
Past experience in the area:	*Variable percolation characteristics in the locality*			

Comments *(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).*

R2[1]*: Acceptable subject to normal good practice (i.e. System selection, construction, operation and maintenance in accordance with EPA (2009). Site may be suitable for discharge to ground, if the minimum depths are met on the site and if there exists suitable percolation. As the soil type in the area is Minimal Grey Brown Podzolics (70% of the land area), and as the area is mapped as High Vulnerability, surface water may be at risk around the site. Groundwater as a resource will be at risk if the minimum depths required are not achieved on the site, or if the percolation rate is too rapid. Older wells in the area may also be at risk, if the minimum separation distances are not adhered to. Groundwater and wells are therefore the main targets, following the desk study. Given the response and the aquifer type, the site is potentially suitable for a conventional septic tank system if the minimum depths required are met on the site, if the minimum separation distances can be met, and if the percolation rate is adequate. A regionally important bedrock aquifer will generally have a high permeability, rapid flow velocities and will provide little attenuation.*

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment

Landscape Position	*Relatively Flat*					
Slope	*Steep <1:5*		*Shallow 1.5 to 1.20*		*Relatively Flat*	✓

Surface features within a minimum of 250 metres (Distances to features should be noted in metres)

Houses	*The nearest house is located approximately >70m Southeast of the proposed percolation area (ppa). Graveyard located North of the ppa.*
Existing Land Uses	*Agricultural Grazing*
Vegetation Indicators	*Grass is the pre-dominant vegetation on the site. The absence of rushes could indicate adequate percolation characteristics in the area.*
Groundwater Flow Directions	*Western Direction.*
Ground Condition	*Dry and firm underfoot in the ppa which could indicate good percolation characteristics of the subsoil.*
Site Boundaries	*Hedge, trees and road located on the Eastern boundary. Hedge and trees located on the Southern boundary. Post and wire fence and wall located on the Northern boundary. Hedge and trees located on the Western boundary.*
Roads	*Road (R 432) is located approximately >100m East of the ppa.*
Outcrops (Bedrock and/or subsoil)	*None identified or evident in the vicinity.*
Surface water ponding	*No evidence of surface water ponding when examined on 21.03.12. It must be noted that weather conditions prior to the site assessment taking place was dry with sunny spells.*
Drainage Ditches	*None identified or evident in the vicinity*

