

Distribution	Report Status	Rev.	Date of Issue	Report Prepared By:	Approved By:				
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FOREWORD

The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards

The ground investigation works for this project (Greater Dublin Drainage Scheme – Preliminary Ground Investigation Scheme – Phase 1) have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). Currently, the Republic of Ireland does not have a National Annex and the following Irish (IS) and European Standards or Norms are referenced:

- IS EN 1997-2 Eurocode 7: 2007 Geotechnical Design Part 2: Ground Investigation & Testing
- IS EN ISO 22475-1:2006 Geotechnical Investigation and Sampling Sampling Methods & Groundwater Measurements
- IS EN ISO 14688-1:2002 Geotechnical Investigation and Testing Identification and Classification of Soil, Part 1: Identification and Description
- IS EN ISO 14688-2:2004 Geotechnical Investigation and Testing Identification and Classification of Soil, Part 2: Classification Principles
- IS EN ISO 14689-1:2004 Geotechnical Investigation and Testing Identification & Classification of Rock, Part 1: Identification & Description

Reporting

Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for Fingal County Council and the information should not be used without prior written permission. The recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures

Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variations is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Rotary Drilling Procedures

Rotary drilling methods have been used to recover bedrock samples in line with Section 3.5 of IS EN 1997-2:2007 and IS EN ISO 22475-1. Open hole drilling methods (odex or symmetrix) were utilized to advance the drillholes through the superficial deposits with coring in bedrock. The key objectives of the rock sampling were to obtain high core recovery (TCR), minimize sample disturbance and facilitate accurate identification of strength, weathering and discontinuity characteristics.

In-Situ Testing

Standard penetration tests were conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling

Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

	* N/S – not state	d. Presume a representative sample of appropriate size
EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S*
5.5.6	Particle Size Analysis	N/S*
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S*
5.5.9	Soil Dispersivity	N/S*
5.5.10	Frost Susceptibility	N/S*
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S*
5.11	Permeability	2

Tab	le A -	 Details c 	of Samp	le Quality	y Requirements
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Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

Fingal County Council proposes to develop a wastewater drainage network and treatment infrastructure across the north Dublin area in a plan termed the Greater Dublin Drainage Scheme. The initiative involves the provision of a new wastewater treatment works, a marine outfall, and a new drainage network in the northern part of the Greater Dublin Area.

The IGSL investigation comprised a number of boreholes and trial excavations on as yet unselected sites for both the wastewater treatment works (Clonshaugh, Annsbrook and NewtownCorduff), the pipeline infrastructure and the eventual marine outfall (north of Loughshinny & southeast of Portmarnock).

Figure 1 - Site Location, North County Dublin



Reproduced from OSI website (www.osi.ie) Ordnance Survey Ireland Licence No. EN 0070013 © Ordnance Survey Ireland / Government of Ireland The geotechnical investigatory works combined a programme of intrusive works across the greater North Dublin area along with geophysical surveying focused on two proposed outfall areas. The works were carried out by IGSL from January to April 2013. The intrusive works comprised cable percussive boreholes, rotary core drillholes and trial pits. The fieldworks were carried out in accordance with BS 5930, Code of Practice for Site Investigations (1999+A2:2010) and Engineers Ireland Specification for Ground Investigation (2006). Geotechnical laboratory testing has been performed on selected samples recovered from the exploratory holes.

The primary objectives of this investigation were as follows:

- Outline the composition and strength or stiffness of the superficial deposits
- Establish bedrock (if present) and associated engineering geological characteristics
- Assess the geophysical properties of the soil / rock present at the northern and southern marine outfall

This report presents the factual data on the ground conditions.

2. FIELDWORK

2.1 General

The geotechnical investigations comprised the following:

- Trial pits incorporating soakaway testing (BRE Digest 365)
- Cable percussion boring
- Rotary drilling
- Groundwater Monitoring including variable head testing
- o Geophysical surveying
- o Surveying of as-built exploratory locations

The fieldworks were supervised by an IGSL Geotechnical Engineer.

2.2 Trial Pits

Trial pitting was performed at seventeen locations using an 8 tonne tracked excavator. The trial pits were logged and sampled by an IGSL engineering geologist in accordance with BS 5930 (1999+A2:2010). The trial pits were positioned at both outfall areas as well as within the footprint of each of the proposed treatment facilities. In a single trial pit at each proposed treatment plant, a soakaway test was performed in accordance with BRE Digest 365 Soakaway Design. The results are presented in Appendix 5.

Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for examination and laboratory testing. The pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

2.3 Cable Percussion Boreholes

Cable percussion boring was undertaken at twenty two locations using a Dando 2000 rig. The boreholes are referenced BH01 to BH26 (not inclusive) and extended to a maximum depth of 13.70m bgl. Boring commenced after CAT scanning to verify the presence or absence of service ducts. Disturbed bulk samples (denoted B on the logs) were recovered during boring and were examined to classify the strata. Chiselling or hard strata boring was necessary to advance the boreholes through cobble / boulder obstructions.

Standard Penetration Tests (SPT's) were performed in the boreholes and given the nature of the soils, a solid cone was used. It is noted that the SPT N-values reported are the number of blows for 300mm increment penetration (e.g. BH 01 at 2.0m where N=12). These exclude the seating blow values, which represent the initial 150mm depth of penetration. Where partial penetration was achieved during testing, the number of blows is shown for the actual penetration depth achieved (e.g. BH01 at 12.0m where N=50 / 285mm). In accordance with Eurocode 7, the SPT hammer has been calibrated and the energy ratio (E_r) reported on the engineering logs. Descriptions of the soils encountered, in-situ tests undertaken and samples recovered are presented on the boring records in Appendix 2. Details of groundwater strikes and hard strata boring (i.e. chiselling) are also presented on the aforementioned records.

2.4 Rotary Drillholes

Rotary drilling was undertaken at fifteen locations denoted RC01 to RC24 (not inclusive) using both a Casagrande top drive rotary rig and a Unimog truck-mounted Knebel rotary coring unit. Symmetrix drilling was utilized to advance the drillholes through overburden / highly fractured rock with rotary coring using the T6116 system producing 86mm diameter cores (P Size Core). Where rotary

coreholes were drilled through the overburden soils, Standard Penetration Tests (SPT's) were carried out to verify soil strengths. The coreholes were terminated at depths specified by the project engineer. The rotary drilling records are presented in Appendix 3.

2.5 Groundwater Monitoring

Groundwater levels were recorded during boring, coring and in trial pits. Details are presented on the engineering logs. Standpipes were installed in eight of the exploratory holes (BH04, RC01, RC02, RC05, RC06, RC07, RC09 & RC12) to establish equilibrium groundwater levels. All water well locations are sited within the proposed treatment areas with the exception of RC12 which is situated at the northern outfall, north of Loughshinny. The standpipes (50mm diameter) incorporated pea gravel response zones, cement-bentonite pellet seals and protective stand-up covers. Groundwater levels in the standpipes were measured using a battery-operated dipmeter and results are presented in Appendix 4.

Both rising and falling head tests were carried out in the borehole installations on completion of site works. The records from the in situ testing are detailed in Appendix 6.

2.6 Geophysical Surveying

Geophysical surveying was performed by Minerex Geophysics Limited on behalf of IGSL. The survey encompassed three distinct sites; the southern and northern outfalls at Portmarnock and Loughshinny as well as north of the R123 in the townland of Maynetown, south west of Portmarnock. A combination of techniques (i.e. seismic refraction and 2-D resistivity) were used to evaluate the stratigraphy and stiffness properties of the ground conditions. The P-wave seismic data was used to produce ground models / profiles. The resistivity values compliment the findings of the seismic survey thus permitting development of the stratigraphic model. Details of the methodologies employed, cross-sections and data interpretation are presented in the geophysical report (Appendix 7).

2.7 Surveying of Exploratory Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to national grid (Malin Head) and ground level (z) established. The co-ordinates and ground levels are incorporated on the engineering logs.

3. LABORATORY TESTING

Geotechnical laboratory testing has been carried out on selected trial pit and cable percussive borehole samples. The geotechnical soils testing was undertaken in accordance with BS 1377 (1990) and results are presented in Appendix 8. The soils testing included the following:

- o Moisture content
- Particle size grading
- Atterberg Limit (Liquid & Plastic Limit)
- o CBR
- Dry Density (MCR)
- o Moisture Condition Value
- o 5 Point MCV
- o pH
- Organic Content
- Acid- & Water-soluble Sulphate content
- o Sulphide content

Point Load Strength Index (PLSI) tests and Unconfined Compressive Strength (UCS) tests were performed on the rock cores in accordance with ISRM. The results of the rock testing are presented in Appendix 9.

4. GROUND CONDITIONS & GROUNDWATER

4.1 Ground Profile

The geotechnical investigatory works undertaken by IGSL have revealed the ground conditions to typically comprise the following:

- o TOPSOIL
- o Brown sandy gravelly CLAY with a low to medium cobble content
- o Grey brown to dark grey black slightly sandy gravelly CLAY with a medium cobble content
- Rockhead consisting of varied Dublin Basin Argillaceous Limestones occasionally with subordinate Mudstone. Brecciation / weathering was noted in the northern outfall boreholes

4.2 Superficial Deposits

Trial pits and boreholes were almost exclusively carried out on farmland with the exception of those sited at Fingal County Council lands near Portmarnock Strand. Topsoil was found in the majority of exploratory holes with generally a thickness of 0.30m to 0.40m. The superficial deposits comprise fine-grained soils (sandy gravelly CLAY with cobbles) which range in consistency from soft to firm in the upper zone (i.e. c.1m), generally becoming firm / occasionally very stiff with depth.

Plate 1 – Typical clay succession observed across the site (exposed in Trial Pit TP16)



In extremities of the site, a contrasting soil profile was encountered (i.e. TP's 12 and TP14 & 15; BH14 & 14A). Medium to coarse grained beach sands were encountered in TP12 and BH14 / 14A with poor stability exhibited during pitting and boring. At the northern outfall, both trial pit excavations encountered firm to stiff brown sandy gravelly CLAY with a high coarse content of cobbles and boulders. Soils in TP14 graded to gravelly SAND from 1.10m to the end depth of 3.10m. In the same region, gravels were sampled in BH11 at 4.0m.

Plate 2a & 2b – Beach / Estuarine Sands exposed in TP12. Coarse-rich gravelly CLAY and SAND strata in TP14





Plate 2a

Plate 2b

Trial excavations were extended to a maximum depth of 3.85m. No pits encountered rockhead. In most cases, trial pitting was terminated on stiff to very stiff clays where slow progress was noted during excavation. Where rockhead was not located the majority of cable percussive boreholes were terminated at refusal in this stiff clay.

It is thought that the soils for the most part represent over-consolidated ablation till deposits. The glacial till matrix is predominantly clay in nature. The gravel constituents or clasts range from fine to coarse and are subangular to subrounded.

Liquid and Plastic Limit tests (Atterberg Limits or Consistency Indices) were determined on a number of samples from both trial pits and boreholes. The results obtained from trial pit samples are summarized in Figure 3. These show the fine soils are mainly intermediate to low plasticity clays (CL to CI) with the majority of the tests plotting above the A-Line on the Casagrande Chart.



Figure 2 – Atterberg Limit Plot for Trial Pit samples

Liquid Limits predominantly range between 28 and 38% while Plastic Limits are principally in the range 16 to 20%. A small number of the samples analysed were found to be non-plastic to varying degrees and these plotted below the A-Line. In most cases, they represented samples recovered from exploratory holes at Portmarnock beach (TP12, BH14, BH14A) and trial pits at Loughshinny where sand- and gravel- prone strata were noted (e.g. TP14 at 1.10m). Plasticity Indices are mainly in the 15 to 20% envelope.

4.3 Bedrock

Reference to the GSI bedrock map for the area (1:100,000 series) shows that the site is underlain by the Lower Carboniferous deposits of the Dublin Basin. Basinal limestones and mudstones dominate the lithological record across the north Dublin area. Rock was found at its shallowest in the west of the site near Toberburr and Balheary, north west of Swords. Here rock was intercepted at 3.0m (RC17) and 5.0m (RC24). Elsewhere, rock was encountered at greater depths and in some cases not at all (RC01 and RC02 at Clonshaugh were terminated at 18.0m without encountering rock). Rock, when cored, was logged as medium strong to strong argillaceous limestone. However more weak rock, occasionally showing brecciation, was also found.

Figure 3 – Bedrock Geology Map for the Area



4.4 Groundwater

Groundwater was encountered as seepages during trial excavations. Soakaway testing proved the clays to be highly impermeable (Appendix 5). Borehole water strikes are recorded on the individual logs presented in Appedices 1 and 2. Ground water monitoring data is also presented in this report in Appendix 4.

References

- BS 5930 (1999+A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).
- 2. BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.
- Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.
- 4. Geological Survey of Ireland (1999). Geology of Meath (Bedrock Geology Sheet 13), 1:100,000 Series
- 5. Geological Survey of Ireland (1994). Geology of Kildare Wicklow (Bedrock Geology Sheet 16), 1:100,000 Series

Appendix 1

Trial Pit Records

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CONT	DNTRACT Greater Dublin Drainage Scheme TRIAL PIT NO. SHEET 20 CDDBNATED 240 224 02 5							TP01 Sheet 1 of 1			
LOGO	CROUND LEVEL (m) 42.70				I/2013 I/2013						
CLIEI	NT Fingal County Council NEER	GROUND LEV	/EL (m)	42.79	1	I	EXCAVA METHO		Kubota KX080-		0-3a
								Samples	\$	(Pa)	rometer
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft to firm brown to grey brown s CLAY. Sand is fine to medium.	lightly sandy	<u>11. 11. 11.</u>								
1.0	Firm grey brown slightly sandy slightly gravell low cobble content. Sand is fine to coarse. Gr subangular to subrounded fine to coarse of lir Cobbles are subrounded of limestone.	y CLAY with a avel is nestone.		0.40	42.39		AN4615	В	0.50-0.70		
	1.40 - 1.60m - Pocket of grey subrounded me with a medium cobble content			1 75	41.04	(Seepage)					
2.0	Firm to stiff dark grey black slightly sandy gra with a low to medium cobble content. Sand is medium. Gravel is subangular to subrounded of limestone. Cobbles are subrounded of lime	fine to coarse		1.75	41.04		AN4616	В	1.90-2.00		
	Stiff to very stiff dark grey black slightly sandy with a low cobble content. Sand is fine to med angular to subrounded fine to medium of lime are subangular to subrounded of limestone.	dium. Gravel is		2.50	40.29		AN4617	В	2.60-2.70		
3.0	End of Trial Pit at 3.20m		_ · · · · · · · ·	3.20	39.59						
4.0											
	Indwater Conditions slight seepage at 1.30m										
Stabi Good											
	eral Remarks rminated on stiff clay										



1	669	5
1	669	と

100	3SL											
CON	TRACT	Greater Dublin Drainage Scheme						TRIAL PI	T NO.			
			CO-ORDINAT	ES	319.60	0.96 E		- SHEET		ED 23/01/2013 Kubota KX080-		
-OG	GED BY	JL			241,81	15.26 N		DATE ST DATE CO				
CLIE ENGI	NT NEER	Fingal County Council	GROUND LEV	/EL (m)	41.28				EXCAVATION METHOD		a KX08	0-3a
								:	Samples	6	a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetrometer
0.0	TOPSOI to mediu	L: Soft to firm grey brown sandy CLA m.	Y. Sand is fine	<u>11. 11. 11. 11. 11. 11. 11. 11. 11. 11.</u>								
	gravelly (m yellow brown to brown slightly san CLAY. Sand is fine to medium. Grave Inded fine to medium of limestone.	dy slightly I is subangular /		0.40 0.60	40.88 40.68		AN4618	в	0.60-0.80		
1.0	to subrounded fine to medium of limestone. Firm brown mottled grey brown slightly sandy slig gravelly CLAY. Sand is fine to medium. Gravel is to subrounded fine to coarse of limestone.		slightly I is subangular									
	04%	www.blad.eR.10	AX		1.75	39.53		AN4619	в	1.60-1.70		
2.0	to mediu subangu	grey black slightly sandy gravelly CL m cobble content. Sand is fine to mer ar to subrounded fine to coarse of .Cobbles are subangular to subround	dium. Gravel is	\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.\.				AN4620	В	1.85-2.00		
3.0	Gravel is	ery stiff dark grey black slightly sandy edium cobble content. Sand is fine to subangular to subrounded fine to co . Cobbles are subrounded of limesto	arse of	- 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	2.75	38.53		AN4621	В	2.80-3.00		
		rial Pit at 3.15m			3.15	38.13						
4.0												
Grou Dry	Indwater (Conditions										
Stab i Good												
	eral Rema											
n te	nimateu C	n stiff clay										

1									REPORT NU	JMBER		
2 103									16695			
CONTR	ACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.				
OGGE	DBY JL	CO-ORDINAT	ES	319,82 241,93	23.90 E 31.69 N		DATE S		D 23/01	t 1 of 1 /2013 /2013		
CLIENT	5 ,	GROUND LEV	/EL (m)	39.18			EXCAVA METHO	ATION		ta KX08	0-3a	
								Sample	es	a)	neter	
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)	
fir	OPSOIL: Soft brown slightly sandy gravelly C ne to coarse. Gravel is subangular to subrour redium of various lithologies.	CLAY. Sand is nded fine to	$\frac{\sqrt{1}}{\sqrt{1}} \cdot \frac{\sqrt{1}}{\sqrt{1}} \cdot \frac{\sqrt{1}}{\sqrt{1}}$									
S	off to firm yellow brown sandy gravelly SILT. nedium.	Sand is fine to	$\begin{array}{c} \underline{(1,1)} \\ \times \\ $	0.40	38.78		AN4611	В	0.50-0.65			
^{1.0} C m of	CLAY with a low to medium cobble content. Sa nedium. Gravel is subangular to subrounded f	oming stiff dark grey brown slightly sandy gravelly h a low to medium cobble content. Sand is fine to Gravel is subangular to subrounded fine to coarse ne. Cobbles are subangular to subrounded of			38.28		AN4612	В	0.90-1.10			
2.0							AN4613	В	2.00-2.10			
C to	tiff to very stiff dark grey black slightly gravell CLAY with a medium cobble content. Gravel is o subrounded fine to coarse of limestone. Cob ubrounded of limestone.	subangular		3.20	35.98		AN4614	В	3.50-3.60			
4.0 E	ind of Trial Pit at 3.85m			3.85	35.33							
Ground Dry	water Conditions											
Stability Good	У											
	I Remarks inated on stiff clay											



5

	SL											
CONT	RACT	Greater Dublin Drainage Schem	e						T NO.	TP0		
			CO-ORDINAT	ES	317.48	34.29 E		DATE S1			t 1 of 1 /2013	
LOGGED BY JL					254,37	76.52 N		DATE S			/2013	
CLIEN ENGIN		Fingal County Council	GROUND LE	VEL (m)	31.61				EXCAVATION Kubota H METHOD			
									Sample	6	a)	neter
		Geotechnical Description	1	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Эс	Depth	Vane Test (KPa)	Hand Penetrometer
					<u>D</u>	Ele	Wa	Sai Rei	Type	De	Vai	Hai
		IL: Soft grey brown silty CLAY		<u>17. 711</u>	0.30	31.31						
	Soft to fi Sand is	rm brown to yellow brown slightly fine to medium.	sandy silty CLAY.	X	0.50	31.11						
	Soft to fi slightly s Gravel is	rm grey brown occasionally mottle sandy slightly gravelly CLAY. Sand s subangular to subrounded fine to	is fine to medium.					AN4642	В	0.60-0.80		
	limeston				0.90	30.71		AN140 40	D	1 00 4 40		
	content. subroun	Sand is fine to medium. Gravel is ded fine to coarse of limestone. Co lar to subrounded of limestone.	angular to					AN4643	В	1.00-1.10		
				<u> </u>	1.60	30.01						
Γ	Stiff dark	c grey brown sandy gravelly CLAY content. Sand is fine to medium. G	with a medium avel is	0	1.00	30.01						
	subangu	are subrounded of limestone.						AN4644	в	1.90-2.00		
2.0									_			
┝	Verv stif	f dark grey brown gravelly CLAY w	vith a low to	<u> </u>	2.30	29.31						
	medium	cobble content. Gravel is subanguoarse of limestone. Cobbles are su	lar to subrounded					AN4645	в	2.50-2.60		
		ded of limestone.							_			
3.0					0.00	00.44						
F	End of T	rial Pit at 3.20m			3.20	28.41						
4.0												
Groun Ory	ndwater	Conditions						1				
Stabil	lity											
Good												
	ral Rema											
vit terr	minated o	on very stiff clay										

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CONT	FRACT Greater Dublin Drainage Scheme						TRIAL PI		TP0 Shee	5 t1 of 1	
_OGC	GED BY JL	CO-ORDINATES 317,525.63 E 253,995.98 N					-			/01/2013 /01/2013	
CLIEN	NT Fingal County Council NEER	GROUND LE	/EL (m)	29.11			EXCAVA METHOD		Kubo	ta KX08	0-3a
								Samples		Pa)	ometer
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer
0.0	TOPSOIL: Soft brown slightly sandy silty CLA' fine.	Y. Sand is	$\frac{\sqrt{1}}{2} \cdot \frac{\sqrt{1}}{2} \cdot \frac{\sqrt{1}}{2} \cdot \frac{1}{2}$	0.30	20.04						
	Soft to firm yellow brown sandy gravelly CLAY to medium.	. Sand is fine		0.30	28.81		AN4626	В	0.50-0.60		
1.0	Soft to firm grey brown occasionally mottled or sandy gravelly CLAY. Sand is fine to medium. subangular to subrounded fine to coarse of lim	Gravel is		0.90	28.21						
	Firm to stiff grey brown occasionally mottled lig			1.40	27.71		AN4627	В	1.20-1.30		
	gravely CLAY with a low to medium cobble co fine to medium. Gravel is subangular to subrou coarse of limestone. Cobbles are subrounded	intent. Sand is unded fine to					AN4628	В	1.50-1.70		
2.0						(Seepage)					
	Stiff to very stiff grey brown slightly sandy grav with a low to medium cobble content and a low content. Sand is fine to medium. Gravel is sub subrounded fine to coarse of limestone. Cobbl subangular to subrounded of limestone. Bould	/ boulder angular to es are		2.40	26.71		AN4629	В	2.60-2.70		
3.0	subrounded of limestone (up to 300mm). End of Trial Pit at 3.00m		- <u>-</u>	3.00	26.11						
4.0											
Grou	ndwater Conditions										
	slight seepage at 2.15m										
Stabi Good	lity										
	ral Remarks minated on stiff to very stiff clay										



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CON	TRACT Greater Dublin Drainage Scheme						TRIAL P SHEET	IT NO.	TP0 Shee	6 t 1 of 1	
LOGGED BY JL			CO-ORDINATES 317,598.82 E 254,006.12 N				DATE STARTED 24/01/20 DATE COMPLETED 24/01/20				
CLIENT Fingal County Council ENGINEER		GROUND LEV	/EL (m)	28.42			EXCAVA METHO		Kubo	ta KX08	0-3a
								Samples		a)	meter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer
0.0	TOPSOIL: Soft grey brown to brown silty CLA	Y	$\frac{\sqrt{l_2} \cdot \sqrt{l_2} \cdot \sqrt{l_2}}{\sqrt{l_2} \cdot \sqrt{l_2} \cdot \sqrt{l_2}}$	0.40	20.02						
	Soft to firm yellow brown mottled light grey bro gravelly silty CLAY. Gravel is subangular to sul to coarse of limestone.	wn slightly brounded fine		0.40	28.02		AN4634	В	0.50-0.60		
1.0	Firm grey brown mottled light grey slightly sand gravelly CLAY with a low cobble content. Sand medium. Gravel is subangular to subrounded f of limestone. Cobbles are subangular to subrou limestone.	l is fine to ine to coarse		0.80	27.62		AN4635	В	0.90-1.10		
2.0	Stiff grey brown slightly sandy gravelly CLAY w medium cobble content and a low boulder cont fine to medium. Gravel is subangular to subrou coarse of limestone. Cobbles and boulders are subrounded occasionally tabular of limestone.	tent. Sand is unded fine to	~ [년 전 [여] (] (] [년 년 년 1] [] [] (] [년 1] [] [] [] (] (1.80	26.62		AN4636	В	1.90-2.00		
3.0	Very stiff to hard grey brown slightly sandy gra with a medium cobble content. Sand is fine to Gravel is subangular to subrounded fine to coa limestone. Cobbles are subangular to subround limestone.	medium. arse of		2.60 2.90	25.82 25.52		AN4637	В	2.70-2.90		
	End of Trial Pit at 2.90m										
4.0											
	undwater Conditions										
Dry											
Stab Good											
	eral Remarks rminated on very stiff clay										



REPORT NUMBER

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CON	TRACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.	TP0	7 t 1 of 1	
LOG	GED BY JL	CO-ORDINATES 317,650.64 E 253,853.31 N				Official Official DATE STARTED 24/01/201 DATE COMPLETED 24/01/201				3	
CLIE ENGI	INT Fingal County Council	GROUND LEV	/EL (m)	25.89			EXCAVATION METHOD		Kubota KX080-3		0-3a
								Samples		(Pa)	ometer
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 - -	TOPSOIL: Soft brown silty CLAY		<u>x 1. x 1.</u> <u>1. x 1.</u> x 0. x 0								
	Soft to firm yellow brown to brown slightly sand Sand is fine to medium.			0.40 0.60	25.49 25.29						
-	Soft to firm brown slightly sandy slightly gravel Sand is fine to medium. Gravel is subangular t fine to medium of limestone.	lly silty CLAY. to subrounded	, × × ×				AN4630	В	0.70-0.80		
- 1.0 	Firm brown mottled orange brown slightly sand gravelly SILT with a medium cobble content. S medium. Gravel is subangular to subrounded of of limestone. Cobbles are subrounded of limest	Sand is fine to fine to coarse	× × × × × × × × × × × × × × × × × × ×	1.00	24.89		AN4631	В	1.10-1.20		
- - - 2.0	Soft to firm brown occasionally mottled reddish slightly sandy slightly gravelly CLAY with a me content. Sand is fine to medium. Gravel is sub subrounded fine to coarse of limestone. Cobbl	dium cobble angular to	φ(φ' \$ × φ °φ ×	1.60	24.29	(Seepage)	AN4632	В	1.70-1.90		
	subangular to subrounded of limestone. Very stiff dark grey brown slightly sandy grave with a low to medium cobble content. Sand is subangular to subrounded fine to coarse of lim Cobbles are subrounded of limestone.	fine. Gravel is		2.10	23.79		AN4633	В	2.30-2.40		
- 3.0 - - - - -	End of Trial Pit at 3.00m			3.00	22.89						
- - 4.0 - -											
-											
	n dwater Conditions t at 1.10m. Seepage at 1.80m										
Stab Poor	ility stability										
	eral Remarks erminated on stiff clay coupled with poor stability	from ground lev	rel to 2.10)m							



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CON	ITRACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.	TP0 Shee	8 t 1 of 1	
LOGGED BY JL		201,001.0114					DATE S DATE C	1/2013 1/2013			
CLIE ENGI	NT Fingal County Council	GROUND LEV	VEL (m)	30.32	1			EXCAVATION METHOD		Kubota KX080	
								Samples	; 	Pa)	ometer
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 -	TOPSOIL: Soft to firm brown slightly sandy Cl fine to medium.	LAY. Sand is	$\frac{\underline{x}^{\underline{1}} \underline{1}_{\underline{y}}}{\underline{1}_{\underline{y}}} \cdot \underline{\underline{x}^{\underline{1}} \underline{1}_{\underline{y}}} \cdot \underline{\underline{x}^{\underline{1}}}$								
-	Soft to firm brown to yellow brown slightly san Sand is fine to medium. Soft to firm grey brown sandy gravelly CLAY v	with rare		0.40 0.55	29.92 29.77		AN4622	В	0.60-0.80	l	
- - - 1.0	rootlets. Sand is fine. Gravel is subangular to a fine to medium of limestone. Firm grey mottled brown and orange brown sa CLAY. Sand is fine to medium.	subrounded /		0.80	29.52		AN4623	В	1.00-1.10	l	
-	1.40m - Occasional subrounded boulder of lim						,	L		1	
- - -	250mm)									l	
- 2.0 	Very stiff grey to grey brown gravelly CLAY wi cobble content. Gravel is subrounded fine to c limestone. Cobbles are subrounded of limesto			2.00	28.32		AN4624	В	2.10-2.20		
3.0				3.20	27.12		AN4625	В	3.10-3.20	1	
- - -	End of Trial Pit at 3.20m									l	
- - - - 4.0										l	
-										l	
- - -										l	
Grou	undwater Conditions										
Dry											
Stab Good											
	eral Remarks erminated on verv stiff clav										
Good											

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CON	TRACT Greater D	ublin Drainage Scheme						TRIAL P	IT NO.	TP0	9 t 1 of 1	
	GED BY JL		CO-ORDINATI	ES	317,81	7.37 E		DATE S	TARTED		/2013	
-06					2.17 N		DATE C	OMPLET	ED 24/01	/2013		
CLIE Engi	NT Fingal Co	unty Council	GROUND LEV	GROUND LEVEL (m) 28.70					ATION D	Kubot	a KX08	0-3a
									Samples	5	a)	neter
	G	entechnical Description					e e				(KPa	etror
	Geotechnical Description			Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer
0.0	TOPSOIL: Soft brown slightly sandy silty CLAY.		Y. Sand is fine		0.10	28.60						
	to medium. Soft grey organic CLAY with occasional rootlet				0.30	28.40						
	Soft becoming firm yellow brown mottled brown sandy gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of limestone.				0.60	28.10		AN4638	В	0.40-0.60		
1.0	to subrounded fine to medium of limestone. Firm grey brown mottled light grey and orange bro sandy slightly gravelly CLAY with a low to medium content. Sand is fine to medium. Gravel is subang subrounded fine to coarse of limestone. Cobbles a subangular to subrounded of limestone.		lium cobble bangular to					AN4639	В	1.00-1.10		
2.0	subrounded fine to	own mottled yellow brown s m cobble content. Gravel is coarse of limestone. Cobbl punded of limestone.	sandy gravelly s angular to les are	אי לאי לאי אי אי אי דער אין אי לאי לאי אי אי אי אי אי אי אין אי אין אי אין אין	1.75	26.95	(Seepage)	AN4640	В	1.80-2.00		
	cobble content. Gra	k grey black gravelly CLAY vel is subangular to subrou . Cobbles are subrounded	unded fine to		2.50	26.20						
3.0					3.30	25.40		AN4641	в	3.20-3.30		
4.0	End of Trial Pit at 3.	30m										
	indwater Conditions age at 1.50m	5										
Stab Good												
Gene Pit te	eral Remarks rminated on stiff clay											



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CON	TRACT Greater Dublin Drainage Scheme						TRIAL P	it no.	TP1 Shee	0 t 1 of 1	
.0G(GED BY JL		CO-ORDINATES 319,539.77 E 254,231.54 N GROUND LEVEL (m) 22.23				DATE STARTED 07/03/2013 DATE COMPLETED 07/03/2013				
CLIEI Engi	NT Fingal County Council	GROUND LEV					EXCAVA METHO		Hitac	hi Zaxis	80SB
								Samples		a)	meter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer
0.0	TOPSOIL: Soft brown slightly sandy CLAY. S medium.	and is fine to	<u>112</u> <u>112</u> <u>12</u> <u>112</u> <u>112</u>		0/ 70						
	Soft to firm brown and yellow brown sandy gr Sand is fine to medium. Gravel is angular to s to medium of limestone.	subrounded fine		0.45	21.78 21.43		AA0211	В	0.50-0.60		
1.0	Firm to stiff grey brown occasionally mottled y slightly sandy gravelly CLAY with a medium of and a low boulder content. Gravel is angular t fine to coarse of limestone. Cobbles and boul subangular to subrounded of limestone (up to	obble content o subrounded ders are					AA0212	LB	1.10-1.20		
2.0	Very stiff to hard dark greyish brown slightly s CLAY with a low to medium cobble content. S medium. Gravel is subangular to subrounded of limestone. Cobbles are subrounded of lime	Sand is fine to fine to coarse	, 여, 여, 여, 여, 여, 0. , 여, 여, 여, 10, 0.	1.80	20.43		AA0213	В	2.00-2.10		
-	End of Trial Pit at 2.60m			2.60	19.63						
4.0											
Grou Dry	Indwater Conditions										
Stabi											
Good											
	eral Remarks rminated on very stiff clay										

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.OGG							SHEET		Snee	t 1 of 1	
	GED BY JL	CO-ORDINATES 319,468.49 E 253,986.28 N				DATE STARTED 07/03/2013 DATE COMPLETED 07/03/2013					
	NT Fingal County Council NEER	GROUND LEVEL (m) 19.40 EXCAVATION METHOD					Hitac	Hitachi Zaxis 80SB			
								Samples		a)	meter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft light brown CLAY			0.50	18.90						
	gravelly CLAY. Sand is fine to medium.				18.45		AA0214	В	0.60-0.70		
1.0	Firm to stiff grey brown occasionally mottled y slightly sandy gravelly CLAY with a low to me content. Sand is fine to medium. Gravel is sul subrounded fine to coarse of limestone. Cobb subrounded of limestone.	dium cobble bangular to	· - 너히 ' 다니 다' 얍 - 너희 ' 더히 ' 너희 '				AA0215	В	1.20-1.30		
2.0	Stiff dark grey to dark greyish brown sandy gr SILT/CLAY with a medium cobble content. Sa medium. Gravel is subangular to subrounded predominantly fine to medium of limestone. C subangular to subrounded of limestone.	and is fine to fine to	0, 1, 0, 1,	1.80	17.60		AA0216	LB	2.00-2.10		
3.0	End of Trial Pit at 2.70m			2.70	16.70						
4.0											
Frour Dry	ndwater Conditions										
itabi l Good											
	ral Remarks minated on stiff clay										

E		RIAL PIT I	RECO	RD					REPORT NU	jmber 695	
	isl/										
CON	TRACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.	TP1		
CO-ORDINATES 324,569.01 E							- SHEET	TARTE	Sheet 1 of 1 23/01/2013		
LOG	GED BY JL			242,30)3.17 N		DATE C			/2013	
CLIE ENGI	NT Fingal County Council NEER	GROUND LEV	VEL (m)	2.47		I	EXCAVA METHO		Kubo	bota KX080-3a	
								Sample	s	Pa)	ometer
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown to grey brown sandy SII occasional rootlets. Sand is fine to medium.	LT with	/× ····	0.05	2.42						
	(Moderately Compact) Grey mottled orange br to medium SAND with rare rootlets (Moderately Compact) Brown to grey brown fir	own silty fine	× · · · · · · · · · · · · · · · · · · ·	0.40	2.07		AN4605	В	0.30-0.40		
	slightly silty SAND		·× · · · · · · · · · · · · · · · · · ·				AN4606	В	0.70-0.90		
1.0	(Moderately Compact) Grey slightly silty media SAND with occasional shell fragments	im to coarse	× · · · · · · · · · · · · · · · · · · ·	1.00	1.47						
			× · · · · · · · · · · · · · · · · · · ·				AN4607	В	1.40-1.50		
2.0 - -	End of Trial Pit at 2.30m		× · · · · · · · · · · · · · · · · · · ·	2.30	0.17	(Seepage)					
- - -											
3.0											
4.0											
- - -											
	ndwater Conditions age at 2.30m										
Stab Very	ility poor stability with sidewall collapse from 0.40m	- 1.40m									
Gene Pit te	eral Remarks rminated due to sidewall instability										

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	ISL								166	695	
CON	TRACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.	TP1:	3 t 1 of 1	
LOG	GED BY JL	CO-ORDINAT	ES		53.63 E 82.46 N		DATE S		D 07/03	2013 2013	
CLIE ENGI	NT Fingal County Council	GROUND LEV	/EL (m)	21.72			EXCAVA METHO		Hitachi Zaxis		80SB
		1						Sample	iS	a)	neter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown sandy CLAY with freque	ent rootlets.	<u></u>	0.05	21.67						-
	Soft to firm light grey brown sandy gravelly CL rootlet. Sand is fine to medium. Gravel is suba subrounded fine to medium of limestone.	AY with rare angular to					AA0206	В	0.40-0.50		
1.0	Firm grey to grey brown occasionally mottled or gravelly CLAY. Sand is fine to medium. Grave to suborunded fine to coarse of limestone.	orange sandy I is subangular		0.90	20.82		AA0207	В	1.10-1.20		
2.0	Soft to firm brown mottled orange, yellow and sandy slightly gravelly SILT. Sand is fine to me	light grey blue edium.	ו×××	2.20	19.97		AA0208	В	1.80-2.00		
	Uncompact dark grey brown sandy gravelly SI occasional lense of soft silt. Sand is fine to me	LT/CLAY with edium.		2.20	18.92	(Seepage)	AA0209	В	2.60-2.70		
- 3.0	Stiff to very stiff dark greyish brown slightly sau SILT/CLAY. Sand is fine to medium. Gravel is subrounded fine to medium of limestone.	ndy gravelly subangular to		1	10.52		AA0210	В	2.80-3.00		
	End of Trial Pit at 3.20m		-x	3.20	18.52						
4.0											
- - -											
	Indwater Conditions t seepage at 2.40m										
Stab Poor	ility from 1.40m. Sidewall collapse from ground leve	el upon completio	on of dig.								
	eral Remarks rminated on stiff to very stiff clay										



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	IRACT Greater Dublin Drainage Scheme	CO-ORDINATE		306 70	03 54 E		TRIAL P			t 1 of 1	
LOG	GED BY JL	CO-ORDINATE	CO-ORDINATES 326,723.54 E 257,816.99 N GROUND LEVEL (m) 43.52				DATE STARTED 07/03/2013 DATE COMPLETED 07/03/2013				
CLIEI ENGI	NT Fingal County Council NEER	GROUND LEV					EXCAVATION Hitachi Zaxis 808				
							Samples		(e		meter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer
0.0	TOPSOIL: Soft grey brown slightly sandy CL to medium. Firm brown to orange brown slightly sandy sli CLAY with a low to medium cobble content. S medium. Gravel is subangular to subrounded of limestone. Cobbles are subangular to subro limestone.	ghtly gravelly Sand is fine to fine to coarse		0.35	43.17		AA0221	В	0.40-0.60		
1.0	Compact orange brown silty/clayey gravelly S high cobble and medium boulder content. Sa coarse. Gravel is angular to subrounded fine limestone. Cobbles and boulders are angular of limestone (up to 350mm)	nd is fine to to coarse of		1.10	42.42		AA0222	LB	1.20-1.30		
2.0					10.50						
3.0	Stiff brown sandy gravelly SILT/CLAY with a content. Sand is fine to coarse. Gravel is ang subrounded fine to coarse of limestone. Cobb to subrounded of limestone. End of Trial Pit at 3.10m	ular to		3.00 3.10	40.52 40.42		AA0223	В	3.00-3.10		
4.0											
Grou Dry	ndwater Conditions										
Jiy											
Stab i Good											
Cono	ral Remarks										

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CON	TRACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.	TP1 Shee	5 t 1 of 1	
LOGGED BY JL		CO-ORDINAT	DINATES 327,133.32 E 257,851.41 N				TARTED OMPLET				
CLIE ENG	NT Fingal County Council	GROUND LEV	/EL (m)	16.85			EXCAVA METHO	ATION		hi Zaxis	80SB
								Samples	5	(ac	meter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 - - - - - - - - - - - - - - - - - -	TOPSOIL: Soft to firm brown sandy CLAY with Sand is fine to medium. Soft to firm brown sandy gravelly CLAY. Sand medium. Gravel is subangular to subrounded of limestone.	l is fine to		0.25	16.60		AA0224	В	0.40-0.65		
- - - - - - - - -							AA0225	В	1.20-1.30		
- - - - - -	Firm brown sandy gravelly CLAY with a mediu boulder content. Sand is fine to coarse. Grave to subrounded fine to coarse of limestone. Co boulders are subangular to subrounded of lime 400mm)	l is subangular bbles and		2.10	14.75		AA0226	В	2.50-2.70		
3.0 	Stiff brown sandy gravelly SILT/CLAY with a r content. Sand is fine to medium. Gravel is sub subrounded fine to medium of limestone. Cob subrounded of limestone.	pangular to		3.00 3.30	13.85 13.55		AA0227	В	3.10-3.20		
- - - - - - - - - - - - -	End of Trial Pit at 3.30m										
Grou Dry	Indwater Conditions										
Stab Good											
	eral Remarks rminated on stiff clay and coarse material										

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	T JSL	RIAL PIT	RECO	RD					166	695	
CON	TRACT Greater Dublin Drainage Scheme						TRIAL P	IT NO.	TP1		
LOG	GED BY JL	CO-ORDINAT	ES	323,89	9.84 E 3.17 N		BHEET	TARTED	23/01	t 1 of 1 /2013	
CLIENT Fingal County Council		GROUND LEVEL (m)		6.75			DATE COMPLET		TED 23/01/2013 Kubota KX080		0-3a
	NEER						METHO	D			
								Samples	s)a)	meter
	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft to firm brown sandy slightly grant sand is fine to coarse. Gravel is subangular to fine to medium of limestone.	avelly CLAY. subrounded	$\frac{\underline{x} \ \underline{h}_{y} \cdot \underline{x} \ \underline{h}_{y}}{\underline{h}_{y} \cdot \underline{x} \ \underline{h}_{y}} \cdot \underline{x}$	0.30	6.45	1					
	Firm to stiff brown slightly sandy gravelly CLA medium cobble content. Sand is fine to mediu subangular to subrounded fine to coarse of lim Cobbles are subrounded of limestone.	Y with a m. Gravel is nestone.		0.00	0.40	(Seepage)	AN4608	В	0.50-0.60		
- 1.0	Stiff to very stiff dark grey black slightly sandy SILT/CLAY with a medium cobble content. Sa	gravelly		1.30	5.45						
2.0	medium. Gravel is subangular to subrounded of limestone. Cobbles are subangular to subro limestone.	fine to coarse					AN4609	В	1.50-1.60		
· · · · · ·	Very stiff dark grey black slightly sandy gravel	ly CLAY with a		2.50	4.25						
3.0	low to medium cobble content. Sand is fine to Gravel is subangular to subrounded fine to coa limestone. Cobbles are subrounded of limesto	arse of					AN4610	В	2.80-3.10		
-	End of Trial Pit at 3.40m			3.40	3.35						
4.0											
- -											
	ndwater Conditions slight seepage at 0.40m						<u> </u>				<u> </u>
Stab Good											
	ral Remarks rminated on very stiff clay										
	· ·										