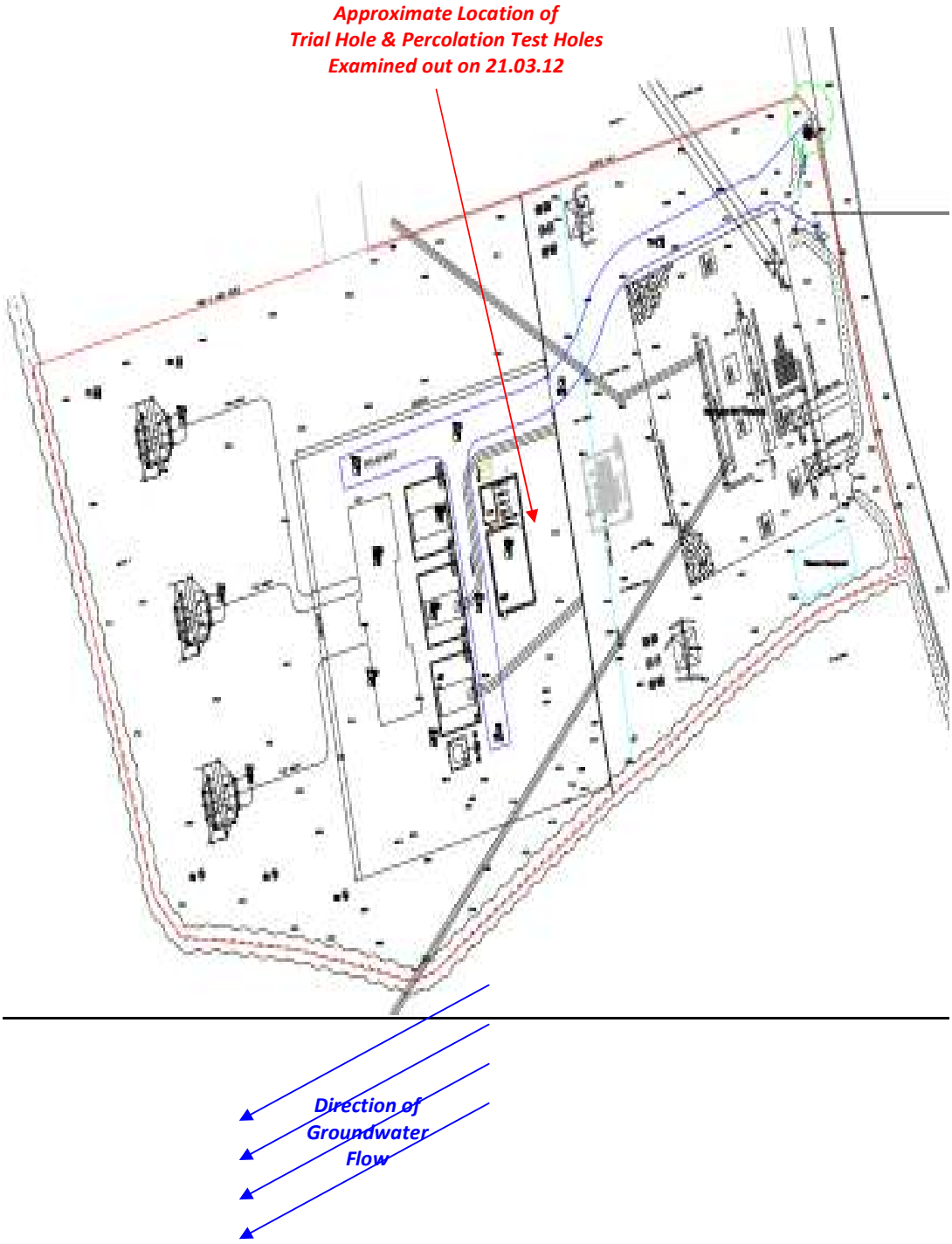
Beaches/Shellfish	*None identified or evident in the vicinity.*	**Areas/Wetlands**	*None identified or evident in the vicinity.*
Karst Features	*None identified or evident in the vicinity.*	**Watercourse/streams**	*Nearest watercourse is located approximately >100m West of the ppa*
Lakes	*None identified or evident in the vicinity*	**Springs/Wells**	*None identified or evident in the vicinity.*

Comments *(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed treatment system on the site.*

**Percolation area is ideally located within the confines of the site. The proposed percolation area should be a minimum of 10m from a dwelling, 10m from a watercourse, 30m down gradient of a well/spring, 20m from any other percolation area, 3m from a boundary and 4m from a roadway*

Sketch of site showing measurement to Trial Hole location and Percolation test Hole locations, wells and direction of ground water flow, proposed house (incl. distances from boundaries) adjacent houses, watercourses, significant sites and other features. North point should always be included.

SITE LAYOUT DRAWING SHOWING TEST HOLE LOCATIONS



3.2 Trial Hole

Depth of Trial Hole	*3.0m*

Depth from Ground Surface to bedrock (m) if Present	*None encountered*	**Depth from Ground Surface to Water Table (m) if Present**	*None encountered*
Depth of water ingress	*None encountered*	**Rock Type if Present**	*None encountered*

Date and Time of Excavation	*18.03.12*	*11.00*	**Date and Time of Examination**	*21.03.12*	*09.20*

	Depth of P & T Test	Soil/Subsoil Texture Classification	Plasticity and Dilatancy	Soil Structure	Density Compactness	Colour	Preferential Flowpaths
0.1m							
0.2m		*Silt/CLAY*	*Ribbons 20,20,30mm 1,3,1 Threads*	*Blocky*	*Low*	*Brown*	*None*
0.3m							
0.4m							
0.5m			*Ribbons 10mm 2 Threads*	*Blocky*	*Low*	*Brown - Grey*	
0.6m	*Depth of T Test*	*Gravelly Sand*					
0.7m							
0.8m							
0.9m							
1.0m							
1.1m		*Gravel*	*Ribbons 5mm 1Threads*	*Blocky*	*Low*	*Grey*	
1.2m							
1.3m							
1.4m							
1.5m							
1.6m							
1.7m							
1.8m							
1.9m							
2.0m							
2.1m							
2.2m							
2.3m							
2.4m							
2.5m							