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CON	TRACT	Greater Dublin Drainage Scheme			_				T NO.	TP1		
LOG	GED BY	JL		CO-ORDINATES 319,183.21 E 254,082.59 N				DATE ST				
CLIENT Fingal County Council ENGINEER		GROUND LE	GROUND LEVEL (m) 21.24								litachi Zaxis 80SE	
								Sample		3	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer
0.0		IL: Soft brown slightly sandy CLAY Sand is fine to medium.	with frequent	<u>17</u> . <u>17</u> . <u>17</u> . <u>17</u> . <u>117</u> . <u>1</u>								
	Soft occ silty CLA medium	asionally firm yellow brown and grey AY with frequent roots and rootlets.	y slightly sandy Sand is fine to		0.30	20.94		AA0217	В	0.40-0.60		
1.0	sandy sl	y brown occasionally mottled yellow ightly gravelly CLAY. Sand is fine to ar to subrounded fine to medium of I	medium. Gravel		0.90	20.34		AA0218	В	1.00-1.20		
2.0	a low to Gravel is	casionally stiff brown sandy gravelly medium cobble content. Sand is fine s subangular to subrounded fine to c e. Cobbles are subrounded of limes	e to medium. coarse of		1.55	19.69	(Seepage)	AA0219	LB	1.90-2.00		
	medium subangu	f dark grey brown sandy gravelly SII cobble content. Sand is fine to med lar to subrounded fine to coarse of are subrounded of limestone.	lium. Gravel is		2.30	18.94		AA0220	В	2.35-2.40		
3.0	350mm)	Occasional subrounded boulder of l	limestone (up to		3.00	18.24						
4.0												
	t seepage	Conditions from 1.90m										
Good												
	eral Rema rminated o	irks on very stiff clay										




TP01 - 2 of 2







<u>TP02 - 2 of 2</u>







<u>TP03 - 2 of 2</u>







<u>TP04 - 2 of 2</u>



<u>TP05 - 1 of 2</u>



<u>TP05 - 2 of 2</u>







<u>TP06 - 2 of 2</u>



<u>TP07 - 1 of 2</u>



TP07 - 2 of 2







TP08 - 2 of 2







TP09 - 2 of 2







<u>TP10 - 2 of 2</u>







<u>TP11 - 2 of 2</u>



IGSL Ltd





<u>TP12 - 2 of 2</u>



<u>TP13 - 1 of 2</u>



<u>TP13 - 2 of 2</u>







<u>TP14 - 2 of 2</u>







<u>TP15 - 2 of 2</u>







<u>TP16 - 2 of 2</u>







<u>TP17 - 2 of 2</u>



Appendix 2

Cable Percussion Borehole Records



REPORT NUMBER

со	NTRAC	CT Gre	eater D	Dublin [Drainage S	Scheme								BOREH	IOLE	NO.	BH01	
со	-ORDIN	ATES			2.72 E		RIG TYPI					Dando 20	00 H	SHEET	`OMI		Sheet 1 of 2 CED 04/02/2013	
GR	OUND	LEVEL (r			1.02 N 44.43			DLE DIAM		•	,	200 14.80		DATE				
	ENT GINEEF		gal Co	ounty C	Council			MER REI RATIO (%) .		SPT6 55		BORED PROCE		D BY	WC JL	
								- (-	1		~			nples				
Depth (m)				Desc	ription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	()	Recovery	Field Test Results	Standpipe Details
- 0	Firm	dark grey	brown	sandy	gravelly S	BILT/CLAY						AN3091	в	1.00-1.4	45		N = 10 (2, 2, 2, 2, 3, 3)	
2	Firm	brown slig	phtly sa	andy sl	ightly grav	elly CLAY			42.4	43	2.00	AN3092	В	2.00-2.4	45		N = 12 (3, 3, 2, 3, 4, 3)	
- 3	Stiff b low to	lack sligh medium	tly san cobble	ndy slig e and b	htly grave ooulder cor	lly CLAY wi ntent	ith a		41.0	63	2.80	 AN3093	в	3.00-3.4	45		N = 21 (3, 4, 4, 5, 5, 7)	
4												AN3094	в	4.00-4.4	45		N = 41 (6, 7, 9, 11, 11, 10)	
5												AN3095	в	5.00-5.4	45		N = 50/220 mm (16, 9, 14, 17, 19)	
- 6									37.	13	7.30	AN3096	в	6.50-6.9	95		N = 32 (4, 7, 7, 9, 7, 9)	
- 8	Sand to me	is coarse dium of li	e. Grav mesto	el is su ne.	Ibangular	sandy GRA to subround	ded fine		-	73	8.70	AN3097	в	8.00-8.4	45		N = 20 (3, 4, 4, 5, 5, 6)	
9						avelly CLA 1 boulder co						AN3098	в	9.50-9.9	95		N = 42 (5, 8, 9, 11, 12, 10)	
HA	ARD ST	RATA BO		1	ELLING			Wate)r	Cas	ina	Sealed	Ris		Time	WA	TER STRIKE DET	AILS
	m (m)	To (m)	Time (h)		omments			Strike	e	Dep	oth	At	То	(min)	Co	omments	
5 12	4.6 5.1 2.55 4.4	4.7 5.4 12.75 14.8	0.75 0.75 0.75 1.5	5				7.30)	7.3	80	8.70	2.4	0	20		Rapid	
											1-1-					GRO	UNDWATER PRO	GRESS
					D7 Door	T		Dat		D	Hole epth	Casing Depth		pth to ater		nment		
	Date	Tip Dep		<u>∠ 10</u> p	RZ Base	Тур		05-02-	-13		7.30	7.30		0.00	Start	of Shift	τ	
REI	MARK	5									D - Small B - Bulk D LB - Larg	le Legence Disturbed (tub) Disturbed e Bulk Disturbed ironmental Sam	ł	/ial + Tub)		Sample P - Undis	disturbed 100mm Diameter sturbed Piston Sample er Sample	

E	
\IGSL	/

REPORT NUMBER

1	66	95
		-

~															
co	NTRAC	T Grea	ter Dublin	Drainage S	Scheme							BOREHO SHEET	DLE NO	. BH01 Sheet 2 of 2	
	-ordin Ound I	ATES _EVEL (m	319,17 241,88 AOD)		E		e)le diami)le dept		mm)	Dando 20 200 14.80		DATE CO		ICED 04/02/2013	
	ent Gineer		al County (Council			MER REI RATIO (%			SPT6 55		BORED		WC Y JL	
											San	nples	_		۵.
Depth (m)			Desc	cription			Legend	Flevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
- 10 - 11	Stiff to a med (contir	ium cobble	lack slight and a low	ly sandy gr to mediun	ravelly CLA n boulder co	Y with ntent	9.401.401.401.43			AN3099	В	10.50-10.9	95	N = 47 (9, 10, 10, 11, 12, 14)	
12										AN3100	В	12.00-12.4	15	N = 50/285 mm (8, 10, 12, 12, 14, 12)	
- 14								20.02	14.00	AN3101	В	13.50-13.9	95	N = 48 (14, 10, 12, 9, 13, 14)	
Ē	End of	Borehole	at 14.80 m	1			<u> </u>	29.63	14.80	5					
16															
			Time				Wate	r C	asing	Sealed	Ris	e Ti	ime		ails
		10 (m)	(h) C	omments			Strike		lepth	At	Tc		nin)	Comments	
4 5 12 14	.6 .1 .55 4.4	5.4	0.75 0.75 0.75 1.5												CRESS
	TALLA								Hole	Casing	De	pth to		OUNDWATER PRO	GRESS
	Date	TION DET	AILS	RZ Base	Туре)	Dat	e	Depth	Depth	Ň	Vater	Comme	nus	
	MARKS								Sam	Iple Legend	b				
4 5 12 14 INS									LB - La	ple Legent all Disturbed (tub) Disturbed rge Bulk Disturbe nvironmental Sam	d	Vial + Tub)	UT - U Samp P - Ur W - W	Jndisturbed 100mm Diameter ele ndisturbed Piston Sample /ater Sample	



REPORT NUMBER

col	NTRAC	CT Gr	eate	r Dublin	Drainage \$	Scheme								BORE		NO.	BH02	
		IATES LEVEL (m A	241,96	3.52 E 60.54 N 41.55			e Dle Diam Dle Dept			n) 2	Dando 20 200 12.00	00	SHEET DATE (DATE (COMN		Sheet 1 of 2 CED 31/01/2013 ED 04/02/2013	
CLI	ENT	Fir		County (MMER REI				SPT6		BORE	ЭBY		WC	
ENG	GINEEF	2					ENERGY	RATIO (%	(6)		Ę	55		PROCE	ESSED) BY	JL	
Depth (m)				Des	cription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth		Recovery	Field Test Results	Standpipe Details
- 0	Firm o grave	dark brov lly CLAY	vn m	nottled gr	ey brown s	slightly sanc	ły					AN3082	в	1.00-1.			N = 14 (3, 4, 4, 3, 4, 3)	01
2												AN3083	в	2.00-2.	45		N = 17 (2, 3, 2, 4, 5, 6)	
- 3	Stiff b	lack sligh e and a le	ntly s ow to	andy gra o mediur	avelly CLA n boulder o	Y with a me content	edium		38.5	5	3.00	- AN3084	в	3.00-3.	45		N = 24 (3, 4, 6, 6, 7, 5)	
- 4	Very : mediu	stiff black um cobble	c slig e an	htly sand d a low t	dy gravelly o medium	CLAY with boulder con	a itent		37.5	5	4.00	AN3085	в	4.00-4.	45		N = 41 (6, 7, 8, 10, 11, 12)	
- 5												AN3086	В	5.00-5.	45		N = 50/245 mm (10, 9, 11, 14, 16, 9)	
- 6												AN3087	в	6.50-6.	95		N = 49 (5, 9, 11, 11, 13, 14)	
8												AN3088	в	8.00-8.	45		N = 50/225 mm (14, 9, 13, 16, 19, 2)	
- 9					ntly sandy g d boulder o	gravelly CL/ content	AY with		32.5	5	9.00	 AN3089	В	9.50-9.	95		N = 50/125 mm (18, 7, 26, 24)	
HA		RATA B	-		ELLING			10/-1-		<u></u>		0			T :	WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)	(<u>n)</u>	omments			Wate Strike		Casi Dep	0	Sealed At	Rise To		Time (min)	C	omments	
8 9	.7 6 .1 .6 1.7	3.9 6.2 8.4 9.9 12	0	1).5 1 .75 1												1	No water strike	
										L	lole	Casing		oth to			UNDWATER PRO	GRESS
	TALLA Date	Tip De		ILS RZ Top	RZ Base	Тур	e	Dat	e		epth	Casing Depth	W	pth to ater	Com	men	ts	
	MARKS										Samp	le Legend	1				dishurbad 100mm Disasataa	
											B - Bulk D LB - Large	Disturbed (tub) isturbed Bulk Disturbed ronmental Sam	i ple (Jar + \	/ial + Tub)	1	Sample P - Undi	disturbed 100mm Diameter sturbed Piston Sample er Sample	

E)
lgsl	

REPORT NUMBER

1	66	39	95

<u> </u>																		
co	NTRAC	T Gre	eater Dubl	n Drai	inage S	Scheme								Boreho Sheet	OLE N	0.	BH02 Sheet 2 of 2	
	-ordin Ound I	ATES _EVEL (n	241,	143.52 960.54 41				PE OLE DIAM OLE DEP1			m) 2	Dando 20 200 12.00		DATE C			ED31/01/2013ED04/02/2013	
	IENT GINEER		gal Count	Cour	ncil			MMER RE Y RATIO ('		0.		SPT6 55		BORED		BY	WC JL	
													San	nples				
Depth (m)			De	escripti	ion			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Racovary	i recover y	Field Test Results	Standpipe Details
10 11 12 13 14 15 16 17 18 19	Very s a low f		9 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	55	12.00	AN3090	В	11.00-11.4	15		N = 50/220 mm (12, 12, 16, 18, 16)							
H	ARD ST	RATA BO	ORING/CH	ISFU	ING				L						,	wΔ	TER STRIKE DET	
		To (m)	Time	Comn				Wate		Cas		Sealed	Ris		ime	1	omments	
1	8.7 6 8.1 9.6 1.7	3.9 6.2 8.4 9.9 12	(h) 1 0.5 1 0.75 1		-			Strik	<u>e</u>	De	pm	At	<u> </u>	<u>(</u> n	nin)	N	No water strike	GRESS
ING								Da			Hole	Casing	De	pth to ater	Comm			5.1200
	Date		oth RZ To	p RZ	ZBase	Ту	/pe				Depth	Depth		/ater				
3 8 9 1 ⁻ INS REI	MARKS									<u> </u>	B - Bulk D	e Legeno Disturbed (tub) isturbed Bulk Disturbed ronmental Sam		√ial + Tub)	Sa P -	mple Undis	tisturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

	NTRAC				Drainage S							D 1 07		BOREH SHEET			BH03 Sheet 1 of 1	
	-ordin Ound	IATES LEVEL (n	:	319,43: 241,814 D)				e Dle Diam Dle Dept			n) 2	Dando 20 200 10.00		DATE C			CED 06/02/2013 ED 06/02/2013	
	ENT		gal C	ounty C	Council			MER RE				SPT6		BORED			WC	
ENG	SINEER	2					ENERGY	ratio (%	%) 	_	Ę	55		PROCE	SSED	BY	JL	
Depth (m)				Desc	ription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth		Recovery	Field Test Results	Standpipe
0	TOPS	OIL: Soft	dark	brown	sandy grav	elly CLAY	,	<u>x 1, x 1, x</u>	42.1	2	0.40							
1	Firm li	ight browr	n san	dy grav	elly SILT/C	CLAY			40.9		1.60	AN3836	В	1.00-1.4	15		N = 13 (2, 2, 3, 4, 3, 3)	
2	Firm b with a	becoming low to me	stiff b edium	olack sli n cobble	ghtly sand and bould	y gravelly der content	CLAY t			-	1.00	AN3837	В	2.00-2.4	15		N = 9 (2, 2, 2, 2, 2, 3)	
3												AN3838	В	3.00-3.4	45		N = 21 (3, 4, 4, 5, 5, 7)	
4									+			AN3839	в	4.00-4.4	15		N = 20 (2, 4, 4, 5, 5, 6)	
5									36.7	2	5.80	AN3840	В	5.00-5.4	15		N = 27 (4, 5, 6, 7, 7, 7)	
6	coarse mediu Stiff b	e. Gravel im of lime ecoming with a lov	is sub stone very s	bangula e. stiff blac	ar to subrou	AVEL. San unded fine sandy grav d low bouk	to elly		36.4	2	6.10	 AN3841	в	6.50-6.5	95		N = 29 (3, 6, 6, 7, 7, 9)	
8												AN3842	В	8.00-8.4	15		N = 36 (10, 12, 9, 8, 9, 10)	
9									32.5	2	10.00	AN3843	В	9.50-9.9	95		N = 42 (8, 12, 11, 12, 10, 9)	
		RATABO	Tim	ne l				Wate	ər (Casi	ina	Sealed	Ris	- -	Fime		TER STRIKE DET	AILS
		To (m)	(h))	omments			Strik	e	Dep	oth	At	То	(min)	Co	omments	
7	.8 7 .5 .2	5.9 7.2 7.9 9.3	0.5 0.7 1 1	5				5.80	J	5.8	U		5.3	ſ	20		Slow	
								_		L	lole	Casing		oth to			UNDWATER PRO	GRES
	TALLA Date	TION DE			RZ Base	Тур	e	Dat	te		epth	Casing Depth	W	pth to ater	Comr	ment	S	
				·														
REN	MARKS	Borehol	e terr	minated	at require	d depth					D - Small B - Bulk D LB - Large	le Legence Disturbed (tub) isturbed Bulk Disturbed ronmental Sam	I		S	Sample ^o - Undis	disturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

10	NTRAC	Grea	ater Dublir	Drainage S									Boreh Sheet	ULE N	J.	BH04 Sheet 1 of 7	I
	-ordin Ound L	ATES _EVEL (m	242,1	15.89 E 18.38 N 39.44	E		e Le diam Le dept		(mm)	Dand 200 10.00		00				07/02/2013 07/02/2013	
	ENT	0	al County	Council			IMER REI			SPT6	3		BORED			WC	
NG	SINEER				E	ENERGY	RATIO (%	6)	_	55			PROCE	SSED E	3Y	JL	
			De	scription			Legend		Depth (m)	Zef	Number	Sample Type	Depth Depth (m)	Recoverv	F	ield Test Results	
		ht brown : content	sandy CL	AY with a lo	w to mediun	n -		38.84	-								
	Firm to with a	o stiff dark low to me	brown slij dium cobb	ghtly sandy ble content	gravelly CL/	AY -		37.64		AN	3844	В	1.00-1.4	15	(1	N = 8 , 2, 2, 2, 2, 2, 2)	
-	Stiff bla cobble	ack slightly content a	y sandy g nd a low t	avelly CLA o medium b	Y with a mea oulder conte	dium - ent -		37.04	. 1.0		3845	в	2.00-2.4	15	(2	N = 10 2, 3, 3, 2, 3, 2)	0
						-		- - -		AN	3846	в	3.00-3.4	15	(3	N = 20 8, 4, 4, 5, 5, 6)	0 0 0
						-				AN	3847	в	4.00-4.4	15	(3	N = 22 8, 4, 5, 5, 6, 6)	0
						-		- - - - -		AN:	3848	В	5.00-5.4	15	(4	N = 30 I, 6, 7, 7, 8, 8)	0 0 0
						- - - - - - - - - - - 				AN	3849	В	6.50-6.9	95	(5	N = 28 5, 6, 6, 7, 7, 8)	0 0 0
						- - - - - - - - - - - - - - - - - - -				AN	3850	В	8.00-8.4	15	(6	N = 29 5, 7, 7, 7, 7, 8)	• • • • • • • • • • • • • • • • • • •
								29.44	10.0		3851	В	9.50-9.9			N = 31 7, 7, 6, 8, 8, 9)	
		RATIA BO	Time				Wate	r C	asing	Seale	ed	Rise	e 1	۱ Time		STRIKE DE	TAI
		To (m)	(h)	Comments			Strike		Depth	At		То		min)	Comm	ents	
6 7	.7 6 .5 9	4.9 6.2 7.75 9.35	0.75 0.75 1 0.75													ater strike	
							_		Holo		eina		oth to			WATER PR	OGF
		TION DET	_				Dat	e	Hole Depth		sing pth	W	pth to ater	Comm	ents		
	Date -02-13	Tip Dept 8.00	h RZ Top 2.00	8.00	Type 50mm												
ĒN	MARKS	Borehole installed.	terminate	ed at require	d depth. 50r	mm diam	eter stand	lpipe	I B - Bi	mple Le mall Disturbe ulk Disturbed arge Bulk D Environmen	1			Sar P -	nple	d 100mm Diameter Piston Sample	



REPORT NUMBER

COI	NTRAC	Gre Gre	eater [Dublin [Drainage S								BOREH SHEET		0.	BH05 Sheet 1 of 2	
		IATES LEVEL (r	2	317,60 253,85 D)				e Dle Diami Dle Dept		(mm)	Dando 20 200 13.20		DATE C DATE C			D 13/02/2013 13/02/2013	
	ENT		gal Co	ounty C	Council			IMER REF			SPT6	I	BORED			WC	
ENC	SINEEF	2					ENERGY	(% RATIO	6)		55		PROCE	SSED	BY	JL	
Depth (m)				Desc	ription			Legend		Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery		Field Test Results	Standpipe Details
0	Soft b	becoming	firm li	ght bro	wn sandy g	gravelly CL	AY				AN3715	в	1.00-1.4	45		N = 5 (2, 1, 1, 2, 1, 1)	
2											AN3716	в	2.00-2.4	45		N = 3 (0, 1, 1, 0, 1, 1)	
- 3	Mediu subro	um dense unded fin	grey e to c	brown s oarse C	sandy suba SRAVEL	angular to			22.58	3 2.90) AN3717	в	3.00-3.4	45		N = 14 (1, 2, 2, 3, 4, 5)	
4	Stiff c		ly ver	y stiff d	ark brown	sandy grav	velly		21.48	3 4.00) AN3718	в	4.00-4.4	45		N = 49 (3, 6, 8, 11, 14, 16)	
- 5									- - - -		AN3719	В	5.00-5.4	45		N = 25 (4, 6, 6, 5, 7, 7)	
- 6									• • • •		AN3720	В	6.50-6.9	95		N = 30 (6, 6, 7, 7, 8, 8)	
8									16.88	8 8.60	AN3721	В	8.00-8.4	45		N = 23 (5, 6, 7, 7, 5, 4)	
9	Grave limes Stiff d	el is subar tone.	ngular	to sub	rounded fir	idy GRAVE ne to coarso with a med	e of		16.28	3 9.20) AN3722	в	9.50-9.9	95		N = 35 (6, 7, 8, 8, 9, 10)	
НА	RD ST	RATA BO	ORING	G/CHIS	ELLING			<u>, </u>							WAT	ER STRIKE DET	AILS
Fron	n (m)	To (m)	Tim (h)		omments			Wate Strike		Casing Depth	Sealed At	Ris To		Time min)	Con	nments	
10 11	.8).6 1.7 2.9	8.9 10.8 11.9 13.2	0.7 0.7 0.5 1.2	5 5 5				2.90 8.60		2.90 8.60	4.00	1.6 7.1	0	20 20	Mo	Slow oderate	
								_		Holo	Casina		oth to			NDWATER PRO	GRESS
					R7 Base	Turn	0	Date	e	Hole Depth	Casing Depth	Ne Ne	pth to /ater	Comm	ents		
	Date	Tip Dep		<u>z iop</u>	RZ Base	Тур	e	-									
REN	MARK	3							1	D - Sm B - Bul LB - La	all Disturbed (tub) k Disturbed (tub) rge Bulk Disturbe nvironmental San	d	Vial + Tub)	Sa P -	mple	urbed 100mm Diameter rbed Piston Sample Sample	



REPORT NUMBER

19	<u> </u>														
со	NTRAC	T Grea	ater Dublin	Drainage S								BOREHC SHEET	DLE NO	. BH05 Sheet 2 of 2	
	-ordin Ound I	ATES LEVEL (m		1.67 E 4.56 N 25.48	В		'e Dle diam Dle dept		nm) 2	Dando 20 200 13.20		DATE CO DATE CO		ICED13/02/2013TED13/02/2013	
	ENT		al County (Council			MMER RE			SPT6		BORED B		WC	
ENG	GINEER				E	NERGY	(RATIO (%	%) 	5	55		PROCES	SED B	Y JL	
(m)			Dee	cription			g	ion	(L)	er			ery	 Field Test	pipe s
Depth (m)			Desi	onpuon			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Results	Standpipe Details
- 10	Stiff da	ark brown	sandy grav	elly CLAY	with a mediu	ım	<u>o</u>	\$							
	CODDIE		continueu)					- -							
- 11	Stiff to	very stiff	ight brown	sandy grav	velly silty CL	AY		14.58	10.90	AN3723	в	11.00-11.4	5	N = 34 (4, 6, 7, 7, 8, 12)	
	with a	medium c	obble and	boulder cor	ntent									(4, 0, 7, 7, 0, 12)	
								I							
12								1							
								I		AN3724	в	12.50-12.9	5	N = 50/225 mm (8, 11, 12, 10, 19, 9)	
- 13							×	40.00	40.00						
- 13	End o	f Borehole	at 13.20 m	1				12.28	13.20	-					
14															
- 15															
-															
- 16															
17															
- 40															
18															
- - 19															
-															
-															
			Time				Wate	er Ca	asing	Sealed	Ris	e Ti	me	ATER STRIKE DET	AILS
	m (m) 3.8	To (m) 8.9	(h) C	omments			Strik		epth	At	Tc		nin)	Comments	
10	0.6	10.8	0.75												
	1.7 2.9	11.9 13.2	0.5 1.25												
									Hole	Casing		nth to		OUNDWATER PRO	GRESS
	Date	TION DET	AILS	RZ Base	Туре		Dat	e	Depth	Depth	N	pth to /ater	Comme	nts	
				112 0056	туре										
RE	MARKS	 ;							Sampl	e Legeno	4				
									D - Small I B - Bulk D LB - Large	e Legend Disturbed (tub) isturbed Bulk Disturber ronmental Sam	d		Samp P - Ur	ndisturbed Piston Sample	
L									Env - Envi	ronmental Sarr	nple (Jar + '	Vial + Tub)	W - W	/ater Sample	



REPORT NUMBER

COI	NTRAC	T Grea	ater Dubli	n Drainag	ae So	cheme								BOREH	IOLE I	NO.	BH06	
				620.73 E	-		RIG TYP	F			r	Dando 20		SHEET			Sheet 1 of 2	
	-ordin Ound	LEVEL (m	254,	276.17 N 276.17 N 29.51	l	E	BOREHO	DLE DIAMI		•	n) 2	200 3.70		DATE (DATE (ED14/02/2013ED15/02/2013	
	ENT	0	al Count	/ Council				MMER REF				SPT6		BORED			WC	
ENG	GINEEF	2				E	ENERG	(RATIO (%	6)	_	5	5		PROCE	SSED	BY	JL	
Depth (m)			De	escription				Legend		Elevation	Depth (m)	Ref. Number	Sample Type	·		Recovery	Field Test Results	Standpipe Details
- 0	Soft to	o firm light	arey brow	vn sandy	grav	elly CLAY				-						LL.		
- 1		C			U	brown sar			27.8	1	1.70	AN3725	В	1.00-1.4	45		N = 9 (1, 2, 2, 2, 2, 3)	
- 2		lly CLAY w					luy					AN3726	в	2.00-2.4	45		N = 11 (2, 3, 3, 2, 3, 3)	
- 3									; ; ;			AN3727	В	3.00-3.4	45		N = 15 (2, 3, 3, 4, 4, 4)	
- 4												AN3728	В	4.00-4.4	45		N = 24 (4, 5, 6, 6, 7, 5)	
- 5	Dons			somo dar	rk bro	own clayey	sand		23.7	'1	5.80	AN3729	В	5.00-5.4	45		N = 24 (6, 6, 5, 5, 7, 7)	
- 6	Dense					Jwn Gayey	Sallu					AN3730	В	6.50-6.5	95		N = 30 (4, 5, 7, 7, 8, 8)	
- 8						CLAY with a ulder conter			21.3	1	8.20	AN3731	В	8.00-8.4	45		N = 50/190 mm (11, 14, 16, 19, 15)	
- 9		stiff dark bi im boulder		dy gravel	lly CL	AY with a			20.2	1	9.30	AN3732	в	9.50-9.9	95		N = 50/225 mm (9, 11, 14, 16, 18, 2)	
HA		RATA BO	1	ISELLIN	G											WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)	Time (h)	Commen	nts			Wate Strike		Casi Dep	U 1	Sealed At	Rise To		Time (<u>min)</u>	Co	omments	
7 1	7 6 8 10 3.5	2.9 6.2 7.9 10.25 13.7	0.5 1 0.5 0.75 1					5.80		5.8	0	6.50	5.80		20		Seepage	
											lole	Casing	De	oth to				GRESS
	TALLA Date	TION DE	T AILS	p RZ Ba	ase	Туре	9	Date	e		epth	Depth	Ŵ	pth to ater	Com	ment	[S	
RE	MARKS	6									D - Small D B - Bulk Di LB - Large	e Legence Disturbed (tub) sturbed Bulk Disturbed onmental Sam	ł	/ial + Tub)	S	Sample - Undis	disturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

со	NTRAC	T Gre	ater Dublin	Drainage S	cheme						BOREHC	DLE NO.	BH06	
co	-ORDIN	IATES	317,62			TYPE			Dando 20	1 00			Sheet 2 of 2	
GR	OUND	LEVEL (m		6.17 N 29.51		ehole diami Ehole dept			200 13.70		DATE CO			
	ENT SINEER		al County (Council		HAMMER REI RGY RATIO (%			SPT6 55		BORED B		WC Y JL	
						()	-,				nples	_	-	
Depth (m)						Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
11	very s mediu	suff dark b Im boulde	rown sandy r content (c	gravelly Cl	AY with a	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			AN3733	в	11.00-11.4	5	N = 49 (6, 8, 11, 12, 12, 14)	
12									AN3734	в	12.50-12.9	5	N = 50/225 mm (10, 11, 13, 16, 18, 3)	
-	End o	f Borehole	e at 13.70 m	1			15.81	13.70	_					
14														
-														
- 15														
-														
- 16 -														
- 17														
- 1/														
- 18														
- 19														
-														
HA	RD ST	RATA BO	RING/CHIS	ELLING									ATER STRIKE DET	AILS
Fror	n (m)	To (m)	Time (h) C	omments		Wate Strike		sing epth	Sealed At	Ris To		me nin) (Comments	
7 1	.7 6 .8 10 3.5	2.9 6.2 7.9 10.25 13.7	0.5 1 0.5 0.75 1											
								Hole	Casing		oth to			GRESS
	TALLA Date	TION DE	TAILS	RZ Base	Туре	Dat		Depth	Depth	M	oth to Vater	Commer	าเร	
REI	MARKS	 ;						Samp	le Legenc Disturbed (tub)	ł				
								B - Bulk L LB - Larg	Disturbed (tub) Disturbed e Bulk Disturbed rironmental Sam	d	Vial + Tub)	Sampl P - Un	Indisturbed 100mm Diameter le disturbed Piston Sample ater Sample	



REPORT NUMBER

	\checkmark																	
col	NTRAC	CT Gre	ater D	ublin [Drainage	Scheme							:	Bore l Sheet		10.	BH07 Sheet 1 of 2	
	ORDIN OUND	IATES LEVEL (n	2	54,28	9.60 E 3.62 N 21.61			'e Dle Diam Dle Dept		•	n) 2	0ando 20 200 0.60		DATE (CED07/03/2013ED08/03/2013	
	ENT		gal Cou	unty C	ouncil			MMER RE				SPT6		BORED			WC	
ENC	SINEER	2					ENERG	(RATIO (%)		5	5		PROCE	ESSED	BY	JL	
ĥ										_	Ê			nples		_	-	e
Depth (m)				Desc	ription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth		Recovery	Field Test Results	Standpipe Details
0	Soft to	o firm light	browr	n sanc	y gravelly	CLAY		<u> </u>	2									
- 1	Firm	prown slig	htly sa	ndy sl	ightly gra	velly CLAY			20.3	1	1.30	AN8543	в	1.00-1.	45		N = 10 (3, 4, 4, 2, 2, 2)	
2								· · · · · · · · · · · · · · · · · · ·	- - - - -			AN8544	В	2.00-2.	45		N = 14 (3, 3, 3, 4, 4, 3)	
- 3 -	Firm I with a	pecoming I low to me	stiff bla edium	ack sli cobble	ghtly san	dy gravelly	CLAY		18.5	1	3.10	_ AN8545	в	3.00-3.	45		N = 15 (3, 4, 4, 4, 3, 4)	
4												AN8546	в	4.00-4.	45		N = 25 (5, 5, 6, 6, 6, 7)	
- 5												AN8547	в	5.00-5.	45		N = 28 (3, 6, 6, 8, 7, 7)	
- 6												AN8548	в	6.50-6.	95		N = 36 (4, 6, 7, 9, 9, 11)	
- 8												AN8549	в	8.00-8.	45		N = 50/285 mm (6, 8, 11, 13, 14, 12)	
9		o very stiff i medium				andy grave	lly CLAY		12.7	1	8.90	AN8550	в	9.50-9.	95		N = 46 (7, 7, 10, 11, 10, 15)	
HA		RATA BO			ELLING										T :	WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)	Time (h)	Co	omments			Wate Strik		Casi Dep	0	Sealed At	Rise To		Time (min)	Co	omments	
7 8	85 .2 .9).4	2.95 7.4 9.1 10.6	0.5 0.75 0.75 1													٢	No water strike	
																GRO	UNDWATER PRO	GRESS
INS	TALLA	TION DE						Dat	te		lole epth	Casing Depth	De W	pth to ater	Comr	nent	ts	
	Date	Tip Dep	th RZ	Тор	RZ Base	Ту	pe	_										
RE	MARKS	\$				1					D - Small E B - Bulk Dis LB - Large	e Legeno Disturbed (tub) sturbed Bulk Disturbed ronmental Sam	ł	/ial + Tub)	S	ample	disturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

1	<u> </u>													
со	NTRAC	T Gre	ater Dublin	Drainage S							BOREH SHEET	IOLE NO.	BH07 Sheet 2 of 2	
	-ordin Ound I	ATES LEVEL (n	254,28	49.60 E 33.62 N 21.61		pe Iole Diam Iole Dept		nm) 2	Dando 20 200 10.60			COMMEN	CED 07/03/2013 TED 08/03/2013	
	ENT		gal County	Council		MMER RE			SPT6		BORED		WC	
EN	GINEER				ENERG	iy ratio ('	%) I	5	55			SSED BY	/ JL	
Depth (m)				cription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth Depth	Recovery	Field Test Results	Standpipe Details
- 10	Stiff to with a	very stiff medium	dark brown cobble cont	n slightly sa ent <i>(continu</i>	ndy gravelly CLAY <i>ued)</i>		11.01	10.60						
-	End o	f Borehole	e at 10.60 r	n			11.01	10.00	1					
- 11														
- 12														
- 13														
- 14														
- 15														
- 16														
17														
-														
- 18														
- 19														
- HA	ARD ST	RATA BC	RING/CHI	SELLING								w	ATER STRIKE DET	AILS
Fror	m (m)	To (m)	Time (h)	comments		Wate Strik		asing s epth	Sealed At	Rise To		Time min) C	Comments	
7 8	.85 7.2 8.9 0.4	2.95 7.4 9.1 10.6	0.5 0.75 0.75 1										No water strike	
								Holo	Casina		oth to	GR	OUNDWATER PRO	GRESS
	TALLA Date	TION DE	TAILS th RZ Top	RZ Base	Туре	Da	te	Hole Depth	Casing Depth	W	oth to ater	Commer	nts	
2. 7 8 10 INS	MARKS	 ;						Samp	le Legenc Disturbed (tub) isturbed	1			ndisturbed 100mm Diameter	
								I LB - Large	isturbed Bulk Disturbed ronmental Sam	1	/ial + Tub)	Sample P - Une		



REPORT NUMBER

00	NTRAC	GI GI	eale	מטטע ה	Drainage S									Boreh Sheet			BH08 Sheet 1 of 2	
		NATES LEVEL (m A	254,09	2.60 E 8.24 N 19.96		RIG TYPE BOREHO BOREHO	LE DIAM		•	n) 1	Dando 20 200 12.60		DATE C DATE C			CED05/03/2013ED06/03/2013	
	ENT SINEEF		ngal	County (Council		SPT HAM).		SPT6 55		BORED PROCE		BY	WC JL	
		· · · · · · · · · · · · · · · · · · ·					LILICOT							nples				
Depth (m)				Des	cription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)		Recovery	Field Test Results	Standpipe Details
0	Soft b		l firm	n dark bro	own sandy	gravelly sil	ty -	X0										
1	CLA	r					-	X	-			AN8525	в	1.00-1.4	5		N = 9 (2, 2, 2, 3, 2, 2)	
2							-	× - - - - - - - - - - - - - - - - - - -				AN8526	в	2.00-2.4	.5		N = 14 (2, 3, 3, 3, 4, 4)	
3	Stiff b	black sligh le content	ntly s t	sandy gra	avelly CLA	Y with a me	edium -		16.7	76	3.20	AN8527	в	3.00-3.4	.5		N = 25 (4, 4, 5, 6, 7, 7)	
4							-		2 			AN8528	В	4.00-4.4	.5		N = 25 (3, 5, 5, 6, 6, 8)	
- 5							-		5			AN8529	В	5.00-5.4	.5		N = 28 (5, 5, 7, 7, 6, 8)	
7	01:15	1-11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1					-		12.7	76	7.20	AN8530	В	6.50-6.9	15		N = 27 (4, 6, 6, 7, 6, 8)	
8	medii Dens	um cobbl e BOULD y subang	e co DER	ntent S with so		LAY with a rown clayey to coarse	-		12.1	16	7.80	AN8531	в	8.00-8.4	.5		N = 50/190 mm (12, 13, 16, 18, 16)	
9									10.1	16	9.80	AN8532	в	9.50-9.9	15		N = 36 (4, 7, 8, 8, 9, 11)	
HA		FRATA B			ELLING				a			1				WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)		ime (h) C	omments			Wate Strike		Casi Dep		Sealed At	Ris To		Time min)	Co	omments	
7 8 9	.8 .2 .8 .8 2.4	3.9 7.9 8.6 10 12.6	0).5).5 1 .75 1				7.80		7.8		10.50	7.00		20		Slow	
											ole	Casing	Dr	oth to			UNDWATER PRO	GRESS
	TALLA Date	ATION DI		ILS RZ Top	RZ Base	Тур	De	Dat	te		ole epth	Casing Depth	W	pth to ater	Comn	nent	S	
	MARK										Sama		4					
	*124174174										D - Small B - Bulk E LB - Laro	le Legence Disturbed (tub) Disturbed e Bulk Disturbed rironmental Sam	ł	/ial + Tub)	Sa	ample - Undis	disturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

1	669	5
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1															
со	NTRAC	T Grea		Drainage S	Scheme							BOREH SHEET	ole no.	BH08 Sheet 2 of 2	_
	-ordin Ound I	ATES LEVEL (m	254,09	2.60 E 8.24 N 19.96	BC		e Dle Diami Dle Dept	•	nm) 2	Dando 20 200 2.60			OMMEN OMPLE	CED05/03/2013TED06/03/2013	
	ENT GINEER	•	al County (Council	-		MMER REF (RATIO (%			SPT6			BY SSED BY	WC / JL	
											San	nples			۵
Depth (m)			Des	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
- 10				unded fine	to coarse		0000								
- 11	Stiff bl	/EL <i>(contir</i> ack slightl m cobble	y sandy gra	avelly CLA [\]	Y with a low to		에 다 아 아 아 아 여 ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	9.56	10.40	AN8533	В	11.00-11.	45	N = 37 (7, 9, 8, 8, 10, 11)	
- 13	GRAV	/EL Ű	ar to subro at 12.60 n	unded fine	to coarse	/		7.46	12.50 12.60	J AN8534	в	12.50-12.	95	N = 50/75 mm (22, 3, 46, 4)	
14			RING/CHIS											ATER STRIKE DET	AILS
		To (m)	Time C	omments			Wate			Sealed	Rise		ime (Comments	
3 7 8 9	3.8 7.8 3.2 9.8 2.4	3.9 7.9 8.6 10 12.6	(h) 0.5 0.5 1 0.75 1				Strike 12.60		epth 2.60	At	<u>To</u> 11.0		20	Moderate OUNDWATER PRO	GRESS
INS			AILS				Date	e	Hole	Casing	De	pth to	Commer		2.1200
	Date		h RZ Top	RZ Base	Туре			-	Depth	Depth		later	5 671110		
3 7 8 9 12 INS REI	MARKS	6			<u> </u>			1	LB - Large	e Legence Disturbed (tub) sturbed Bulk Disturbed ronmental Sam	1	√ial + Tub)	Sampl P - Un	Indisturbed 100mm Diameter e disturbed Piston Sample ater Sample	



REPORT NUMBER

CO	NTRAC	T Great	ter Dublir	Draina	ige S	Scheme								BOREH SHEET	OLEN	10.	BH09 Sheet 1 of 2	
	ordin Ound I	ATES LEVEL (m	254,3	67.32 E 56.57 N 22.90	١			e Dle Diam Dle Dept			m) :	Dando 20 200 11.70		DATE C DATE C			CED06/03/2013ED07/03/2013	
	ENT SINEER	•	al County	Counci	I			MMER RE (RATIO (⁴) .		SPT6 55		BORED		BY	WC JL	
									/0/					nples	UULD			
Depth (m)			Des	scriptior	ı			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)		Recovery	Field Test Results	Standpipe Details
- 0		o firm light b			-		1 - 1		- - - - -	66	1.30	AN8534	в	1.00-1.4	15		N = 10 (2, 2, 2, 2, 3, 3)	
- 2	gravel	ly CLAY	and dark	brown	siigni	tly sandy sl	ignuy		- - - - - - -	26	2.70	AN8535	В	2.00-2.4	15		N = 20 (3, 4, 4, 5, 5, 6)	
- 3	Stiff bl low to	ack slightly medium co	sandy sl bble con	ightly g tent	ravel	lly CLAY wi	ith a		- - -	20	2.10	AN8536	в	3.00-3.4	15		N = 26 (4, 6, 6, 7, 7, 6)	
- 4												AN8537	в	4.00-4.4	15		N = 22 (3, 4, 5, 5, 6, 6)	
- 5												AN8538	В	5.00-5.4	15		N = 23 (3, 4, 5, 5, 6, 7)	
- 7	Stiff da mediu	ark brown s m cobble c	andy gra	velly Cl	LAY	with a low t	0		- - - - - -	16	6.80	AN8539	В	6.50-6.9	95		N = 35 (6, 7, 7, 8, 11, 9)	
- 8												AN8540	в	8.00-8.4	45		N = 24 (4, 5, 5, 6, 6, 7)	
- 9	mediu Mediu	m cobble c	ontent Ity sandy	subang	gular	CLAY with a to subroun o medium.			13. 13. 13.	56	9.00 9.40 9.60	AN8541	В	9.50-9.9	95		N = 41 (6, 7, 8, 10, 12, 11)	
HA		RATA BOF	-	SELLIN	IG					_		<u> </u>				WA	TER STRIKE DET	AILS
Fron	n (m) [·]	To (m)	Time (h)	Comme	nts			Wate Strik		Cas Dep		Sealed At	Rise To		Гіте min)	Co	omments	
9.	6 9 75 1.4		0.5 0.75 0.75 1.5					9.40		9.4		10.00	8.60		20		Slow	
												Cooinc		oth tr			UNDWATER PRO	GRESS
	TALLA Date	TION DET		RZB	lase	Тур	e	Da	te		Hole Nepth	Casing Depth	W	pth to ater	Comr	nent	S	
RE	MARKS										D - Small B - Bulk D	le Legence Disturbed (tub) Disturbed e Bulk Disturbed			S	ample	disturbed 100mm Diameter	

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lgsl

REPORT NUMBER

1	66	39	95

7	كوم														
со	NTRAC	T Grea		Drainage S								BOREHO SHEET	LE NO.	BH09 Sheet 2 of 2	
	-ordin Ound L	ATES _EVEL (m	319,36 254,35 AOD)		E		e Dle Diam Dle Dept		nm) 2	Dando 20 200 11.70		DATE CO DATE CO		CED 06/03/2013	
1	IENT GINEER	•	al County (Council			MMER RE 7 RATIO (9			SPT6 55		BORED E		WC JL	
											San	nples			
Depth (m)			Desc	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
- 10	a low t	tiff black sl o medium	cobble cor	ntent <i>(conti</i>	jravelly CLA inued)	Y with		11.26	11.70	AN8542	в	11.00-11.45	5	N = 50/255 mm (9, 11, 11, 12, 16, 11)	
12															
16															
ŧ															
E															
HA	ARD STI	RATA BOF		ELLING			10/-+-		noina	Coolor ¹	Die.			ATER STRIKE DET	AILS
1	m (m) -	To (m)	Time (h) C	omments			Wate Strik		asing epth	Sealed At	Ris To		ne in) C	Comments	
9.	6 9 .75 1.4		0.5 0.75 0.75 1.5											DUNDWATER PRO	GRESS
INS							Dat	te	Hole	Casing	De	pth to /ater C	Commer		
1143	Date		RZ Top	RZ Base	Туре	9			Depth	Depth	N	/ater			
REI	MARKS								D - Small B - Bulk D LB - Large Env - Env	le Legend Disturbed (tub) Disturbed e Bulk Disturbed ironmental Sam	d hple (Jar + 1	Vial + Tub)	Sample P - Uno	ndisturbed 100mm Diameter a Jisturbed Piston Sample ter Sample	



REPORT NUMBER

со	NTRAC	T Grea	ter Dublin	Drainage S	cheme							BOREH	OLE NO		
	-ordin Ound	IATES LEVEL (m	257,57	56.52 E 79.62 N 41.73	B		e Dle Diam Dle Dept			Dando 20 200 7.20	000	SHEET DATE C DATE C		Sheet 1 of NCED 18/02/2013 ETED 18/02/2013	5
CLI	ENT	Finga	al County		s	PT HAN	MER RE	F. NO.		SPT6		BORED		WC	
ENG	GINEER				E	NERGY	ratio (୨	%) 		55		PROCES	SSED E	BY JL	
Depth (m)			Des	cription			Legend	Flevation	Depth (m)	Ref. Number	Sample Type		Recovery	Field Test Results	Standpipe Details
- 1	Soft lin mediu	ght brown s im cobble c	sandy grav	relly CLAY v	with a low to					AN3735 AN3736	В	2.00-2.4	5	N = 7 (1, 1, 2, 2, 2, 1) N = 8 (1, 2, 2, 1, 2, 3)	
- 3		ark brown			<i>i</i> ith a mediur			<u>39.13</u> 38.53		AN3737	в	3.00-3.4	5	N = 26 (3, 4, 6, 6, 7, 7)	
4		e content	andy grav	OLAY W	nin a mediur	n				AN3738	В	4.00-4.4	5	N = 32 (5, 6, 7, 7, 8, 10)	
- 5										AN3739	В	5.00-5.4	5	N = 50/285 mm (7, 9, 11, 12, 14, 13	3)
6				ome grey gr				<u>35.43</u> 35.03		AN3740	в	6.50-6.9	5	N = 50/105 mm (21, 4, 36, 14)	
- 7	mediu	stiff dark br im boulder f Borehole	content	<i>r</i> gravelly C	LAY with a		<u>a</u> D ⁰ .	34.53	7.20	-					
9															
HA	ARD ST	RATA BO	RING/CHI	SELLING				I					v		TAILS
Fror	m (m)	To (m)	Time (h) C	omments			Wate Strike		asing Depth	Sealed At	Ris To		ïme nin)	Comments	
6	.75 5.4 7	4.85 6.6 7.2	0.5 0.75 1.5											No water strike	
									11-1				G	ROUNDWATER PR	OGRESS
	TALLA Date	TION DET	AILS	RZ Base	Туре	· · · · · · · · · · · · · · · · · · ·	Dat	e	Hole Depth	Casing Depth	De W	pth to /ater	Comme	ents	
	MARKS								Sam	ble Legend	L L				
									D - Sma B - Bulk LB - Lar	Il Disturbed (tub) Disturbed ge Bulk Disturbe vironmental San	d	Vial + Tub)	Sam P-U	Undisturbed 100mm Diameter nple Jndisturbed Piston Sample Water Sample	



REPORT NUMBER

1																		
CONTRACT Greater Dublin Drainage Scheme												:	BOREHOLE NO. BH11 - SHEET Sheet 1 of 1					
							E Dando 2000 DLE DIAMETER (mm) 200 DLE DEPTH (m) 4.80						DATE COMMENCED 19/02/2013 DATE COMPLETED 19/02/2013					
o j							MMER REF. NO.			5	SPT6 I		BORED BY			WC		
ENGINEER ENERG							Y RATIO (%)			5	5		PROCESSED BY			JL		
Ê									ç	Ê			nples	>	<u>,</u>		be	
Depth (m)			D	escriptio	า		end		Elevation	Depth (m)	. Inbei	e e	ţ	over	Fie	eld Test Results	idpr	
Dep							Legend	i	E	Dep	Ref. Number	Sample Type	(m)	Recoverv			Standpipe Details	
- 0	Soft d	ark brown	sandy g	avelly C	LAY		<u></u>	7						+				
-							<u> </u>											
-							<u> </u>	28.0	2	0.90								
1	Soft to	o firm light	 Υ		5			AM2742	в	1.00-1.45	5	(1,	N = 7 2, 2, 2, 2, 1)					
-							<u> </u>	2										
- 2											AM2743	в	2.00-2.45	5	(2.	N = 8 2, 2, 2, 2, 2, 2)		
																,		
							· <u> </u>	26.1	2	2.80								
3		o firm light ly SILT/CL		nd grey :	slightly sa	andy slightly					AM2744	в	3.00-3.45	5	(2	N = 2 1, 0, 0, 1, 1)		
-	3	. ,													(2,	1, 0, 0, 1, 1)		
4	Dense	Dense brown clayey/silty very sandy GRAVEL with a low						24.9	2	4.00	AM2745	в	4.00-4.45	5		= 50/180 mm 12, 16, 19, 15)		
-	to med	dium cobbl	e conter	nt				1							(13,	12, 10, 13, 13)		
							8 X G: X 0 X	24.1	2	4.80								
- 5	End o	End of Borehole at 4.80 m																
-																		
Ē																		
- 6																		
-																		
- 7																		
-																		
- 8																		
-																		
- 9																		
-																		
		To (m)	Time	Comme				Casin	sing Sealed		Rise		ime	Comme	STRIKE DET	AILS		
	.4	4.8	(h) 1.5				Strik	e	Depth		At	To	(n	nin)				
		1.0	1.0												No wa	ter strike		
															GROUNDWATER PROGRESS			
INS	TALLA	TION DET	Date		Ho De		Casing Depth	De	pth to ater	Comm	ents							
Date		Tip Dept	h RZ To	p RZ E	Base	Туре	\neg											
REI	MARKS	5								Sampl	e Legend Disturbed (tub) sturbed	ł		UT ·	- Undisturbed	100mm Diameter		
									B - Bulk Disturbed LB - Large Bulk Disturbed Env - Environmental Sample (Jar + Vial +					Sample P - Undisturbed Piston Sample + Tub) W - Water Sample				


REPORT NUMBER

1																		
	NTRAC		ater Dubli		-	cheme							:	BOREH(SHEET	OLE NO	0.	BH12 Sheet 1 of 1	
	ordin	IATES LEVEL (m	257,9)94.71 945.22 15.4	Ν			'e Dle diam Dle dept			n) 2	Dando 20 200 I.70		DATE C DATE C			ED 21/02/2013 D 21/02/2013	
	IENT GINEER		al County	/ Cound	cil			MMER RE				SPT6 55		BORED PROCES		RY	WC JL	
							LINEIKOI		/oj			, <u>,</u> ,		nples			<u> </u>	
Depth (m)			De	escriptic	on			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recoverv	6.5.555	Field Test Results	Standpipe Details
0	Soft b CLAY	ecoming fi with a me	rm light r	eddish ble cor	brown	sandy gr	avelly			ш		AN3748	В	1.00-1.4	5	-	N = 8 (1, 2, 2, 2, 2, 2) N = 10 (2, 2, 2, 3, 3, 2)	0
3	Firm b with a	prown sligh low to me	ntly sandy dium cob	slightly ble con	y grave	elly SILT/	CLAY		12.4	5	3.00	- AN3750	В	3.00-3.4	5		N = 14 (2, 3, 3, 4, 3, 4)	
4		f Borehole							10.7	5	4.70	AN3751	в	4.00-4.4	5		N = 50/225 mm (7, 8, 11, 14, 16, 9)	
- 5 - 6 - 7 - 8 - 9 - H	ARD STI	RATA BO		ISELLI			Wate									TER STRIKE DET.	AILS	
Fro	m (m)	To (m)	Time (h)	Comm	ents			Wate Strike		Casi Dep	U 1	Sealed At	Rise To		ime nin)	Co	mments	
4	4.3	4.7				-								lo water strike				
									,			-	_		G	ROI	UNDWATER PRO	GRESS
INS	STALLA Date	TION DE	T AILS	p RZ	Base	Ту	pe	Dat	e		lole epth	Casing Depth	De W	oth to ater	Comm	ents	5	
INS	MARKS	 ;									D - Small I B - Bulk D	e Legenc Disturbed (tub) isturbed Bulk Disturbec ronmental Sam		/ial + Tub)	Sar P -	nple Undist	isturbed 100mm Diameter turbed Piston Sample r Sample	



REPORT NUMBER

col	NTRAC	T Gre	eate	r Dublin	Draina	age S	cheme								BOREH	IOLE	NO.	BH13	
CO	-ORDIN	ATES		323,82	2.42	E		RIG TYP	E				Dando 20	00 H	SHEET			Sheet 1 of 2	
		LEVEL (r	n A	241,67		N		BOREHC	DLE DIAM		•	m) :	200 13.00		DATE (CED 30/01/2013 ED 31/01/2013	
	ENT		igal	County (Counc	il					0.		SPT6		BORED			wc	
ENC	GINEER							ENERGY	ratio (%	%) 			55		PROCE	SSEL	JBA	JL	
Depth (m)				Desc	criptio	n			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth		Recovery	Field Test Results	Standpipe Details
1	Soft to CLAY	o firm dar ´with a lo	k br w to	own sligi medium	nlty sa 1 cobb	andy : ble co	slightly grav	velly					AN3072 AN3073	В	1.00-1.			N = 8 (1, 2, 2, 3, 1, 2) $N = 9$ (2, 2, 2, 3, 2, 2)	
3	Firm t mediu	o stiff bla ım cobble	ck s e and	slightly sa d a low to	indy g o mec	jravel lium t	ly CLAY w boulder con	ith a itent		6.		2.70	AN3074	в	3.00-3.	45		N = 22 (3, 4, 4, 5, 6, 7)	
4	Stiff b cobble	/ with a me ontent	edium		5.2	21	4.00	AN3075	В	4.00-4. 5.00-5.			N = 32 (6, 7, 7, 8, 8, 9)						
-6										2.3	71	6.50						(4, 6, 6, 8, 10, 9) N = 50/265 mm	
7	Very S a meo	Stiff to ha dium cobb	rd b ble a	lack sligh and a low	ntly sa to m	andy g edium	gravelly CL boulder ca	AY with ontent					AN3077	В	6.50-6.	95		(7, 8, 11, 12, 14, 13)	
8				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				AN3078	В	8.00-8.	45		N = 50/95 mm (25, 36, 14)						
									AN3079	В	9.50-9.	95		N = 50/225 mm (9, 11, 14, 17, 17, 2)					
HA	RD ST	RATA BO			ELLI	NG			10/04-		0	ina	Socied 1	Die		Time	WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)	(<u>n)</u>	omme	ents			Wate Strike		Cas De		Sealed At	Rise To		Time (min)	Co	omments	
7	4 7.9 9 2.7	4.2 8.3 9.2 13	0	.75 1 .75 2													١	No water strike	
														-			GRO	UNDWATER PRO	GRESS
					ידם	Poss	Τ		Dat	e	_	Hole Depth	Casing Depth	De W	oth to ater	Com	ment	ts	
	Date		pth	RZ Top	RZ	base	Тур	e	-										
RE	MARKS	5										D - Small B - Bulk D LB - Larg	le Legence Disturbed (tub) Disturbed e Bulk Disturbed ironmental Sam	I	/ial + Tub)		Sample P - Undi:	disturbed 100mm Diameter isturbed Piston Sample ter Sample	

E
lgsl

REPORT NUMBER

16695

7	GDL															
	NTRAC			Drainage S									Boreho Sheet	DLE NO	BH13 Sheet 2 of 2	
	-ordin Ound I	ATES _EVEL (m	241,6	22.42 E 78.81 N 9.21		EHC	e)le diami)le dept	•	mm) 2	ando 20 00 3.00		DATE CO DATE CO			
1	ENT GINEER		al County	Council			MER REI RATIO (%			S 5	PT6 5		BORED I PROCES		WC Y JL	
												San	nples			6
Depth (m)			Des	scription			Legend	Flevation		Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
- 10 - 11 - 11 - 12	Very S a med <i>(contir</i>	ium cobbl	d black slig le and a lov	htly sandy (v to medium	gravelly CLAY wi	ith t	\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	-3.79		13.00	AN3080 AN3081	В	11.00-11.4		N = 50/225 mm (7, 9, 11, 12, 19, 8) N = 50/210 mm (12, 13, 16, 18, 16)	
- 13 - 14 - 15 - 16 - 17 - 18 - 19	End of	^F Borehole	e at 13.00 r	n												
HA	ARD STI	RATA BO	RING/CHI	SELLING				L			I	I	I	w		AILS
Fror	m (m) ⁻	To (m)	Time (h)	Comments			Wate Strike		asin)eptł	U 1	Sealed At	Ris To		me nin)	Comments	
7	4 7.9 9 2.7	4.2 8.3 9.2 13	0.75 1 0.75 2							/				No water strike	GRESS	
							Det		Нс	ble	Casing	De	pth to			UNE 33
	Date	TION DE		RZ Base	Туре		Dat		De		Depth	W	pth to vater	Comme	1115	
REI	MARKS								E	D - Small D B - Bulk Dis LB - Large	e Legence isturbed (tub) sturbed Bulk Disturbed onmental Sam	ł	/ial + Tub)	Same	Undisturbed 100mm Diameter le ndisturbed Piston Sample Vater Sample	



REPORT NUMBER

	NTRAC)rainage S							<u> </u>		BOREH SHEET		0.	BH14 Sheet 1 of 2	
	-ordin Ound	IATES LEVEL (24		7.66 E 8.42 N 2.77	BC		.e diam .e dept		•	m)	Dando 20 200 10.50		DATE C DATE C			23/01/2013 24/01/2013	
	ENT GINEER		ngal Cou	unty C	ouncil			MER RE RATIO (') .		SPT6 55		BORED		ev	WC CB	
									/0)			<u> </u>		nples			00	
Depth (m)				Desci	ription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recoverv	6.0000	Field Test Results	Standpipe Details
0	Loose	, dark br	own SA	ND.			İ	• . • . • . •								-		
- 1	Loose	e to medi) with sh	um den ell mate	se ligh rial.	t brown si	Ity slightly grav		о 	1.5	57	1.20	AN3061	в	1.00-1.4	5		N = 7 (1, 1, 2, 2, 1, 2)	
- 2								(× (× (× (×	0.2	27	2.50	AN3062	в	2.00-2.4	5		N = 10 (2, 2, 2, 2, 3, 3)	
- 3	Mediu mater		e light bi	own s	lightly silty	/ SAND with s	hell ×					AN3063	в	3.00-3.4	5		N = 15 (2, 2, 3, 3, 4, 5)	
- 4			×					AN3064	в	4.00-4.4	5		N = 14 (2, 2, 3, 3, 4, 4)					
- 5	Stiff da	ark grey	×	× · · × • · · × • × · × • × · × • × · ×	-2.	33	5.10	AN3065	в	5.00-5.4	5		N = 16 (1, 3, 3, 4, 4, 5)					
6							* * * * * * *	· · · · · · · · · · · · · · · · · · ·	-4.2	23	7.00	AN3066	в	6.50-6.9	5		N = 15 (3, 4, 4, 3, 4, 4)	
- 7	Mediu mater Soft to	im dense ial. o firm da	e grey si rk browi	lty sar n to da	irk grey sli	EL with shell	⁄Ĭ		-4.	53	7.30 7.60						N 40	
- 8	slightly	y gravell	y SILΤ ν	vith sh	ell materia	al	×××	°× ^ ×° × ° × °× × ×				AN3067	В	8.00-8.4	5		N = 13 (2, 2, 3, 3, 4, 3)	
-		× × × ×	× • × • × • × • × • × • × • ×	-7. ⁻	13	9.90	AN3068	в	9.50-9.9	5		N = 9 (2, 2, 2, 2, 3, 2)						
HA	ARD ST	RATA B		CHISE	ELLING			۱۸/	or	Car	inc	Socia-	05	<u> </u>		NAT	ER STRIKE DET	AILS
Fror	m (m)	To (m)	Time (h)	Co	mments			Wate Strik		Cas Dep		Sealed At	Ris To		ïme min)	Con	nments	
1	7.3 10 1.7		2.20 9.20		2.2 9.2	20	7.30	1.90 4.30	о 🗋	20 20		Slow Slow						
															G	ROU	NDWATER PRO	GRESS
INS	TALLA	TION DI	ETAILS					Da	te		Hole Depth	Casing Depth	De	pth to /ater	Comm	ents		
	Date	Tip De	pth RZ	Тор	RZ Base	Туре		-			ерит							
REI	MARKS	ground	l level -	sand b	eginning	10.50m depth to collapse. Or ned, and borel	n Health	& Safet		I	D - Small B - Bulk I LB - Larg	Disturbed (tub) Disturbed Disturbed Pe Bulk Disturbed vironmental Sam	ł	/ial + Tub)	Sar P -	mple	turbed 100mm Diameter rbed Piston Sample Sample	



REPORT NUMBER

1	669	5
	0000	-

1														
со	NTRAC	T Gre	eater Dublir	n Drainage S	Scheme						BOREHO SHEET	DLE NO	. BH14 Sheet 2 of 2	
	-ordin Ound I	ATES LEVEL (r	242,2	57.66 E 68.42 N 2.77		'PE Hole Diam Hole Dept		nm) 2	Dando 20 200 10.50		DATE CO DATE CO		ICED23/01/2013TED24/01/2013	
	ENT		igal County	Council	SPT H	AMMER RE	F. NO.		SPT6		BORED		WC	
ENG	GINEER				ENERG	SY RATIO (9	%) 	5	55		PROCES	SED B	Y CB	
(m) r				scription		p	tion	(L)	Der		nples	'ery	 Field Test	pipe s
Depth (m)				Scription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Results	Standpipe Details
10	Stiff da	ark grey :	sandy SILT	(continued,)	× ·× · × ·× × × ·× ×	-7.73	10.50						
- 11	Pit ten End o	minated (f Boreho	due to unst le at 10.50	able ground m	conditions.									
- 13														
- 15														
16														
- 18														
19														
HA	ARD ST	RATA B	ORING/CH	SELLING			I	I		I	I		ATER STRIKE DET	AILS
Fror	m (m)	To (m)	Time (h)	Comments		Wate Strik		asing 3 epth	Sealed At	Rise To		ime nin)	Comments	
1	7.3 10 1.7	7.5 10.1 12	0.75 0.5 0.75											
								1141-	0	-		GR	OUNDWATER PRO	GRESS
	TALLA Date	TION DE	ETAILS) RZ Base	Туре	24-01		Hole Depth 10.50	Casing Depth 10.50	W		Commei End of Bor		
REI	MARKS	ground	level - sand	d beginning	10.50m depth with to collapse. On He ned, and borehole	ealth & Safet	e at y	D - Small I B - Bulk D LB - Large	Le Legend Disturbed (tub) isturbed Bulk Disturbed ronmental Sam	ł	√ial + Tub)	Samp P - Un	Jndisturbed 100mm Diameter le ndisturbed Piston Sample ater Sample	



REPORT NUMBER

CO	NTRA	CT Gr	eater Dub	olin Di	rainage \$	Scheme							BOREH	HOLE N	NO.	BH14A	
co-	ORDI	NATES			.67 E		RIG TYP				Dando 20	000 F				Sheet 1 of 2 24/01/2013	
GRO	OUND	LEVEL (.67 N 2.78			OLE DIAM		mm)	200 13.70		DATE				
	ENT SINEE		ngal Cour	ty Co	ouncil			MMER RE (RATIO (%			SPT6 55		BORED		BY	WC CB	
										_			nples				0
Depth (m)			C)escri	ption			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth		Recovery	Field Test Results	Standpipe Details
0	Loos	e dark bro	own SANI	D.													
1		e to medi material.	um dense	light	brown s	ilty SAND	with		1.58	1.20	_						
3		ium dense material	e light bro	wn sil	ty SAND	with occa	asional		0.28	2.50							
4		- 4.60m - ILDER	Rare sub	angu	lar to sul	prounded		× · · × × · · × × · · × × · · × × · · ×	-2.32	5.10							
6	Stiff	dark grey	sandy Sl	_T wi	th shell r	naterial.		× · × · × × · × · × × · × · × × · × · × × · × ·									
7	Firm	grey san		ith oh	all moto	rial		× . × . ×. × × · × ·	-4.22	7.00	_						
		ium dense	-				hell		-4.52 -4.82								
8	mate Soft	erial. to firm da	rk brown :	sandy	/ SILT w	ith shell m	aterial.		4.02	1.00							
_	.PD S	TRATA B		HISE				× · · × · × × · · × · × × · · × · × × · · × · ×	-7.12	9.90	_				wa	TER STRIKE DET	AII S
	n (m)	To (m)	Time		nments			Wate	-	asing	Sealed	Ris		Time		omments	AILS
4 12 13	(h) (c) (c) 4.4 4.6 1.5 12.9 13 0.5 3.4 13.5 0.75 3.6 13.7 1							<u>Strik</u> 2.20 9.20)	Depth	At	<u> </u>		<u>(min)</u>			
										Hole	Casing		nth to			UNDWATER PRO	GRES
	TALL Date	Tip De	ETAILS	on	RZ Base	Т\	/pe	Dat	te	Depth	Depth	W	pth to /ater	Comr	ment	S	
l	Date					(1 	ibe										
REN	MARK	silts. C comple	asing red eted in 15	uced 0mm	to 150m casing.	m diamete Obstructio	er at 9.50n	fficult in sa n. Borehole ered at 13.	Э.	D - Sma B - Bulk LB - Lar	Il Disturbed (tub) Disturbed ge Bulk Disturbe vironmental San	d	Vial + Tub)	S	Sample ? - Undis	tisturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

			n atau Dul I	in Duality	2 ala an							BOREHO			
	NTRA			in Drainage S			-			Dend- 00		SHEET		D. BH14A Sheet 2 of 2	
		NATES	242,	661.67 E 270.67 N 2.78			e Dle Diam Dle Dept	•	nm) 2	Dando 20 200 13.70		DATE CO DATE CO		NCED24/01/2013ETED24/01/2013	
	ENT GINEE		ngal Count	y Council			MMER RE (RATIO (%			SPT6 55		BORED E		WC SY CB	
									_		San	nples			0
Depth (m)			D	escription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
10	Stiff	grey sand	ly SILT wit	h shell mater	ial. (continu	ıed)	× ·× · ·× ·×								
11							× ·× ·× × ·× ·× × ·× ·× × ·× ·× × ·× ·× × ·× ·× × ·× ·×			AN3069	В	10.50-10.9	5	N = 27 (5, 5, 6, 6, 7, 8)	
12	Very	stiff dark	brown san	dy gravelly C	CLAY		× ×	-8.92	11.70	AN3070	в	12.00-12.4	5	N = 39 (5, 7, 9, 10, 10, 10)	
13	grair	ied GŔAV		ubangular fino	e to mediur	n	0.x0 0.x0 0.x0 0.x0 0.x0	-10.62	13.40 13.70	AN3071	в	13.50-13.9	5	N = 50/150 mm (22, 5, 37, 13)	
15															
16															
18															
- 19			OPING/CL	IISELLING										VATER STRIKE DET	
	1		Time				Wate	er Ca	asing	Sealed	Ris	e Tir	me		AILO
4 12 13	n (m) .4 2.9 3.4 3.6	To (m) 4.6 13 13.5 13.7	(h) 1.5 0.5 0.75 1	Comments			Strik		epth	At	Tc		<u>iin)</u>	Comments	
									Hole	Casing	De	pth to		ROUNDWATER PRO	GRESS
	Date	Tip De	etails	p RZ Base	Тур)e	Dat		Depth	Depth	Ň	pth to /ater C	Comme	ents	
RE	MARK			mm diameter					Samp	le Legeno	k k		UT -	Undisturbed 100mm Diameter	
		comple	eted in 150	iced to 150mi Imm casing. (ng, borehole	Obstruction	encounte	ered at 13.		LB - Large	Disturbed (tub) Disturbed Bulk Disturbed ironmental Sam	d	Vial + Tub)	Sam P-L		



REPORT NUMBER

1														
	NTRAC			lin Drainage S							Boreho Sheet	DLE NO.	BH15 Sheet 1 of 1	
	-ordin Ound I	ATES _EVEL (r	247,	,067.51 E ,660.39 N 78.49		pe Iole Diam Iole Dept		nm) 2	Dando 20 200 3.40		DATE CO DATE CO		CED25/02/2013ED25/02/2013	
	ENT GINEER		igal Count	ty Council		MMER RE			SPT6 55		BORED I PROCES		WC JL	
_								<u> </u>		San	nples			
Depth (m)			D	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
1					sandy slightly oulder content.				AN8502 AN8503	В	1.00-1.45 2.00-2.45		N = 7 (1, 2, 2, 2, 1, 2) N = 14 (2, 2, 3, 3, 4, 4)	
3			le at 3.40				75.09	3.40	AN8504	в	3.00-3.40		N = 50/150 mm (5, 7, 9, 18, 23)	
5														
- 7														
9														
HA			ORING/CI Time	HISELLING		Wate	or Co	sing	Sealed	Rise	<u>а т</u> :	mo	ATER STRIKE DET	AILS
		To (m)	(h)	Comments		Strik	e De	pth	At	То	(m	nin)	Comments	
3	.2	3.4	1.5			3.10) 3.	10		2.70	0 2	20	Slow	
								Hole	Casing		oth to		DUNDWATER PRO	GRESS
	TALLA Date		ETAILS	op RZ Base	Туре	Dat	te	Depth	Depth	W	oth to ater	Commen	nts	
		Boreho	le termina		Driller reports obs	truction / pc	ossible	Samp	le Legeno Disturbed (tub) Disturbed	t t		1177 11-	ndisturbed 100mm Diamatar	
INS REI		rockhea	ad					LB - Larg	Disturbed (tub) Disturbed e Bulk Disturbed rironmental Sam	b	√ial + Tub)	Sample P - Uno	ndisturbed 100mm Diameter e disturbed Piston Sample ater Sample	



REPORT NUMBER

	ONTRAC			n Drainage S			_					BOREHO SHEET	OLE NO.	BH17 Sheet 1 of 1	
	o-ordin Round I	ATES _EVEL (n	251,2	274.53 E 201.85 N 23.43	BC		e)le diam)le dept	•	mm)	Dando 20 200 3.10		DATE C		CED 22/02/2013 TED 22/02/2013	
	.IENT GINEER		gal County	Council						SPT6 55		BORED		WC JL	
						IERGI	RATIO (%	/0)		55		nples		JL	
Depth (m)			De	escription			Legend	Elevation	Depth (m)	Ref. Number	Sample		Recovery	Field Test Results	Standpipe Details
- 0	Soft da	ark brown	sandy gr	avelly CLAY			<u>. </u>	5							
- 1		becomin		-	grey silty grave	elly	0	22.33	1.10	3759	В	1.00-1.45	5	N = 8 (1, 2, 2, 2, 2, 2)	
2	Firm to	o stiff blac	ck sandy <u>c</u>	ravelly silty	CLAY		× · · · ×	21.13	2.30	3759	в	2.00-2.45	5	N = 11 (1, 1, 2, 2, 3, 4)	
3	Mediu		dark grey		ngular fine to			20.53 20.33	2.90 3.10		в	3.00-3.45	5	N = 50/0 mm (25, 50)	
4															
		RATA BO		ISELLING			Mate			Sociad				ATER STRIKE DET	AILS
Fro	m (m) [·]	To (m)	Time (h)	Comments			Wate Strik		asing epth	Sealed At	Ris To		ime nin) C	comments	
	2.9	3.1	1.5				1.10		.10	2.30	0.6		20	Slow	
<u> </u>							_		Hole	Casino		oth to		OUNDWATER PRO	GRESS
IN	STALLA Date	TION DE	TAILS hth RZ To	p RZ Base	Туре		Dat	te	Depth	Casing Depth		pth to ater	Commen	its	
IN	MARKS								LB - La	ple Legen all Disturbed (tub) i: Disturbed rovironmental Sar	ed	Vial <u>+ Tub</u>)	Sample P - Uno	ndisturbed 100mm Diameter e listurbed Piston Sample tter Sample	



REPORT NUMBER

~	\square																	
	NTRAC				ainage S			-				Davida 00		BOREH SHEET		NO.	BH19 Sheet 1 of 1	
	-ordin Ound I	IATES LEVEL (n	255		27 E 62 N 34.01			e Dle Diam Dle Dept			m) 2	Dando 20 200 9.70		DATE (ED21/02/2013ED22/02/2013	
	ENT SINEER		gal Cour	ty Co	uncil			MMER RE 7 RATIO (9) .		SPT6 55		Borei Proci) BY	WC JL	
									///					nples				
Depth (m)			C	escri)	ption			Legend		Elevation	Depth (m)	Ref. Number	Sample Type		(III)	Recovery	Field Test Results	Standpipe Details
0		ark browr e content	i sandy (CLAY	with a lov	w to mediur	m											
1									32.	11	1.90	AN3752	В	1.00-1.	.45		N = 7 (1, 2, 2, 1, 2, 2)	
2	Firm li cobble	ght browr e content	n sandy (grave	lly CLAY	with a med	ium					AN3753	В	2.00-2.	.45		N = 9 (2, 2, 3, 2, 2, 2)	
3									- - - 	21	3.80	AN3754	В	3.00-3.	.45		N = 18 (3, 4, 7, 4, 4, 3)	
4	Firm to cobble	o stiff darl e content a	k brown and a lov	sandy v bou	/ silty CL/ Ider conte	AY with a m ent	nedium		-		0.00	AN3755	в	4.00-4.	.45		N = 19 (3, 4, 5, 5, 5, 4)	
- 5												AN3756	В	5.00-5.	.45		N = 31 (5, 6, 6, 7, 8, 10)	
- 6 - 7		stiff black and bou			v silty CLA	AY with a m	nedium		27.	31	6.70	AN3757	В	6.50-6.	.95		N = 50/200 mm (11, 13, 16, 17, 17)	
8												AN3758	В	8.00-8.	.45		N = 50/190 mm (12, 13, 16, 19, 15)	
9	End o	f Borehole	e at 9.70	m					24.	31	9.70	AN3759	В	9.50-9.	.95		N = 50/95 mm (20, 5, 32, 18)	
HA	RD ST	RATA BC		HISE	LLING					_						WA	TER STRIKE DET	AILS
Fror	m (m)	To (m)	Time (h)	Con	nments			Wate Strik		Cas Dep		Sealed At	Rise To		Time (min)	Co	omments	
7.	5.6 .75 9.5	7 7.85 9.7	1 0.5 1													Ν	No water strike	
											1-1	0	-			GRO	UNDWATER PRO	GRESS
	TALLA Date	TION DE	TAILS	op F	RZ Base	Туре	e	Dat	te		Hole Depth	Casing Depth	De W	oth to ater	Com	ment	S	
REI	MARKS	6									Sampl D - Small I B - Bulk Di	e Legenc Disturbed (tub) sturbed	1			Sample	tisturbed 100mm Diameter	
											LB - Large	Bulk Disturbed	l ple (Jar + \	/ial + Tub)		P - Undis	sturbed Piston Sample er Sample	



REPORT NUMBER

CO	NTRAC	Gre Gre	eater	Dublin	Drainage S	scheme								Boreh Sheet		10.	BH20 Sheet 1 of 2	
	-ordin Ound	IATES LEVEL (r	n AC	324,48 257,26 CD)		В		e Dle Diam Dle Dept		(mm	1)	Dando 20 200 10.20		DATE C DATE C			CED01/03/2013ED01/03/2013	
	ENT SINEER		gal (County C	Council	-		MER RE RATIO (9				SPT6 55		BORED PROCE		BV	WC JL	
		<u> </u>					INERGI	KATIO (7	/0)			55		nples	JJED	ы	JL	
Depth (m)				Desc	cription			Legend	i	Elevation	Depth (m)	Ref. Number	Sample Type			Recovery	Field Test Results	Standpipe Details
- 0		ark brown e content		y sandy	gravelly Cl	LAY with a lo	W		52.20	6	1.80	AN8509	в	1.00-1.4	5		N = 8 (2, 2, 2, 2, 2, 2)	
2	Soft to CLAY	p firm ligh	it brc	own sligh	tly sandy s	slightly grave	elly		5 			AN8510	в	2.00-2.4	.5		N = 9 (1, 2, 2, 3, 2, 2)	
3	CLAY	, 0		Ū		slightly grave			51.00		3.00 3.70	AN8511	В	3.00-3.4	.5		N = 20 (2, 3, 3, 4, 6, 7)	
4	Stiff to to me	o very stif dium cob	f dar ble c	k brown content	silty sandy	/ CLAY with	a low					AN8512	в	4.00-4.4	.5		N = 19 (3, 3, 4, 4, 5, 6)	
- 5												AN8513	В	5.00-5.4	.5		N = 45 (5, 6, 7, 7, 14, 17)	
6									16.6	6	7.40	AN8514	В	6.50-6.9	15		N = 31 (6, 7, 7, 8, 9, 7)	
- 8	GRA\ Stiff b	/EL lack sligh	tly s	andy slig	e to coarse htly grave oulder conte	lly CLAY with	h a		46.60		7.70	AN8515	в	8.00-8.4	.5		N = 38 (5, 7, 8, 8, 10, 12)	
9												AN8516	в	9.50-9.9	15		N = 50/225 mm (7, 9, 12, 17, 19, 2)	
HA	RD ST	RATA BO	-		ELLING		ŀ				i					WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)		me h) Co	omments			Wate Strik		Casir Dept	•	Sealed At	Ris To		Time min)	Co	omments	
5 7	1.7 1.3 1.6 1.9	3.9 5.6 7.7 10.2	0 0. 0	.5 75 .5 .5				7.40		7.40		7.70	7.00		20		Slow	
													-		(GRO	UNDWATER PRO	GRESS
INS	TALLA	TION DE						Dat	te		ole epth	Casing	De W	pth to ater	Comr	nent	s	
	Date	Tip Dep	oth	RZ Top	RZ Base	Туре												
RE	MARKS	<u> </u>			<u> </u>	I					B - Bulk L LB - Larg	Disturbed (tub) Disturbed Disturbed Bulk Disturbed vironmental Sam		/ial + Tub)	S	ample	disturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

1	6	6	9	5
	v	J	$\mathbf{\sigma}$	\sim

со	NTRAC	T Grea	ater Dublin	Drainage S	cheme							BOREH SHEET	OLE NO	D. BH20 Sheet 2 of 2	
	-ORDIN		257,26	87.08 E 6.58 N		G TYPI REHC	e Dle Diam	ETER (r	nm) 2	Dando 20 200	000	DATE C		NCED 01/03/2013	
		LEVEL (m		54.06			DLE DEPT			10.20		DATE C			
	ient Gineer	-	al County	Council			<mark>/IMER RE</mark> I ' RATIO (%			SPT6 55		Bored Proce		WC B Y JL	
						LINGT		~oj				nples			
Depth (m)			Dos	cription			p	tion	Depth (m)	Der	e	_	ery	Field Test	Standpipe Details
epth			Des	cription			Legend	Elevation	epth	Ref. Number	Sample Type	Depth (m)	Recovery	Results	tand etail
- 10									10.20				ŕŘ		νD
-	End o	f Borehole	at 10.20 n	า				40.00	10.20						
-															
- 11															
12															
13															
14															
- 15															
_															
- - 16															
-															
. 17															
- 18															
19															
			Time				Wate	er Ca	asing	Sealed	Rise	е Т	ime	VATER STRIKE DE	TAILS
	m (m) 3.7	To (m) 3.9	(h) C 0.5	omments			Strike		epth	At	То		min)	Comments	
5	5.3	5.6 7.7	0.75 0.5												
	9.9	10.2	1.5												
									Hole	Casing	De	oth to			OGRESS
INS		TION DE	T AILS th RZ Top	RZ Base	Tupo		Dat	e	Depth	Depth	W	oth to ater	Comme	ents	
	Date		<u> rvz 10p</u>	nz dase	Туре		\neg								
RE	MARKS	;							Samp	le Legeno	d 1				
									D - Small B - Bulk D	Disturbed (tub)			Sam P - L	Undisturbed 100mm Diameter aple Jndisturbed Piston Sample	
									Env - Env	e Bulk Disturbed ironmental Sam	- nple (Jar + \	/ial + Tub)	w-1	Water Sample	



REPORT NUMBER

<	\square														
	NTRAC			n Drainage	Scheme							Boreho Sheet	DLE NO.	BH24 Sheet 1 of 1	
	-ordin Ound	IATES LEVEL (n	249,	67.22 E 26.22 N 10.76			Pe Ole diam Ole dept	•	nm) 🛛	Dando 20 200 4.20		DATE CO DATE CO		CED26/02/2013ED26/02/2013	
	ENT GINEER		gal County	Council			MMER RE			SPT6 55		BORED I PROCES		WC JL	
						LINENG		~oj				nples		<u>JL</u>	
Depth (m)			De	scription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
- 0	Soft b	ecoming 1	firm dark b	rown sand	y gravelly C	CLAY	· · · · · · · · · · · · · · · · · · ·	7 - - - - - -		AN8505	в	1.00-1.45		N = 7 (1, 2, 2, 2, 1, 2)	
2				rey silty sa gravelly C	INDY GRAVI	EL		8.76 8.66	2.00	AN8506	В	2.00-2.45	;	N = 11 (2, 3, 3, 3, 3, 2, 3)	
3	subro	unded fine	e to coarse	GRAVEL	bangular to . Sand is co low cobble			7.96 7.36	2.80 3.40	AN8507	в	3.00-3.45	;	N = 16 (3, 4, 4, 3, 4, 5)	
- 4	Mediu	Im dense	to dense g	rey slightly	clayey/silty arse GRAV	sandy		6.86 6.56	3.90 4.20	AN8508	в	4.00-4.45	;	N = 50/75 mm (21, 4, 40, 10)	
			Time	ISELLING			Wate	r Ca	asing	Sealed	Ris	e Ti	me	ATER STRIKE DET	AILS
Fror	m (m)	To (m)	Time (h)	Comments			Wate Strike		asing epth	Sealed At	Ris To		me hin) C	Comments	
	2.8 3.9	2.9 4.2	0.5 1.5				2.40) 2	.40 .90	3.40	1.8 3.0	0 2	20	Slow Moderate	
									1141-	0	-		GRO	DUNDWATER PRO	GRESS
	TALLA Date	TION DE	TAILS	D RZ Bas	e Tv	rpe	Dat	e	Hole Depth	Casing Depth	De W	pth to /ater	Commer	its	
		Borehol		ed at 4.20	n. Driller rej		ruction / po	ssible	D - Small	Disturbed (tub)	ł			ndisturbed 100mm Diameter	
				-					B - Bulk E LB - Larg	Disturbed e Bulk Disturber vironmental Sarr	d	√ial + Tub)	Sample P - Uno W - Wa	e disturbed Piston Sample ater Sample	



REPORT NUMBER

CO	NTRAC	CT Grea	ater Dub	in Drainage	e Scheme								Boreh Sheet	OLE N	0.	BH25 Sheet 1 of 1	
	ORDIN	IATES LEVEL (m	243	983.94 E 516.89 N 17.69			e Dle Diam Dle Dept			m)	Dando 20 200 10.00	000				ED 08/02/2013	
	ENT		al Count	y Council		SPT HAI	MMER RE	F. NO).		SPT6		BORED			WC	
ENC	SINEER	2				ENERG	(RATIO (%	%)			55		PROCE	SSED	BY	JL	
Depth (m)			D	escription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type			recovery	Field Test Results	Standpipe Details
- 0	Soft b CLAY	ecoming fi ′ with a low	irm light v to medi	orown sligh um cobble	tly sandy gr content	ravelly		3 			AN3852	в	1.00-1.4			N = 11 (2, 2, 5, 2, 2, 2)	
2											AN3853	В	2.00-2.4	.5		N = 12 (2, 3, 3, 2, 3, 4)	
3											AN3854	В	3.00-3.4	.5		N = 12 (3, 3, 4, 4, 2, 2)	
4											AN3855	В	4.00-4.4	.5		N = 17 (3, 4, 4, 5, 4, 4)	
- 5	Stiff lig to me	ght brown dium cobb	slightly s le conter	andy grave It	Ily CLAY wi	ith a low		12.6	59	5.00	- AN3856	В	5.00-5.4	.5		N = 25 (4, 6, 9, 5, 5, 6)	
7	Dense Grave	el is suban	vn sandy gular to s	GRAVEL.	Sand is coa fine to med	arse. dium of		10.8		6.80 7.30	AN3857	В	6.50-6.9	15		N = 47/170 mm (3, 3, 4, 12, 31)	
8		stiff to harc lly CLAY	l dark br	own slightly	[,] sandy sligh	htly		7			AN3858	в	8.00-8.4	.5		N = 50/210 mm (9, 14, 16, 19, 15)	
9								7.6	9	10.00	AN3859	в	9.50-9.9	15		N = 50/190 mm (8, 12, 18, 21, 11)	
HA	RÐIST	Ratabg		IIS ELLING									·		WA	TER STRIKE DET	AILS
Fron	n (m)	To (m)	Time (h)	Comment	6		Wate Strike		Cas Dep		Sealed At	Ris To		Time min)	Co	omments	
4.	75 65 .8	2.85 4.85 7.2	0.5 0.75 1.5				6.80		6.8		7.30	6.20		20		Slow	
											Casin			G	RO	UNDWATER PRO	GRESS
		TION DE					Dat	te		-lole epth	Casing Depth	De	pth to ater	Comm	nent	s	
	Date		th RZ To			уре				_							
RE	MARKS	Borehole	e termina	ted at requ	red depth					LB - Bulk	Die Legend I Disturbed (tub) Disturbed ge Bulk Disturber vironmental Sam	d	/ial + Tub)	Sa P ·	ample - Undis	tisturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