Evaluation: ***Weather conditions:*** *Dry and Bright – Weather generally wet prior to testing.*

According To The Flowchart For Describing Subsoil's based on BS5930:1999, the subsoil is best described as a Gravelly Sand

****Excellent percolation characteristics of the subsoil exhibited in the trial hole.***

Likely T Value	*< 5.00 min /25mm*

*Note: Depth of percolation test holes should be indicated on log above (Enter P & T Depths as appropriate)
* See Appendix E for BS5930 Classification
** 3 samples to be tested on each horizon and results should be entered above for each horizon.
*** All signs of mottling should be recorded.

3.3a Percolation ("T" Test for Deep Subsoils and Water Table)

Step 1 Test Hole Preparation

Percolation Test Hole	*1*	*2*	*3*
Depth from ground surface to top of hole (mm) (A):	*400*	*400*	*430*
Depth from ground surface to base of hole (mm) (B):	*800*	*810*	*850*
Depth of hole (mm) (B-A):	*400*	*410*	*420*
Dimensions of hole [length x breadth (mm)]:	*320 x 300*	*300 x 300*	*330 x 320*

Step 2 Pre-Soaking Test Holes

Date and Time Pre-soaking Started	*20.03.12*	*10.17*	*20.03.12*	*10.18*	*20.03.12*	*10.19*

Each hole should be pre-soaked twice before the test is carried out. Each hole should be empty before refilling.

Step 3 Measuring T_{100}

Percolation Test Hole	***1***	***2***	***3***
Date of Test	*21.03.12*	*21.03.12*	*21.03.12*
Time Filled to 400mm	*11.25*	*11.25*	*11.25*
Time Water Level at 300mm	*11.36*	*11.38*	*11.41*
Time to drop 100mm (T_{100})	*11.00*	*13.00*	*16.00*
Average T_{100}			*13.33*

If T_{100} >300mins then P Value >90 – site unsuitable for discharge to ground
If $T_{100} \leq$ 210mins then go to Step 4
If $T_{100} \geq$ 210mins then go to Step 5

Step 4 Standard Method (where $T_{100} \leq 210$min)

Percolation Test Hole	1			2			3		
Fill No.	**Start Time at 300mm**	**Finish Time at 200mm**	**Δt (min)**	**Start Time at 300mm**	**Finish Time at 200mm**	**Δt (min)**	**Start Time at 300mm**	**Finish Time at 200mm**	**Δt (min)**
1	*11.37*	*11.50*	*13.00*	*11.39*	*11.54*	*15.00*	*11.42*	*11.59*	*17.00*
2	*11.51*	*12.06*	*15.00*	*11.55*	*12.13*	*18.00*	*12.00*	*12.19*	*19.00*
3	*12.07*	*12.26*	*19.00*	*12.14*	*12.36*	*22.00*	*12.20*	*12.43*	*23.00*
Average Δt			*15.67*			*18.33*			*19.67*
	Average Δt/4 = [Hole No. 1]		*3.91*	Average Δt/4 = [Hole No. 2]		*4.58*	Average Δt/4 = [Hole No. 2]		*4.91*

Result of Test : T *4.47* min/25mm

Comments
Excellent percolation characteristics of the subsoil

4.0 CONCLUSIONS of SITE CHARACTERISATION:

Not suitable for Development	

Suitable for		**Discharge Route**
1. Septic tank System (Septic tank and soil percolation system)	✓	***Groundwater***
2. Secondary Treatment System		
a. Septic tank and intermittent filter system and polishing unit	✓	
b. Package Wastewater Treatment system and polishing unit	✓	

5.0 RECOMMENDATION:

Propose to install	*The site is suitable for a conventional EN Certified septic tank and percolation area. Primary treatment within a two chamber septic tank designed and installed in accordance with Section 7.1.1 of the EPA CoP 2009 - 'Wastewater Treatment System and Disposal systems serving Single Houses'.*

And discharge to	*Groundwater*

Trench Invert Level (m)	*0.20m*

Site Specific Conditions (if any) e.g. special works, Site Improvement Works, Testing etc.