1	\square																	
	NTRAC		eate			e Scheme						Danala 00		BORE SHEE		E NO.	BH26 Sheet 1 of 1	
	-ORDIN	IATES LEVEL (I	m A	241,80	3.33 E 9.63 N 12.60			'e Ole diam Ole dept		•	ım) 2	Dando 20 200 10.00				IMENC	ED02/03/2013ED02/03/2013	
CL	IENT	Fir	ngal	County (Council		SPT HA	MMER RE	F. N	0.	;	SPT6		BORE	DBY	,	WC	
EN	GINEER	1					ENERG	<mark>Y RATIO (</mark> %	%)			55			ESSE	ED BY	JL	
ک										L	Ê	<u> </u>	-	nples		~	-	e
Depth (m)				Des	cription			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth	(E)	Recovery	Field Test Results	Standpipe Details
0	Soft b	ecoming	firm	n dark br	own to g	rey brown s	lightly	<u></u>										
	sandy	slightly	grav	elly CLA	Y			<u> </u>	ł									
								<u> </u>										
1									ł			AN8517	в	1.00-	1.45		N = 9 (2, 2, 2, 3, 2, 2)	
									1									
									ļ									
2									1			AN8518	в	2.00-2	2.45		N = 9	
									ţ								(3, 3, 2, 2, 2, 3)	
										70	0.00							
3	Firm t	o stiff bla	ick s	slightly sa	andy slig	htly gravelly	/ CLAY	<u></u>	9. 1	.70	2.90	AN8519	в	3.00-3	3.45		N = 15	
5	with a	low to m	nedi	um cobbl	e conter	t			ļ								(3, 4, 4, 3, 4, 4)	
								<u> </u>										
									Į			AN8520	в	4.00-4	4.45		N = 20	
4												AIN8520	В	4.00-4	4.45		(3, 5, 5, 4, 5, 6)	
									ł									
									1								N. 64	
5									ł			AN8521	В	5.00-	5.45		N = 24 (4, 6, 6, 7, 5, 6)	
									*									
									ļ									
6									1									
									ł								N = 37	
									5	.70	6.90	AN8522	В	6.50-6	6.95		(6, 7, 8, 8, 10, 11)	
7						lightly grav	elly CLAY	<u>à .</u>	10.		0.00	1						
	with a	low to m	nedi	um cobbl	e conter	t			}									
									\$									
8								\overline{O}	{			AN8523	в	8.00-8	8 45		N = 41	
0								$\overline{\mathbf{O}}$	i i				-				(8, 9, 9, 10, 11, 11)	
									ţ									
_								- <u>···</u>	1									
9									ļ									
												AN8524	в	9.50-9	9.95		N = 49/285 mm (7, 12, 12, 13, 13, 11)	
									2.	.60	10.00						(7, 12, 12, 10, 10, 11)	
HÆ	AREDIST	ƙa ta B		ing/09/15	ELLING	i		Wate		6	aina	Sealed	Rise		Time		TER STRIKE DET	AILS
		To (m)		(h)	omment	6		Strike			sing pth	At	To		(min		omments	
5	.65 5.7 8	3.8 5.9 8.3	().75 0.5).75												٢	No water strike	
										_	Hole	Casing	De	pth to	~		UNDWATER PRO	GRES
	Date			RZ Top	RZ Ba	т	ype	Dat	e		Depth	Depth	Ŵ	ater	Co	mment	S	
	Dale		Pul				չիշ											
RE	MARKS	Boreho	ole te	erminated	d at requ	ired depth				-	Samp	le Legend	1		-	UT - Um	disturbed 100mm Diameter	
											LB - Large	Disturbed (tub) Disturbed Bulk Disturbed	I			Sample P - Undis	sturbed Piston Sample er Sample	
											Env - Env	ironmental Sam	ple (Jar + \	Vial + Tub))	w - Wat	er Sample	

Appendix 3

Rotary Drillhole Records

	A														R	EPORT	NUME	BER
	<i>इ</i> // ।उड	ر ل			(GEOT	ECH	INIC	CAL CO	RE LOG	RECOF	RD				1	669	5
СС	ONTR	АСТ	G	reate	r Dublin [Drainage	Sche	me						LHOLE	NO	RC		_
СС	-ORE	DINA	TES		319,172 241,887	2.72 E							DATE	ET E DRILLE	D		et 1 of 2 2/2013	
GF	ROUN	D LE	VEL	(mOI		44.43			RIG TYPE FLUSH			Knebel Air/Mist	DATE	LOGGE	D		2/2013	
	IENT GINE		Fi	ngal	County C	ouncil			INCLINATI	ON (deg) METER (mn		-90		LED BY GED BY			etersen O'Shea	
Downhole Depth (m)	(m) H	%	%	%			đ										ails	
Dept	Core Run Depth (m)	T.C.R.%	S.C.R.%	.Q.D.%	Frac Spa	cing	Non-intact Zone				Descripti	on			~		Standpipe Details	alue)
nhole	e Run	Η	Ś	R.	Lo (mi		-intac	pue							Depth (m)	Elevation	ıdpipe	SPT (N Value)
Dov	Core				0 250	500	Non	Legend							Dep	Elev	Star	SPT
0									Cased dov	wn Shell & A	uger Hole							
Ē																		
Ē1																		
Ē																		
-2																		
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-3																		
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8																		
Ē																	0 0 8/7/2	
- 9																		
Ē																	X	
	MAR	ĸs													WA	TER ST		DETAILS
	le cas	sed 0	.00-18	8.00r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	s	
Ho															N	lo wate	r strike	recorded
0.000																		
	STAL	ا ד ۵	ם אס	FTA	IIS					Date	Hole	Casing	Depth to Water	Com			VATER	DETAILS
	Date	-	Tip De	epth	RZ Top			Ту		Date	Depth	Depth	Water					
26	5-02-1	13	8.80)	6.80	8.80		50mn	n SP									

	.A															R	EPORT	r nume	BER
	<u>ह</u> ्य टिट	مر 1			(GEC	DTE	ECH	INIC	CAL CO	RE LOG	RECO	RD				1	669	5
со	NTR	ACT	G	reate	er Dublin I	Draina	age	Sche	me						LLHOLE	NO	RC		
со	-ORI	DINA	TES		319,17									SHE	ET E DRILL	FD		et 2 of 2 2/2013	
GR	OUN	ID LE	VEL	(mOl	241,88 D)		N .43			RIG TYPE FLUSH			Knebel Air/Mist		ELOGG			2/2013	
	ENT GINE		Fi	ingal	County C	Counci	il			INCLINATI		m)	-90		LLED B' GED B'			etersen .O'Shea	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Spa Lo	og m)	500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10										Cased dov	wn Shell & /	Auger Hole ((continued))		40.50			
11 12 13 13 14 14 15 15 16 16 16 16 16 16 16 16 16 16 16 16 16										SYMMET	RIX DRILLI	NG: No reco d consisting	y of Shell &	Auger Fill	iller as		2 29.63		N = 75/125 mm (25, 50) N = 50/125 m0 (14, 11, 32, 18)
17										End	of Borehole	at 18.00 m					26.43		N = 50/230 mm (13, 12, 15, 18, 14, 3) N = 50/115 mm (16, 9, 29, 21)
RE	MAR e cas		.00-1	8 00,							Water	Casing	Sealed	Rise	Time				DETAILS
RE Hol			.00-1	0.001							Strike	Depth	At	To	(min)		omment lo wate		recorded
																GR		NATE	R DETAILS
INS											Date	Hole Depth	Casing Depth	Depth Water	to Con	nment	S		
26	Date -02-1		Tip Do 8.80		RZ Top 6.80	RZ E			Typ 50mm										

	A														R	EPORT		ER
	<i>ह</i> ें] 103	ر ل			C	GEOTI	ECH	INIC	CAL COF	re log	RECOF	RD				1	669	5
СС	ONTR/	АСТ	Gı	reate	r Dublin [Drainage	Schei	me						LLHOLE	NO	RC		
СС	-ORD	DINA	TES		319,443 241,960	3.52 E							DAT	ET E DRILLE	D		et 1 of 2 2/2013	
GF	ROUN	D LE	VEL (mOI		41.55			RIG TYPE FLUSH			Knebel Air/Mist	DAT	e logge	Ð	26/0	2/2013	
	IENT GINE		Fi	ngal	County C	ouncil			INCLINATI	ON (deg) METER (mr		-90		LLED BY			etersen .O'Shea	I
Downhole Depth (m)	Core Run Depth (m)	%	%	%	_		e										ails	
e Dep	n Dep	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo	cing	Non-intact Zone				Descriptio	on			(r	_	Standpipe Details	SPT (N Value)
whol	re Ru		0)	Ľ	(mi		n-inta	Legend							Depth (m)	Elevation	didpu	T (N
	Co				0 250	500	Ž	Leç							De	Ele	Sta	SP
0									Cased dov	vn Shell & A	uger Hole) (
Ē																		
Ē																		
2																		
Ē																		
-3																		
Ē																		
4																		
Ē																		
Ē																		
5																		
Ē																		
6																		
Ē								***	SYMMET		IG: No recov	very, obser	ved by dri	ller as	6.50	35.05		
7									returns of	madeground	d consisting	of Shell &	Auger Fill					
Ē																		
- 8																		
Ē																		
Ē																		
9																		
2																	\mathbb{X}	
	MAR			2.00	_			KXXX	1	Water	Casing	Sealed	Rise	Time				DETAILS
HO	le cas	sed ()	.00-18	5.00n	n					Strike	Depth	At	To	(min)		mmen		
Ho															N	lo wate	r strike	recorded
															6.00	יחאור		DETAILS
	STAL	LATI	ON D	ETA	LS					Date	Hole Depth	Casing Depth	Depth t Water	O Com	ments			DETAILO
	Date 5-02-1		Tip De 18.0		RZ Top 13.00	RZ Base 18.00		Typ 50mm										
				-				201111										

	A	-						16.114							R	EPORT	NUME	BER
	33	Ľ			C	EOT	ECH	INIC	CAL COF	KE LOG	RECO	Κ D				1	669	5
0	NTR/	ACT	G	reate	r Dublin E	Drainage	Sche	me					DRI	LLHOLE	NO	RC Shee	02 et 2 of 2	2
		DINA [.] D LE	TES	(mOl	319,443 241,960 D)				RIG TYPE FLUSH			Knebel Air/Mist		e drilli E loggi			2/2013 2/2013	
	ent Sine	ER	Fi	ngal	County C	ouncil		I	INCLINATIO		m)	-90		LLED BY GED BY			etersen O'Shea	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (mr 0 ²⁵⁰	cing vg m)	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10										madegroun	NG: No reco d consisting				12.00	29.55		
12									returns of g		NG: No reco very gravelly			I	13.60	27.95		N = 50/1 mm (16, 9, 32,
14										grey sandy	VG: No reco gravelly clay						0 0 0 0	N = 44 (7, 9, 11, 10, 10)
16																	0 0 0 0 0 0	N = 50/29 mm (10, 12, 1 12, 12, 1
17									returns of g SYMMETF returns of g and boulde	grey fine sa RIX DRILLIN grey sandy ers.	NG: No reco gravelly clay	very, obse	rved by dri	ller as	17.80	24.15 23.75 23.55		N = 44 (6, 10, 12, 10, 13) N = 50/1 ⁻ mm (17, 8, 29,
19										of Borehole	at 18.00 m							
۶EN	MAR	KS	L						I						WA	TER ST	RIKE	DETAILS
Hole	e cas	ed 0	.00-1	8.00r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	s	
															N	lo wate	r strike	recorded
											Llele	Cocina	D 11 -		GR	OUND	VATER	R DETAIL
						D7 D		т	20	Date	Hole Depth	Casing Depth	Depth t Water	Com	ment		101	
	Date -02-1		110 De 18.0		RZ Top 13.00	RZ Base 18.00	*	Ty 50mn		26-02-13	18.00	18.00	13.30	drilling		ecorded	10mins a	after end of

Γ	/	1	$\overline{\ }$													R	EPORT		BER
(33	רק נ			(GEOTE	CH	INIC	AL COP	re log	RECOR	RD				1	669	5
1	CON	NTR/	АСТ	G	reate	er Dublin [Drainage S	Scher	ne					DRIL	LHOLE	NO	RC	05	
	<u></u>	ORE	NNA.	TES		317,60 ⁷	1 67 F							SHEE				et 1 of 3	
				VEL	(mO	253,854	4.56 N 25.48			RIG TYPE FLUSH			Casagrand Air/Mist	e C ⁶ DATE		ED ED		3/2013 3/2013	
		ENT	ER	Fi	ingal	County C	ouncil			INCLINATION CORE DIA		n)	-90 80		LED BY GED BY		M JL	. Newla	Ind
		Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (mi 0 ²⁵⁰	cing og m)	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	2 3 4 5 6 7 7 8										vn Shell & A	IG: No reco er Fill	/ery, obsen	/ed by drill		3.50	_ 21.98		
IGSL RC FI 10M 16695.GPJ IGSL.GDT 10/5/13	REN	/AR	ĸs		I	l										WA	TER S	ra ra Frike i	DETAILS
Б Г				.00-2	4.0m	1					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)		ommeni		
											22.00	Doput	/ w		(1111)	1			
- Ci																			
695.G																			
													Cooine	D(1		GR		VATER	DETAILS
											Date	Hole Depth	Casing Depth	Depth to Water	Com	ment	s		
ž-	Date Tip Depth RZ Top RZ Base Type 13-03-13 24.00 22.50 24.00 50mm SP																		
	13-	·UJ-1	3	∠4 .0		22.50	24.00	'	JUMI	135									

	A				(GEOT	ECH	INIC	CAL CO	RE LOG	RECO	RD			R	EPORT	г NUM 669	
<	යියි NTR/	/	G	reate	r Dublin [Drainage	Sche	me					DRII SHE	LHOLE	NO	RC	05 et 2 of	2
		DINA [.]	TES VEL	(mOE	317,60 ⁷ 253,854))				RIG TYPE FLUSH			Casagran Air/Mist			ED ED	12/0	3/2013 3/2013	3
	ENT SINE	ER	Fi	ngal (County C	Council			INCLINATI		m)	-90 80		LED BY		M JL	. Newl	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (mi 250	cing og m)	Non-intact Zone	Legend			Descript				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10 11									SYMMET returns of	RIX DRILLII Shell & Aug	NG: No recc ger Fill <i>(con</i> i	overy, obse tinued)	rved by dri	ller as				
13 14									SYMMET returns of	RIX DRILLII boulder cla <u>y</u>	NG: No reco y with grave	overy, obse I bands.	rved by dri	ller as		12.28		
15										RIX DRILLII boulder cla	NG: No reco y	overy, obse	rved by dri		13.00	10.48		N = 50/8 mm (5, 20, 32,
17									- - - - -									N = 50/8 mm (8, 17, 35,
18 19									* * * * * *									N = 50/8 mm (18, 7, 44, N = 50/11
	100	Ke						<u> </u>	ł						14/4			mm (7, 18, 32, DETAILS
	/IAR e cas		.00-24	4.0m						Water Strike 22.00	Casing Depth	Sealed At	Rise To	Time (min)		iter s mmen		JETAILS
															GR		NATE	R DETAIL
NS	TAL	LATI	ON D	ETAI	LS					Date	Hole Depth	Casing Depth	Depth to Water	⁰ Com	ments	S		
	Date •03-1		Tip De 24.0		RZ Top 22.50	RZ Base 24.00		Ту; 50mn		12-03-13	18.00	18.00	7.00		r level r	ecorded	at start o	of shift

6	A														R	EPORT		BER
	35	L)			(3EO I	ECF	INIC	CAL CO	RE LOG	RECO	RD				1	669	5
		АСТ		ireate	er Dublin [Sche	me					DRIL SHE	LHOLE ET	NO	RC Shee	05 et 3 of 3	3
		DINA [.] ID LE	TES VEL	(mOl	317,60 ⁻ 253,854 D)				RIG TYPE FLUSH			Casagrano Air/Mist	DATI de C ⁶ DATI	e drille E logge	ED ED		3/2013 3/2013	
	ent Sine		Fi	ingal	County C	Council			INCLINATI		m)	-90 80		LED BY GED BY		M JL	. Newla	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 ²⁵⁰	cing og m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20											NG: No reco y (continued		ved by dril	ler as				N = 50/3 mm (7, 25, 50
22																		N = 50/0 r (9, 16, 5
24 25	25.00	0	0	0					boulder wi	Coring obs ith some cla	-	ller as poss	ible limest	one	<u>24.00</u> 25.00	0.48		N = 50/0 r (25, 50
26																		
27 28																		
29																		
DEA	MAR	Ke													10/07	red er		DETAILS
		-	.00-2	4.0m	I					Water Strike 22.00	Casing Depth	Sealed At	Rise To	Time (min)		mment		
											Hole	Casing	Donth t				VATER	R DETAIL
						D7 Dec		Τ	20	Date	Depth	Depth	Depth to Water	Com	ments		at c = 1 - 3	
	Date -03-1		24.0		RZ Top 22.50	RZ Base 24.00	*	Ту; 50mn		12-03-13	25.00	24.00	16.50	Water	ievel re	ecorded	at end of	borehole

e U	- दि				(GEOT	ECł	INIC	CAL COI		RECO	RD			R	epor 1	т NUM 1669	
	NTR			ireate	r Dublin [Sche	me						RILLHOLE	NO	RC She	06 et 1 of	3
		DINA [.]	tes Vel	(mOl	317,620 254,270 D)	0.73 E 6.17 N 29.51			RIG TYPE FLUSH			Casagran Air/Mist	de C6 _{D4}	TE DRILL	ED ED)3/2013)3/2013	
	ENT GINE	ER	Fi	ingal	County C	Council			INCLINATI		m)	-90 82		RILLED BY		M JI	I. Newl	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%		cing og m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2 3 4 5 6 7 8 9	<u>نابانانانانانانانانانانانانانانان</u> SYM								SYMMETI returns of	RIX DRILLII	NG: No recc y	vvery, obse	rved by o	Iriller as				
	MAR e cas		.00-1	8.00r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)		TER S		DETAILS
										JUIKE	υσριτι	~1	10		N	lo wate	er strike	e recorded
											Hole	Casing	Dent				WATE	R DETAIL
	TAL Date		ON D		ILS RZ Top	RZ Bas	e.	Ту)e	Date 14-03-13	Depth	Casing Depth	Depth Wat		nments		in oper	cable tool
	-03-1		18.0		15.00	18.00	<u> </u>	50mn		14-03-13			2.50	pre-b		ecoraed	in open	Cable 1001

	A				(GEOT	ECł	INIC	AL COF	RE LOG	RECO	RD			R		г NUME 669	
<	ସମ NTR/	/	G	reate	r Dublin I	Drainage	Sche	me						ILLHOLE	NO	RC	06 et 2 of 3	3
		DINAT		(mOl	317,62 254,27				RIG TYPE			Casagrar Air/Mist	DA		ED ED	14/0	3/2013 3/2013	
CLIE	ENT				County C		1		FLUSH INCLINATI CORE DIA		m)	-90 82		GGED B		M JI	. Newla	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Spa Lo	m)	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10 11 12 13 14										RIX DRILLII			rved by d	riller as	15.00	14.51	XAIXAIXAIXAIXAIXAIXAIXAIXAIXAIXAIXAIXAIX	
15 16 17									SYMMETF returns of I	RIX DRILLII	NG: No reca y with bands	overy, obse s of gravel	rved by d	riller as				N = 50/1 mm (11, 14, 5 N = 50/3 mm (9, 16, 5
	18.40 18.85	100 100	30 56	30 33					LIMESTOI medium st Weatherin	rong thinly l NE with occ rong to wea g: Negligab ities 18.0-2	asional me ak very thin le	dium to wid black MUD	ely space STONE.	ed	18.00	11.51		N = 50/0 r (25, 50
1	19.70	100 100	84 64	46 0			4		spaced sm extremely 18.0-18.12	nooth plana closely spa m Fracture	r tight to pa ced fracture 90° smoot	rtly open, cl es in mudste h planar	ean. Occ					
		KS sed 0.	00.1	8 00-	n					Water	Casing	Sealed	Rise	Time				DETAILS
		.cu U.	.00-1	5.001						Strike	Depth	At	To	(min)	N		er strike	recordec
											Hole	Casing	Donth	to			WATEF	RDETAIL
[TALI Date 03-1			epth	ILS RZ Top 15.00	RZ Bas 18.00	e	Ту; 50mn		Date 14-03-13 15-03-13	15.00 15.00	Depth 15.00 15.00	Depth Wate 14.00 12.50	Wate	g	ecorded	10mins a at start o	after end of f shift

	e Ar	T.				EOT		אוות	CAL COI			חם			R		r nume	
J	ଟ୍ର	L)			Ĺ	JEOI	ECI				RECO	RD				1	669	5
co	NTR/	ACT	Gr	eate	r Dublin E	Drainage	Sche	me					DRI SHE	LLHOLE	NO	RC She	06 et 3 of 3	3
			res Vel (mOE	317,620 254,276 D)				RIG TYPE FLUSH			Casagrar Air/Mist	DAT Ide C6	'E DRILL 'E LOGG	ED ED		3/2013 3/2013	
	ENT GINE		Fir	ngal (County C	ouncil		I	INCLINATI		m)	-90 82		LLED BY GED BY		M JL	. Newla	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac: Spac Lo (mr 0 ²⁵⁰	cing g m)	Non-intact Zone	Legend			Descript	lion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	20.15 20.50	100	57	34		<u></u>			Medium st	trong thinly	-sized disse	y fine grain	ed agrillac	eous				
		100	80	31					LIMESTO medium st	NE with occ trong to wea	casional me ak very thin	dium to wid	dely space	ł				
21	20.95	100	73	42			4 - -			ig: Negligab uities 18.0-2	le 2.15m 0-10	° very clos	ely to med	ium				
	21.50 21.80	100	90	37			/		spaced sn extremely	nooth plana closely spa	r tight to par ced fracture	tly open, c s in mudst	lean. Occa one <i>(contil</i>	sional nued)				
	22.15	100	14	0					gravel-size	ed fragment	firm black (s of very we	eak mudsto	one		22.15	7.36		
										RIX DRILLI	NG: No reco IE	overy, obse	erved by dr	iller as				
23									-									
23																		
									-						24.00	5.51		
24									End	of Borehole	at 22.15 m				24.00	0.01	~////>	
25																		
26																		
20																		
27																		
28																		
29																		
	MAR		.00-18	2 000	'n			•		Water	Casing	Sealed	Rise	Time				DETAILS
	u uas	.cu U.	10							Strike	Depth	At	To	(min)		ommen lo wate		recordec
										1				1				
															GRO		NATEF	
Hol	TAL	LATIO		ETAI	ILS					Date	Hole	Casing Depth	Depth Wate	to Corr	GR		WATER	R DETAIL

	A														R	EPORT	NUME	BER
	<i>£/</i>]]GS				(GEOT	ECH	INIC	CAL COP	re log	RECO	RD				1	669	5
С	ONTR	АСТ	Gr	eate	r Dublin [Drainage	Schei	me						LLHOLE	NO	RC		_
С	D-ORI	DINA	TES		319,149 254,283								DAT		Đ		et 1 of 2 4/2013	
GI	ROUN	ID LE	VEL (mOI		21.61			RIG TYPE FLUSH			Casagrand Air/Mist	^{de C6} DAT	'E LOGGE	Ð		4/2013	
	IENT		Fir	ngal	County C	ouncil			INCLINATI	ON (deg) METER (mr	n)	-90 90		LLED BY		M JL	. Newla	Ind
Downhole Denth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 250	cing og m)	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									Cased dov	vn Shell & A	uger Hole							
- 1																		
2																		
- 3																		
4																		
5																		
6																		
7																		
8									SYMMETR returns of	RIX DRILLIN Shell & Aug	IG: No reco er Fill	very, obser	ved by dri		7.50	14.11		
9																		
	MAR							****	1						WA	TER S	rike	DETAILS
Ho	ole ca	sed C	.00-15	5.0m						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	s	
Н										12.00								
-	OT									D-1-	Hole	Casing	Depth t	0 0			VATER	DETAILS
IN	Date		ON DI Tip De			RZ Base	9	Тур	De	Date	Depth	Depth	Depth t Water	Com	ments	5		
0	4-04-		13.00		11.50	13.00		50mm										

2	A								CAL COF		RECO	PD			R			
	ઉક	L/			,	SEON		INIC			RECO					1	669	5
col	NTR	٩СТ	G	reate	r Dublin [Drainage	Sche	me					DRIL SHE	.LHOLE ET	NO	RC She	07 et 2 of 2	2
				(O	319,149 254,283	3.62 N			RIG TYPE			Casagran			ED ED	03/0)4/2013)4/2013	i
CLI	ENT		VEL Fi		County C	21.61 ouncil)	-90	DRIL	LED B	(М	I. Newla	
-									CORE DIA	NETER (mr	n)	90	LOG	GED B		JL	_	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi 0 250	cing yg m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10									SYMMETF returns of	RIX DRILLIN Shell & Aug	NG: No reco er Fill <i>(cont</i>	overy, obse inued)	rved by dril	ler as	10.60	11.01		
11										RIX DRILLIN boulder clay		overy, obse	rved by dril	ler as	10.00	11.01		
12									SYMMETF returns of	RIX DRILLIN SAND	IG: No reco	overy, obse	rved by dril	ler as	12.00	9.61		
13										RIX DRILLIN gravelly CL/		overy, obse	rved by dril	ler as	12.80	8.81	•	
14									SYMMETR returns of Rockhead	RIX DRILLIN gravelly BO)	IG: No reco ULDERS (F	overy, obse Possible W	rved by dril eathered	ler as	13.50	8.11		N = 50/0 r (25, 50
15							<u>k</u> -		medium gr	rong thinly t rained argilla	aceous LIM	ESTONE v	with mediur	n to	15.00	6.61		N = 50/0 r (25, 50
16	16.40	100	86	49			-		widely spa bands. We extremely 16.48m)	ced very thi eathering: Lo closely fract	n medium s oss of wall s tured / lamir	strong black strength to nated muds	k MUDSTO very weak stone. (16.4	NE in 10 -				
		100	97	16			A		medium pr clean.	iities 15.0-1 redominantly	y closely sp	aced smoo	oth planar ti	ght,				
17	17.10 17.16	100	100	0					fragments	8m Non int of argillaced 2m Fractur	ous limesto	ne wiith so	me black cl	ay				
18	17.80	94	78	45			<u> </u>		with thin (1 17.34-17.4 non-penet	I-2mm Fractur I-2mm thick I3m Fractur rative discol of Borehole) brwon CL e 60° smoo ouration	AY veneer	•		<u>17.80</u>	3.81		
19																		
DE	//AR	Ke													14/47			DETAILS
			.00-1	5.0m						Water Strike 12.00	Casing Depth	Sealed At	Rise To	Time (min)		mmen		
INS	TAL	LATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Depth to Water	D Com	GRC nments		WATEF	R DETAIL
	Date - 04- 1	1		epth	RZ Top 11.50	RZ Base 13.00	•	Typ 50mm		03-04-13 04-04-13 04-04-13	12.50 12.50 17.80	12.50 12.50 15.00	DRY 10.00 9.30	DRY Wate	at end c r level r	ecorded	at start of at end of	f shift

	A					0007		1.1.1							R	EPOR	T NUME	BER
	35 	L)			(GEOI	ECH	1NIC	CAL COI	KE LUG	RECO	KD				1	669	5
		АСТ		ireate	er Dublin I		Sche	me						RILLHOLE HEET	NO	RC She	09 et 1 of 2	2
		DINA D LE	TES VEL	(mOl	319,36 254,35 D)	7.32 E 6.57 N 22.96			RIG TYPE FLUSH			Casagran Air/Mist	de C6 _D 4	ATE DRILL	ED ED)4/2013)4/2013	
	ENT SINE		F	ingal	County C	Council		1	INCLINATI CORE DIA		m)	-90 90		RILLED BY		M JI	I. Newla	nd
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Spa Lo (m	m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2 3 4 5 6 7 8 9	SYM return								SYMMETI returns of	RIX DRILLII	NG: No recc	wery, obse	rved by o	driller as			KUKUKUKUKUKUKUKUKUKUKUKUKUKUKUKUKUKUKU	
	VAR e cas		.00-1	5.0m	1					Water	Casing	Sealed	Rise	Time		TER S		DETAILS
										Strike 11.00	Depth	At	<u>To</u>	<u>(min)</u>				
NG.	TA1 1	יא די								Data	Hole	Casing	Dept				WATER	DETAIL
[Date	-	Tip D		RZ Top	RZ Bas		Ту		Date	Depth	Depth	Depti Wat	er Con	nment	5		
	04-1		12.0		10.00	12.00		50mn										

2	A	F.			(GEOT	ECH	HNIC	CAL CO	RE LOG		RD			R		г NUME 669	
	33 	Ŀ/											T			I	009	5
COI	NTR/	аст	G	reate	r Dublin I	Drainage	e Sche	me					DRIL	LHOLE	NO	RC	09 et 2 of 2	2
co-	ORE	INA	res		319,36 254,35				RIG TYPE			Casagrap	ΠΑΤ		ED	05/0	4/2013	
	oun Ent	D LE		(mOI	D) County C	22.96	6		FLUSH			Casagrano Air/Mist -90		LED BY			4/2013	
	SINE	ER		nyai		Jourici			INCLINATI		m)	-90 90		GED BY		JL		
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Spa Lo	cture cing og m) ^{0 50}	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10										RIX DRILLIİ boulder clay			ved by dril	ller as				
12									- - - - - -						13.00	9.96		
13 14									SYMMETF returns of	RIX DRILLII black CLAY	NG: No recc (Possible V	overy, obser Veathered I	ved by dril Rockhead)	ller as	10.00	. 0.00		N = 50/1 mm (6, 19, 5
15									Medium st	rong to stro	ng medium	to thickly be	edded darl		15.00	7.96		N = 50/0 (25, 50
16	16.50	100	73	55			539.999 ()))		Negligable Discontinu smooth pla		8.0m 0-10° ulating, tight	closely to n , clean. Rai	nedium sp re brown s	urface				
17		100	67	57			<u> </u>											
18	18.00								End	of Borehole	at 18.00 m				18.00	4.96		
19																		
	MAR	-								Motor	Caping	Socied	Pigo	Timo	WA	TER S	TRIKE	DETAILS
Hole	e cas	ed 0.	.00-1	5.0m						Water Strike 11.00	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
												Cosine			GRO	DUND	WATEF	
	TAL Date			ETA	ILS RZ Top	RZ Bas		Τ\ 4		Date 05-04-13	Hole Depth	Casing Depth	Depth to Water 10.20	Con			at ond - '	chift
	-04-1		12.0		10.00	12.00		Ty 50mn		05-04-13 06-04-13	18.00 18.00	15.00 15.00	3.30				at end of at start o	

	1		1												R	EPORT	NUME	BER
	<i>£//</i> GS	ر ر			(GEOTI	ECH	INIC	CAL COF	re log	RECO	RD				1	669	5
СС	NTR/	ACT	G	reate	r Dublin [Drainage	Schei	me						LHOLE	NO	RC		
СС	-ORD	DINA	TES		325,356									ET E DRILL	FD		et 1 of 2 5/2013	
GF		D LE	VEL	(mOl	257,579 D)	9.62 N 41.73			RIG TYPE FLUSH			Knebel Air/Mist		E LOGG			5/2013	
	ient Gine		Fi	ngal	County C	ouncil			INCLINATI	ON (deg) METER (mr	n)	-90 82		LLED BY		Pe JL	etersen	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (mi 0 ²⁵⁰	cing vg m)	Non-intact Zone	Legend			Descripti	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									Cased dov	vn Shell & A	uger Hole							
- 1																		
2																		
3																		
4																		
5																		
6																		
- - - - 7									returns of	RIX DRILLIN	IG: No reco agments (P	very, obsei ossible We	rved by dri eathered	ller as	7.20	34.53		
8									Rockhead)					8.20	33.53		
9	9.10	100	60	43					9 28-0 52-	n Reduction	of core to b	black grave						
		100	61	44					Notably br	n Reduction ecciated ma aced calcite	terial with a	network of	f extremely	/				
1	MAR le cas		0m-8	20m						Water	Casing	Sealed	Rise	Time				DETAILS
HO			0							Strike	Depth	At	То	(min)		mment		recorded
10.000																		
	STAL	ΙΔΤΙ	ם אס	ETA	ILS					Date	Hole	Casing	Depth t Water	0 Corr	GR(VATER	RDETAILS
	Date				RZ Top	RZ Base		Ту	De	09-05-13	<u>Depth</u> 9.10	<u>Depth</u> 8.20	6.50			ecorded a	at start o	f shift

er.	A				GEOT	ECH		CAL COF	RE LOG	RECO	RD			R	EPORT		
	33 	Ŀ/													1	669	5
	NTR/			reate	r Dublin Drainage	Sche	me					DRI She	llhole Et	NO	RC ² Shee	10 et 2 of 2	2
		DINAT		(mOI	325,356.52 E 257,579.62 N D) 41.73			RIG TYPE			Knebel Air/Mist		'E DRILL 'E LOGG			5/2013 5/2013	
CLI	ENT				County Council			FLUSH INCLINATI CORE DIA		m)	-90 82		LLED BY		Pe JL	etersen	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.50							on fracture	e surface	e 75° rough p							
		100	40	18		4	Ē	fine graine	d argillaced	greyish black	ONE with o	ccasional	widely				
11	11.00 11.40	100	90	25				calcite veir	nfilÌ (10 25n	alcite vein. \ 1). Rare orar louration of o	nge brown /	vellow	ung of				
						/ ia)./		(15.60-16.	.20m)				-11				
12	12.40	100	54	27		4		spaced pre	edominantly	7.60m 35-55 closely space ccasionally w	ced smooth	n planar cl	ean,				
13	. 2.+0	100	73	50		<u> </u>		fracture su 11.68-11.7 black grav	urfaces. (co 72m & 12.5 elly CLAY.		15.42-15.4 gular fine to	5m Band	s of platy				
14	13.70	100	65	65					27m Fractur fracture su	re subvertica rface	al smooth p	lanar with	calcite				
15	14.80	100	80	54		<u> </u>											
	15.60	100	45	22													
	16.20	100	88	65		(\ 4 <i>\)</i> (No. fractures		h planar v	vith				
17	16.80 17.60	100	72	51		<u> </u>								17 60	24.13		
18								End	of Borehole	at 17.60 m							
19																	
									1								
	MAR e cas	-	0m-8	3.20m	1				Water Strike	Casing Depth	Sealed At	Rise To	Time (min)		TER ST		DETAILS
									Guild	Doput	<u></u>	10		N	lo wate	r strike	recordeo
NS	TAL	ATIC	ON D	ETA	ILS				Date	Hole	Casing Depth	Depth Water	to Com	GR		VATER	R DETAIL
	Date	T	īp De	epth	RZ Top RZ Bas	e	Ту	ре			Dopui						

	A	_	1												R	EPORT	NUM	BER
	<i>£]</i>]]GS	مر لا)		(GEOTE	ECH	INIC	CAL CO	re log	RECOR	RD				1	669	5
co	ONTR	ACT	G	ireate	er Dublin [Drainage	Scher	me					DRILLI		10	RC1	11	
c	D-ORI		TES		326,914	4 15 F							SHEET				et 1 of 2	
			EVEL	(mO	257,853				RIG TYPE FLUSH			Knebel Air/Mist		DRILLEI LOGGEI			3/2013 3/2013	
	IENT		F	ingal	County C	Council			INCLINATI	ON (deg) METER (mr	n)	-90 82	DRILLI			Pe JL	etersen	ı I
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 ²⁵⁰	cing og m)	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
= 0									Cased dov	vn Shell & A	uger Hole							
1 1 2 3 4 6 6 7 7	6.30	100	0	0					SYMMETR returns of limestone Strong gre very stiff yo	Shell & Aug RIX DRILLIN brown sand boulders y calcisiltite ellow brown RIX DRILLIN brown sand	er Fill IG: No reco y gravelly Cl limestone E to brown sa	very, obser AY with or OULDER ndy gravel	with some st ly CLAY ved by driller	r as	<u>3.80</u> <u>4.80</u> <u>5.30</u>	N = 50/200		
- 8											IG: No reco		ved by driller		7.80	21.12		N = 50/260 mm (9, 12, 16, 11, 16, 7)
										orown sand		_~1						N = 45 (7, 9, 10, 10, 14, 11)
0/5/13		K.e.							I						14/47		סוער	
` 	EMAR ble ca:).00-1	3.40	m					Water Strike 15.60	Casing Depth	Sealed At	Rise To	Time (min)	Со	mment	s	DETAILS
W IN	ST 41	۱ ۸ ۲								Date	Hole	Casing	Depth to	Comn			VATEF	RDETAILS
	INSTALLATION DETAILS Date Tip Depth RZ Top RZ Base Type										Depth	Depth	Water	Comin	i ei its	•		
GSLR							Tip Depth RZ Top RZ Base Type											

GEOTECHNICAL CORE LOG RECORD												R	REPORT NUMBER							
	33	Ľ			GEOT	ECł	HNIC	CAL COF	re log	= LOG RECORD						16695				
CONTRACT Greater Dublin Drainage Scheme									DRILLHOLE I SHEET					NO RC11 Sheet 2 of 2						
								RIG TYPE Knebel FLUSH Air/Mist					DATE DRILLED		01/03/2013					
CLIENT Fingal ENGINEER					County Council	I	INCLINATIO		n)	-90		DRILLED BY LOGGED BY		Pe JL	etersen	1				
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend			Descript	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)			
10 11								SYMMETF returns of t	RIX DRILLIP	VG: No reco y Boulder C	very, obser LAY <i>(conti</i> i	ved by dril nued)	ler as				N = 50/95 mm (25, 38, 12			
12										NG: No reco wn LIMEST(ler as	<u>12.10</u>	16.82		N = 50/19 mm (6, 11, 17, 1 12)			
13	14.40	100	90	52		(•),		LIMESTON penetrative features / p Slight loss	NE with sign brown disc bitting of co of core stre	ded light gre hificant brec colouration a re walls (up ength in area	ciation cou and honeyc to 20mm). as displayin	pled with omb disso Weatherir	e lution 1g:	<u>13.40</u>	15.52					
15	15.40	100	96	41	F			Discontinu medium sp open, occa SET 2: Sul	ities 13.40- baced rough asionally with bvertical with	onally weak 16.10m SE a undulating h brown fine dely spaced ring on fract	F 1: 0-10° c occasional e sand on fi rough undi	ly smooth racture sur ulating, ope	faces.							
16 17	17.00	100	92	44		<u> </u>		argillaceou loosely cer strength to	ns LIMESTO mented. We weak at fra	m bedded lig DNE with loc eathering: O actures. Pen uration note	alised brec ccasional lo etrative (up	cciation often oss of wall o to 5mm)	ained en	<u>16.10</u>	12.82					
18	18.50	100	88	31	ļ.			rough undu closely to r displaying light grey g set often a	ulating tight medium spa orange brov green sandy ssociated w	19.30m SE to partly op aced rough u wn discolour cLAY vene vith non inta -sized fragm	en, clean. S indulating, ration, occa eer on surfa ct angular t	SET 2: 60- open ofter isionally wi aces. Fract io subroun	80° i th ture ded							
19	19.30	100	100	95		1		limestone. 18.35-18.5 vein	•	thick subver	· ·			<u>19.30</u>	9.62					
REMARKS Hole cased 0.00-13.40m									Water Strike 15.60	Casing Depth	Sealed At	Rise To	Time (min)		TER ST		DETAILS			
									13.00											
	TAL Date			DETA epth	ILS RZ Top RZ Base	e	Ту	pe	Date	Hole Depth	Casing Depth	Depth to Water	D Com	GRC ments		VATER	RDETAIL			

															R	EPORT		BER				
	£/[GS	ריק נ			(GEOT	ECł	INIC	CAL COP	re log	RECOF	RD				16695						
СС	NTR/	АСТ	Gı	reate	r Dublin [Drainage	Sche	me														
СС	-ORD	DINA	TES		327,094					SHEET DATE DRILL						Sheet 1 of 3 LED 04/03/2013						
GR							RIG TYPE FLUSH	YPE Knebel					D		3/2013							
									INCLINATI							Petersen JL						
(m)	(m) เ			. 0													s					
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	% % % Fracture e o Δ Δ Spacing to to to to Δ Δ Δ Δ to to to to Δ Δ Δ Δ Δ to to to Δ Δ Δ Δ Δ Δ To <								Docorinti						Standpipe Details	(enline)				
hole	Run	Τ.(Description						ttion	dpipe	SPT (N Value)				
Dowr	Core				0 250	500	Non-i	Legend							Depth (m)	Elevation	Stanc	SPT				
- 0					<u></u> .	<u></u>		<u></u>	SYMMET	RIX DRILLIN Brown TOP	IG: No recov	very, obser	ved by drille	eras	0.20	15.25						
								 0	SYMMET	RIX DRILLIN	IG: No recov	very, obser	ved by drille	eras								
- 1								- <u>o</u>	returns of I	Brown sand	y gravelly Bo	buider CLA	Y									
-																						
Ē									•													
2								- <u>-</u>														
Ē								<u>.</u>														
-3																						
Ē								0														
4								 	•													
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5								- <u>°</u> -									\mathbb{S}					
Ē								• <u>•</u>														
6								 														
Ē																		N = 44				
Ē.,																		(9, 12, 15, 10, 8, 11)				
Ē																						
È																						
8																		N = 50/205				
Ē								<u> </u>	+									(6, 9, 14, 18, 18)				
- 9																						
È																		N = 50/175				
RE								- <u>°</u>										mm (4, 10, 12, 29,				
	REMARKS Hole cased 0.00m-20.50m								Water		Sealed	Rise	Time		TER S		DETAILS					
										Strike 14.80	Depth	At	To	(min)								
Hole cased 0.00m-20.50m																						
															GRO		NATER	R DETAILS				
										Date	Hole Depth	Casing Depth	Depth to Water	Com								
05	Date -03-1		Tip De 16.5		RZ Top 10.50	RZ Base 16.50		Typ 50mm														
			2.0						-													

															R	EPORT		BER				
	GEOTECHNIC								AL COI	RE LOG	RECOF		16695									
со	NTR	АСТ	G	reate	r Dublin [Drainage	Sche	me		DRILLHOLE												
со	-ORD	DINA	TES		327,094					SHEET DATE DRILLED							Sheet 2 of 3 04/03/2013					
GR	GROUND LEVEL (mOD) 15.45								RIG TYPE FLUSH	PE Knebel DATE LOG						04/0						
									INCLINATI	ON (deg) METER (mr	,	Petersen JL										
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 ²⁵⁰	cing og m)	Non-intact Zone	Legend		Description							Standpipe Details	SPT (N Value)				
- 10										RIX DRILLIN grevish brov				er as	10.10	5.35	\mathbb{X}	9)				
- 11									SYMMETI	RIX DRILLIN Brown sand	IG: No recov				<u>10.90</u>	4.55		N = 38 (6, 6, 8, 9, 9, 12)				
12									returns of	RIX DRILLIN Soft dark br	<u>13.20</u>	2.25	0 0 0 0 0 0 0 0 0	N = 50/60 mm (25, 50)								
- 14									fragments	(Possible W			0 0 0 0 0	N = 21 (2, 4, 5, 6, 5, 5)								
16																		N = 22 (3, 4, 4, 7, 5, 6)				
17																		N = 38 (6, 13, 16, 8, 7, 7)				
- 19																		N = 25 (4, 6, 6, 4, 7, 8)				
	REMARKS									Water Cooing Socied Bigs Time								DETAILS				
Hole cased 0.00m-20.50m										Water Strike 14.80	Casing Depth	Sealed At	Rise To	Time (min)		mmeni						
INSTALLATION DETAILS										Date	Hole	Casing	Depth to Water	Com	GROUNDWATER DETAILS							
											Depth	Depth	vvaler									
08	08-03-13 16.50 10.50 16.50 50mm						I SP															
	1		1												R	EPORT	NUME	BER				
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	-21 GS	لمر ل)		(GEOTE	ECH	INIC	CAL CO	RE LOG	RECOF	RD				1	669	5				
со	NTR	ACT	G	reate	er Dublin [Drainage S	Scher	ne					DRILL	HOLE	NO	RC	12					
со	-ORE	DINA	TES		327,094	4.71 E							SHEET				et 3 of 3	3				
GR	OUN	D LE	EVEL	(mO	257,94				RIG TYPE FLUSH			Knebel Air/Mist		DRILLE			3/2013 3/2013					
	ENT GINE		F	ingal	County C	Council			INCLINATI	ON (deg) METER (mr		-90 82		ED BY ED BY		Pe JL	etersen					
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 ²⁵⁰	cing og m)	Non-intact Zone	Legend			Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)				
- 20	21.50	0	0	0	-				recovered gravel-size	as angular t ed fragments iities 20.50-2	reyish browr o subangula s. (Poor Rec 24.80m Diffi	r medium t overy)	o coarse		20.50	-5.05						
22	23.20	6	0	0																		
- 24	24.80	13	0	0	-				Fad	Developing	at 22 20 m			2	24.80	-9.35						
·	MAR e cas		0.00m	-20.5						Water Strike 14.80		Sealed At	Rise To	Time (min)		TER SI mment		DETAILS				
16695.															GRO		VATER	DETAILS				
	TAL									Date	Hole Depth	Casing Depth	Depth to Water	Comr	nents	3						
NP RC	Date -03-1		Tip D 16.5		RZ Top 10.50	RZ Base 16.50		Tyj 50mn														
	50-1	·•	10.0	~	.5.50		`															