The tests showed that the site has a ''T'' value rating of 4.47min/25mm Groundwater level was not encountered in the trial hole. Bedrock level was not encountered in the trial hole.

The purpose built percolation area which is constructed on site has a minimum of 1.20m of suitable percolating material between the base of the lowest part of the percolation area at all times. The distribution pipes used in the system are smooth walled, have a diameter of 100mm have 7mm holes drilled in them 300mm apart, and each pipe is spaced parallel and 2000mm apart. The distribution pipes are bedded on 250mm depth of crushed stone (20 - 30 mm in size). The distribution pipes which are in place are surrounded and covered to a depth of 150mm of crushed stone which extends the full width of the percolation area. Before the distribution pipes were backfilled with the topsoil the crushed stone was covered with geotextile.

Anua's range of septic tanks for single houses and larger developments are designed and manufactured to the highest standards and are the only septic tank in Ireland with EN 12566-1 Certification

6.0 TREATMENT SYSTEM DESIGN DETAILS

SYSTEM TYPE: *Septic Tank System (EN Certified 12566) Recommendation Bord Na Mona Septic Tank*

Tank Capacity (m^3)	*2.8m^3*	***Percolation Area***		***Mound Percolation Area***	
		No. of Trenches	*2*	*No. of Trenches*	*N/A*
		Length of Trenches (m)	*15m*	*Length of Trenches (m)*	*N/A*
		Invert Level (m)	*0.2m*	*Invert Level (m)*	*N/A*

SYSTEM TYPE: *Package Sewage Treatment System*

Filter Systems

Media Type	**Area (m^2)**	**Deep of Filter (m)**	**Invert Level (m)**
Sand/Soil	*N/A*	*N/A*	*N/A*
Soil	*N/A*	*N/A*	*N/A*
Constructed Wetland	*N/A*	*N/A*	*N/A*
Other	*N/A*	*N/A*	*N/A*

Package Treatment Systems

Type	*N/A*
Capacity PE	*N/A*
Sizing of Primary Compartment	
N/A **m^2**	

SYSTEM TYPE: *Tertiary Treatment*

Polishing Filter: *Surface Area (m^2)*	*N/A*	**Package Treatment Systems:** Capacity (PE)	*N/A*
or Gravity Fed:		**Constructed Wetland:** *Surface Area (m^2)*	*N/A*
No. of Trenches	*N/A*		
Length of Trenches (m)	*N/A*		
Invert Level (m)	*N/A*		

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate ($l/m^2.d$)	*210l/d*
Surface Water		Discharge Rate	*0.024l/s*

TREATMENT STANDARDS:

Treatment System Performance Standards (mg/l)	**BOD**	**SS**	**NH_3**	**Total N**	**Total P**
Conventional Septic Tank	*<20*	*<30*	*<10*	*5 - 10*	*12.5*

QUALITY ASSURANCE:

Installation & Commissioning	**On-going Maintenance**
Recommend to be overseen by plant supplier.	*Maintain and de-sludge annually*

7.0 SITE ASSESSOR DETAILS

Company:	*Traynor Environmental Ltd*				
Prefix:	*Mr.*	**First Name:**	*Nevin*	**Surname:**	*Traynor*
Address:	*Belturbet Business Park, Creeny, Belturbet, Co. Cavan.*				
Qualifications/Experience:	*BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.*				
Date of Report:	*30.03.12*				
Phone:	*049 9522236*	**Fax:**	*049 9522808*	**E-mail:**	*nevin@traynorenvironmental.com*
Indemnity Insurance Number:	*AGD /11 / 109*				

Signed: 

Nevin Traynor

BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.