	A	2													R	EPORT	NUME	BER
	£71. IGSI	ر ر			(GEOTI	ECH	INIC	CAL CO	re log	RECOF	RD				1	669	5
СС	NTR/	ACT	G	reate	r Dublin [Drainage	Sche	me					DRIL	LHOLE	NO	RC	13	
cc	-ORD	DINA	TES		323,822	2.42 E							SHE	ET E DRILLE			et 1 of 3	
GE			VFI	(mOl	241,678 ות	8.81 N 9.21			RIG TYPE			Knebel		E LOGGE			2/2013 2/2013	
	IENT				County C				FLUSH INCLINATI	ON (deg)		Air/Mist -90	DRIL	LED BY	,	Pe	etersen	
	GINE	ER							CORE DIA	METER (mn	n)	82	LOG	GED BY	,	D.	O'Shea	a
Downhole Depth (m)	Core Run Depth (m)	%	<i>,</i> 0	%			¢)										ils	
Depi	Dept	T.C.R.%	.C.R.%	Q.D.%	Frac Spa	cing	Zon				Descriptio	n					Deta	alue)
hole	Run	Τ.(ŝ	Я.	Lo (m		intact	pu			Description				(m) r	ution	dpipe	(N Va
Dowr	Core				0 250) 500	Non-intact Zone	Legend							Depth (m)	Elevation	Standpipe Details	SPT (N Value)
_ 0	-				<u></u>	<u>uuuili</u>	_	_	Cased dov	vn Shell & A	uger Hole				_	_		
Ē																		
Ē.																		
- 1																		
Ē																		
2																		
-																		
- 3																		
Ē																		
4																		
Ē																		
5																		
Ē																		
Ē																		
6																		
	$\left - \right $								SYMMET	RIX DRILLIN	IG: No recov	very, obser	ved by dril	ler as	6.50	2.71		
-,									returns of	madeground	consisting	of Shell &	Auger Fill					
Ę,																		
8																		
- 9																		
Ę																		
	MAR		00.5		1			• × × ×	1	Water	Casing	Sociat	Diag	Times	WA	TER ST	RIKE	DETAILS
Ho	le cas	sed 0	.00-2	4.50r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	s	
Ho										15.00						Slow		
			<u></u>								Hole	Casing	Denth tr				VATEF	DETAILS
	Date				ILS RZ Top	RZ Base	•	Тур	De	Date	Depth	Depth	Depth to Water	Com	ments	6		
					- P			7										

CONTRACT Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contract Greater Dublin Drainage Scheme Contr		олов 1009		RE				D	RECOF	RE LOG		INIC	ECł	GEOTI	(A	2
CO-ORDINATES 323.822.42 241.678 81 N RCI 221.02011 27002011 2000002011 27002011 200002011 27002011 200002011 27002011 200002011 27002011 200002011 27002011 20000001 20000000000		13	RC1	10								me	Sche	Drainage	r Dublin I	reate	G	/		<hr/>
ENGINEER CORE DIAMETER (mm) 82 LOGGED BY D.O'Shea (a) (b) (b) (c)		2/2013 2/2013	27/02 27/02		DRILLE	DATE DATE		Air/Mist			FLUSH			8.81 N 9.21	241,67)		VEL		OUN	GR
10 10<															County C	ngar	FI	ER		
10 SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey sandy very gravelly clay with occasional cobles and boulders. 13.60 4.29 13 SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey sandy very gravelly clay with occasional cobles and boulders. 13.60 4.29 14 SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey sandy very gravelly clay with occasional cobles and boulders. 14.80 5.59 16 SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/borwn sandy very gravelly clay with occasional cobles and boulders. 14.80 5.59 16 SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey/borwn sandy very gravelly clay with occasional cobles and boulders. 14.80 5.59 16 Strike Strike Depth Ketter Strike Definition S	SPT (N Value)	Standpipe Details	Elevation	Depth (m)				'n	Descriptio			Legend	Non-intact Zone	cing og m)	Spa Lo (m	R.Q.D	S.C.R.%	T.C.R.%	Core Run Depth (m)	Downhole Depth (m)
14 14.80 -5.59 15 SYMMETRIX DRILLING: No recovery, observed by driller as returns of gresybrown sandy very gravelly clay with occasional cobbles and boulders. 14.80 -5.59 15 SYMMETRIX DRILLING: No recovery, observed by driller as returns of gresybrown sandy very gravelly clay with occasional cobbles and boulders. 14.80 -5.59 16 SYMMETRIX DRILLING: No recovery, observed by driller as returns of gresybrown sandy very gravelly clay with occasional cobbles and boulders. 14.80 -5.59 18 SYMMETRIX DRILLING: No recovery, observed by driller as returns of gresybrown sandy very gravelly clay with occasional cobbles and boulders. 14.80 -5.59 18 Strike Strike Strike 16 19 Strike Strike Strike Casing Sealed 19 Strike Deph At To Tim 10 Strike Deph At To Comments					er as	d by drille Iger Fill	erved & Aug	ery, obs of Shell &	G: No recov	madegroun	returns of									11 12
16 17 10 <	N = 45 (9, 12, 10 12, 14				er as	casional d by drille	erved	clay with	ery gravelly G: No recov	grey sandy nd boulders.	returns of cobbles a SYMMET									
18 Image: Constraint of the second of th	N = 21/1 mm (25, 29, 14				sional	vith occas ed rock.	ay wi	ravelly cl hly weat	andy very g possible hiç	grey/brown nd boulders	returns of cobbles a									-
REMARKS Water Casing Sealed Time Comments Hole cased 0.00-24.50m Vater Strike Depth At To Time Comments 15.00 Image: Comment strike Image: Comment strike Image: Comment strike Slow Slow	N = 50/1 mm (16, 9, 17, 14) N = 75/1																			
Hole cased 0.00-24.50m Water Strike Casing Depth Sealed At Rise To Time (min) Comments 15.00 15.00 1 1 1 1 Slow	mm (25, 50																			19
Strike Depth At To (min) Comments 15.00 Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image: Strike Image	ETAILS	RIKE I	ER ST	WAT	Time	Disc		Social	Casing	Motor						4.55	<u> </u>	-		
		s		Со						Strike					n	4.50n	.00-24	ed 0	e cas	Hol
	DETAIL	VATER			0	Depth to	у Г	Casing	Hole	Deta						CT 4 .	011 5		T 4 1	
INSTALLATION DETAILS Date Hole Depth Casing Depth Depth to Water Comments Date Tip Depth RZ Top RZ Base Type Image: Comments Image: Comments				ients	Com	Water		Depth		Date)e	Ту		RZ Base						

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J	ઉક	Ŀ/													1	669	5
	NTR/			reate	r Dublin Drainage	Sche	me					DRIL SHEI	LHOLE N ET	10	RC1 Shee	<b>13</b> et 3 of 3	3
		DINAT	res Vel (	(mOl	323,822.42 E 241,678.81 N 0) 9.21			RIG TYPE			Knebel Air/Mist		E DRILLE E LOGGE			2/2013 2/2013	
CLI	ENT				County Council			INCLINATIO		n)	-90 82		LED BY GED BY			tersen O'Shea	1
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend			Descripti				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20								feturns of g	grey/brown id boulders	NG: No reco sandy very <u>c</u> - possible hi	gravelly clay	with occa	er as asional				
22 23													2	3.60	-14.39		
24									RIX DRILLIN grey solid ro	IG: No reco ock	very, observ	ved by drill	er as				
25	24.50	100	76	21	F.			grey/pale g sheared), f Discontinu	greym fine-g fresh to slig ities are me	r strong, med grained, LIMI ntly weather dium to clos e tight to mo	ESTONE (lo ed. ely spaced.	ocally plas	tically	4.50	-15.29		
26	26.00							clay-smea	red, commo cite-veined (	nly moderat	ely iron-oxic	le stained,					
27	27.45	100	92	32					- Constants	-+ 07.45			2	27.45	-18.24		
28									of Borehole	ai 27.45 m							
29																	
REM	MAR	KS												WAT	TER ST	RIKE	DETAILS
			.00-24	4.50r	n				Water Strike 15.00	Casing Depth	Sealed At	Rise To	Time (min)		mment Slow		
NS	TAL	LATI	ON D	ETA	ILS				Date	Hole Depth	Casing Depth	Depth to Water	Comr			VATER	DETAIL
	Date	1	Γip De	epth	RZ Top RZ Bas	e	Ту	pe	27-02-13	27.45	24.50	12.80	Water drilling	level r	ecorded '	10mins a	fter end of

	A														R	EPORT	NUME	BER
	<i>£//</i> ]GS	ر 1.			(	GEOTE	ECH	INIC	CAL COP	re log	RECOF	RD				1	669	5
С	ONTR	ACT	G	reate	r Dublin [	Drainage \$	Sche	me						LHOLE	NO	RC1		
С	)-ORI	DINA	TES		324,66 242,27								DATE	=T E DRILLE	D		et 1 of 3 2/2013	
GI	ROUN	ID LE	VEL	(mOl		2.78			RIG TYPE FLUSH			Knebel Air/Mist	DATE	LOGGE	D	28/02	2/2013	
	IENT		Fi	ngal	County C	Council			INCLINATI	ON (deg) METER (mn		-90 82		LED BY GED BY			tersen O'Shea	
Downhole Denth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 250	cing og m)	Non-intact Zone	· Legend			Descriptio				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMETR returns of	RIX DRILLIN brown sand	G: No recov	ery, obser	ved by drill	er as				
1																		
2																		
3								· · · · · · · · · · · · · · · · · · ·										
4																		
5								· · · · · · · · · · · · · · · · · · ·										
								· · · · ·										
6								· · · · · · · · · · · · · · · · · · ·										
7		-						· · · · ·	SYMMETF returns of	RIX DRILLIN grey silty fine	G: No recov e sand	rery, obser	ved by drill		7.30	-4.52		
8								× . × . × . × .										
9								· · · × · · · · × · · · · ×										
								× .										
<u> </u>	EMAR		00.2	0.20-	n	1				Water	Casing	Sealed	Rise	Time				DETAILS
	ne udi	seu l	.00-2	0.201						Strike 7.30	Depth	At	To	(min)	Co	mment Slow	s	
																2.011		
															GRO	DUND	VATER	DETAILS
	STAL									Date	Hole Depth	Casing Depth	Depth to Water	Com	ments	3		
	Date		⊺ïp De	epth	RZ Top	RZ Base		Тур	De									

	A														R	EPORT	NUM	BER
	£71 IGS	רת נ			(	GEOTI	ECł	INIC	AL COP	re log	RECOF	RD				1	669	5
СС	NTR/	АСТ	G	reate	r Dublin [	Drainage	Sche	me						LHOLE	NO	RC		
СС	-ORE	DINA	TES		324,66									ET E DRILLI	=D		et 2 of 3 2/2013	
GR		D LE	VEL (	(mOI	242,270 <b>)</b>	0.67 N 2.78			RIG TYPE FLUSH			Knebel Air/Mist		E LOGGI			2/2013	
	ient Gine	ER	Fi	ngal	County C	Council			INCLINATI	ON (deg) METER (mn		-90 82		LED BY			etersen O'She	
Downhole Depth (m)		T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi 0 250	cing og m)	Non-intact Zone	Legend			Descriptio				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10								× · · × · · × · · × · · ×	SYMMETF returns of	RIX DRILLIN grey silty find	IG: No recov e sand <i>(cont</i>	rery, obser tinued)	ved by dri					
12									SYMMETR returns of	RIX DRILLIN grey clay	G: No recov	very, obser	ved by dri	ler as		-9.22		
- 14									returns of l	RIX DRILLIN brown sandy nd boulders -	very gravel	ly clay with	n occasion	ler as al		-10.72		N = 50/115 mm (8, 17, 29, 21)
16									SYMMETF returns of	RIX DRILLIN grey highly v	IG: No recov veathered rc	rery, obser ock.	ved by dri		<u>15.40</u>	-12.62		
- 18																		
															19.70	-16.92		
1	MAR		.00-20	1 20-	n					Water	Casing	Sealed	Rise	Time				DETAILS
Ho		eu U	.00-20	J.∠Uſ						Strike 7.30	Depth	At	To	(min)		Slow		R DETAILS
- 1	STAL		ON D							Date	Hole Depth	Casing Depth	Depth to Water	Com	ments			
	Date		Tip D€	epth	RZ Top	RZ Base	•	Тур	e									

_	A	-			0503		1.114				חר			R	EPORT	NUME	BER
	35 	L)			GEOI	ECI		CAL CO	KE LOG	RECO	<b>Κ</b> υ				1	669	5
col	NTR	АСТ	G	reate	r Dublin Drainage	e Sche	eme	I				DRIL SHEE	LHOLE	NO	RC1 Shee	<b>14A</b> et 3 of 3	3
		DINAT		(mOI	324,661.67 E 242,270.67 N D) 2.78			RIG TYPE			Knebel Air/Mist		DRILLE LOGGE			2/2013 2/2013	
	ent Sinei	ER	Fi	ngal	County Council		1	INCLINATI	ON (deg) METER (mi	n)	-90 82		LED BY GED BY			etersen O'Shea	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	- o Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	20.20	100	70	26				returns of Medium si grey/pale sheared.r	grey solid ro trong to very greym fine-g predominant	NG: No recov ock <i>(continue</i> v strong, med grained, LIMI ely calci-silti e approx eve	<i>ed)</i> dium to thir ESTONE ( te but grad	nly bedded, locally plas		20.20	-17.42		
22		100	94	45		<u>(</u> 6 )		moderatel Discontinu Apertures slightly iro	y weathered uities are me are tight to	d (at 20.80-2 dium to clos open, locally ned, locally o	0.91m). ely spaced clay-smea	l, rough, pla ared, locally					
23	22.70					<i></i>		End	of Borehole	at 22.70 m				<u>22.70</u>	-19.92		
24																	
25																	
27																	
28																	
29																	
									1					14/			DET 4
	<b>VAR</b> e cas	kS ed 0.	00-2	0.20r	n				Water	Casing	Sealed	Rise	Time	-	mment		DETAILS
									Strike 7.30	Depth	At	То	(min)		Slow		
											Casimi			GRO	DUNDV	VATER	
	TALI	LATIO	DN D	ETA	ILS				Date	Hole	Casing Depth	Depth to Water	Com	monte	,		

	4	J.			GEOT	ECH	INIC	CAL COF	RE LOG	RECO	RD			R	EPORT	669	
CON	TRA	٩СТ	G	reate	r Dublin Drainage	Sche	me					DRIL	LHOLE	NO	RC	15	
												SHE	ET		Shee	et 1 of 4	4
		DINAT		(mOE	313,067.51 E 247,660.39 N ) 78.49	)		RIG TYPE FLUSH			Casagrand Air/Mist	DATE e C ⁶ DATE	e drille E logge	ED ED		3/2013 3/2013	
LIE					County Council			INCLINATIO		n)	-90 90		LED BY GED BY		M JL	. Newla	and
(n	<del>ل</del>																
	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm)	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2								Cased dov	vn Shell & A	uger noie							
3 4	l.70	100	35	15				dark grey t occasional calcisiltite 8.80-9.11n widely spa	black fine gr widely spa LIMESTON n, 28.95-29 ced very thi	ng medium t ained argilla ced medium IE (3.70-3.90 .90m) and o n calcite vei Dm) Weathe	thickness b thickness b 0m, 7.50-7.7 ccasional m n (rarely sho	ESTONE v and of 70m, nedium to owing plas	and vith stic	<u>3.40</u>	75.09		
5 5	5.10	100	85	25				yellow brow	wn non-pen	etrative stail	ning on fract						
6	5.45	100	77	39	F	<u> </u>		Discontinu smooth pla non-peneti spaced sm occasional	ities 3.40-8 anar tight, cl rative discol nooth planar very thin c	.25m SET 1 ean with rar ouration. SE to undulatir alcite (~1mm led calcite vo	: 0-10° close e yellow bro T 2: Subve ng partly ope n) veneer on	wn rtical wide en with					
,	7.70	100	89	61						subvertical fr		brown sta	aining				
	3.25	100	100	95				along fract					-				
	3.80	100	100	95				Diserviti	itiaa 0.05 0	0.000	1.0.109 -1		lahi				
,		100	100	93	E			spaced pre 45-60° me	edominantly	9.80m SET medium spaced s	aced tight, c	lean. SET	2:				
	9.65	100	100	100					-g. a olouri								
	9.95	100	100	100										14/4	TED OT	רסוער	
	cas		00-3	.40m					Water Strike 3.50	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	ts	DETAILS
										Hole	Casing	Depth to				NATER	R DETAIL
	ALL Date			eral	LS RZ Top RZ Bas	e	Ту	De	Date 21-03-13 21-03-13	<u>Depth</u> 3.40 9.65	Depth 3.40	1.20 6.00	Water	level r	ecorded		

2	A	التر			GEOT	FCF	INIC	CAL COF			RD			R			
	ઉક	Ŀ/			GLUI										1	669	5
	NTR/			reate	r Dublin Drainage	Sche	me					DRII SHE	LHOLE   Et	NO	RC Shee	<b>15</b> et 2 of 4	4
				(mOI	313,067.51 E 247,660.39 N D) 78.49			RIG TYPE			Casagrand	DAT de ^{C6} DAT	e drille E logge	D		3/2013 3/2013	
CLI	ENT				County Council			FLUSH INCLINATI CORE DIA		m)	Air/Mist -90 90	DRI	LED BY		M JL	. Newla	and
(m)	m)																
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend			Descript	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10							H				to thinly be aceous LIM						
		100	100	100			H	calcisiltite	LIMEŚTÓN	JE (3.70-3.9	n thickness I 90m, 7.50-7.	.70m,					
11	11.05							widelv spa	ced verv th	in calcite ve	occasional r in (rarely sh	owing pla	stic				
	11.95	100	100	92				yellow bro	wn non-per		ering: Slight ining on frac ble.						
12	12.30	100	100	100							1: 0-10° clos ire yellow bro		d				
							H	non-penet	rative disco	louration. Sl	ET 2: Subve ing partly op	ertical wide	ey				
13		100	100	93				occasional	very thin c	alcite (~1mr	m) veneer or vein <i>(continu</i>	n exposed	l				
	13.50							-									
						580		13.70-13.9	5m Incipie	nt fracture 7	70° partly op	en					
14		100	100	88				-									
	14.80																
15		100	100	71			Þ	-									
	15.45							15.45m Cl	uster of cut	nic nvrite alc	ong incipient	t subvertic	al				
								fracture tig	lht	cture smool	•	00000100					
16		100	100	100			┢┼	-									
	16.80							16.35-16.7	'Um Incipie	nt subvertic	al fracture ti	gnt					
17							╞┼╴	-									
		100	100	97		770											
18																	
	18.30																
19		100	100	94				-									
	19.70							19.60-19.7	′0m 45° fra	cture smoo	th planar wit	th					
RE	MAR	ĸs					<u> </u>			v brown dise				WA	TER S	TRIKE	DETAILS
			.00-3	.40m					Water Strike 3.50	Casing Depth	Sealed At	Rise To	Time (min)		omment		
Ne	TA1	AT1		ETA					Date	Hole	Casing	Depth t Water	o Comi			NATER	R DETAIL
	Date				RZ Top RZ Bas	e	Ту	pe	22-03-13	Depth 14.80	Depth 3.40	3.00	Water	level r	ecorded	at end of	
				T					25-03-13	14.80	3.40	1.35	Water	level r	ecorded	at start o	of shift

	A				GEOT	ECł	INIC	CAL COF	RE LOG	RECO	RD			R	EPORT 1	г NUMI 669	
/	යප NTR/	АСТ	G	ireate	r Dublin Drainage	Sche	me					DRI SHE		NO	RC'	<b>15</b> et 3 of 4	4
		D LE		(mOl	313,067.51 E 247,660.39 N D) 78.49			RIG TYPE FLUSH			Casagrand Air/Mist	ΠΑΤ		ED ED	21/0	3/2013 3/2013	3
	ent Sine	ER	Fi	ingal	County Council		1	INCLINATIO		m)	-90 90		LLED BY		M. JL	. Newla	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20		100	100			609.9999	9999999										
22	21.20	100	100	100		599.9999	9999999	21.60-22.0 brown non	)m 70-80° f i-penetrative	racture smo e discoloura	ooth undulat tion on fract	ing with o ture surfa	range ces				
	23.00	100	100	100				22.40-22.5 brown non	50m 50° fra 1-penetrative	cture smoot e discoloura	th undulating	g with ora ture surfa	ces	23.00	55.49		
24	24.40	100	100	86				wackeston	e LIMESTO	matrix-supp DNE (clasts ∟imestone b	ported fossil up to 45mm poulder	iferous m ı)	ud-rich				
25		97	93	73				wall streng	jth	. ,	veinfill redu						
26	25.90	100	90	69		4				CLAY vene vel fragmen	eer on non-ii its	ntact ang	ular				
	27.40 28.00	100	100	100													
28	28.65	100	92	77													
29	28.95	100 100	100 88	100 88													
	29.80							29.70-29.8	30m Non-ini	act angular	medium to	coarse					
	MAR e cas		.00-3	.40m					Water Strike 3.50	Casing Depth	Sealed At	Rise To	Time (min)		TER ST		DETAILS
	<b>TAL</b> Date			<b>DETA</b> epth	ILS RZ Top RZ Base	9	Ту	De	Date 25-03-13	Hole Depth 23.00	Casing Depth 3.40	Depth t Water 2.85		ment	s		R DETAIL

	A														R	EPORT	NUME	BER
	<i>ई/</i> ] 163	جر ل			(	GEOTI	ECH	INIC	CAL CO	re log	RECOF	RD				1	669	5
С	ONTR	АСТ	G	reate	er Dublin [	Drainage	Schei	me						LHOLE	NO	RC		
С	D-ORI	DINA	TES		313,06										Ð		et 4 of 4 3/2013	
GI	ROUN	ID LE	VEL	(mOl	247,660 <b>D)</b>	78.49			RIG TYPE			Casagrand Air/Mist		LOGGE	D		3/2013	
	IENT		Fi	ngal	County C	ouncil			INCLINATI	ON (deg) METER (mn		-90 90		LED BY GED BY		M. JL	Newla	and
Downhole Denth (m)		T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 ²⁵⁰	cing vg m)	Non-intact Zone	Legend			Descriptio				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 30									gravel-size End o	ed fragments of Borehole a	of strong an at 23.00 m	rgillaceous	limestone					
- 3 [,]																		
- 32	2																	
33	5																	
34	Ļ																	
- 38	i																	
- 36	i																	
37																		
38	5																	
39																		
										1								
1	MAR		.00-3.	.40m						Water		Sealed	Rise	Time		ren ST mment		DETAILS
										Strike 3.50	Depth	At	То	<u>(min)</u>				
200															GRO	DUNDV	VATER	RDETAILS
	STAL									Date	Hole Depth	Casing Depth	Depth to Water	Com	ments			
	Date		Tïp D€	epth	RZ Top	RZ Base		Ту	oe									

					GEOT	ECH	INIC	CAL COF	re log	RECO	RD			R	eport 1	г NUM 669	
	NTR/			ireate	r Dublin Drainage	Sche	me					DRIL SHE	.lhole et	NO	RC Shee	<b>17</b> et 1 of	2
		D LE		(mOl	315,274.53 E 251,201.85 N D) 23.43			RIG TYPE FLUSH			Casagrand Air/Mist	DAT Ie C ⁶ DAT	e drille E logge	ED ED		3/2013 4/2013	
	ENT	ER	Fi	ingal	County Council		1	INCLINATI		m)	-90 90		LED BY		M JL	. Newl	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend		vn Shell & A	Descript	lion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
1 2 3							<u>p</u>				vith cobbles.		are	3.00	_ 20.43		
4	4.00	10	0	0				subangula	r to subrour	ided of arer	naceous lime	esione		4.50	18.93		
5	5.00	80	0	0				subangula strong to v with subon pockets of Weatherin brown surf	r gravel- an ery weak bl dinate black firm black g g: Recover ace discolo	d cobble-siz ack and gre MUDSTOI gravelly clay completely uration on c	overed as ar zed fragmen ey argillaceo NE. Frequer (Poor Recc ( non-intact. cobble-sized	ts of Medi us LIMES nt cobble-s overy). Rare orar	um TONE sized				N = 50/0 n (9, 16, 50
7										e. (8.0 - 8.10 3.0m Core i	Um) recovered n	on intact					N = 50/1 mm (17, 8, 50
8	7.80	100	0	0				-									N = 50/0 r (18, 7, 50
	0.00	58	0	0				-									
9	9.00 9.50	50	0	0													N = 50/0 m (25, 50)
							H	-									
			00-1	2.00r	m				Water	Casing	Sealed	Rise	Time				DETAILS
									Strike 1.20	Depth	At	То	(min)		mment	.5	
														GR	OUND	NATE	R DETAIL
NS	TALI	ATI	ON D	ETA	ILS				Date	Hole Depth	Casing Depth	Depth to Water	D Com	ment	S		
[	Date	1	Γip De	epth	RZ Top RZ Base	9	Ту	De	27-03-13 27-03-13 28-03-13	3.10 7.50 7.50	7.50 7.50	1.20 5.50 0.20	Water pre-bo Water	ore r level r	ecorded ecorded ecorded	at end o	cable tool of shift

Z	A				GEOT	ECH	HNIC		RE LOG		RD			R	EPORT		
<	33 	Ŀ/				-										669	00
COI	NTR/	АСТ	G	ireate	r Dublin Drainage	Sche	me					DRIL — SHE	.lhole et	NO	RC' Shee	<b>17</b> et 2 of :	2
				(mOI	315,274.53 E 251,201.85 N 23.43			RIG TYPE			Casagrand	DAT		ED ED	27/0	3/2013 4/2013	3
CLI	ENT				County Council			FLUSH		m)	Air/Mist -90 90	DRIL	LED B' GED B'	Y	M. JL	Newla	and
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 ²⁵⁰ 500	Non-intact Zone	Legend			Descript				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.50	30	0	0			H	subangula	r gravel- an	d cobble-siz	vered as and ed fragment	s of Medi					
	11.00	100	0	0				with subor	dinate black	< MUDSTOP	y argillaceou NE. Frequen (Poor Reco	t cobble-s very).	ized				N = 50/0 n (16, 9, 50
11		50	0	0				brown surf	face discolo	y completely puration on c e. (8.0 - 8.10	non-intact. l obble-sized )m)	Rare orar fragment	ige s of				
12	12.00	80	0	0				Discontinu (continued		3.0m Core r	ecovered no	on intact					
														13.00	10.43		
13		100	56	47				fine graine	d argillaced	us LIMEST	ck very thin to ONE with clo NE bands an	osely to m	edium	10.00	10.40		
14	13.70	92	59	19		/ :: . / / :: . /		firm black material (1 Weatherin strength to Discontinu	clay often a 13.10-13.26 g: Mudston o very weak iities 13.0-1	ssociated w 6, 13.45-13.6 e bands disp 5.0m 0-10°	ith brecciate 51m & 14.44 blay occasion very closely ly associated	d limesto -14.75m) nal loss o to closely	ne ). f wall /	15.00	0.40		
15	15.00							non intact and mudst (<2mm)	gravel-sized tone, partly	d fragments	of argillaced	us limest	one	15.00	8.43		
16																	
17																	
18																	
19																	
REN	MAR	ks												WAT	TER ST	RIKE	DETAILS
Hole	e cas	ed 0.	.00-1	2.00r	n				Water Strike 1.20	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	S	
										Lisis				GRO	OUNDV	VATER	R DETAIL
	<b>TAL</b> Date			<b>DETA</b>	ILS RZ Top RZ Base	e	Tv	ре	Date 28-03-13	Hole Depth 13.00	Casing Depth 12.00	Depth to Water 9.00	Con	nments er level r	S ecorded a	at end o	f shift
	2010	+	ים קי	5001			· y	~~	02-04-13 02-04-13	13.00 13.00 15.00	12.00 12.00 12.00	2.00 9.00	Wate	er level r	ecorded a	at start o	

	A														R	EPORT	NUME	BER
	१ <u>७</u> २। 163	لسر لے			C	GEOTI	ECH	INIC	AL COF	re log	RECOF	RD				1	669	5
со	NTRA	АСТ	G	reate	r Dublin [	Drainage	Sche	me					DRIL	LHOLE	NO	RC	19	
СС	-ORD	DINA	TES		320,704								SHE	et E drilli	<b>ED</b>		et 1 of 3	
GR	OUN	D LE	VEL	(mOI	255,469 <b>)</b>	9.62 N 34.01						Knebel Air/Mist		E LOGGI			2/2013 3/2013	
CL	ient Ginei				County C	ouncil			FLUSH INCLINATION CORE DIA	ON (deg) METER (mr		-90		LED BY			etersen O'Shea	
(E	(u)									·								
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi 0 250	cing og m)	Non-intact Zone	Legend	2		Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
Ę									Cased dov	vn Shell & A	uger Hole							
- 1																		
2																		
3															3.80	30.21		
4									SYMMETH returns of	RIX DRILLIN madeground	IG: No recover the second second second second second second second second second second second second second s	/ery, obser of Shell & .	ved by dri Auger Fill	ller as				
5																		
6																		
7																		
8																		
9															9.70	24.31		
RE		×6						<u>e</u> 7										
	MARI le cas		.00-20	0.00r	n					Water Strike		Sealed	Rise	Time (min)		mment		DETAILS
Ho										Juike	Depth	At	To	(11111)	N	lo wate	r strike	recorded
		=-	<u></u>								Hole	Casing	Denth t	0 -			VATEF	RDETAILS
	Date		<b>ON D</b> Tip D€		ILS RZ Top	RZ Base		Тур	e	Date	Depth	Depth	Depth to Water	- Com	ments	5		

2	A				C	GEOT	ECH	INIC	CAL COF	RE LOG	RECO	RD			R	eport 1	олика 1969	
/	ପ୍ରଟ NTR/	/	G	reate	r Dublin D	Drainage	Sche	me							NO	RC	19	
GRO		DINA ⁻	VEL		320,704 255,469 <b>D)</b> County C	9.62 N 34.01			RIG TYPE FLUSH INCLINATIO			Knebel Air/Mist -90	DAT	E DRILL E LOGG	ED	28/02 01/03	et 2 of 3 2/2013 3/2013 etersen	}
	SINE	ER		ngai				1	CORE DIA		m)	-90		GED B			O'She	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fract Spac Lo (mr 0 ²⁵⁰	cing vg m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10									returns of g cobbles an	grey sandy Id boulders	NG: No recc very gravell . (continued	y clay with )	occasiona	I	11.80	22.21		N = 50/18 mm (10, 14, 1 22, 9)
12										grey sandy	gravelly cla							N = 40 (6, 8, 9, 11 12)
14									SYMMETF returns of g cobbles an	RIX DRILLII grey very si id boulders	NG: No recc andy gravell	overy, obse y clay with	rved by dri occasiona	iller as I	14.10	19.91		N = 50/1 ⁻ mm (9, 13, 27,
16																		N = 75/1 mm (25, 50)
18										brown sand	NG: No reco ly gravelly cl				17.90	16.11		N = 50/14 mm (19, 6, 23, N = 47 (7, 10, 9, 14, 16)
19									SYMMETF returns of b	RIX DRILLI	NG: No reco	overy, obse elly clay wit	rved by dri <u>h occa</u> sior	ller as		14.41		
			00.2	0 00-	m					Water	Casing	Sealed	Rise	Time				DETAILS
1016	e cas	ea U	.00-2	0.00r						Strike	Depth	At	To	(min)		mment		recorded
											Hole	Cacina	Dorth 1				VATE	R DETAIL
	<b>TALI</b> Date				ILS RZ Top	R7 Base		Ту	<u>1</u>	Date	Depth	Casing Depth	Depth t Water	Con	nments	6		
	Juic		ים קי		. <u></u> 10p		-	' y										

	A	>													R	EPORT	NUME	BER
	<i>इ</i> // ।उड	רת נ			(	GEOTI	ECH	INIC	CAL CO	re log	RECOF	RD				1	669	5
СС	DNTR/	ACT	G	reate	r Dublin [	Drainage	Sche	me					DRIL	LHOLE	NO	RC	19	
cc	-ORE	DINA	TES		320,704	4.27 E							SHEE				et 3 of 3	
GF	ROUN	D LE	VEL	(mOl	255,469	9.62 N 34.01			RIG TYPE FLUSH			Knebel Air/Mist					2/2013 3/2013	
	IENT GINE		Fi	ngal	County C	council		1	INCLINATI	ON (deg) METER (mn		-90		LED BY GED BY			etersen O'Shea	
B Downhole Depth (m)		T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 ²⁵⁰	cing og m)	Non-intact Zone	Legend	cobbles ar	nd boulders -	Descriptio		ered rock.		Depth (m)	Elevation	Standpipe Details	SPT (N Value)
Ē									End	of Borehole a	at 20.00 m							
21																		
22																		
23																		
24																		
- 25																		
- 26																		
27																		
28																		
- 29																		
Ē																		
	MAR	ĸs													W۵	TFR ST	RIKE	DETAILS
	le cas		.00-2	0.00r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)		mment		
Ho											Doput							recorded
	STAL		ם אס	ETA	ILS					Date	Hole	Casing	Depth to Water	Com			VATER	DETAILS
	Date					RZ Base		Ту	ре	Date	Depth	Depth	Water			-		

	A	man)													R	EPORT	NUME	BER
	*/    GS	مر ك			(	GEOTI	ECH	INIC	CAL CO	RE LOG	RECOF	RD				1	669	5
СС	NTR/	АСТ	G	reate	r Dublin [	Drainage	Sche	me					DRII	LHOLE	NO	RC	20	
cc	-ORD	DINA	TES		324,487	7.08 E							SHE				et 1 of 3	
				(m0	257,266	6.58 N 54.06			<b>RIG TYPE</b>			Knebel		e drille E logge			3/2013 3/2013	
	IENT				County C				FLUSH INCLINATI	ON (dea)		Air/Mist -90	DRII	LED BY	,	Pe	etersen	
EN	GINE	ER		-	-					METER (mr	n)	82	LOG	GED BY	,	JL		
) (E	(m)			-													<u>s</u>	
Depth	epth	T.C.R.%	.C.R.%	.D.%	Frac Spa		Zone										Detai	(en
ole [	Run D	T.C	S.O	R.Q.	Lc (mi	g	tact	σ			Descripti	on			(E	on	oipe I	N Val
Downhole Depth (m)	Core Run Depth (m)						Non-intact Zone	Legend							Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0	Ö				0 250 	, 500 	Ż	Ľ	Coood dou	wn Shell & A					Δ	Ξ	ŵ	ō
Ē									Cased dov		uger Hole							
Ē																		
1																		
Ē																		
-																		
2																		
Ē																		
-3																		
Ē																		
Ē																		
4																		
-																		
- 5																		
Ē																		
Ē																		
6																		
Ē								×××		RIX DRILLIN		very, obser	ved by dri		6.50	47.56		
Ę,										Shell & Aug		-	-					
Ē																		
Ē																		
8																		
Ē																		
Ē,																		
- 9																		
ļ																		
RE	MAR	ĸs						××××	1						WA	TER ST	RIKE	DETAILS
	le cas	sed 0	.00-1	7.0m						Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	s	
										13.20								
Ho																		
															GRO		VATER	DETAILS
INS	STAL									Date	Hole Depth	Casing Depth	Depth t Water	^o Com	ments	6		
	Date		Tip De	epth	RZ Top	RZ Base	•	Ту	pe									
3																		

/	A		1												R	EPORT	NUM	BER
	£//  GS	لمر ل			(	GEOT	ECł	HNIC	CAL CO	RE LOG	RECOR	RD				1	669	5
со	NTR/	ACT	G	reate	r Dublin [	Drainage	Sche	me					DRIL	LHOLE	NO	RC	20	
со	-ORE	DINA	TES		324,48	7.08 E							SHE				et 2 of	
			VEL	(mOI	257,260				RIG TYPE			Knebel		e drill E loggi			3/2013 3/2013	
	IENT				County C				FLUSH INCLINATI	ON (deg)		Air/Mist -90	DRI	LED B	(	Pe	etersen	1
EN	GINE	ER	<u> </u>						CORE DIA	METER (mr	n)	82	LOG	GED B	1	JL		
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 250	cing og m) ⁰ 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10										RIX DRILLIN stiff grey gra			ved by dri	ler as	10.20	43.86		
12															10.00	44.00		N = 50/135 mm (8, 16, 24, 26)
13									SYMMET returns of	RIX DRILLIN brown very s	IG: No reco sandy grave	very, obsei lly boulder	ved by dri clay	ler as		41.26		N = 29 (6, 7, 7, 10, 6, 6)
- 14										RIX DRILLIN stiff grey gra			ved by drii	ler as	14.00	40.06		N = 50/215 mm (11, 14, 15, 18, 17)
16									SYMMET returns of	RIX DRILLIN black heavil	IG: No reco y fractured r	very, obsei ock / Poss	ved by dri ible fault b	ler as reccia.		37.96		N = 50/125 mm (25, 29, 21)
17	18.50	7	0	0					occasional angular to fragments	trong dark g I gravel-size subangular . Weathering itties 17.0-2 nature	d pocket of f medium to o g: Negligable	irm black o coarse gra e.	clay recove vel-sized	h ered as	17.00	37.06		
19	19.80	15	0	0											19.80	34.26		
-								ДŢ,									רסייער	
	MAR le cas		.00-1	7.0m						Water	Casing	Sealed	Rise	Time		mment		DETAILS
										Strike 13.20	Depth	At	То	(min)				R DETAILS
	TAL	LATI		ETA	ILS					Date	Hole Depth	Casing Depth	Depth to Water	D Corr	nments			
	Date		Tip D	epth	RZ Top	RZ Base	•	Ту	be									

	A														R	EPORT	NUME	BER
	£// (GS	רק נק			(	GEOT	ECH	INIC	CAL CO	RE LOG	RECOF	RD				1	669	5
со	NTR/	ACT	G	reate	r Dublin [	Drainage	Sche	me						LHOLE	NO	RC2		
со	-ORD	DINA	TES		324,487								DATE	T DRILLE	Đ		et 3 of 3 3/2013	
GR	OUN		VEL	(mOl	257,266 <b>D)</b>	54.06			RIG TYPE			Knebel Air/Mist		LOGGE			3/2013	
	ient Ginei	ER	Fi	ngal	County C	ouncil			INCLINATI	ON (deg) METER (mn		-90 82		LED BY GED BY		Pe JL	etersen	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (mi 0 250	cing yg m)	Non-intact Zone	Legend			Descripti				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 20 - -	20.70	39	6	0					LIMESTO	rong dark gr NE with mult and much firr alcite veins a	iple very clo n black clav	sely space	d incipient		20.70	33.36		
Ē	21.20	0	0	0				_	No Recove	ery		ith dreccia	tion. ( <i>contil</i>	luea)		32.86		
									End	of Borehole a	at 21.20 m							
22																		
23																		
-																		
- 24																		
- 25																		
- 26																		
27																		
28																		
29																		
Ē																		
	MAR		.00-1	7 0m						Water	Casing	Sealed	Rise	Time				DETAILS
	J 045		1	011						Strike 13.20	Depth	At	To	(min)	Co	mment	S	
Ho																		
															GP	ייחאוור		
INS	TAL	LATI		ETA	ILS					Date	Hole	Casing	Depth to Water	Com	ments			DETAILO
	Date				RZ Top	RZ Base	9	Ту	pe		Depth	Depth	vvaler					

	4 33	L			GEOT	ECF	INIC	CAL COF	RE LOG	RECO	RD			R		669	
:01	NTR/	٩СТ	G	reate	r Dublin Drainage	Sche	me					DRIL	LHOLE	NO	RC	24	
	000				247.067.00 5							SHE	ET		Shee	et 1 of 2	2
				( <b>0</b>	317,067.22 E 249,126.22 N			<b>RIG TYPE</b>			Casagrand	DATI ^{e C6} DATI	e drill E logg	ED ED		4/2013 4/2013	
			VEL Fi		D) 10.76 County Council			FLUSH INCLINATI	ON (dea)		Air/Mist -90		LED B			. Newla	
ING	SINE	R		-	-			CORE DIA		m)	90	LOG	GED B	(	JL		
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend			Descript	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2 3									vn Shell & A								
5	5.40	100	100	28				Strong gre	y and dark	ed argillace	very medium bed ous LIMEST m) and rare	ONE with	ı.	4.20 5.00			
6		100	100	100				sheared m Discontinu predomina	atrix. Weatl iities 5.0-10 intly mediur	hering: Negl .10m 5-20° n spaced sn	igable closely to wi nooth undula	dely spac	ed				
7	6.60 7.45	100	98	85					y open, clea								
8	8.75	100	100	100		620.0000											
9		100	100	100										10.00	0.70		
١E	MAR	٨S	1			1		1							0.76	I Rike	DETAILS
			.00-5	.00m					Water Strike 2.80	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	ts	
NS.	ΤΔΙΙ	ΔΤΙ	ON D	ETA	ILS				Date	Hole	Casing	Depth to		ments			R DETAIL
	Date				RZ Top RZ Base	e	Ту	De	02-04-13 03-04-13	Depth 7.45 7.45	5.00 5.00	2.00 0.60	Wate	r level r	ecorded	at end of at start o	

	A														R	EPORT	NUME	BER
	<i>£/</i> [ ]GS	ر ر			(	GEOTE	ECH	INIC	CAL COP	RE LOG	RECOR	RD				1	669	5
С	ONTR	АСТ	G	reate	er Dublin [	Drainage	Scher	ne						LLHOLE	NO	RC		
С	D-ORI	DINA	TES		317,06								SHE DAT		Ð		et 2 of 2 4/2013	
GI	ROUN	ID LE	VEL	(mOl	249,120 <b>D)</b>	5.22 N 10.76			RIG TYPE FLUSH			Casagrand Air/Mist	le C ⁶ DAT	'E LOGGE	D		4/2013	
	IENT		Fi	ngal	County C	council			INCLINATI	ON (deg) METER (mn	n)	-90 90		LLED BY GED BY		M. JL	Newla	Ind
Downhole Denth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	cing og	Non-intact Zone	p			Descripti	on			(m)	tion	Standpipe Details	SPT (N Value)
	Core I						Non-ir	Legend							Depth (m)	Elevation	Stand	SPT (
	10.10					) 500 	-	-	End	of Borehole a	at 10.10 m				-			
[ 1'																		
- 12	2																	
1:																		
- 14	ŀ																	
- 1	i																	
- 16	1																	
- 18																		
- 19																		
	MAR			0.2	1				I	Watar	Casing	Socied	Diac	Time	WA	TER ST	RIKE	DETAILS
Ho	ole cas	sed C	.00-5.	.00m	I					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mment	s	
										2.80								
			<u></u>	·							Hole	Casing	Denth f	0			VATEF	DETAILS
	STAL Date					RZ Base		Ту	De	Date 03-04-13	Depth 10.10	Depth 5.00	Depth t Water 1.70				at end of	borehole
			. = `		-r-													