For Traynor Environmental Ltd

8.0 SITE PHOTOGRAPHS

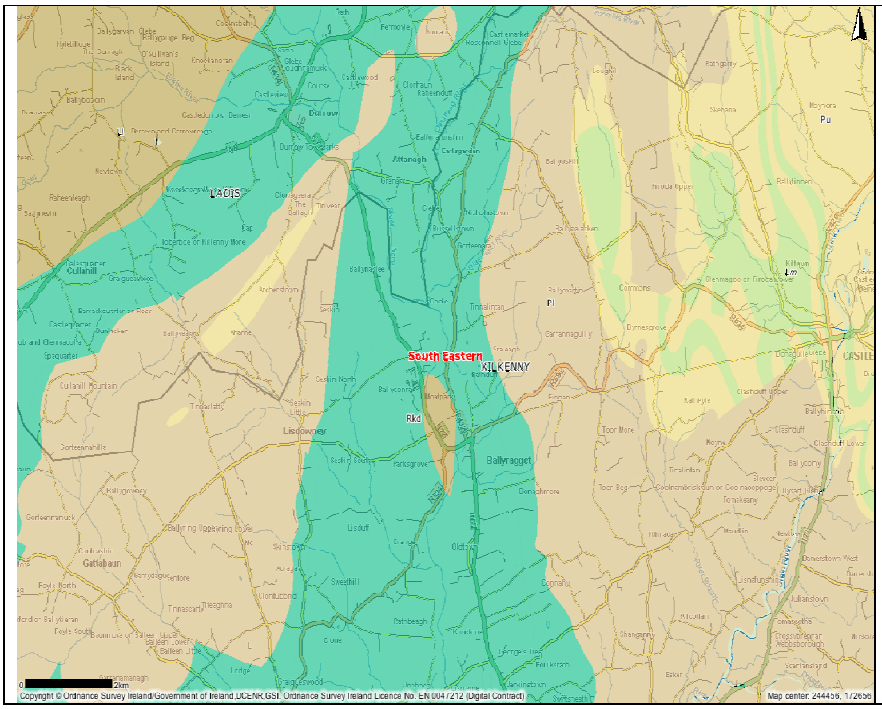
Facing South From the Proposed Percolation Area	*Facing West From the Proposed Percolation Area*
	
Facing North From the Proposed Percolation Area	***Facing East From the Proposed Percolation Area***
	
Trial Hole Side View	***Trial Hole Front View***
	

Percolation ("T") Test 1	*Percolation ("T") Test 2*
	

Percolation ("T") Test 3

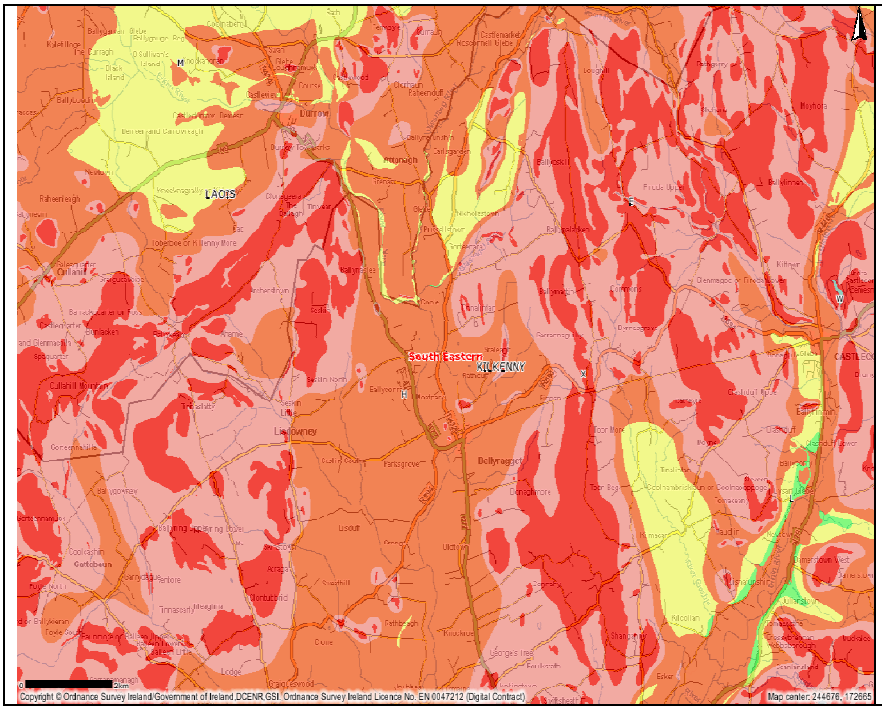

Maps Used As Part of the EPA Site Suitability Assessment

Groundwater/Aquifer Map



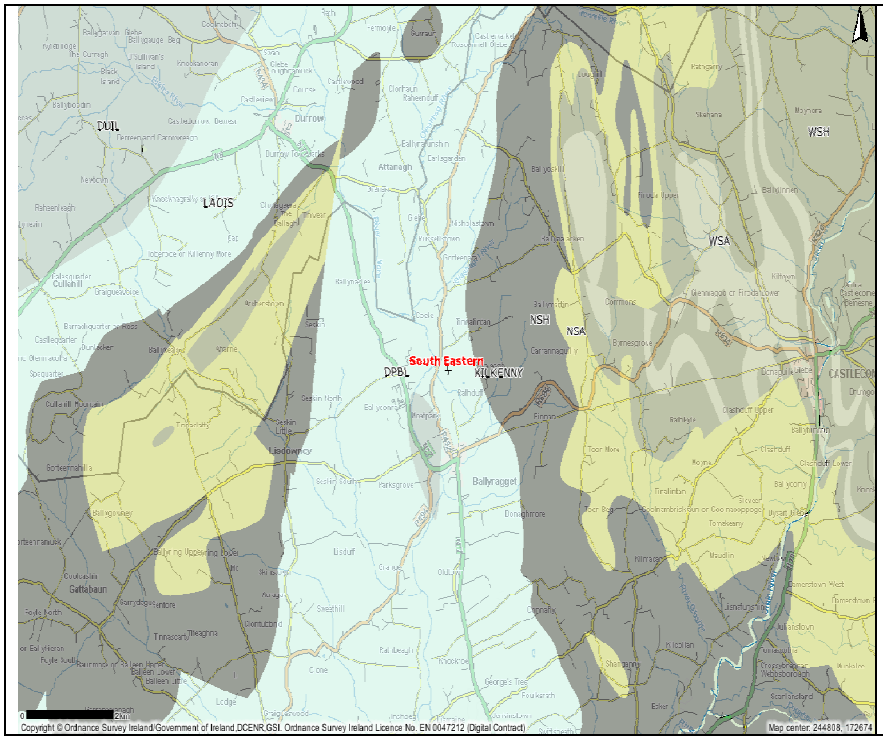
From the GSI Groundwater Aquifer Map Site is classified as Regionally Important (RKd)

Vulnerability Map



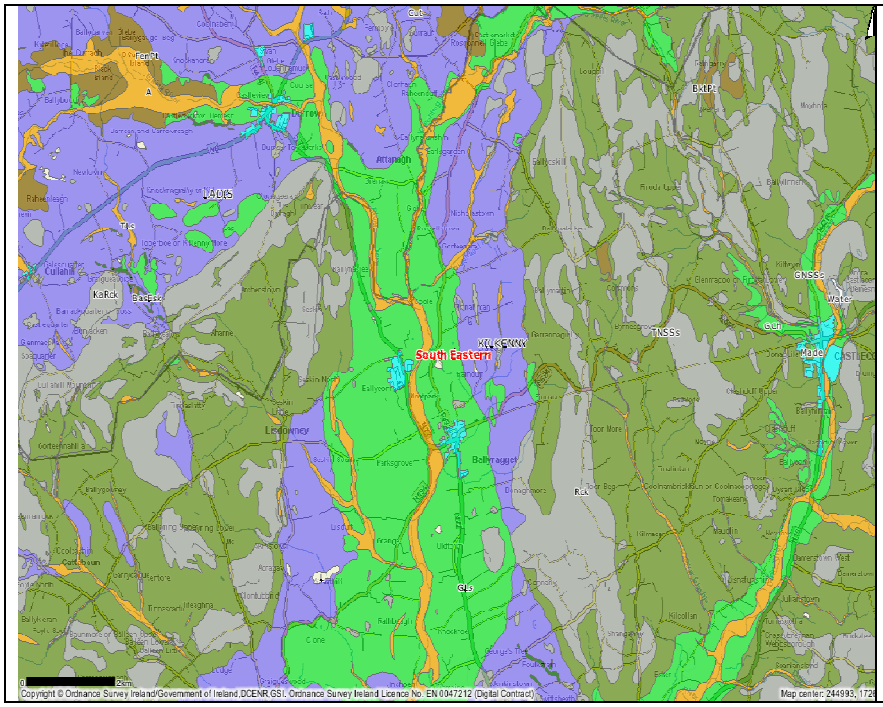
From the GSI Vulnerability Map Site is classified as High