RC06 Box 1 of 2 - 18.0-20.70m



RC06 Box 2 of 2 - 20.70-22.15m



RC07 Box 1 of 1 - 15.0-17.80m



RC09 Box 1 of 2 - 15.0-16.50m



RC09 Box 2 of 2 - 16.50-18.0m



IGSL Ltd

RC10 Box 1 of 4 - 8.20-11.0m



RC10 Box 2 of 4 - 11.0-13.70m



RC10 Box 3 of 4 - 13.70-16.80m



RC10 Box 4 of 4 - 16.80-17.60m



RC11 Box 1 of 3 - 5.30-15.40m



RC11 Box 2 of 3 - 15.40-18.35m



RC11 Box 3 of 3 - 18.35-19.30m



# RC12 Box 1 of 1







# RC14A Box 1 of 1 - 20.20-22.70m



RC15 Box 1 of 16 - 3.40-5.20m



RC15 Box 2 of 16 - 5.20-7.10m



# RC15 Box 3 of 16 - 7.20-8.80m



#### RC15 Box 4 of 16 - 8.80-10.65m



# RC15 Box 5 of 16 - 10.65-12.05m



RC15 Box 6 of 16 - 12.05-13.50m



RC15 Box 7 of 16 - 13.50-14.80m



# RC15 Box 8 of 16 - 14.80-16.30m



RC15 Box 9 of 16 - 16.30-18.10m



RC15 Box 10 of 16 - 18.10-20.05m



# RC15 Box 11 of 16 - 20.05-21.60m



# RC15 Box 12 of 16 - 21.60-23.0m



# RC15 Box 13 of 16 - 23.0-24.85m



# RC15 Box 14 of 16 - 24.85-26.70m


16695 - Greater Dublin Drainage Scheme – Core Photography

RC15 Box 15 of 16 - 26.70-28.25m



# RC15 Box 16 of 16 - 28.25-29.80m



16695 - Greater Dublin Drainage Scheme - Core Photography

RC17 Box 1 of 3 - 3.0-11.0m



RC17 Box 2 of 3 - 11.0-13.70m



16695 - Greater Dublin Drainage Scheme – Core Photography

RC17 Box 3 of 3 - 13.70-15.0m



RC20 Box 1 of 1 - 17.0-21.20m



16695 - Greater Dublin Drainage Scheme - Core Photography

RC24 Box 1 of 2 - 5.0-7.45m



RC24 Box 2 of 2 - 7.45-10.10m



IGSL Ltd

Water Monitoring Records

	Wate	r Reac	lings					
Project Name	Greater D	ublin Drai	nage Sche	me		1/	GS]	L/
Project No.							Ltd.	
		unty Coun	ncil					
	<b>J</b> ****							
Date	Bŀ	104	Bŀ	101	BH	102	Bŀ	105
Elevation (m OD)	39.	435	44.	432	41.	547	25.	478
	m bgl	m OD	m bgl	m OD	m bgl	m OD	m bgl	m OD
25/02/2013	1.32	38.12						
28/02/2013	1.24	38.20	0.78	43.65	6.00	35.55		
27/03/2013	1.03	38.41	0.30	44.13	5.78	35.77	11.88	13.60
17/04/2013	-							
24/04/2013	1.32	38.12	0.615	43.817	5.98	35.57	12.01	13.47
13/05/2013	1.37	38.07	0.60	43.83	6.60	34.95	12.26	13.22
Date	BF	106	Bł	112	BF	107	Bł	109
Elevation (m OD)	29.	511	15.	15.452		21.613		957
	m bgl	m OD	m bgl	m OD	m bgl	m OD	m bgl	m OD
25/02/2013								
28/02/2013								
27/03/2013	9.86	19.651	10.28	5.172				
17/04/2013			13.55	1.90				
24/04/2013	10.07	19.44			3.02	18.593	2.68	20.277
13/05/2013	10.04	19.47	14.23	1.22	3.5	18.113	2.71	20.247

Soakaway Test Records





Soak	away	Design f -value from	n field tests	IGS
Contract:	Greater D	Publin Drainage Scheme	Contract No.	16695
est No.	SA TP10			
Client		unty Council		
ate:	07/03/201			
		l conditions		Creved water
from	to	Description		Ground water
0.00 0.45	0.45 0.80	TOPSOIL: Soft brown slightly sandy CLAY Soft to firm brown and yellow brown sandy		_
0.80	1.80	Firm to stiff grey brown occasionally mottle		
0.00	1.00	silty CLAY with a medium cobble and low b		DRY
1.80	2.00	Very stiff to hard dark greyish brown slightly low to medium cobble content		_
Notes:				
Field Data	9	Field Test		
				_
Depth to	Elapsed	Depth of Pit (D)	2.00	m
Water	Time (min)	Width of Pit (B)	0.60	m
(m)	(min)	Length of Pit (L)	2.65	m
0.90	0.00	Initial depth to Wa	ter = 0.90	٦m
0.90	0.50	Final depth to wate		
0.900	1.00	Elapsed time (min		
0.900	1.50		-, 00.00	
0.900	2.00	Top of permeable	soil	m
0.90	2.50	Base of permeable		m
0.900	3.00			
0.905	4.00			
0.905	5.50	Base area=	1.59	m2
0.905	9.00	*Av. side area of permeable stratum over te	est period= 7.0525	m2
0.91	18.00	Total Exposed area	a = 8.6425	m2
0.92	25.00			
0.92	30.00			1
0.925	45.00	Infiltration rate (f) = Volume of water us	sed/unit exposed area / unit tim	ie
0.93	55.00	f 0.05 05 m/min or	4 522425 0	C
0.93	60.00	f= 9.2E-05 m/min or	1.53312E-0	6 m/sec
	70.00	Depth of water vs Elapsed	Time (mins)	
	60.00		•	_
	50.00		•	_
	<b>40.00</b>		•	_
	<b>Ц</b> 30.00		•	_
	Elapsed Time(mins) 40.00 30.00 50.00	•	•	_
	₩ 10.00			_
		↓ ▲ ▼		
	0.00		1 1 1	
		90 0.90 0.91 0.91 0.92	0.92 0.93 0.93	0.94
		90 0.90 0.91 0.91 0.92 Depth to Wate		0.94

Variable Head Test Records

E	Borehole	Soa	kaway [·]	Test R	eport Sheet	t	IGSL
CONTRACT:	Greater Dublin			TEST RESPONSE ZONE DETAILS:			
NUMBER	16695						
CLIENT:	Fingal County	Council		Top (mbg			6.80
				Bottom (			8.80
LOCATION:	Clonshaugh			Length (r			2.00
BOREHOLE No.	RC01			Diamete			0.500
TEST No.	1				anding Water Level		0.615
	-				top of casing)		
Elapsed	Depth				casing or standpip	e:	0.00
Time	to Water*				ound level (m)		
(mins)	(m)			Falling o	r Rising Head Test?		RISING
$\begin{array}{c} 0\\ 0.5\\ 1\\ 1.5\\ 2\\ 2.5\\ 3\\ 3.5\\ 4\\ 4.5\\ 5\\ 10\\ 15\\ 20.5\\ 22\\ 23\\ 24\\ \end{array}$	5.85 5.78 5.67 5.47 5.36 5.23 5.10 4.97 4.85 4.72 4.60 3.49 2.39 1.65 1.53 1.48 1.43	Depth (metres)		7.00 6.00 5.00 4.00 3.00 2.00 1.00	•••	•	
		с	.1	0.00	Log Time (mins)	0	100
					Log Time (timis)		
		T1 (min T2 (min Period c Initial de Final de Fall in le Volume f-value =	s) of flow opth (m) opth (m) ovel (m) Dispersed	3.00 20.50 17.50 5.10 1.65 -3.45 -0.6775	e it exposed area / unit -0.0116	<b>Respone Zone</b> Length (m) Diameter (m) Exposed Area	2.000 0.500
<ul> <li>Depth of wa top of casin</li> </ul>							

E	Borehole	Soa	kaway	Test R	eport Sheet	t	IGSL
CONTRACT:	Greater Dublin			TEST RESPONSE ZONE DETAILS:			
NUMBER	16695		-				
CLIENT:	Fingal County	Council		Top (mbg	JI):		15.00
				Bottom (I	nbgl):		18.00
LOCATION:	Annsbrook			Length (n	n):		3.00
BOREHOLE No.	RC06			Diameter	r (m):		0.500
TEST No.	1			Initial Sta	inding Water Level		10.070
					top of casing)		
Elapsed	Depth			Height of	casing or standpip	e :	0.00
Time	to Water*				ound level (m)		
(mins)	(m)			Falling or	Rising Head Test?		RISING
				· · · · ·			
0 0.5 1 1.5 2 2.5 3 3.5 4 5 10 15 20	11.88 11.78 11.73 11.68 11.62 11.58 11.54 11.50 11.47 11.40 11.16 10.99 10.87	Depth (metres)		12.00 11.80 11.60 11.40 11.20 11.00		•	
		0	0.1	<del>- 10.80 +</del> 1	1(	)	100
					Log Time (mins)		
		T1 (min T2 (min Period c Initial de Final de Fall in le Volume f-value =	s) of flow epth (m) pth (m) evel (m) Dispersed	1.50 20.00 18.50 11.68 10.87 -0.81 -0.1591	e t exposed area / unit -0.0018	Respone Zone Length (m) Diameter (m) Exposed Area	3.000 0.500
* Depth of wa top of casin			, <b>,</b>				

E	Borehole	Soa	kaway [·]	Test R	eport Shee	t	IGSL
CONTRACT:	Greater Dublin	n Draina	ge Scheme		TEST RESPONSE ZONE DETAILS:		
NUMBER	16695		5				
CLIENT:	Fingal County	Council		Top (mbg	al):		11.50
	r nigar oounty	Countin		Bottom (			13.00
LOCATION:	NewtownCord	uff		Length (r			1.50
BOREHOLE No.		un		Diamete			0.500
TEST No.	1				Inding Water Level		3.500
	1				top of casing)		3.300
Florend	Denth						0.00
Elapsed Time	Depth to Water*				casing or standpip	je:	0.00
					ound level (m)		510110
(mins)	(m)			Falling o	r Rising Head Test?		RISING
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 10 15 20 25	3.88 3.74 3.69 3.65 3.65 3.61 3.61 3.61 3.60 3.59 3.59 3.57 3.56 3.55 3.55	Depth (metres)		3.90 3.85 3.80 3.75 3.70 3.65 3.60 3.55	•••		
				3.50	1		
		C	.1	1	1	0	100
					Log Time (mins)		
		Calcula	tion of stead	ly flow Rat	e		
				-		Doonene 7em	
		T1 (min T2 (min		0.00		Respone Zone	
		T2 (min		1.50		Length (m)	1.500
		Period c	DT TIOW	1.50		Diameter (m)	0.500
			a. 7. 5	0.00		Exposed Area	2.553
		Initial de		3.88			
		Final de		3.65			
		Fall in le		-0.23			
		Volume	Dispersed	-0.0452			
		f-value =	= Volume disp	persed / uni	t exposed area / unit	time	
		f-value (	(m/min) =		-0.0118		
<ul> <li>Depth of wa top of casin</li> </ul>							

E	Borehole	Soa	kaway	Test R	eport Shee	et	IGSL
CONTRACT:	Greater Dublin	n Drainad	ge Scheme		TEST RESPONSE	ZONE DETAILS	
NUMBER	16695						
CLIENT:	Fingal County	Council		Top (mbg	al):		13.00
	r nigai oouniy	oounon		Bottom (			18.00
LOCATION:	Clonshaugh			Length (r			5.00
BOREHOLE No.				Diamete			0.500
TEST No.	1				Inding Water Level		6.600
TEST NO.	1					1	0.000
<b>E</b> 1	D	1			top of casing)		
Elapsed	Depth				casing or standpi	pe :	0.00
Time	to Water*				ound level (m)		
(mins)	(m)			Falling o	r Rising Head Test	?	FALLING
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 10 15 20 25	2.28 2.84 3.05 3.20 3.30 3.35 3.40 3.45 3.48 3.50 3.53 3.66 3.78 3.89 4.00	Depth (metres)		4.50 4.00 3.50 3.00 2.50 2.00 1.50	• • • • • • • • • • • • • • • • • • •		
		с	.1	0.50	Log Time (mins)	10	100
					Log Thio (hillo)		
		T1 (min T2 (min Period c Initial de Final de Fall in le Volume f-value =	s) of flow opth (m) opth (m) evel (m) Dispersed	0.50 25.00 24.50 2.84 4.00 1.16 0.2278	e t exposed area / un 0.0012	<b>Respone Zon</b> Length (m) Diameter (m) Exposed Area it time	5.000 0.500
* Depth of wa top of casin			,		5.0012		

E	Borehole	Soa	kaway [·]	Test R	eport Sheet	t	IGSL
CONTRACT:	Greater Dublin	n Draina	ge Scheme	TEST RESPONSE ZONE DETAILS:			
NUMBER	16695		-				
CLIENT:	Fingal County	Council		Top (mbg	(l):		22.50
	3 <b></b>			Bottom (			24.00
LOCATION:	Annsbrook			Length (n			1.50
BOREHOLE No.				Diameter			0.500
TEST No.	1				Inding Water Level		12.260
					top of casing)		12.200
Elapsed	Depth				casing or standpip	0.	0.00
Time	to Water*					ς.	0.00
					ound level (m)		
(mins)	(m)			Falling or	Rising Head Test?		FALLING
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 10 15 20 25	11.17 11.59 11.73 11.83 11.88 11.94 11.97 12.00 12.01 12.02 12.04 12.11 12.14 12.16 12.17	Depth (metres)		12.40 12.20 12.00 11.80 • • • • • • • • • • • • •	•••••	• • •	
				11.00			
		c	0.1	1	10	)	100
					Log Time (mins)		
		T1 (min T2 (min Period c Initial de Final de Fall in le Volume f-value =	s) of flow opth (m) opth (m) evel (m) Dispersed = Volume disp	0.00 5.00 5.00 11.17 12.04 0.87 0.1708	t exposed area / unit	<b>Respone Zone</b> Length (m) Diameter (m) Exposed Area	1.500 0.500
* Depth of wa top of casin	ter below	n-value (	(m/min) =		0.0134		

E	Borehole	Soa	kaway [·]	Test R	eport Sheet		IGSL
CONTRACT:	Greater Dublin	n Drainag	ge Scheme	TEST RESPONSE ZONE DETAILS:			
NUMBER	16695		-				
CLIENT:	Fingal County	Council		Top (mbg	ıl):		10.00
	3-11 - 0 0 m			Bottom (r			12.00
LOCATION:	NewtownCord	uff		Length (n			2.00
BOREHOLE No.		an		Diameter			0.500
TEST No.	1				nding Water Level		2.710
	I				top of casing)		2.1 10
Elapsed	Depth				casing or standpipe		0.00
Time	to Water*				ound level (m)	· ·	0.00
(mins)	(m)			Failing or	Rising Head Test?		FALLING
$\begin{array}{c} 0.5 \\ 1 \\ 1.5 \\ 2 \\ 2.5 \\ 3 \\ 3.5 \\ 4 \\ 4.5 \\ 5 \\ 10 \\ 15 \\ 20 \\ 25 \end{array}$	0.80 0.96 1.20 1.40 1.55 1.70 1.86 2.00 2.10 2.33 2.62 2.68 2.68 2.68 2.68 2.68	Depth (metres)		3.00 2.50 2.00 1.50 1.00 0.50 0.50		•••	
		C	.1	1	10		100
					Log Time (mins)		
		T1 (min T2 (min Period c Initial de Final de Fall in le Volume	s) of flow opth (m) opth (m) ovel (m) Dispersed	1.50 4.50 3.00 1.20 2.10 0.90 0.1767	e t exposed area / unit	<b>Respone Zone</b> Length (m) Diameter (m) Exposed Area	2.000 0.500
			m/min) =		0.0176		
<ul> <li>Depth of wa top of casin</li> </ul>							

**Geophysical Survey Report** 

Greater Dublin Drainage Scheme Fingal, Dublin Geophysical Survey

Report Status: Final MGX Project Number:5671 MGX File Ref: 5671f-005.doc 23th April 2013

# **Confidential Report To:**

I.G.S.L. Unit F M7 Business Park Naas Co. Kildare

## Report submitted by : Minerex Geophysics Limited

Issued by:

MATL

Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Ireland Tel.: 01-6510030 Fax.: 01-6510033 Email: <u>info@mgx.ie</u>

Hartmut Krahn (Senior Geophysicist)



Subsurface Geophysical Investigations

# **EXECUTIVE SUMMARY**

- 1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of 2D-Resistivityand seismic refraction (p-wave) for the ground investigation for the Greater Dublin Drainage Scheme.
- 2. The main objectives of the survey were to determine ground conditions, estimate the depth to rock and overburden thickness and generate a ground model for three sites.
- 3. At the Southern Site at the R123 at Portmarnock a thick layer of boulder clay is present and the depth to rock is 14 m and more under the seismic profiles. The boulder clay is highly consolidated with a stiffness of very stiff to hard. The site conditions are suitable for development as the ground has a high bearing capacity but can be also excavated by digging.
- 4. The Southern Outfall Site on the beach near Portmarnock shows thick overburden consisting of marine sediments and boulder clay to a considerable depth of 10 m bgl. The rock head slowly dips towards the sea in the east.
- 5. The Northern Outfall Site has relatively shallow rock on the higher westerly part of the site. The site topography dips to the east and at the easternmost profile the overburden thickness has increased to approx. 8 m. Excavations on this site, especially at the western part, will reach strong rock after a few meters and that will require breaking and blasting for excavation.
- 6. The geophysical survey for this preliminary ground investigation achieved good data quality and a rapid overview of ground conditions and further surveying for the sites and routes of this scheme can be recommended.
- 7. It is recommended to carry out a marine seismic refraction survey in the sea east of the beach over the proposed length of the outfall pipeline to determine the sediment thickness and depth to rock.
- 8. Borehole information nearby the two southern survey areas indicates deep rock.
- 9. On the northern site boreholes and geophysics indicate the rock topography has some irregularities and that some deeper zone of rock weathering are present. Borehole logs indicate quite fractured rock cores. It is recommended to investigate this site with more boreholes and surveying with 2D-Resistivity and Seismic Refraction.
- 10. This report was reviewed after ground investigation information was available.

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3.2	2 Seismic Refraction Data
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# List of Tables, Maps and Figures:

Title	Pages	Document Reference
Table 1: Summary of Interpretation Southern Site at R123	In text	In text
Table 2: Summary of Interpretation Southern Outfall SiteTable 3: Summary of Interpretation Northern Outfall Site	In text In text	In text In text
Map 1: Geophysical Survey Location Map	1 x A3	5671f_Maps.dwg
Figure 1a: Results at Southern Site R123 Portmarnock	1 x A3	5671f_Figs.dwg
Figure 1b: Interpretation at Southern Site R123 Portmarnock	1 x A3	5671f_Figs.dwg
Figure 2a: Results at Southern Outfall Site Portmarnock	1 x A3	5671f_Figs.dwg
Figure 2b: Interpretation at Southern Outfall Site Portmarnock	1 x A3	5671f_Figs.dwg
Figure 3a: Results at Northern Outfall Site Loughshinny	1 x A3	5671f_Figs.dwg
Figure 3b: Interpretation at Northern Outfall Site Loughshinny	1 x A3	5671f_Figs.dwg

# 1. INTRODUCTION

# 1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the preliminary ground investigation for the Greater Dublin Drainage Scheme. The survey was carried out at three sites. The survey consisted of 2D-Resistivity and seismic refraction (p-wave) profiles. The survey was commissioned by I.G.S.L.

The survey employed two geophysical methods that complement each other and improve the interpretation.

### **1.2 Objectives**

The main objectives of the geophysical survey were:

- To determine the ground conditions under the site
- To determine the depth to rock and overburden thickness
- To estimate the strength/stiffness/compaction of overburden materials and the quality of rock
- To determine the type of overburden and rock
- To detect lateral changes within the geological layers
- To determine the presence of possible faults and fracture zones

### 1.3 Site Description

The three sites are the Southern Site at the R123 in Portmarnock, the Southern Outfall Site at Portmarnock and the Northern Outfall Site at Loughshinny. The southern outfall site is on the beach and intertidal zone and was surveyed at low tide. The other two sites are located in farm land.

### 1.4 Geology

The bedrock geological map of Meath (GSI, 1999) indicates that the survey areas at the three sites are underlain by Carboniferous lithologies. The southern sites at Portmarnock are underlain by the Malahide Formation, described as an argillaceous bioclastic limestone and shale. The northern site at Loughshinny is underlain by the Loughshinny Formation, described as dark micritic & calcarenite and shale.

### 1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

# 2. GEOPHYSICAL SURVEY

# 2.1 Methodology

The methodology was given in the tender documents and consisted of 2D-Resistivity and Seismic Refraction Profiles.

The survey locations are indicated on Map 1. Each of the three sites was surveyed with 3 x 155m 2D-Resistivity and 3 x 69 m seismic refraction.

All geophysical surveys are acquired, processed and reported in accordance with British Standards BS 5930:1999 +A2:2010 'Code of Practice for Site Investigations'.

# 2.2 2D-Resistivity

2D-Resistivity profiles with electrode spacing of 5m, 32 electrodes per set-up and a length of 155m per profile were surveyed at the locations shown on Map 1. The readings were taken with a Tigre Resistivity Meter and Imager Cables.

During 2D-Resistivity surveying data is acquired in the form of linear profiles using a suite of metal electrodes. A current is injected into the ground via a pair of electrodes while a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the profile. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

2D-Resistivity has proven zones of anomalous rock/karstified rock with lateral extents of 5 m and more.

### 2.3 Seismic Refraction

The seismic survey consisted of p-wave seismic refraction profiling at the locations shown on Map 1. Each of the profiles consisted of 24 geophones with 3 m spacing, resulting in lengths of 69m per profile. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5 Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero delay trigger was used to start the recording. Seven shot points per p-wave profile were used.

In the seismic refraction survey method a p-wave is generated by a source at the surface resulting in energy travelling through surface layers directly and along boundaries between layers of differing seismic wave velocities. Processing of the seismic data allows geological layer thicknesses and boundaries to be established.

Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction/strength/rock quality changes with an accuracy of 10 - 20% of depth to that layer. Where low velocity layers or shadow zones are present or where layers dip with more than 20 degrees angle the accuracy becomes much less.

# 2.4 Site Work

The data acquisition was carried out on the 25th of January and 1st of February 2013. The weather conditions were fair throughout the acquisition period. Health and safety standards were adhered to at all times.

The locations and elevations were surveyed with a TRIMBLE RTK-GPS to accuracy < 0.02m.

# 3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was carried out utilising the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

## **3.1 2D-Resistivity Profiles**

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. Overlapping and roll-along profiles were concatenated for a joint inversion. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface model resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of < 4.0%. The resulting models were colour contoured with the same resistivity scale for all profiles within a site and they are displayed as cross sections (Figure 1a, 2a and 3a).

The southern outfall site is on the beach and the beach is saturated with saline sea water. This causes very low resistivities and therefore an appropriately low colour scale was selected. The other two site have a higher scale with higher resistivities which is the same for the two sites.

Resistivities ranges are typical for certain geological materials and this is reflected in the interpretation tables. Very low values under 10 Ohmm indicate saline water saturation and intrusion, and it is not possible to determine the material type as the salinity takes over (Southern Outfall).

Values between 30 and 100 Ohmm are typical for boulder clay and the thick sequence of such readings at the southern site at the R123 indicates a sequence of thick boulder clay.

High resistivity readings of over 1000 Ohmm indicate rock type with a quite clean limestone and low argillaceous or shale content.

### 3.2 Seismic Refraction Data

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The numbers of layers has been determined by analysing the seismic traces and between 2 and 4 layers were used in the models. All seismic profiles were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.8 msec RMS have been obtained for each profile. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the 2D-Resistivity cross sections (Figure 1a, 2a and 3a). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

# 3.3 Interpretation of Resistivity and Seismic Refraction

Tables 1 to 3 summarise the interpretation for the three sites. The strength/stiffness/compaction and the rock quality have been estimated from the seismic velocity. The estimation of the excavatability for the bedrock has been made according to the caterpillar chart published in Reynolds (1997). The geotechnical assessment for rippability will have to take factors like rock type and jointing into account and the estimation in this report is solely based on the seismic velocities.

The proposed works may not require the excavation of rock though the assessment for rippability gives a good indication about the strength of the rock.

Interpreted cross sections are shown in Figure 1b, 2b and 3b. The interpretation has been made from all available information. For overburden layers and the top of the rock the seismic refraction data has been used as seismic refraction is the best method to delineate layer boundaries. The resistivity models have been used to delineate rock and overburden type and to indicate layers where no seismic refraction data was acquired at the profile ends. Resistivity data is better suited to show rock types and features within the rock while seismic refraction velocities are indicating the change of compaction/stiffness/rock quality with depth.

Layer	General Seismic Velocity Range (km/sec)	General Resistivity Range (Ohmm)	Compaction/ Strength/ Rock Quality	Interpretation	Estimated Excavation Method
1	0.4	< 100	Soft	Topsoil	Diggable
2	1.0	< 100	Firm to stiff	Boulder Clay	Diggable
3	2.3	< 100	Very stiff – hard	Boulder Clay	Diggable
4	3.5	< 100	Strong competent rock	Rock	Breaking & Blasting

Table 1: Summary of Interpretation at the Southern Site at R123

The rock is quite deep under the site and approx. 15 - 20 thick highly consolidated boulder clay are under the site surface. The rock is so deep that the resistivity profile encounters it at the lower end and the rock type cannot be determined from resistivities. It was not intended to survey deeper and given the ground conditions a deeper survey is not required.

Rotary core hole 13 is located to the east of the site and indicates deep rock at a depth of 23.60 m below ground level. Borehole 13 indicates very stiff to hard clay in good agreement with the layer 3 of highly consolidated boulder clay.

The ground conditions appear suitable for deep excavations and high bearing pressures and no further geophysical surveying is recommended.

Layer	General Seismic Velocity Range (km/sec)	General Resistivity Range (Ohmm)	Compaction/ Strength/ Rock Quality	Interpretation	Estimated Excavation Method
1	1.6	< 50	N/A	Marine Sediments and Boulder	Diggable
4	3.5	> 50	Strong competent	Rock	Breaking & Blasting

Table 2: Summary of Interpretation at the Southern Outfall Site

The saline conditions do not allow determining if the sediments are clay or sand/gravel. The seismic velocities for layer 1 are 1.6 km/s and derive from the water saturation (the seismic velocity of water is 1.5 km/s). Therefore the compaction of layer 1 sediments cannot be determined. It can be interpreted that the layer can be excavated for creating a pipeline trench.

Rotary core hole 14 is located to the west of the site and indicates deep rock at a depth of 13.50 m below ground level. Borehole 14A indicates marine sediments, sand and silts with shell material, as the main overburden type.

It is recommended to carry out a marine seismic refraction survey along the proposed outfall pipeline from the high water mark to the proposed outfall. This will establish the depth to rock which is useful o know for future trenching operations.

Layer	General Seismic Velocity Range (km/sec)	General Resistivity Range (Ohmm)	Compaction/ Strength/ Rock Quality	Interpretation	Estimated Excavation Method
1	0.3	< 500	Soft	Topsoil	Diggable
2	1.0	< 500	Firm to stiff	Boulder Clay	Diggable
3	2.2	< 500	Very stiff – hard	Boulder Clay	Diggable/Rippable
			Poor rock	Or weathered Rock	
4	4.0	> 1000	Strong competent rock	Rock	Breaking & Blasting

Table 3. Summary	of Interpretation at the North	horn Outfall Site
rable 5. Summar	or interpretation at the North	

The rock is quite shallow under profiles R9/S9 and R8/S8 with strong rock occurring within a depth of approx. 3 m bgl. On profile R7/S7 the overburden is notable thicker and strong rock appears approx. 8 m bgl.

Trial pits and boreholes are located near the geophysical profiles on this site and indicate a similar ground model than the geophysics. Rotary Core Hole 12 is located past the end of R12 (Figure 3a) and shows the rock relatively deep. At the end of R12 the resistivities are low and seem to extend downwards, indicating a thickening of rock over the end of the profile.

Rotary Core Hole 13 is located near the end of R9 but 25 m beside the profile. The rock is shown much deeper than on the geophysical profile, and there may be a local deepening of rock over a weathered, fractured or paleo-karstified zone.

There are some indications for an irregular rock head on this site with possible deep weathering of rock. It is recommended to investigate the site with further rotary core holes and geophysical surveying. The survey should consist of 2D-Resistivity and Seismic Refraction, as carried out in this survey, but should encompass the entire site and cross the site at a denser grid with less spacing of adjacent profiles.

# 4. **REFERENCES**

- 1. **GSEG 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002.
- 2. **GSI, 1995.** Geology of Meath. Geological Survey of Ireland 1999.
- 3. Milsom, 1989. Field Geophysics. John Wiley and Sons.
- 4. Reynolds, 1997. An Introduction to Applied and Environmental Geophysics. John Wiley and Son.














Appendix 8

Laboratory Test Records

Schedule 1

	Laboratory						Te	st Repo	rt					150 17025
	17 Business P	ark			Determ	ination of	Moisture	e Content	, Liquid &	R Plastic I	Limits			IVNAB
Newhall, N Co. Kildar									•					TESTING
045 84617					Tested in ad	cordance	with BS137	7:Part 2:19	990, clause	es 3.2, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 1337
	Report No.	R51363		Contract	No.	16695		Contract N	Name:	Greater D	ublin Drain	age Scher	ne	
	Customer	Fingal Cou	unty Council,	Grove Ro	ad, Blanchar	dstown, Du	ıblin 15.							
	Samples Re	ceived:	26/02/13	Date Tes	sted:	26/02/13								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n
Tp 01	4615	0.5	A13/0794	В	15	32	16	16	50	WS	4.4	CL	Brown slight	y sandy, slightly gravelly, CL
Tp 01	4616	1.9	A13/0795	В	13	38	18	20	52	WS	4.4	CI	Brown sandy	gravelly CLAY
Tp 01	4617	2.6	A13/0796	В	12	33	16	17	53	WS	4.4	CL	Grey brown s	sandy gravelly CLAY
Tp 02	4618	0.6	A13/0797	В	14	30	17	13	58	WS	4.4	CL	Brown slight	y sandy, slightly gravelly, CL
Tp 02	4619	1.6	A13/0798	В	9.0	34	17	17	59	WS	4.4	CL	Grey brown s	slightly sandy, slightly gravell
Tp 02	4620	1.9	A13/0799	В	11	30	15	15	56	WS	4.4	CL	Grey brown s	sandy gravelly CLAY
Тр 03	4611	0.5	A13/0800	В	24	39	25	14	86	WS	4.4	ΜI	Brown sandy	gravelly SILT
Tp 03	4613	2.0	A13/0802	В	12	33	16	17	10	WS	4.4	CL	Grey black s	lightly sandy, gravelly, CLAY
Tp 04	4642	0.6	A13/0803	В	25	39	18	21	67	WS	4.4	CI	Brown slight	y sandy, slightly gravelly, CL
Tp 04	4643	1.0	A13/0804	В	20	35	18	17	56	WS	4.4	CL	Brown sandy	gravelly CLAY
Tp 04	4643	1.9	A13/0805	В	8.7	38	18	20	41	WS	4.4	CI	Brown sandy	gravelly CLAY
Tp 05	4626	0.5	A13/0806	В	29	43	24	19	81	WS	4.4	CI	Brown sandy	gravelly CLAY
Tp 05	4627	1.2	A13/0807	В	22	33	17	16	74	WS	4.4	CL	Grey brown s	sandy gravelly CLAY
Tp 05	4628	1.5	A13/0808	В	18	35	23	13	66	WS	4.4	CL	Grey brown s	sandy gravelly CLAY
Tp 06	4635	0.9	A13/0809	В	18	35	16	19	64	WS	4.4	CL	Brown slight	y sandy, slightly gravelly, CL
Notes:	Preparation:	WS - Wet sie AR - As recei NP - Non plas	ived		Sample Type:	B - bulk distu U - Undisturb		Remarks:						
	Liquid Limit Clause:	4.3 Cone Per	netrometer defini					-	-		e the scope of ted. Any rema			ned for one month.
	Clause: 4.4 Cone Penetrometer one point metho					Persons authorized to approve reports				b the specimens tested. Any remaining material will be Approved by Da			Page	
IG	IGSL Ltd Materials Laboratory				J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)								1 of 1	

R51363.PI

	Laboratory			Test Report										ISO 17025
	17 Business P	Park			Determ	ination of	Moisture	e Content	, Liquid 8	R Plastic I	_imits			
Newhall, N Co. Kildar									-					TESTING
045 84617					Tested in ac	cordance	with BS137	7:Part 2:19	990, clause	es 3.2, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 1337
	Report No.	R51364		Contract	No.	16695		Contract N	lame:	Greater D	ublin Drain	age Scher	ne	
	Customer	Fingal Cou	inty Council,	Grove Ro	ad, Blanchar	dstown, Du	ıblin 15.							
	Samples Re	ceived:	26/02/13	Date Tes	ted:	26/02/13								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n
Tp 07	4631	1.1	A13/0811	В	22	43	26	17	73	WS	4.4	ΜI	Brown slightly sa	ndy, slightly gravelly, SILT
Tp 07	4632	1.7	A13/0812	В	21	31	18	13	71	WS	4.4	CL	Brown slightly sa	ndy, slightly gravelly, CLAY
Tp 08	4622	0.6	A13/0813	В	24	41	19	22	68	WS	4.4	CI	Brown sandy	gravelly CLAY
Tp 08	4623	1.0	A13/0814	В	19	37	17	20	57	WS	4.4	CI	Grey brown s	andy gravelly CLAY
Tp 09	4638	0.4	A13/0815	В	24	47	20	27	80	WS	4.4	CI	Grey brown s	andy gravelly CLAY
Tp 09	4639	1.0	A13/0816	В	17	37	17	20	55	WS	4.4	CI	Grey brown sligh	tly sandy, slightly gravelly, CLAY
Tp 09	4640	1.8	A13/0817	В	16	34	16	18	45	WS	4.4	CL	Grey brown s	andy gravelly CLAY
Tp 12	4606	0.7	A13/0818	В	26	32	NP	NP	99	WS	4.4	CL	Brown slightl	y silty, SAND
Tp 12	4607	1.4	A13/0819	В	28	32	NP	NP	98	WS	4.4	CL	Brown slightl	y silty, SAND
Tp 16	4608	0.5	A13/0820	В	11	32	17	15	62	WS	4.4	CL	Brown slightl	y sandy, gravelly, CLAY
Tp 16	4609	1.5	A13/0821	В	12	32	16	16	58	WS	4.4	CL	Grey black s	andy gravelly SILT/CLAY
Bh 14	3062	2.0	A13/0822	В	23	29	NP	NP	98	WS	4.4	CL	Brown silty, s	lightly gravelly, SAND
Bh 14	3063	3.0	A13/0823	В	30	30	NP	NP	100	WS	4.4	CL	Brown slightl	y silty, SAND
Bh 14	3065	5.0	A13/0824	В	28	30	NP	NP	92	WS	4.4	CL	Brown slightly silt	y, slightly gravelly, SAND
Bh 14	3067	8.0	A13/0825	В	20	27	NP	NP	88	WS	4.4	CL	Grey slightly san	dy, slightly gravelly, SILT
Notes:	Preparation: Liquid Limit Clause:		ved stic netrometer defini	tive method	Sample Type:	B - bulk distur U - Undisturb		•	•		e the scope of			and for one month
	UIDUSE.	4.4 Cone Per	etrometer one p		ed The results relate to the Persons authorized to approve reports				eiale lo lite S	the specimens tested. Any remaining material will be reta Approved by Date			Page	
IG	IGSL Ltd Materials Laboratory				J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)					H Byrne 19/03/13 1 of 1				

R51364.PI

	е	'ark <b>R51365</b>		Contract	Tested in a	ination of ccordance 16695	Moisture		, Liquid 8 990, clause	es 3.2, 4.3,		age Scher	ne	ISO 17025 ACREME TESTING DETAILED IN SCOPE REG NO. 1351
	Customer Samples Re	-	inty Council, 26/02/13	Grove Ro Date Tes		dstown, Du 26/02/13	ıblin 15.							
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n	
Bh 13	3072	1.0	A13/0826	B	13	32	16	16	<425μm 59	WS	4.4	CL	Brown slightly sa	ndy, slightly gravelly, CLAY
Bh 13	3072	2.0	A13/0827	B	10	36	18	18	68	WS	4.4			velly, CLAY with many cobbles
Bh 13	3078	8.0	A13/0828	B	14	28	10	10	67	WS	4.4	CL		sandy, gravelly, CLAY
DIT 13	3070	0.0	A10/0020		10	20	14	17	07	~~~	7.7		Croy olighty	oundy, gravony, obrit
Notes:	Preparation:	WS - Wet sie	ved		Sample Type:	B - bulk distu	rbed	Remarks:		1				
		AR - As recei	ved			U - Undisturb	ed							
		NP - Non plas												
	Liquid Limit		etrometer defini					-	-		e the scope of			ad for one month
	Clause:	4.4 Cone Per	etrometer one p		Persons author	ized to annrow	/e renorte	i ne results r	eiate to the s	Approved	,	aming materia	1	ned for one month. Page
10	SL Ltd M	aterials	Laborato									0		
			Laboratory J Barrett (Dep. Quality M H Byrne (Quality Ma									19/03/13	1 of 1	





			TEST cermination of Part accordance with: BS137 (note: Sedimentation	7:Part2:1990 , cla	use 9.2 & 9.5			ISO 17025 ACORP JIE J SETALLED IN SCOPE REGINUL 15	51
particle	%		Contract No	o: 16695	Report No.		R51382		
size	passing		Contract:	Greater D	ublin Drainage	Scheme			
75	74	COBBLES	Тр:	2					
63	74	COBBEES	Sample No.	4619	Lab. Samp	le No.	A13/0798		
50	74		Sample Type	e: B					
37.5	67		Depth (m):	1.60	Customer:		Fingal County Co	ouncil, Grove Road, E	Blanchardstown, D
28	64		Date Receiv	ed 26/02/2	013 Date Testi	ng started	27/02/2013		
20	60		Description:	Grey brow	vn slightly sand	ly, slightly gravel	lly, CLAY with many	cobbles	
14	58	GRAVEL							
10	55	GIVIVEE	Remarks						
6.3	52					5 33	.3 125 .6 .18	5 22	ъ
5	50		100			0.063	0.3 0.425 0.6 1.18 2	3.35 5.3 6.3 10 20 20	423070
3.35	47		100 -						
2	44		90						
1.18	40		80						
0.6	37		× 70 + + + + + + + + + + + + + + + + + +						
0.425	35	SAND							
0.3	33		se 50						
0.15	30		40						
0.063	27		Decentage passing (%) 00 00 00 00 00 00 00 00 00 00 00 00 00						
0.038	22								
0.027	20		20						
0.017	18	SILT/CLAY	10						
0.010	16		0						
0.007	13		0.0001	0.001	0.01	0.1	1	10	100
0.005	11			CLAY	<i>SILT</i> Si	ieve size (mm)	SAND	GRAVEL	
0.002	9					Ammunation			
		IGSL Lt	d Materials Labora	tory		Approved by: H	: Da Byrne	ate: 19/03/13	Page no: 1 of 1
					Persons aut		reports: J Barrett (Dep.		