Bedrock Map



From the GSI Bedrock Map Site is classified as DPBL – Dinantian Pure Bedded Limestones

Teagasc Subsoil Map



From the GSI Teagasc Subsoil Map Site is classified as GLs

9.0 EPA/FAS CERTIFICATE

FETAC
Further Education and Training Awards Council
Comhairle na nDámhachtainí Breisoideachais agus Oiliúna

National Skills Certificate
(FÁS)

Awarded to
Bronnta ar

Nevin Traynor

who has achieved the National Standards for
a bhain Caighdeáin Náisiúnta amach maidir le

Site Suitability Assessment for On-Site

Wastewater Treatment Systems

Chair, FETAC

Chief Executive, FETAC

F/NSC 003535

Griffiths & Armour

ENGINEERS IRELAND
VERIFICATION OF PROFESSIONAL INDEMNITY INSURANCE

Insured:	**Traynor Environmental Ltd**
Address:	**Belturbet Business Park Creeny Belturbet Co. Cavan**
Description of Business:	**Consulting Engineers**
Policy Number and Name/Address of Lead Insurer:	**A G Doré Syndicate 2526 at Lloyd's 4th Floor, 70 Gracechurch Street London EC3V 0XL United Kingdom Policy No: AGD/11/109**
Period of Insurance:	**12 July 2011 to 11 July 2012**
Renewal Date:	**12 July 2012**
Retroactive Date:	**None**
Limit of Indemnity any one claim:	**A sum not less than €1,000,000 (separate aggregate limits of indemnity for all claims in the period relating to** • **pollution or contamination** • **asbestos)**
Excess applying to each and every claim:	**€5,000**
Total amount of Excess amounts payable for all claims during any one period of insurance:	**€15,00**
Does cover include Joint Venture Projects?	**Yes**
Does cover include Sub-Consultants?	**Yes - Insured's liability**
Is there a Sub-Consultant's Warranty?	**None**
Are there any Restrictions/Limitations/Warranties in relation to the Policy connected with the Project or Brief presented by the Local Authority, Health Board, Vocational Educational Committee, Regional Technical College or other Public Body? If so, could you provide details:	**None other than those which are standard to this class of insurance protection**

Signed: .....

For and on behalf of Griffiths & Armour Professional Risks

GROUP OFFICES Liverpool London Manchester Glasgow Dublin Guernsey

Date: **13 July 2011**

The policy is subject to the insuring agreements, exclusions, conditions and declarations contained therein. The above is accurate at the date of signature. No obligation is imposed herein on the signatory to advise of any alteration.