			TEST REP ermination of Particle accordance with: BS1377:Part (note: Sedimentation stage	Size Dist 2:1990 , cla	use 9.2 & 9.	5		ISO 1700 ACD # MI UCTAILED IN SCOPE ART NU.	8 8 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
particle	%		Contract No:	16695	Report N	No.	R51394	-	
size	passing		Contract:	Greater D	ublin Drainag	je Scheme			
75	100	COBBLES	Bh:	14					
63	100	COBBEES	Sample No.	3065	Lab. Sar	nple No.	A13/0824		
50	100		Sample Type:	В					
37.5	100		Depth (m):	5.00	Custome	er:	Fingal County	Council, Grove Road,	Blanchardstown, D
28	100		Date Received	26/02/20	013 Date Te	sting started	27/02/2013	3	
20	100		Description:	Brown slig	htly silty, sli	ghtly gravelly, SAN	ID		
14	100	GRAVEL							
10	100	GIVITEE	Remarks						
6.3	100					5 33	.3 425 .6 .18	222	ъ
5	100		100			0.063	0.3 0.425 0.6 1.18	2 3.35 6.3 10 14 20	28 50.7 53.7
3.35	100		100						
2	99		90						
1.18	98		80				_/		
0.6	95		≥ 70 <del></del>				/		
0.425	93	SAND					/		
0.3	90		se 50						
0.15	25		Der centage passing (%) 60 06 passing (%) 40 07 08 00 (%) 40 08 00 00 00 00 00 00 00 00 00 00 00 00						
0.063	1		30						
			20						
		SILT/CLAY	10						
			0						
			0.0001 0.	001	0.01	0.1	1	10	100
			CL	ĹΑΥ	SILT	Sieve size (mm)	SAND	GRAVEL	
	1		d Materials Laboratory	,		Approved by		Date:	Page no:
			u materiais Laboratory	1	Parcons		Byrne	19/03/13 Dep. Quality Manager) H E	1 of 1









IGSL Ltd Materials Laboratory		Test Report		50 17025					
M7 Business Park Naas	Determination of Mois	ture Condition Value at Nat Content	ural Moisture						
Co. Kildare	Tested in accordan	ce with BS1377:Part 4:1990, c	clause 5.4	DETAILED IN SCOPE REG NO.13					
Report No	) <b>.</b>	R51399							
Contract N	0.	16695							
Contract N	ame:	Greater Dublin Drainage S	cheme						
Customer:		Fingal County Council, Grove Roa	ad, Blanchardstown,	Dublin 15.					
BH/TP		Тр 4							
Sample No	).	4612							
Depth (m)		0.60							
Sample Ty	pe:	В							
Lab Sampl	e No.	A13/0804							
Source (if a	applicable)	N/A							
Material Ty	/pe (if applicable):	soil 26/02/13 28/02/13							
Sample Re	eceived:								
Date Teste	ed:								
Sample Ce	ert:	Not Provided							
Moisture C	ontent (%):	22							
% Particles (By dry ma		5							
MCV:		4.8							
Interpretati	on of Plot:	Steepest Straight Line							
Descriptior	n of Soil:	Brown slightly sandy, slight	tly gravelly, CLA	Y					
The result relates to the specin Any remaining material will be Sampling and opinions and inte			Sons authorised to a J Barrett (Dep H Byrne (Qua	Quality Manager)					
		Approved by	Date	Page					
IGSL Ltd Mater	rials Laboratory	H Byrne	20/03/13	1 of 1					

IGSL Ltd Materials Laboratory		Test Report		150 17025						
M7 Business Park	Determination of Moist	ure Condition Value at Content	Natural Moisture	I NAB ACCREDITED						
Co. Kildare	Tested in accordanc	e with BS1377:Part 4:19	90, clause 5.4	DETAILED IN SCOPE REG NO. 133						
Report No	).	R51400								
Contract N	lo.	16695								
Contract N	lame:	Greater Dublin Draina	ge Scheme							
Customer:		Fingal County Council, Grove Road, Blanchardstown, Dublin 15.								
BH/TP		Тр 5								
Sample No	Э.	4627								
Depth (m)		1.20 В								
Sample Ty	rpe:									
Lab Samp	le No.	A13/0807								
Source (if	applicable)	N/A								
Material Ty	/pe (if applicable):	soil								
Sample Re	eceived:	26/02/13								
Date Teste	ed:	28/02/13								
Sample Ce	ert:	Not Provided								
Moisture C	Content (%):	21								
% Particles (By dry ma		8								
MCV:		3.3								
Interpretati	ion of Plot:	Steepest Straight Line								
Description	n of Soil:	Grey brown sandy grav	velly CLAY							
The result relates to the specin Any remaining material will be Sampling and opinions and inte		of accreditation.	Persons authorised to a J Barrett (Dep H Byrne (Qua	Quality Manager)						
		Approved by	Date	Page						
IGSL Ltd Mate	rials Laboratory	H Byrne	20/03/13	1 of 1						

IGSL Ltd Materials Laboratory		Test Report		ISO 17025					
M7 Business Park	Determination of Mois	sture Condition Value at Nat Content	tural Moisture						
Co. Kildare	Tested in accordar	nce with BS1377:Part 4:1990, o	clause 5.4	DETAILED IN SCOPE REG NO. 13					
Report No	).	R51401							
Contract N	lo.	16695							
Contract N	lame:	Greater Dublin Drainage S	Scheme						
Customer:		Fingal County Council, Grove Ro	ad, Blanchardstown,	Dublin 15.					
BH/TP		Тр 7							
Sample No	р.	4631							
Depth (m)		1.10							
Sample Ty	/pe:	В	В						
Lab Samp	le No.	A13/0811							
Source (if	applicable)	cable) N/A							
Material Ty	ype (if applicable):	soil 26/02/13 28/02/13							
Sample Re	eceived:								
Date Teste	ed:								
Sample Ce	ert:	Not Provided							
Moisture C	Content (%):	22							
% Particle: (By dry ma		8							
MCV:		< 1							
Interpretat	ion of Plot:	Steepest Straight Line							
Description	n of Soil:	Brown slightly sandy, sligh	tly gravelly, CLA	Y					
The result relates to the specir Any remaining material will be Sampling and opinions and int			sons authorised to a J Barrett (Dep H Byrne (Qua	Quality Manager)					
		Approved by	Date	Page					
IGSL Ltd Mate	rials Laboratory	H Byrne	20/03/13	1 of 1					





IGSL Ltd Materials Laboratory M7 Business Park Naas Co. Kildare		-	Tes nsity/Moisti d in accordance		nt Relatio	-	ISO 17025 NAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.13 ²¹			
Report No. R514	 102		Contract No.	16695						
-	Greater Dubli	n Drainag	e Scheme							
	16695			TP 3						
Sample No. 461	2 De	epth (m)	0.9	Material Ty	pe	В				
Lab sample no. A13/0		Customer: Fingal County Council, Grove Road, Blanchardstown, Dublin 15.								
Date Received: 26/02/2		Test Method: 2.5 KG Rammer								
Date Tested: 28/02/2	2013	BS1377:Part 4:1990 3.3								
Dry Density (Mg/m ³ )	1.93	2.01	1.98	1.98	1.88					
Moisture Content (%)	14	11	13	8.8	5.9					
2.02	10%	5%	~	0%	<b>\</b>					
2.00	<u>``</u>		<u>``</u>	•	$\square$					
1.98										
			, ``							
1.96		``\		· · .						
5 1.94		,		```						
1.94 1.92 1.90 1.90	$\checkmark$		<u>```</u>	```	· ``.		$\overline{\mathbf{A}}$			
1.90			<u> </u>		· · · · · · · · · · · · · · · · · · ·					
1.88	+				`.	·				
1.86	+			<u>`````````````````````````````````````</u>		<u>``</u>				
1.84	++					`.				
1.82				`.			``````````````````````````````````````			
5 6	7 8	9 M	10 oisture Content		12 13	3 14	15			
Maximum Dry Density (Mg/n	n ³ ):	2.01		Optimum M	loisture Co	ntent (%):	11			
			elly SILT/CLA	-						
Sample Preparation:	vaterial passi	ing 20mm	I	<del>Single</del> / Sep	parate sam	ples used				
Particle Density (Mg/m ³ ):		2.66		Particle Der	nsity:	Assumed				
% retained on 20/37.5mm si	eve:	14								
Natural Moisture Content (%	»):	14		Γ	Persons auth	orised to app	prove reports			
The result relates to the specimen Opinions and interpretations are ou		of accredita	ation				p. Quality Manager) ality Manager)			
ICCI Matariala	oborator	,	Approved by			Date	Page			
IGSL Materials L	aboratory	/	••		20/03/13	1 of 1				



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

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Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA

Tel: +44 (0) 1244 833780 Fax: +44 (0) 1244 833781



Attention : John Clancy Date : 8th March, 2013 16695 Your reference : Test Report 13/2282 Batch 1 Our reference : **GREATER DUBLIN** Location : Date samples received : 27th February, 2013 Status : Final report Issue : 1

Nineteen samples were received for analysis on 27th February, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Compiled By:** 

6 lun

Bruce Leslie Project Co-ordinator

Ruiellward

Bob Millward B.Sc Principal Chemist

# Jones Environmental Laboratory

Client Name:	IGSL	-					Report :	Solid					
Reference:	16695												
Location:	GREATE	R DUBLI	N				Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
Contact:	John Cla	ncy											
JE Job No.:	13/2282			1			1				1		
J E Sample No.		2	3	4	5	6	7	8	9	10			
Sample ID	TP1	TP3	TP4	TP4	TP4	TP6	TP7	TP8	TP8	TP9			
Depth	1.9-2.0	0.9-1.1	0.6-0.8	1.0-1.1	1.9-2.0	0.9-1.1	1.1-1.2	0.6-0.8	1.0-1.1	0.4-0.6		e attached n	
COC No / misc											abbrevi	ations and a	cronyms
Containers	J	J	J	J	J	J	J	J	J	J			
Sample Date	25/02/2013	25/02/2013	25/02/2013	25/02/2013	25/02/2013	25/02/2013	25/02/2013	25/02/2013	25/02/2013	25/02/2013			
Sample Type	Soil	Soil											
Batch Number	1	1	1	1	1	1	1	1	1	1			Method
Date of Receipt	27/02/2013	27/02/2013	27/02/2013	27/02/2013	27/02/2013	27/02/2013	27/02/2013	27/02/2013	27/02/2013	27/02/2013	LOD	Units	No.
Total Sulphate	-	-	247	-	-	151	-	-	178	-	<50	mg/kg	TM50/PM15
Sulphate as SO4 (2:1 Ext) [#]	0.0113	0.0135	-	0.0086	-	-	0.0188	0.0059	-	0.0232	<0.0015	g/l	TM38/PM20
Organic Matter	-	-	-	-	-	-	-	-	-	0.9	<0.2	%	TM21/PM24
Sulphide	-	-	-	-	<10	-	-	-	-	-	<10	mg/kg	TM106/PM45
рН#	-	8.33	8.44	8.24	7.76	7.43	8.29	8.02	7.80	8.34	<0.01	pH units	TM73/PM11

# Jones Environmental Laboratory

Client Name:	IGSL						Report :	Solid					
Reference:	16695						•						
Location:	GREATE		N				Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
Contact:	John Cla	ncy											
JE Job No.:	13/2282												
J E Sample No.	11	12	13	14	15	16	17	18	19				
Sample ID	TP12	TP12	BH1	BH1	BH2	внз	BH13	BH14	BH25				
Depth	0.7-0.9	1.4-1.5	2.00	4.00	3.00	3.0	1.00	2.00	3.00		Please se	e attached n	otes for all
COC No / misc												ations and a	
Containers	J	J	J	J	J	J	J	J	J				
Sample Date													
Sample Type		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number		1	1	1	1	1	1	1	1				
											LOD	Units	Method No.
Date of Receipt											<50		
Total Sulphate	-	-	-	-	-	-	-	-	-		<50	mg/kg	TM50/PM15
Sulphate as SO4 (2:1 Ext) [#]	0.0127	0.0111	0.0079	0.1770	0.1713	0.1359	0.4809	0.0063	0.0175		<0.0015	g/l	TM38/PM20
Organic Matter	-	-	-	-	-	-	-	-	-		<0.2	%	TM21/PM24
Sulphide	-	-	-	-	-	-	-	-	-		<10	mg/kg	TM106/PM45
pH #	8.44	7.91	7.93	7.97	8.96	8.37	8.39	7.27	6.81		<0.01	pH units	TM73/PM11

# NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/2282

#### SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

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It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of  $\pounds 1$  (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

#### WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory . It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

#### **DEVIATING SAMPLES**

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

#### SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

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## ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
СО	Suspected carry over
NFD	No Fibres Detected

# Jones Environmental Laboratory

#### Method Code Appendix

### JE Job No 13/2282

	13/2282						
Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Solid Results expressed on Dry/Wet basis
TM21	TOC and TC by Combustion	PM24	Eltra preparation			AD	DRY
TM38	SO4,CI,NO3,NO2,F,PO4, Amm N2,ThioCN, Hex Cr by Aquakem	PM20	1:2 soil to water extraction	Yes		AD	DRY
TM50	Total Sulphate by ICP-OES	PM15	Aqua Regia extraction (Soils)			AD	DRY
TM73	pH in by Metrohm	PM11	1:2.5 soil/water extraction	Yes		AR	WET
TM106	Sulphide by CFA	PM45	Cyanide & Thiocyanate prep for soils			AR	DRY
						L	
Appendix 8

Laboratory Test Records

Schedule 2

IGSL Ltd Materials Laboratory		Test Report											ISO 17025		
	17 Business F	Park			Determ	ination of	Moisture	e Content	, Liquid &	R Plastic I	_imits			IVNAB	
Newhall, Naas Co. Kildare					Determination of Moisture Content, Liquid & Plastic Limits										
0. Riidai 045 8461					Tested in ad	cordance	with BS137	7:Part 2:19	990, clause	es 3.2, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 1337	
	Report No.	R51361		Contract	No.	16695		Contract N	lame:	Greater D	ublin Drain	age Schen	ne		
Customer Fingal County Council, Grove					Road, Blanchardstown, Dublin 15.										
	Samples Re	ceived:	26/02/13	Date Tes	sted:	26/02/13									
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n	
Bh 01	3091	1.0	A13/0722	В	16								Grey brown s	sandy gravelly SILT/CLA	
Bh 01	3092	2.0	A13/0723	В	12	39	19	20	53	WS	4.4	CI	Brown slightly sa	ndy, slightly gravelly, CLAY	
Bh 01	3094	4.0	A13/0724	В	8.7	28	14	14	58	WS	4.4		Brown slightly sandy, slightly gravelly, CLAY		
Bh 01	3096	6.5	A13/0725	В	10	34	17	17	56	WS	4.4	CL	Grey black slightly sandy, gravelly, CLAY with some cobbles		
Bh 01	3099	10.5	A13/0727	В	11	30	15	15	63	WS	4.4	CL	Grey black slightly sandy, gravelly, CLAY		
Bh 02	3082	1.0	A13/0728	В	13	38	19	19	63	WS	4.4	CI	Grey black slight	y sandy, slightly gravelly, CLAY	
Bh 02	3083	2.0	A13/0729	В	11								Grey black s	andy gravelly SILT/CLAY	
Bh 02	3084	3.0	A13/0730	В	9.4	30	14	16	58	WS	4.4	CL	Grey black slight	y sandy, slightly gravelly, CLAY	
Bh 02	3089	9.5	A13/0731	В	8.2	32	15	17	65	WS	4.4	CL	Grey black slight	y sandy, gravelly, CLAY	
Bh 03	3836	1.0	A13/0732	В	16								Brown sandy	gravelly SILT/CLAY	
Bh 03	3838	3.0	A13/0733	В	9.6	31	14	17	55	WS	4.4	CL	Brown slight	y sandy, gravelly, CLAY	
Bh 03	3840	5.0	A13/0734	В	13	35	17	18	57	WS	4.4	CL	Grey slightly san	dy, slightly gravelly, CLAY	
Bh 04	3844	1.0	A13/0735	В	10	36	16	20	58	WS	4.4	CI	Brown slight	y sandy, gravelly, CLAY	
Bh 04	3846	3.0	A13/0736	В	9.0	32	15	17	53	WS	4.4	CL	Black slightly sar	dy, slightly gravelly, CLAY	
Bh 25	3853	2.0	A13/0737	В	9.5	28	14	14	54	WS	4.4	CL	Brown slightly sandy, grav	velly, CLAY with some cobbles	
Notes:	Preparation: Liquid Limit Clause:		ved	tive method		B - bulk distu U - Undisturb		Remarks: Opinions and	ed for one month						
	UIQUSE.	T.T COLLE FEI	ieu onie ter one p		Persons author	ized to approv	/e reports	THE TESUILS I	כומוכ וט ווופ 3	specimens tested. Any remaining material will Approved by			-	Page	
IGSL Ltd Materials Laboratory						Barrett (De	•	• •					19/03/13	1 of 1	

	е	Park R51362		Test Report   Determination of Moisture Content, Liquid & Plastic Limits   Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3   Contract No.   16695 Contract Name: Greater Dublin Drainage Scheme											
	Customer Samples Re	-	unty Council, 26/02/13	nty Council, Grove Road, Blanchardstown, Dublin 15. 26/02/13 Date Tested: 26/02/13											
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n	
Bh 25	25 3859 8.0 A13/		A13/0739	B	14	35	16	19	65	WS	4.4	CL	Grey slightly san	dy, slightly gravelly, CLAY	
220		0.0		_								01			
Notes:	Preparation:	Sample Type:	B - bulk distu	rbed	Remarks:										
		AR - As recei				U - Undisturb	ed								
		NP - Non plas													
	Liquid Limit Clause:		netrometer defini netrometer one p						-	ons are outside the scope of accreditation. specimens tested. Any remaining material will be reta				ed for one month	
	Viause.	T.T COLLE FEI			Persons author	rized to appro	ve reports	The results relate to the s		Approved by				Page	
IGSL Ltd Materials Laboratory						Barrett (De		Manager)				19/03/13	1 of 1		







			TEST ermination of Part accordance with: BS137 (note: Sedimentation	7:Part2:1990 , cla	ause 9.2 & 9.	5			25 3 16 15 15	
particle	%		Contract No	p: 16695	Report N	lo.	R51369			
size	passing		Contract:	Greater D	ublin Drainag	e Scheme				
75	100	COBBLES	Bh:	1						
63	100	COBBLES	Sample No.	3097	Lab. San	nple No.	A13/0726			
50	100		Sample Typ	e: B						
37.5	100		Depth (m):	8.00	Custome	er:	Fingal County	Council, Grove Road,	Blanchardstown, D	
28	100		Date Receiv	ved 26/02/2	013 Date Tes	sting started	27/02/2013	}		
20	99		Description:	Black gre	y slightly clay	/ey/silty, very san	idy, GRAVEL			
14	96	GRAVEL								
10	91	GRAVEL		Remarks						
6.3	80						Ω Ω	ω Ω 0	ы Б	Ω
5	72					0.063	0.3 0.425 0.6 1.18	2 5.3 10 20 20	50 53 63 7	
3.35	55		100 -							
2	35		90							
1.18	22		80							
0.6	14		8 70							
0.425	12	SAND	^{is} 60 –							
0.3	10		sed 50							
0.15	7		Der centage passing (%) 60							
0.063	5		Cent							
		SILT/CLAY	20							
			10							
			0							
					0.0001	0.001	0.01	0.1	1	10
				CLAY	SILT	Sieve size (mm)	SAND	GRAVEL		
	L					Approved by	/:	Date:	Page no:	
		IGSL LT	d Materials Labora	liory			l Byrne	19/03/13 ep. Quality Manager) H E	1 of 1	























Appendix 8

Laboratory Test Records

Schedule 3

IGSL Ltd Materials Laboratory							Te	st Repoi	rt					150 17025	
Unit J5, M7 Business Park			Determination of Moisture Content, Liquid & Plastic Limits												
Newhall, Naas Co. Kildare															
0. Kildar 045 8461				Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3											
	Report No.	R51742		Contract	No.	16695		Contract N	lame:	Greater D	ublin Drain	age Scher	ne		
	Customer	Fingal Cou	inty Council,	Grove Ro	ad, Blancha	rdstown, Du	ıblin 15.								
	Samples Re	eceived:	06/03/13	Date Tes	sted:	06/03/13									
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n	
Bh 05	AN3716	2.0	A13/1017	В	13	29	15	14	67	WS	4.4	CL	Brown sandy gravelly CLAY		
Bh 06	AN3725	1.0	A13/1022	В	21	42	20	22	78	WS	4.4	CI	Grey brown sandy gravelly CLAY		
Bh 06	AN3728	4.0	A13/1024	В	13	32	19	13	61	WS	4.4	CL	Brown sandy gravelly CLAY		
Bh 06	AN3733	11.0	A13/1028	В	12	32	14	18	66	WS	4.4	CL	Brown sandy gravelly CLAY		
Bh 10	AN3736	2.0	A13/1030	В	17	30	16	14	60	WS	4.4	CL	Brown sandy gravelly CLAY		
Bh 10	AN3738	4.0	A13/1031	В	12	32	14	18	59	WS	4.4	CL	Grey black sandy gravelly CLAY		
Bh 11	AM2743	2.0	A13/1035	В	14	30	15	15	64	WS	4.4	CL	Brown sandy gra	velly CLAY	
Bh 11	AM2744	3.0	A13/1036	В	15								Brown slightly sa	ndy, slightly gravelly, SILT/CLA	
Bh 11	AM2745	4.0	A13/1037	В	11								Brown clayey/silt	y, very sandy, GRAVEL	
Bh 12	AN3749	2.0	A13/1038	В	13	31	16	15	57	WS	4.4	CL	Brown sandy gra	velly CLAY	
Bh 12	AN3750	3.0	A13/1039	В	13								Brown slightly sa	ndy, slightly gravelly, SILT/CLA	
Bh 19	AN3753	2.0	A13/1041	В	14	26	13	13	61	WS	4.4	CL	Brown sandy gra	velly CLAY	
Bh 19	AN3758	8.0	A13/1046	В	17	36	18	18	47	WS	4.4	CI	Grey black sandy	gravelly CLAY	
Notes:	Preparation:	WS - Wet sie AR - As recein NP - Non plas	ved	Sample Type:	B - bulk distur U - Undisturb		Remarks:								
	Liquid Limit Clause:	4.3 Cone Pen	netrometer defini netrometer one p						•	ns are outside				ed for one month	
	0.0000.			Persons author	rized to approv	/e reports			pecimens tested. Any remaining material Approved by				Page		
IGSL Ltd Materials Laboratory						Barrett (De	•	ity Manager)					16/04/13	1 of 1	


































IGSL Ltd Materials Laboratory		Test Report		50 12025				
M7 Business Park	Determination of Moistu	re Condition Value at Content	Natural Moisture	I NAB ACCREDITED TESTING				
Co. Kildare	Tested in accordance	with BS1377:Part 4:199	90, clause 5.4	DETAILED IN SCOPE REG NO. 1337				
Report No		R51744						
Contract No	0.	16695						
Contract Na	ame:	Greater Dublin Drainag	je Scheme					
Customer:		Fingal County Council, Grove	e Road, Blanchardstown,	, Dublin 15.				
BH/TP		Bh 19						
Sample No		AN3756						
Depth (m)		5.00						
Sample Ty	pe:	В						
Lab Sample	e No.	A13/1045						
Source (if a	applicable)	N/A						
Material Ty	pe (if applicable):	soil						
Sample Re	ceived:	06/03/13						
Date Teste	d:	22/03/13						
Sample Ce	rt:	Not Provided						
Moisture C	ontent (%):	16						
% Particles (By dry ma		36						
MCV:		6						
Interpretation	on of Plot:	Steepest Straight Line						
Description	of Soil:	Brown sandy, gravelly,	SILT/CLAY					
The result relates to the specim	ien tested.		Persons authorised to a	approve reports				
Any remaining material will be r		f accreditation.		o.Quality Manager)				
ICSL 1 to Motor	ials Laboratory	Approved by	Date	Page				
	ials Laboratory	H Byrne 16/04/13 1 of 1						





IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

# Jones Environmental Laboratory

Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA

Tel: +44 (0) 1244 833780 Fax: +44 (0) 1244 833781



Attention : John Clancy Date : 15th March, 2013 16695 Your reference : Test Report 13/2566 Batch 1 Our reference : **GREATER DUBLIN** Location : Date samples received : 7th March, 2013 Status : Final report Issue : 1

Four samples were received for analysis on 7th March, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Compiled By:** 

1. June

Bruce Leslie Project Co-ordinator

Ruiellward

Bob Millward B.Sc Principal Chemist

Client Name:	IGSL					Report :	Solid					
Reference:	16695					-						
Location:	GREATE	R DUBLI	N			Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
Contact:	John Cla	ncy										
JE Job No.:	13/2566					 						
J E Sample No.	1	2	3	4								
Sample ID	BH5 3716	BH6 3725	BH11 2742	BH19 3753								
Depth	2.00	1.00	1.00	2.00						Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	J	J	J	J								
Sample Date	05/03/2013	05/03/2013	05/03/2013	05/03/2013								
Sample Type		Soil	Soil	Soil								
Batch Number		1	1	1								
Date of Receipt				07/03/2013						LOD	Units	Method No.
Total Sulphate	178	198	410	139						<50	mg/kg	TM50/PM15
	110	150	410	100						-00	inging	
Sulphate as SO4 (2:1 Ext) [#]	0.0202	0.0065	<0.0015	-						<0.0015	g/l	TM38/PM20
Sulphide	<10	<10	<10	<10						<10	mg/kg	TM106/PM45
рН#	7.62	7.81	7.31	8.17						<0.01	pH units	TM73/PM11
pri	1.02	7.01	7.01	0.17						-0.01	pri unito	
		l	l		l			l				

# NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/2566

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#	UKAS accredited.
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
СО	Suspected carry over
NFD	No Fibres Detected

### Method Code Appendix

## JE Job No 13/2566

JE JOD NO	13/2500						
Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Solid Results expressed on Dry/Wet basis
TM38	SO4,CI,NO3,NO2,F,PO4, Amm N2,ThioCN, Hex Cr by Aquakem	PM20	1:2 soil to water extraction	Yes		AD	DRY
TM50	Total Sulphate by ICP-OES	PM15	Aqua Regia extraction (Soils)			AD	DRY
TM73	pH in by Metrohm	PM11	1:2.5 soil/water extraction	Yes		AR	WET
TM106	Sulphide by CFA	PM45	Cyanide & Thiocyanate prep for soils			AR	DRY

Appendix 8

Laboratory Test Records

Schedule 4

	Laboratory						Tes	st Repoi	rt					ISO 17025	
	17 Business P	Park			Determ	ination of	Moisture	Content	, Liquid &	R Plastic I	Limits			IVNAB	
Newhall, N Co. Kildar									, 1					TESTING	
045 84617					Tested in ac	cordance	with BS137	7:Part 2:19	990, clause	es 3.2, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO.133T	
	Report No.	R51829		Contract	No.	16695		Contract N	lame:	Greater D	ublin Drain	age Scher	ne		
	Customer	Fingal Cou	unty Council,	Grove Ro	ad, Blanchar	dstown, Du	ıblin 15.								
	Samples Re	ceived:	27/03/13	Date Tes	ted:	27/03/13									
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n	
Тр 13	AA0206	0.4	A13/1118	В	22	39	19	20	84	WS	4.4	CI	Brown sandy gra	velly CLAY with root hairs	
Tp 13	AA0207	1.1	A13/1119	В	26	40	19	21	75	WS	4.4	CI	Brown sandy gra	velly CLAY	
Tp 13	AA0208	1.8	A13/1120	В	26	29	NP	NP	93	WS	4.4	CL	Grey sandy, sligh	ntly gravelly, SILT	
Tp 13	AA0209	2.6	A13/1121	В	12								Grey black sandy	ack sandy gravelly SILt/CLAY	
Tp 13	AA0210	2.8	A13/1122	В	14								Grey sandy grave	elly SILT/CLAY	
Tp 10	AA0211	0.5	A13/1123	В	23	36	18	18	78	WS	4.4	CI	Brown sandy gra	Brown sandy gravelly CLAY	
Tp 10	AA0212	1.1	A13/1124	В	13	29	15	14	63	WS	4.4	CL	Grey brown sligh	tly sandy, gravelly, CLAY	
Tp 10	AA0213	2.0	A13/1125	В	11								Brown sandy gra	velly CLAY	
Tp 11	AA0214	0.6	A13/1126	В	28	38	20	18	90	WS	4.4	CI	Brown sandy gra	velly CLAY	
Tp 11	AA0215	1.2	A13/1127	В	16	33	17	16	60	WS	4.4	CL	Grey brown sligh	tly sandy, gravelly, CLAY	
Tp 11	AA0216	2.0	A13/1128	В	12								Grey sandy grav	elly SILT/CLAY	
Tp 17	AA0217	0.4	A13/1129	В	23	41	19	22	85	WS	4.4	CI	Grey brown sligh	tly sandy, gravelly, CLAY	
Tp 17	AA0218	1.0	A13/1130	В	21	31	15	16	63	WS	4.4	CL	Grey brown sligh	tly sandy, slightly gravelly, CLAY	
Tp 17	AA0219	1.9	A13/1131	В	13								Grey brown sand	y gravelly SILT/CLAY	
Tp 17	AA0220	2.4	A13/1132	В	12								Grey brown sand	y gravelly SILT/CLAY	
Notes:	Preparation:	WS - Wet sie AR - As recei NP - Non plas	ved stic		Sample Type:	B - bulk distur U - Undisturb		Remarks:							
	Liquid Limit Clause:		netrometer defini						•	etations are outside the scope of accreditation.				ed for one month	
	Clause: 4.4 Cone Penetrometer one point meth					hod The results relate to t Persons authorized to approve reports				late to the specimens tested. Any remaining material will be re Approved by Date			7	Page	
IG	SL Ltd M		J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)					H Byrne 24/04/13			1 of 1				

	Laboratory						Tes	st Repor	-t					150 17025
nit J5, M ewhall, N	17 Business P	ark			Determ	ination of	Moisture	Content	, Liquid &	R Plastic I	Limits			
o. Kildar					Tested in ad		with DC107	7.Dort 0.10			1 1 9 5 3			DETAILED IN SCOPE REG NO. 1337
45 84617	76				rested in ad	cordance		7.Part 2.18	990, clause	25 3.2, 4.3,	4.4 α 5.3			
	Report No.	R51830		Contract	No.	16695		Contract N	lame:	Greater D	ublin Drain	age Schen	ne	
	Customer	Fingal Cou	inty Council,	Grove Ro	ad, Blanchar	dstown, Du	ıblin 15.							
	Samples Re	ceived:	27/03/13	Date Tes	sted:	27/03/13								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n
Tp 14	AA0221	0.4	A13/1133	В	19	41	18	23	75	WS	4.4	CI	Brown slightly sa	ndy, slightly gravelly, CLAY
Tp 14	AA0222	1.2	A13/1134	В	9.9								Brown silty/claye	y gravelly SAND
Tp 14	AA0223	3.0	A13/1135	В	12								Brown sandy gravelly SILT/CLAY	
Tp 15	AA0224	0.4	A13/1136	В	17	35	19	16	79	WS	4.4	CL	Brown sandy gra	velly CLAY
Tp 15	AA0225	1.2	A13/1137	В	15								Brown sandy gra	velly SILT/CLAY
Tp 15	AA0226	2.5	A13/1138	В	14	30	19	11	67	WS	4.4	CL	Brown sandy gra	velly CLAY
Tp 15	AA0227	3.1	A13/1139	В	13	29	13	16	69	WS	4.4	CL	Brown sandy gra	velly SILT/CLAY
Notes: Preparation: WS - Wet sieved AR - As received NP - Non plastic					Sample Type:	B - bulk distur U - Undisturb		Remarks:		<u> </u>	<u> </u>		<u> </u>	
	Liquid Limit4.3 Cone Penetrometer definitive methodClause:4.4 Cone Penetrometer one point method							-	-	rpretations are outside the scope of accreditation. to the specimens tested. Any remaining material will be retained for one				ned for one month.
					Persons author	••	•			Approved				Page
IG	IGSL Ltd Materials Laboratory			ry	J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)					H Byrne 24/04/13 1 of			1 of 1	





			TEST REP ermination of Particle accordance with: BS1377:Par (note: Sedimentation stage	Size Distr t2:1990 , clau		.5		ISO 1702 ISO 1702 ACOTE IN DETAILED IN SCOPE REINING	5 3 6 3 3 3
particle	%		Contract No:	16695	Report I	No.	R51833		
size	passing		Contract:	Greater Du	blin Draina	ge Scheme			
75	81	COBBLES	Tp:	11					
63	81	COBBLES	Sample No.	AA0216	Lab. Sa	mple No.	A13/1128		
50	81		Sample Type:	В					
37.5	81		Depth (m):	2.00	Custom	er:	Fingal County Council, G	rove Road, Blanchardstown, Dublin 1	15.
28	81		Date Received			sting started	27/03/2013		
20	77		Description:	Black slight	ly sandy, s	lightly gravelly, SIL1	CCLAY with som	e cobbles	
14	74	GRAVEL							
10	71	GIVITEE	Remarks						
6.3	67					5	3 425 6 .18	3.5	Ω
5	65		100			0.063	0.3 0.425 0.6 1.18	2 3.35 6.3 10 14 20	28 23 23 23 28
3.35	62		100						
2	58		90						
1.18	55		80						
0.6	51		≥° 70 <del></del>						
0.425	49	SAND							
0.3	47		se 50						
0.15	43		tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du tu du						
0.063	36		Der centage passing (%) 60 60 40 40 30 06 07 08 08 08 08 08 08 08 08 08 08						
0.038	28								
0.027	26		20		111				
0.017	23	SILT/CLAY	10						
0.010	21		0						
0.007	18		0.0001 0.	.001	0.01	0.1	1	10	100
0.005	15		Ci	LAY	SILT	Sieve size (mm)	SAND	GRAVEL	
0.002	9					Approved by		Date:	Page pat
		IGSL Lt	d Materials Laborator	V		Approved by:	Byrne	24/04/13	Page no:
							-	ep. Quality Manager) H B	1 of 1



			TEST REP ermination of Particle accordance with: BS1377:Par (note: Sedimentation stage	Size Distr t2:1990 , clau		5		ISO 1700 ACCOR AT VETALLED IN SCOME AREY NU.	5 3 5 5 3 1
particle	%		Contract No:	16695	Report N	۱o.	R51835		
size	passing		Contract:	Greater Du	blin Drainag	je Scheme			
75	100	COBBLES	Tp:	14					
63	100	COBBLEO	Sample No.	AA0221	Lab. Sar	nple No.	A13/1133		
50	100		Sample Type:	В					
37.5	97		Depth (m):	0.40	Custome	er:	Fingal County Council, G	Grove Road, Blanchardstown, Dublin	15.
28	97		Date Received			sting started	27/03/2013	3	
20	96		Description:	Brown sligh	ntly sandy,	slightly gravelly, Cl	LAY		
14	94	GRAVEL							
10	92		Remarks						
6.3	89					53 15	.3 125 .6 .18	35	0 vi 0 √ 8
5	87		100			0.063	0.3 0.425 0.6 1.18	2 5 6.3 10 20	28
3.35	86		100						
2	83		90						
1.18	80		80					1	
0.6	77		≥ 70 <del></del>						
0.425	74	SAND							
0.3	71		<u><u></u> 50 – – – – – – – – – – – – – – – – – – </u>						
0.15	61		Der centage passing (%) 60 60 40 40 30 06 07 08 08 08 08 08 08 08 08 08 08						
0.063	49								
0.038	39								
0.027	36		20						
0.018	31	SILT/CLAY	10						
0.010	28		0 +						
0.007	24		0.0001 0.	001	0.01	0.1	1	10	100
0.005	21		Ci	LAY	SILT	Sieve size (mm)	SAND	GRAVEL	
0.002	16					Approved by	·	Date:	Page no:
		IGSL Lt	d Materials Laborator	/			Byrne	24/04/13	1 of 1
					Persons			ep. Quality Manager) H E	

			TEST REF ermination of Particle accordance with: BS1377:Par (note: Sedimentation stage	Size Distr t2:1990 , clau				ISO 170 ISO 170 ACOFF IESTIN SETALEO IN SCOPE REGINU		
particle	%		Contract No:	16695	Report No	).	R51836			
size	passing		Contract:	Greater Du	blin Drainage	Scheme				
75	100	COBBLES	Tp:	17						
63	100	COBBEES	Sample No.	AA0217	Lab. Sam	ple No.	A13/1129			
50	100		Sample Type:	В						
37.5	100		Depth (m):	0.40	Customer	:	Fingal County Council, G	Grove Road, Blanchardstown, Dublin	15.	
28	100		Date Received		13 Date Test	-	27/03/2013	3		
20	100		Description:	Grey browr	n slightly san	dy, slightly grave	lly, CLAY			
14	100	GRAVEL								
10	97	0.0.1122	Remarks							
6.3	95					5 33	.3 125 .6 .18	35	ъ	
5	94		100			0.063	0.3 0.425 0.6 1.18	2 3.35 6.3 10 20 20	28 50 53 53 78	
3.35	93		100							
2	91		90							
1.18	89		80							
0.6	87		<u>گ</u> 70							
0.425	86	SAND								
0.3	84		<u>6</u> 50							
0.15	78		t 40							
0.063	66		Der centage passing (%) 60 50 40 30 06 07 08 08 08 08 08 08 08 09 08 09 08 09 09 09 09 09 09 09 09 09 09							
0.038	53		20							
0.027	48									
0.018	42	SILT/CLAY	10							
0.010	36		0							
0.007	30			.001	0.01	0.1	1	10	100	
0.005	26		C	LAY	SILT S	Sieve size (mm)	SAND	GRAVEL		
0.002	19					Approved by		Date:	Page no:	
		IGSL Lt	d Materials Laborator	y			Byrne	24/04/13	1 of 1	
	Persons authorized to approve reports: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)									

			TEST REP ermination of Particle accordance with: BS1377:Part (note: Sedimentation stage	Size Distr t2:1990 , clau		.5		I SO 170 ACGP AI TESTIN	28 3 15 15 15 15
particle	%		Contract No:	16695	Report I	No.	R51837		
size	passing		Contract:	Greater Du	blin Draina	ge Scheme			
75	100	COBBLES	Tp:	17					
63	100	COBBLES	Sample No.	AA0218	Lab. Sai	mple No.	A13/1130		
50	100		Sample Type:	В					
37.5	100		Depth (m):	1.00	Custom	er:	Fingal County Council, 0	Grove Road, Blanchardstown, Dublin	15.
28	100		Date Received			esting started	27/03/2013	3	
20	98		Description:	Grey browr	n slightly sa	andy, slightly grave	lly, CLAY		
14	96	GRAVEL							
10	92	GIVIVEE	Remarks						
6.3	87					5 33	.3 425 .6 .18	22	ъ
5	85					0.063	0.3 0.425 0.6 1.18	2 3.35 6.3 10 20 20	28 50 53 53 78
3.35	81		100						
2	77		90						
1.18	73		80						
0.6	68		Š 70 − − − − − − − − − − − − −						
0.425	66	SAND	00						
0.3	63		se 50						
0.15	56		ada tu do tu d						
0.063	46		Der centage passing (%) 60 60 40 40 30 60 60 60 60 60 60 60 60 60 6						
0.038	37								
0.027	33		20		1111				
0.018	29	SILT/CLAY	10						
0.010	25		0						
0.007	21		0.0001 0.	001	0.01	0.1	1	10	100
0.005	18		CL	LAY	SILT	Sieve size (mm)	SAND	GRAVEL	
0.002	13					<b>A a a a a a b b b b b b b b b b</b>		Data	Designed
		IGSL Lt	d Materials Laboratory	/		Approved by		Date:	Page no:
				,			Byrne	24/04/13 Pep. Quality Manager) H B	1 of 1

particle         %         Contract No:         16695         Report No.         R52066           75         100         Greater Dublin Drainage Scheme         Trp:         13           50         82         Trp:         13           50         82         Trp:         13           28         78         Sample No.         A13/1121           20         76         Date Received         27/03/2013 Description:         Greater Bublin Standard, gravelly, SILT/CLAY with some cobbles           14         75         68         Date Received         Z7/03/2013 Description:         Great Schemer           5         68         Femarks         Femarks         Femarks         Femarks           6.3         69         Femarks         Femarks         Femarks         Femarks           7.0         GRAVEL         Remarks         Femarks         Femarks         Femarks           6.4         66         57         SAND         Femarks         Figure Gree No.         SAND           0.015         43         Jound         Jound         Jound         Jound         Jound         Jound         Jound           0.027         23         SAND         Jound         Jound <t< th=""><th></th><th></th><th></th><th>TEST RE cermination of Particle accordance with: BS1377:Pa (note: Sedimentation stage</th><th>e Size Distri art2:1990 , claus</th><th></th><th>5</th><th></th><th>ISO 1700 ACCEPTING ACCEPTING DETAILED IN SCORE REVIEW.</th><th>85 <b>3</b> 1 1 1 1 1 1 1 1 1 1 1</th></t<>				TEST RE cermination of Particle accordance with: BS1377:Pa (note: Sedimentation stage	e Size Distri art2:1990 , claus		5		ISO 1700 ACCEPTING ACCEPTING DETAILED IN SCORE REVIEW.	85 <b>3</b> 1 1 1 1 1 1 1 1 1 1 1
75       100       COBBLES         50       82         50       82         50       82         75       79         28       78         20       76         14       75         63       69         5       68         63       69         5       68         3.35       66         71       10         72       64         1.18       61         0.66       57         0.33       53         0.063       33         0.027       23         0.027       23         0.027       23         0.027       23         0.027       23         0.027       23         0.027       23         0.027       23         0.027       14         0.027       14         0.027       14         0.027       14         0.027       14         0.027       14         0.021       0.01       0.01       0.1       1       10       100	particle	%		Contract No:	16695	Report N	0.	R52066		
63       82       COBBLES       AA0209       Lab. Sample No.       A13/111         50       82       37.5       79       Sample No.       A0209       Lab. Sample No.       A13/1121         28       78       Depth (m):       2.6-2.7       Customer:       regetom:/curvet.forwertoxet.street.curvetoxet.street.street.curvetoxet.street.street.curvetoxet.street.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxet.street.curvetoxetoxetoxetoxetoxetoxetoxetoxetoxetox	size	passing		Contract:	Greater Dub	olin Drainag	e Scheme			
63       82       Sample No.       AA0209       Lab. Sample No.       A13/1121         50       82       Sample Type:       B       Perturbation (Sample No.       A13/1121         28       78       Depth (m):       2.6-2.7       Customer:       Frequicance (Gave Rauk, Banchurdsson, Dalin 15.         20       76       Date Received       27/03/2013 Date Testing started       27/03/2013         14       75       GRAVEL       Remarks       Remarks         6.3       69       100       90       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100 <td>75</td> <td>100</td> <td>COBBLES</td> <td>Tp:</td> <td>13</td> <td></td> <td></td> <td></td> <td></td> <td></td>	75	100	COBBLES	Tp:	13					
37.5       79         28       78         20       76         14       75         6.3       66         5       68         3.35       66         1.18       61         0.63       55         0.64       76         1.18       61         0.63       55         0.63       55         0.63       57         0.63       57         0.63       53         0.63       53         0.63       53         0.63       53         0.038       264         1.18       61         0.63       53         0.017       21         0.010       18         0.017       21         0.010       10         0.003       10         0.001       0.001       0.01       1       10         0.001       0.001       0.01       0.01       1       10       100         0.001       0.001       0.01       0.01       0.01       1       10       100         0.0027       10	63	82	COBBEED	Sample No.	AA0209	Lab. San	nple No.	A13/1121		
28       78         20       76         14       75         16.3       69         5       68         3.35       66         1.18       61         0.6       57         0.425       55         5.3       SAND         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90         90       90 <td>50</td> <td>82</td> <td></td> <td>Sample Type:</td> <td>В</td> <td></td> <td></td> <td></td> <td></td> <td></td>	50	82		Sample Type:	В					
20       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76       76 <th< td=""><td>37.5</td><td>79</td><td></td><td>Depth (m):</td><td>2.6-2.7</td><td>Custome</td><td>r:</td><td>Fingal County Council, G</td><td>irove Road, Blanchardstown, Dublin</td><td>15.</td></th<>	37.5	79		Depth (m):	2.6-2.7	Custome	r:	Fingal County Council, G	irove Road, Blanchardstown, Dublin	15.
14       75       GRAVEL       Remarks         6.3       69       5       68         3.35       66	28	78		Date Received			-			
10       72       GRAVEL       Remarks         6.3       69	20	76		Description:	Grey slightl	y sandy, gr	avelly, SILT/CLAY v	vith some cobble	es	
10       72       Remarks         6.3       69	14	75	GRAVEI							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	10	72	GIUTTEE	Remarks						
3.35       66         2       64         1.18       61         0.6       57         0.425       55         55       SAND         0.425       55         0.3       53         0.15       43         0.063       33         0.038       26         0.027       23         0.017       21         0.010       18         0.007       16         0.002       10         0.002       10         0.002       10	6.3	69					2 33	8 0.52	3.5	ъ
3.35       66         2       64         1.18       61         0.6       57         0.425       55         55       SAND         0.425       55         0.3       53         0.15       43         0.063       33         0.038       26         0.027       23         0.017       21         0.010       18         0.007       16         0.002       10         0.002       10         0.002       10	5	68		100			0.06	0.3 0.42 0.6	2 3.3 2 4 4 0.3 2 0 6.3 2 0 4 1 0 0.3	28 50 63 73
1.18       61         0.6       57         0.425       55         0.3       53         0.15       43         0.063       33         0.038       26         0.027       23         0.017       21         0.017       21         0.017       21         0.017       10         0.007       16         0.002       10         IdSI Ltd Materials Laboratory	3.35	66								
0.6       57       SAND ⁰ 0,425       55       SAND ⁰ 0,425 ⁰ 0,55 ⁰ 0,425 ⁵ 55       SAND ⁰ 0,425 ⁵ 60 ⁰ 0,425 ⁵ 60 ⁰ 0,425 ⁵ 61 ⁰ 0,425 ⁵ 61 ⁰ 0,425 ⁵ 61 ⁰ 0,425 ⁵ 61 ⁰ 0,425 ⁵ 61 ⁰ 0,425 ⁵ 61 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60 ⁶ 60	2	64		90						
0.027       23         0.017       21         0.017       21         0.010       18         0.007       16         0.0001       0.001       0.01       0.1       1       10       100         0.0002       10 <i>CLAY SILT</i> Sieve size (mm) <i>SAND GRAVEL</i>	1.18	61								
0.027       23         0.017       21         0.017       21         0.010       18         0.007       16         0.0001       0.001       0.01       0.1       1       10       100         0.0002       10 <i>CLAY SILT</i> Sieve size (mm) <i>SAND GRAVEL</i>	0.6	57		≥ 70 <del></del>						
0.027       23         0.017       21         0.017       21         0.010       18         0.007       16         0.0001       0.001       0.01       0.1       1       10       100         0.0002       10 <i>CLAY SILT</i> Sieve size (mm) <i>SAND GRAVEL</i>	0.425	55	SAND							
0.027       23         0.017       21         0.017       21         0.010       18         0.007       16         0.0001       0.001       0.01       0.1       1       10       100         0.0002       10 <i>CLAY SILT</i> Sieve size (mm) <i>SAND GRAVEL</i>	0.3	53		<u><u> </u></u>						
0.027       23         0.017       21         0.017       21         0.010       18         0.007       16         0.0001       0.001       0.01       0.1       1       10       100         0.0002       10 <i>CLAY SILT</i> Sieve size (mm) <i>SAND GRAVEL</i>	0.15	43								
0.027       23         0.017       21         0.017       21         0.010       18         0.007       16         0.0001       0.001       0.01       0.1       1       10       100         0.0002       10 <i>CLAY SILT</i> Sieve size (mm) <i>SAND GRAVEL</i>	0.063	33								
0.017       21         0.017       21         0.010       18         0.007       16         0.005       14         0.002       10										
0.010       18         0.007       16         0.007       16         0.0001       0.001         0.001       0.01         0.002       10										
0.010       18       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 <td>0.017</td> <td>21</td> <td>SILT/CLAY</td> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	0.017	21	SILT/CLAY	10						
0.005     14     CLAY     SILT     Sieve size (mm)     SAND     GRAVEL       0.002     10     Image: Constraints of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se	0.010	18		0						
0.002 10 Approved by: Date: Page no:		16		0.0001 (	0.001	0.01	0.1	1	10	100
ICSL Ltd Materials Laboratory Approved by: Date: Page no:		14		(	CLAY	SILT	Sieve size (mm)	SAND	GRAVEL	
ICSL Ltd Materials Laboratony	0.002	10								
			IGSL 1+	d Materials Laborator	rv					
H Byrne       14/05/13       1 of 1         Persons authorized to approve reports: J Barrett (Dep. Quality Manager)       H Byrne (Quality Manager)					· J	_		-		