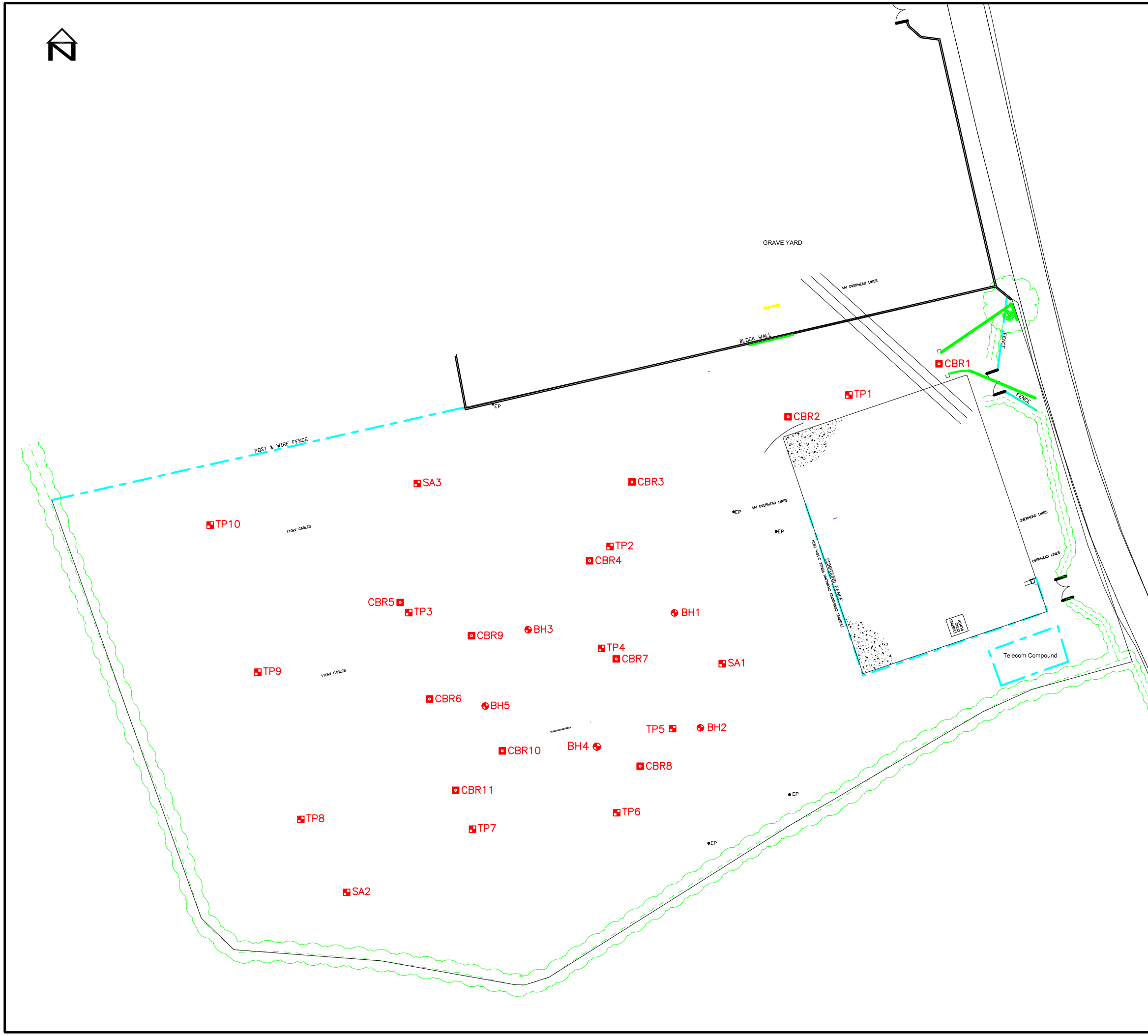
ENCLOSURE H

DRAWINGS

Site Location Plan

Soil Mechanics

Notes: Not to scale	**Project** Laois Kilkenny Reinforcement Project – Ballyragget 400kV: Ground Investigation **Project No.** Y2012-12B **Carried out for** EirGrid	**Figure**



LEGEND TO SYMBOLS

- Denotes Borehole Location
- Denotes CBR Test Location
- Denotes Trial Pit Location

Scale: 1:250

0 2.5m 5 7.5 10 12.5

Title

SITE PLAN

Project

LAOIS KILKENNY REINFORCEMENT PROJECT -BALLYRAGGET

Client

EirGrid

Soil Mechanics

Date	Drawn By	Approv. By
14/06/12	AW	AJ

Sheet Size	Scale	Project No
A3	1:250	Y2012-12B

Figure No	Rev
D2	0