			TEST REF ermination of Particle accordance with: BS1377:Par (note: Sedimentation stage	Size Distr t2:1990 , clau		).5		ISO 1700 ACCHE AT VETALED IN SCOME RESTING	5 3 5 5 7 7
particle	%		Contract No:	16695	Report	No.	R52067		
size	passing		Contract:	Greater Du	blin Draina	ge Scheme			
75	100	COBBLES	Тр:	14					
63	100	CODDEED	Sample No.	AA0222	Lab. Sa	mple No.	A13/1134		
50	86		Sample Type:	В					
37.5	82		Depth (m):	1.2-13	Custom	ner:	Fingal County Council, G	rove Road, Blanchardstown, Dublin	15.
28	81		Date Received	27/03/20	13 Date Te	esting started	27/03/2013	}	
20	73		Description:	Brown sligh	ıtly sandy,	gravelly, SILT/CLAY	, ,		
14	67	GRAVEL							
10	64	GRAVEL	Remarks						
6.3	58					Ω 3	8 21	Ω	2
5	56					0.063	0.3 0.425 0.6 1.18	2 3.35 6.3 110 20	28 53 53 53
3.35	52		100						
2	48		90						
1.18	45		80						
0.6	41		8 70						
0.425	39	SAND	ق 90						
0.3	36		d 50						
0.15	29		age 40						
0.063	20		Bercentage passing (%) 60						
			д 30 <del></del>						
			20						
		SILT/CLAY	10						
		SILT/CLAT	0						
			0.0001 0	.001	0.01	0.1	1	10	100
			C	LAY	SILT	Sieve size (mm)	SAND	GRAVEL	
	1					Approved by:		Date:	Page no:
		IG9T TL	d Materials Laborator	у		HI	Byrne	14/05/13	1 of 1
					Persons	authorized to approve r	reports: J Barrett (D	ep. Quality Manager) H B	Syrne (Quality Manage

















IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

# Jones Environmental Laboratory

Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA

Tel: +44 (0) 1244 833780 Fax: +44 (0) 1244 833781



Attention :	John Clancy
Date :	9th April, 2013
Your reference :	16695
Our reference :	Test Report 13/3112 Batch 1
Location :	GREATER DUBLIN DRAINAGE SCHEME
Date samples received :	25th March, 2013
Status :	Final report
Issue :	1

Four samples were received for analysis on 25th March, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Compiled By:** 

b. luce

Bruce Leslie Project Co-ordinator

Rjuiellward

Bob Millward B.Sc Principal Chemist

Client Name:	IGSL							Report : Solid							
Reference:	16695														
Location:	GREATE	R DUBLI		AGE SCHI	EME		Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub								
Contact:	John Cla	ncy													
JE Job No.:	13/3112														
J E Sample No.	1	2	3	4											
Sample ID	TP13	TP13	TP10	TP14											
Depth	1.1-1.2	1.8-2.0	0.5-0.6	0.4-0.6							Please se	otes for all			
COC No / misc											abbrevi	cronyms			
Containers	J	J	J	J											
Sample Date	20/03/2013	20/03/2013	20/03/2013	20/03/2013											
Sample Type		Soil	Soil	Soil											
Batch Number		1	1	1											
Date of Receipt											LOD	Units	Method No.		
Total Sulphate #	23/03/2013	-	102	-							<50	mg/kg	TM50/PM15		
Total Sulphate	224		102								-00	ing/itg			
Sulphate as SO4 (2:1 Ext) [#]	0.0091	-	0.0068	0.0358							<0.0015	g/l	TM38/PM20		
Organic Matter	-	0.7	-	-							<0.2	%	TM21/PM24		
Sulphide	<10	-	<10	<10							<10	malka	TM106/PM45		
Sulphide	×10	-	×10								10	mg/kg	1101/00/145		
рН#	8.45	-	7.89	7.51							<0.01	pH units	TM73/PM11		

# NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/3112

## SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of  $\pounds 1$  (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

### WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

### **DEVIATING SAMPLES**

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

### SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

#### NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

# ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
СО	Suspected carry over
OC	Outside Calibration Range
NFD	No Fibres Detected

### Method Code Appendix

# JE Job No 13/3112

JE JOD NO							
Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Solid Results expressed on Dry/Wet basis
TM21	TOC and TC by Combustion	PM24	Eltra preparation			AD	DRY
TM38	SO4,CI,NO3,NO2,F,PO4, Amm N2,ThioCN, Hex Cr by Aquakem	PM20	1:2 soil to water extraction	Yes		AD	DRY
TM50	Total Sulphate by ICP-OES	PM15	Aqua Regia extraction (Soils)	Yes		AD	DRY
TM73	pH in by Metrohm	PM11	1:2.5 soil/water extraction	Yes		AR	WET
TM106	Sulphide by CFA	PM45	Cyanide & Thiocyanate prep for soils			AR	DRY

Appendix 8

Laboratory Test Records

Schedule 5

IGSL Ltd Materials Laboratory							Te	st Repo	rt					ISO 17025	
Unit J5, M Newhall, N	17 Business F	Park		Determination of Moisture Content, Liquid & Plastic Limits											
Co. Kildar									-					TESTING	
045 8461					Tested in ad	cordance	with BS137	7:Part 2:19	990, clause	es 3.2, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO.1337	
Report No. <b>R51844</b> Contract					No.	16695		Contract Name:		Greater Dublin Drainage Scheme					
	Customer	Fingal Cou	unty Council,	Grove Ro	ad, Blanchar	dstown, Du	ıblin 15.								
Samples Received: 08/04/13 Date Tested: Various															
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	n	
Bh 7	N/A	2.0	A13/1287	В	13	35	17	18	62	WS	4.4	CL	Brown slightly sa	ndy, slightly gravelly, CLAY	
Bh 7	N/A	4.0	A13/1288	В	13	32	15	17	60	WS	4.4	CL	Grey slightly	sandy, gravelly, CLAY	
Bh 7	N/A	6.5	A13/1289	В	7	33	16	17	63	WS	4.4	CL	Grey slightly sandy, gravelly, CLAY with some cobbles		
Bh 7	N/A	9.5	A13/1290	В	12	34	18	16	63	WS	4.4	CL	Grey slightly sandy, gravelly, CLAY		
Bh 8	N/A	2.0	A13/1291	В	12.5	33	16	17	65	WS	4.4	CL	Brown slightly sandy, slightly gravelly, CLAY		
Bh 8	N/A	5.0	A13/1293	В	11.5	35	17	18	61	WS	4.4	CL	Brown slightly sandy, gravelly, CLA		
Bh 8	N/A	8.0	A13/1295	В	15	38	20	18	24	WS	4.4	CI	Brown clayey, very sandy, GRAVE		
Bh 8	N/A	11.0	A13/1296	В	16.9	42	22	20	35	WS	4.4	CI	Brown slight	y sandy, gravelly, CLAY	
Bh 9	N/A	2.0	A13/1297	В	21	38	19	19	70	WS	4.4	CI	Grey brown sligh	tly sandy, slightly gravelly, CLAY	
Bh 9	N/A	5.0	A13/1302	В	10	34	20	14	70	WS	4.4	CL	Grey black slight	y sandy, slightly gravelly, CLAY	
Bh 9	N/A	11.0	A13/1303	В	16.3	30	16	14	60	WS	4.4	CL	Grey slightly san	dy, slightly gravelly, CLAY	
Bh 15	N/A	2.0	A13/1304	В	14	33	16	17	55	WS	4.4	CL	Brown slightly sa	ndy, slightly gravelly, CLAY	
Bh 20	N/A	3.0	A13/1305	В	14	32	14	18	66	WS	4.4	CL	Brown slightly sa	ndy, slightly gravelly, CLAY	
Bh 20	N/A	8.0	A13/1307	В	12	32	17	15	52	WS	4.4	CL	Grey slightly sandy, slight	ly gravelly, CLAY with many cobbles	
Bh 24	N/A	2.0	A13/1307	В	16	51	NP	NP	27	WS	4.4		Grey silty, sa	ndy, GRAVEL	
Notes:	AR - As received       U - Undisturbed         NP - Non plastic       U - Undisturbed         Liquid Limit       4.3 Cone Penetrometer definitive method       Opinions and interpretations are outside the scope of accreditation.									and for one menth					
	Clause:	4.4 Cone Per	netrometer one p		Persons authorized to approve reports					e specimens tested. Any remaining material will be re Approved by Date			-	Page	
IGSL Ltd Materials Laboratory					J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)								24/04/13	1 of 1	

	re 76 Report No. Customer	R51845 Fingal Cou	-		Tested in ac	l, Blanchardstown, Dublin 15.								ISO 17025 ACCRUIED DETAILED IN SCOPE REG NO. 1331
	Samples Re	eceived:	08/04/13	Date Tes	sted:	Various								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425μm	Preparation	Liquid Limit Clause	Classification (BS5930)	Descriptio	'n
Bh 24	N/A	3.0	A13/0794	В	7.3				•	WS	4.4		Grey clayey/	silty, sandy, GRAVEL with sc
Bh 24	N/A	4.0	A13/0795	В	3.2					WS	4.4		Grey slightly	clayey/silty, sandy, GRAVEL
Bh 26	N/A	2.0	A13/1311	В	13	32	16	16	60	WS	4.4	CL	Grey brown	slightly sandy, slightly gravell
Bh 26	N/A	3.0	A13/1312	В	10	32	15	17	54	WS	4.4	CL	Grey black s	lightly sandy, slightly gravelly
Bh 26	N/A	8.0	A13/0798	В	13	28	12	16	76	WS	4.4	CL	Brown sandy	/, slightly gravelly, CLAY
					-									
					1									
					1									
Notes:	Preparation:	WS - Wet sie	ved		Sample Type:	B - bulk distu	rbed	Remarks:						
		AR - As recei	ved			U - Undisturb	ed							
		NP - Non plas												
	Liquid Limit		netrometer defini					-	-		e the scope of			
	Clause:	4.4 Cone Per	netrometer one p	oint method	Persons author	rized to oppro	vo roporto	The results r	elate to the s	Approved		aining materia	al will be retain Date	ned for one month. Page
10	SI I td M	laterials	Laborato	rv				Manager)		Approved				
IGSL Ltd Materials Laboratory				. ,	J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)					H Byrne 24/04			24/04/13	1 of 1

			TEST F ermination of Parti accordance with: BS1377 (note: Sedimentation st	:Part2:1990 , cla	use 9.2 & 9.5	5		ISO 1702 ACOVE IN DETAILED IN SCOPE RES NUM	5 1 3 3		
particle	%		Contract No:	16695	Report No	0.	R51846				
size	passing		Contract:	Greater Du	ublin Drainage	e Scheme					
75	100	COBBLES	Bh:	7							
63	100	COBBLES	Sample No.	N/A	Lab. Sam	ple No.	A13/1287				
50	100		Sample Type	: В							
37.5	100		depth (m)	2.00	Custome	r:	Fingal County Council, G	rove Road, Blanchardstown, Dublin 1	5.		
28	97		Date Receive		08/04/2013 Date Testing started 11/04/20			13			
20	92		Description:	Brown slig	htly sandy, s	lightly gravelly, CLA	ΑY				
14	87	GRAVEL									
10	85	GIVIVEE	Remarks								
6.3	80					2 23	.3 125 .6 .18	2	Ω		
5	78					0.063	0.3 0.425 0.6 1.18	2 5 6.3 110 20 20	2332		
3.35	74		100								
2	70		90								
1.18	67		~ 80 -		+++++++-						
0.6	63		° 70 − − − − − −		++++++						
0.425	61	SAND	¹ 60 -		+++++++-						
0.3	58		se 50								
0.15	52		40 trade								
0.063	45		Dercentage passing (%)								
0.038	38										
0.027	35		20								
0.017	32	SILT/CLAY	10		+++++++++++++++++++++++++++++++++++++++						
0.010	29		0								
0.007	26		0.0001	0.001	0.01	0.1	1	10	100		
0.005	24			CLAY	SILT	Sieve size (mm)	SAND	GRAVEL			
0.002	18					<b>A</b>		Deter			
		IGSL L t	d Materials Laborat	Approved by:		Date:	Page no:				
	Image: Host Little Materials Laboratory       H Byrne       24/04/13       1 of 1         Persons authorized to approve reports: J Barrett (Dep. Quality Manager)       H Byrne (Quality Manager)										


			TEST RE ermination of Partic accordance with: BS1377:P (note: Sedimentation stag	le Size Distr art2:1990 , clau				ISO 1702 ISO 1702 ACOPE JU- DETAILED IN SCOPE RES NUC	
particle	%		Contract No:	16695	Report No.		R51848		
size	passing		Contract:	Greater Du	blin Drainage S	Scheme			
75	100	COBBLES	Bh:	7					
63	84	COBBELS	Sample No.	N/A	Lab. Sample	e No.	A13/1289		
50	72		Sample Type:	В					
37.5	61		depth (m)	6.50	Customer:		Fingal County Council, G	rove Road, Blanchardstown, Dublin 1	5.
28	57		Date Received	08/04/20	13 Date Testin	g started	09/04/2013		
20	55		Description:	Grey slight	ly sandy, grave	elly, CLAY with so	ome cobbles		
14	51	GRAVEL							
10	50	GRAVEL	Remarks	Sample size did not meet	the Requirments of BS1377				
6.3	46					2 23	<u>ه</u> ۲	Ω	ъ
5	45					0.063 0.15	0.3 0.425 0.6 1.18	2 55.3 6.3 114 120 20	933.0
3.35	43		100 -						
2	40		90						
1.18	38		80						
0.6	36		8 70						
0.425	35	SAND	^{sin} 60 +						
0.3	33		d 50						
0.15	30		age 40						
0.063	25		Bercentage passing (%) 60 60 60 60 60 60 60 60 60 60						
0.038	21								
0.027	20		20						
0.017	18	SILT/CLAY	10				-+		
0.010	16		0						
0.007	15		0.0001	0.001	0.01	0.1	1	10	100
0.005	14			CLAY	SILT Sie	eve size (mm)	SAND	GRAVEL	
0.002	11								
			d Materials Laborato			Approved by:		Date:	Page no:
				יי y			Syrne	24/04/13	1 of 1
					Persons auth	norized to approve re	eports: J Barrett (D	ep. Quality Manager) H B	yrne (Quality Manage











			TEST ermination of Part accordance with: BS137 (note: Sedimentation	7:Part2:1990 , cla	use 9.2 & 9.5	;		ISO 1702 AGO H ALI VETALLO IN SCOPE ART NU.	28 3 16 531
particle	%		Contract No	p: 16695	Report No	э.	R51854		
size	passing		Contract:	Greater D	ublin Drainage	e Scheme			
75	100	COBBLES	Bh:	9					
63	100	CODDLL3	Sample No.	N/A	Lab. Sam	ple No.	A13/1297		
50	100		Sample Typ	e: B					
37.5	100		depth (m)	2.00	Customer	:	Fingal County Council, G	rove Road, Blanchardstown, Dublin	15.
28	100		Date Receiv	red 08/04/20	013 Date Test	ting started	08/04/2013	i	
20	99		Description:	Grey brov	n slightly san	dy, slightly gravelly	y, CLAY		
14	98	GRAVEL							
10	94	UNAVEL	Remarks						
6.3	88					Ω 23	.3 425 .6 .18	2	ы
5	85		100			0.063	0.3 0.425 0.6 1.18	2 5 6.3 10 20 20	28 50 53 53
3.35	80		100 -						
2	75		90						
1.18	71		~ 80 + + + +						
0.6	67		× 70 − − − −						
0.425	65	SAND	¹ 60 +						
0.3	62		se 50						
0.15	55		40 trage						
0.063	46		Dercentage passing (%) 60						
0.038	39								
0.027	36		20						
0.017	33	SILT/CLAY	10						
0.010	29		0						
0.007	26		0.0001	0.001	0.01	0.1	1	10	100
0.005	23			CLAY	SILT	Sieve size (mm)	SAND	GRAVEL	
0.002	16					<b>A</b>		Data	
		IGSL L t	d Materials Labora	itorv		Approved by:		Date:	Page no:
							Byrne	24/04/13 ep. Quality Manager) H E	1 of 1









particle	%		(note: Sedimentation Stage	not accredited)	ise 9.2 & 9.5				331
	70		Contract No:	16695	Report No	).	R51859		
size	passing		Contract:	Greater Du	ıblin Drainage	Scheme			
75	80	COBBLES	Bh:	20					
63	80	COBBEE3	Sample No.	N/A	Lab. Samp	ole No.	A13/1307		
50	80		Sample Type:	В					
37.5	77		depth (m)	8.00	Customer:	:	Fingal County Council, G	rove Road, Blanchardstown, Dublin 1	5.
28	75		Date Received		13 Date Testi	-	08/04/2013		
20	73		Description:	Grey slight	ly sandy, sligh	htly gravelly, CLAY	with many cob	bles	
14	68	GRAVEL							
10	65	GIVIVEL	Remarks	Sample size did not meet	the Requirments of BS1377				
6.3	61					2 33	.3 425 .6 .18	20	ъ.
5	59					0.063 0.15	0.3 0.425 0.6 1.18	2 5 6.3 114 20 20	2330 7 8 20 7 8
3.35	56		100 -				<u> </u>		
2	52		90						
1.18	49		80						
0.6	45		× 70 − − − − − − − − − − − − −						
0.425	43	SAND							
0.3	40		se 50						
0.15	33		abe 40						
0.063	25		Der centrade bassing (%) 60 60 60 60 60 60 60 60 60 60						
0.038	22								
0.027	20		20						
0.017	19	SILT/CLAY	10						
0.010	17		0						
0.007	15		0.0001 0.	.001	0.01	0.1	1	10	100
0.005	13		C	LAY	SILT S	Sieve size (mm)	SAND	GRAVEL	
0.002	9								
		IGSL I to	d Materials Laboratory	v		Approved by:		Date:	Page no:
				,			yrne	24/04/13 ep. Quality Manager) H B	1 of 1



$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	
75       84       COBBLES         63       84       Sample No.       N/A       Lab. Sample No.       A13/1309         50       84       Sample No.       N/A       Lab. Sample No.       A13/1309         50       84       Sample Type:       B       depth (m)       3.00       Customer:       Fingal County Council, Grove Road, Blanchardstown, Dub         28       73       Date Received       08/04/2013 Date Testing started       08/04/2013         20       64       Date Received       08/04/2013 Date Testing started       08/04/2013         20       64       Date Received       08/04/2013 Date Testing started       08/04/2013         20       64       Remarks       Sample stee dd not meet the Requirments of BS1377         6.3       46       Sample stee dd not meet the Requirments of BS1377         6.3       42       100       Sample stee dd not meet the Requirments of BS1377         100       90       100       100       100       100         2       31       90       100       100       100       100	
63       84       COBBLES       Sample No.       N/A       Lab. Sample No.       A13/1309         50       84       Sample No.       N/A       Lab. Sample No.       A13/1309         50       84       Sample No.       N/A       Lab. Sample No.       A13/1309         50       84       Sample No.       N/A       Lab. Sample No.       A13/1309         28       73       depth (m)       3.00       Customer:       Fingal County Council, Grove Road, Blanchardstown, Dub         28       73       Date Received       08/04/2013 Date Testing started       08/04/2013         20       64       Date Received       08/04/2013 Date Testing started       08/04/2013         10       52       GRAVEL       Remarks       sample size dd not meet the Requirments of 851377         6.3       46       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100       100	
63       84       Sample No.       N/A       Lab. Sample No.       A13/1309         50       84       Sample No.       N/A       Lab. Sample No.       A13/1309         37.5       76       Gravel       B       B       B         28       73       Date Received       08/04/2013 Date Testing started       08/04/2013         20       64       Date Received       08/04/2013 Date Testing started       08/04/2013         10       52       Gravel       Remarks       Sample size dd not meet the Requirments of B51377         6.3       46       100       Sample size dd not meet the Requirments of B51377       Sample size dd not meet the Requirments of B51377         6.3       42       100       90       100       Sample size dd not meet the Requirments of B51377	
37.5       76         28       73         20       64         14       57         10       52         6.3       46         5       42         3.35       36         2       31	
28       73         20       64         14       57         10       52         6.3       46         5       42         3.35       36         2       31	
$\begin{bmatrix} 20 & 64 \\ 14 & 57 \\ 10 & 52 \\ 6.3 & 46 \\ 5 & 42 \\ 3.35 & 36 \\ 2 & 31 \end{bmatrix} $ GRAVEL GRAVEL GRAVEL GRAVEL GRAVEL with some cobbles GRAVEL with some cobbles $\begin{bmatrix} 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 $	lin 15.
14     57       10     52       6.3     46       5     42       3.35     36       2     31	
10     52     GRAVEL     Remarks     Sample size did not meet the Requirments of BS1377       6.3     46       5     42       3.35     36       2     31	
10     52       6.3     46       5     42       3.35     36       2     31	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	
3.35     36       2     31	ы
3.35     36       2     31	- 28 - 28 - 28 - 28 - 28 - 28 - 28 - 28
0.425 21 SAND 분 60	
0.0001 0.001 0.01 1 10	
CLAY SILT Sieve size (mm) SAND GRAVEL	100
Approved by: Date:	100
IGSL Ltd Materials Laboratory       H Byrne       24/04/13         Persons authorized to approve reports: J Barrett (Dep. Quality Manager)       H	100 Page no:



			ermination of Par accordance with: BS137		use 9.2 & 9	.5		ISO 1702 ACCREMENT SETAILED IN SCOPE RESIDUE	221 2 2
particle	%		Contract N	lo: 16695	Report	No.	R51863		
size	passing		Contract:	Greater D	ublin Draina	ge Scheme			
75	100	COBBLES	Bh:	26					
63	100	COBBEES	Sample No.	. N/A	Lab. Sa	mple No.	A13/1311		
50	100		Sample Typ	pe: B					
37.5	97		depth (m)	2.00	Custom	er:	Fingal County Council, G	rove Road, Blanchardstown, Dublin 1	5.
28	89		Date Receiv	ved 08/04/20	013 Date Te	esting started	08/04/2013		
20	87		Description	n: Grey brov	n slightly s	andy, slightly gravell	y, CLAY		
14	84	GRAVEL							
10	81	GNAVLL	Remarks	Sample size did not me	et the Requirments of BS137	77			
6.3	77					ω n	Ω Ø	Ω	Ŋ
5	75					0.063 0.15	0.3 0.425 0.6 1.18	2 5 6.3 10 20 20	28 23 23 23 23
3.35	71		100						
2	67		90						╪╪┼┼╋╫╫┥
1.18	64		80						
0.6	59		8 70						
0.425	57	SAND	^{is} 60					1	
0.3	55		sed 50						
0.15	49		de						
0.063	42		04 te						
0.038	36								
0.027	33		20						
0.017	29	SILT/CLAY	10						
0.010	27	JIL I / CLAT	0						
0.007	24		0.0001	0.001	0.01	0.1	1	10	100
0.005	21			CLAY	SILT	Sieve size (mm)	SAND	GRAVEL	
0.002	14								
			d Materials Labor	aton/		Approved by:		Date:	Page no:
			d Materials Labora	atory		HE	Byrne	24/04/13	1 of 1
					Persons	authorized to approve r	eports: J Barrett (D	ep. Quality Manager) H B	yrne (Quality Manage

			TEST   cermination of Part accordance with: BS1377 (note: Sedimentation s	':Part2:1990 , clau		.5		ISG 1702 AGGE MI SETAILED IN SCOPE RAY N. 1	s , ; ;;		
particle	%		Contract No:	: 16695	Report	No.	R51864				
size	passing		Contract:	Greater Du	ublin Draina	ge Scheme					
75	100	COBBLES	Bh:	26							
63	100	COBBEES	Sample No.	N/A	Lab. Sa	mple No.	A13/1312				
50	100		Sample Type	e: B							
37.5	100		depth (m)	3.00	Custom	er:	Fingal County Council, G	rove Road, Blanchardstown, Dublin 1	5.		
28	100		Date Receive	ed 08/04/20	13 Date Te	esting started	09/04/2013				
20	97		Description:	Grey black	slightly sa	ndy, slightly gravel	ly, CLAY				
14	90	GRAVEL									
10	86	UNAVEL	Remarks								
6.3	81					Ω Ω	.3 425 .6 .18	Ω	υ		
5	78					0.063	0.3 0.425 0.6 1.18	2 5 6.3 110 20	23 23 23 23 23 23 23 23 23 23 23 23 23 2		
3.35	74		100								
2	69		90		++++++						
1.18	65		80		++++++						
0.6	60		8 70								
0.425	58	SAND	buis 60								
0.3	55		sed 50								
0.15	50		bercentage passing (%) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0								
0.063	43										
0.038	36										
0.027	34		20		1						
0.017	31	SILT/CLAY	10		++++++						
0.010	28		0								
0.007	25		0.0001	0.001	0.01	0.1	1	10	100		
0.005	21			CLAY	SILT	Sieve size (mm)	SAND	GRAVEL			
0.002	14										
		1661 1+	d Materials Labora	tony		Approved by		Date:	Page no:		
	IGSL Ltd Materials Laboratory H Byrne 24/04/13 1 of 1										
					Persons	authorized to approve	e reports: J Barrett (D	ep. Quality Manager) H B	yrne (Quality Manage		











IGSL Ltd Materials Laboratory	-	Test Report		150 17025				
M7 Business Park	Determination of Moistu	re Condition Value at I Content	Natural Moisture					
Co. Kildare	Tested in accordance	with BS1377:Part 4:199	00, clause 5.4	DETAILED IN SCOPE REG NO. 1337				
Report No		R52111						
Contract N	0.	16695						
Contract N	ame:	Greater Dublin Drainage Scheme						
Customer:		Fingal County Council, Grove	Road, Blanchardstown,	Dublin 15.				
BH/TP		Bh 9						
Sample No	).	N/A						
Depth (m)		5.00						
Sample Ty	pe:	В						
Lab Sampl	e No.	A13/1302 N/A soil 08/04/13 01/05/13						
Source (if a	applicable)							
Material Ty	rpe (if applicable):							
Sample Re	eceived:							
Date Teste	d:							
Sample Ce	ert:	Not Provided						
Moisture C	ontent (%):	22						
% Particles (By dry ma		10						
MCV:		8.3 Steepest Straight Line						
Interpretati	on of Plot:							
Description	n of Soil:	Grey black slightly sand	dy, slightly gravelly,	CLAY				
The result relates to the specim Any remaining material will be r Sampling and opinions and inte		accreditation.	Persons authorised to a J Barrett (Dep H Byrne (Qua	Quality Manager)				
		Approved by	Date	Page				
IGSL Ltd Mater	rials Laboratory	H Byrne 15/05/13 1 c						



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

# Jones Environmental Laboratory

Unit 3 Deeside Point Zone 3 Deeside Industrial Park Deeside CH5 2UA

Tel: +44 (0) 1244 833780 Fax: +44 (0) 1244 833781



Attention :	John Clancy
Date :	12th April, 2013
Your reference :	16695
Our reference :	Test Report 13/3384 Batch 1
Location :	GREATER DUBLIN DRAINAGE SCHEME
Date samples received :	5th April, 2013
Status :	Final report
Issue :	1

Five samples were received for analysis on 5th April, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

**Compiled By:** 

6 June

Bruce Leslie Project Co-ordinator

Ruielward

Bob Millward B.Sc Principal Chemist

# Jones Environmental Laboratory

Client Name:	IGSL					Report :	Solid					
Reference:	16695											
Location:	GREATE			GE SCH	EME	Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
Contact:	John Cla	ncy										
JE Job No.:	13/3384					 						
J E Sample No.	1	2	3	4	5							
Sample ID	BH7	BH8	BH9	BH15	BH26							
Depth	4.00	6.50	4.00	2.00	3.00						e attached n	
COC No / misc										abbrevi	ations and a	cronyms
Containers	J	J	J	J	J							
Sample Date	04/04/2013	04/04/2013	04/04/2013	04/04/2013	04/04/2013							
Sample Type	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1							Method
Date of Receipt	05/04/2013	05/04/2013	05/04/2013	05/04/2013	05/04/2013					LOD	Units	No.
Total Sulphate [#]	874	355	858	236	365					<50	mg/kg	TM50/PM15
Sulphate as SO4 (2:1 Ext) [#]	0.0886	0.0279	0.0610	-	-					<0.0015	g/l	TM38/PM20
Sulphide	<10	<10	~10							<10	mallin	TM106/PM45
Sulphide	×10	×10	<10	-	-					×10	mg/kg	1100/P1043
рН#	8.17	8.43	8.19	8.56	8.49					<0.01	pH units	TM73/PM11
												-

# NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/3384

#### SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of  $\pounds 1$  (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

#### WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

#### **DEVIATING SAMPLES**

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

#### SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

#### NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

## ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
СО	Suspected carry over
OC	Outside Calibration Range
NFD	No Fibres Detected

# Jones Environmental Laboratory

#### Method Code Appendix

### JE Job No 13/3384

	13/3384						
Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Solid Results expressed on Dry/Wet basis
TM38	SO4,CI,NO3,NO2,F,PO4, Amm N2,ThioCN, Hex Cr by Aquakem	PM20	1:2 soil to water extraction	Yes		AD	DRY
TM50	Total Sulphate by ICP-OES	PM15	Aqua Regia extraction (Soils)	Yes		AD	DRY
TM73	pH in by Metrohm	PM11	1:2.5 soil/water extraction	Yes		AR	WET
TM106	Sulphide by CFA	PM45	Cyanide & Thiocyanate prep for soils			AR	DRY

Appendix 9

**Rock Core Test Records** 





			POINT	LOAD TE	EST RESULTS				
Contract: G Contract no Date of test	. 16695	n Drainage Scheme	Sample Type: Co	ore					
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	ls (index strength) Mpa	ls(50) (index strength) Mpa	*UCS MPa	Туре	Orienation
RC06	19 19.6 21.4 21.6	82 82 82 82	20.0 29.0 34.0 22.0	1.249 1.249 1.249 1.249 1.249	2.97 4.31 5.06 3.27	3.72 5.39 6.32 4.09	74 108 126 82	PL PL PL PL	90° 90° 90°
RC07	21.6 15.6 15.80	82 82 82	22.0 23.0 28.0	1.249 1.249 1.249	3.42 4.16	4.09 4.27 5.20	82 85 104	PL PL PL	90° 90°
RC09	15.10 15.90 16.30	86 86 86	19.0 30.0 29.0	1.276 1.276 1.276	2.57 4.06 3.92	3.28 5.18 5.00	66 104 100	PL PL PL	90° 90°
RC11	14.50 14.60 18.30 18.40	78 78 78 78	20.0 17.0 2.0 3.0	1.222 1.222 1.222 1.222	3.29 2.79 0.33 0.49	4.02 3.41 0.40 0.60	80 68 8 12	PL PL PL PL	90° 90° 90°
RC13	25.40 25.90 26.10 27.10	78 78 78 78	8.0 12.0 18.0 21.0	1.222 1.222 1.222 1.222	1.31 1.97 2.96 3.45	1.61 2.41 3.61 4.22	32 48 72 84	PL PL PL PL	90° 90° 90°
RC14	21.30 21.70 22.30 22.40	78 78 78 78 78	26.0 15.0 22.0 10.0	1.222 1.222 1.222 1.222 1.222	4.27 2.47 3.62 1.64	5.22 3.01 4.42 2.01	104 60 88 40	PL PL PL PL	90° 90° 90°
		mmary Data	ls(50)	UCS*		Normal Distribution Curve			breviations
Minimum Average Maximum Standard Do Upper 95%	Samples Te ev. Confidence Confidence	Limit	21 0.40 3.68 6.32 1.58 6.77 0.60	21 8 74 126 32 135.45 11.94	0.3 0.25 0.2 0.15 0.1 0.05			b d approx	irregular axial block diametral c. orientation to planes of <u>ness/bedding</u> unknown
	as k x Poin	t Load Is(50): k=		20	0 +	100 200	300		perpendicular parallel

			POINT	LOAD TE	EST RESULTS				
Contract: G Contract no Date of test	. 16695	n Drainage Scheme	Sample Type: Co	ore					
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	ls (index strength) Mpa	ls(50) (index strength) Mpa	*UCS MPa	Туре	Orienation
RC15 RC17 RC24	$ \begin{array}{r}     6.55 \\     7.65 \\     7.95 \\     14 \\     14.35 \\     22.90 \\     23.45 \\     23.90 \\     27.65 \\     28.10 \\     13.60 \\     14.20 \\     5.50 \\     6.35 \\     6.70 \\     8.85 \\     9.65 \\     10.00 \\   \end{array} $	82 82 82 82 82 82 86 86 86 86 86 86 82 82 82 82 82 82 82 82 82 82 82	4.0 2.0 7.0 9.0 8.0 18.0 12.0 2.0 16.0 10.0 11.0 14.0 21.0 15.0 20.0 22.0 18.0 16.0	1.249 1.249 1.249 1.249 1.249 1.276 1.276 1.276 1.276 1.276 1.222 1.249 1.249 1.249 1.249 1.249 1.249 1.249	0.59 0.30 1.04 1.34 1.19 2.68 1.62 0.27 2.16 1.64 1.64 2.08 3.12 2.23 2.97 3.27 2.68 2.38	0.74 0.37 1.30 1.67 1.49 3.34 2.07 0.35 2.76 2.01 2.04 2.60 3.90 2.79 3.72 4.09 3.34 2.97	15 7 26 33 30 67 41 7 55 40 41 52 78 56 74 82 67 59	PL PL PL PL PL PL PL PL PL PL PL	90° 90° 90° 90° 90° 90° 90° 90° 90° 90°
Number of	tatistical Sur Samples Te		ls(50) 18	UCS* 18	*UCS Normal Distribution Curve		i	breviations irregular	
Average         2.31         4           Maximum         4.09         8			7 46 82 23	0.3 0.25 0.2			b d	axial block diametral	
Upper 95% Confidence Limit       4.60       91.93         Lower 95% Confidence Limit       0.02       0.42 <u>Comments:</u> *UCS taken as k x Point Load Is(50):       k=       20			0.1	100 200	300	weak U P	k. orientation to planes of <u>ness/bedding</u> unknown perpendicular parallel		

Unia	ixial Compression	<b>Test Report Shee</b>	t I.G.S.L.
Sample Identification			
Contract Name: Job Number: Hole No: Depth (m):	Greater Dublin Drair 16695 RC9 16.0-16.4m	nage Scheme	
Sample Description			
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolouration, slight we Considerable weakening, penetra		hand
Sample Measurements			Sketch of Failure Surfaces
Length Diameter (Ø)	190 88	mm	
<u>Testing</u> Load Rate Load at Failure (P)	3.3 354	kN/min kN	
Strength Calculations			
Uniaxial Compressive S	Strength =	<u> </u>	
	=	<u>1000 x P</u> ∏ x (Ø/2)^2	_
	=	58.20	] (Mpa)
Bulk Density	=	2.64	] (Mg/m³)
Notes:			

Unia	ixial Compression	<b>Test Report Shee</b>	t I.G.S.L.
Sample Identification			
Contract Name: Job Number: Hole No: Depth (m):	Greater Dublin Drair 16695 RC14 21.3-21.5m	nage Scheme	
Sample Description			
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolouration, slight we Considerable weakening, penetration		hand
Sample Measurements			Sketch of Failure Surfaces
Length Diameter (Ø)	160 76	mm	
<u>Testing</u> Load Rate Load at Failure (P)	3.3 259	kN/min kN	
Strength Calculations			
Uniaxial Compressive S	Strength =	<u>259000</u> 4534.10	
	=	<u>1000 x P</u> ∏ x (Ø/2)^2	-
	=	57.09	] (Mpa)
Bulk Density	=	2.66	] (Mg/m³)
Notes:			

Unia	ixial Compression	<b>Test Report Shee</b>	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	Greater Dublin Drair 16695 RC15 7.7-7.9m	nage Scheme		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE			
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolouration, slight we Considerable weakening, penetration		n hand	
Sample Measurements			Sketch of Failur	e Surfaces
Length Diameter (Ø)	201 88	mm		
<u>Testing</u> Load Rate Load at Failure (P)	<u>3.3</u> 386	kN/min kN		
Strength Calculations				
Uniaxial Compressive S	Strength =	<u>386000</u> 6079.0		
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	63.46	(Mpa)	
Bulk Density	=	2.69	] (Mg/m ³ )	
Notes:				

Unia	ixial Compression	<b>Test Report Shee</b>	et I.G.S.L.
<u>Sample Identification</u> Contract Name: Job Number:	Greater Dublin Drair 16695	nage Scheme	
Hole No: Depth (m):	RC15 14.1-14.30m		
Sample Description			
Colour:	Grey		
Grain size:	Fine-grained		
Weathering Grade:	Fresh		
Rock Type:	LIMESTONE		
Weathering Grade Criteria I. Fresh: II. Slightly weathered:	Unchanged f Slight discolouration, slight we	rom original state	
III. Moderately weathered: IV. Highly weathered:	Considerable weakening, penetra		n hand
Sample Measurements			Sketch of Failure Surfaces
			<u></u>
Length Diameter (Ø)	201 88	mm	
Testing			
Load Rate Load at Failure (P)	3.3 87	kN/min kN	
Strength Calculations			
Uniaxial Compressive S	Strength =	<u> </u>	
	=	1000 x P ∏ x (Ø/2)^2	_
	=	14.30	(Mpa)
Bulk Density	=	2.69	(Mg/m ³ )
Notes:			

Unia	ixial Compression	<b>Test Report Shee</b>	et I.G.S.L.
Sample Identification Contract Name:	Greater Dublin Drair	nage Scheme	
Job Number: Hole No: Depth (m):	16695 RC15 23.0-23.4m		
Sample Description			
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Unchanged f Slight discolouration, slight we Considerable weakening, penetra		n hand
Sample Measurements			Sketch of Failure Surfaces
Length Diameter (Ø) _Testing	198 88	mm	
Load Rate Load at Failure (P)	3.3 282	kN/min kN	
Strength Calculations			
Uniaxial Compressive S	Strength =	28200 6079.0	
	=	1000 x P ∏ x (Ø/2)^2	_
	=	46.37	(Мра)
Bulk Density	=	2.72	] (Mg/m ³ )
Notes:			

Unia	xial Compression	<b>Test Report Shee</b>	t <i>I.G.</i> S	S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	Greater Dublin Drair 16695 RC15 27.8-28.0m	nage Scheme		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE			
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolouration, slight we Considerable weakening, penetrat		hand	
Sample Measurements			Sketch of Failure Surfac	<u>es</u>
Length Diameter (Ø) <u>Testing</u>	181 88	]mm		
Load Rate Load at Failure (P)	3.3 162	kN/min kN		
Strength Calculations				
Uniaxial Compressive S	strength =	<u> </u>		
	=	<u>1000 x P</u> ∏ x (Ø/2)^2	-	
	=	26.64	] (Mpa)	
Bulk Density	=	2.69	] (Mg/m³)	
<u>Notes:</u>				

Unia	xial Compression	Test Report Shee	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	Greater Dublin Drair 16695 RC24 6.3-6.6m	nage Scheme		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE			
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolouration, slight we Considerable weakening, penetration		n hand	
Sample Measurements			Sketch of Failu	re Surfaces
Length Diameter (Ø) _Testing	182 88	]mm		
Load Rate Load at Failure (P)	3.3 212	kN/min kN		
Strength Calculations				
Uniaxial Compressive S	strength =	21200 6079.0		
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	34.86	(Mpa)	
Bulk Density	=	2.67	] (Mg/m ³ )	
<u>Notes:</u>				

Unia	ixial Compression	<b>Test Report Shee</b>	et I.G.S.L.
Sample Identification			
Contract Name: Job Number:	Greater Dublin Drair 16695	nage Scheme	
Hole No: Depth (m):	RC24 9.75-9.95m		
Sample Description			
Colour:	Grey		
Grain size:	Fine-grained		
Weathering Grade:	Fresh		
Rock Type:	LIMESTONE		
Weathering Grade Criteria	Unchanged f	from original state	
II. Slightly weathered:	Slight discolouration, slight we	eakening	
III. Moderately weathered:	Considerable weakening, penetra		
IV. Highly weathered:	Considerable weakening, p	enetrative discolouration, breaks ir	hand
Sample Measurements			Sketch of Failure Surfaces
Length	160		
Diameter (Ø)	88	mm	
Testing			V X
Load Rate	2.2		
Load at Failure (P)	<u>3.3</u> 573	kN/min kN	
Strength Calculations			
Uniaxial Compressive S	Strength =	573000 6079.04	
	=	1000 x P	
	_	∏ x (Ø/2)^2	_
	=	94.21	] (Мра)
Bulk Density	=		] (Mg/m ³ )
Notes:			