Appendix A.9.1 - Part 2 Ground Investigation Reports

Appendix A.9.1.4

Phase 3 Contract 1, N6 Galway City Transport Project Phase 3 Ground Investigation Contract 1, January to April 2016 N6 Galway City Transport Project – Phase 3 Ground Investigation Contract 1

Factual Report

Project No. 18963

July 2017



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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 (**N6 Galway City Transport Project – Phase 3 Ground Investigation Contract 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 +A2:2010 and BS 1377 (Parts 1 to 9) and the following European Norms:

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

Reporting

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.

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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 variation 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.

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.

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.

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	рН	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

Table A – Details of Sample Quality Requirements

N/S – not stated. Presume a representative sample of appropriate size.

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.

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

At the instruction of ARUP on behalf of their Client Galway County Council, IGSL has undertaken a programme of geotechnical site investigation works in the environs around Galway City from Bearna in the west to Coolagh, Briarhill in the east (Figure 1). It is understood that the Client (Galway County Council) intends to construct a new by-pass road extending east-west across the northern fringe of Galway City incorporating a new River Corrib bridge crossing. Tunnelling and the construction of a viaduct will also form part of the scheme. This will allow the road infrastructure to cross the Lough Corrib cSAC without direct impact on Annex I habitat (N6 Galway City, 2015).

Figure 1 – Site Location Plan – Proposed N6



Reproduced from N6galwaycity.ie website (N6 Galway City, 2015)

The investigations comprised both machine-excavated and hand-dug trial pits, window samples, cable percussive boreholes and rotary coreholes. In situ testing comprised falling head permeability testing and soakaway testing to BRE Digest 365. The intrusive works were supplemented by numerous geophysical 2D resistivity and seismic survey lines throughout the scheme. Geotechnical instrumentation (50mm diameter standpipes) was installed in nominated cable percussive boreholes and rotary coreholes. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (1999+A2:2010) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing.

Geotechnical laboratory testing was carried out on a range of disturbed bulk samples. The testing included particle size distributions, moisture contents, Atterberg Limits, CBR, compactions and 5-point MCV testing. Chemical soil analyses were also completed comprising pH, sulphate and organic testing. Specialist environmental testing (ARUP Disposal Suite and asbestos screening) were also undertaken on nominated soil samples.

Rock strength testing comprising Point Load Strength Index (PLSI) and Unconfined Compressive Strength (UCS) tests were performed on the rock core samples acquired from the rotary coring. The strength testing was carried out in accordance with ISRM. Los Angeles abrasion, slake durability and 10% fines analysis were also conducted on rock core samples. The 'as-built' exploratory locations were surveyed by IGSL and the co-ordinates and elevations are presented on the field logs. An exploratory hole location plan is presented in Appendix 17.

2. FIELDWORK

2.1 General

The fieldworks were carried out from January 2016 to April 2016 and comprised the following:

- Cable percussion boreholes (29 No.)
- Hand-excavated pits at cable percussive borehole locations (18 No.)
- Rotary Coreholes (40 No.)
- Machine-excavated inspection pit at rotary corehole (1 No.)
- Trial pits (38 No.) (i)
- Hand-excavated pits at trial pit locations (5 No.)
- o Soakaway Testing (2 No.)
- Falling head Permeability Testing (5 No.)
- Plate BearingTests (4 No.)
- Window Sampling (4 No.)
- o Geophysical Survey
- o Groundwater Monitoring
- o Surveying of as-built exploratory locations

(i) Including hand-excavated pit record from TP3/43 (formerly BH3/05)

2.2 Cable Percussion Boreholes

Cable percussive boring (200mm diameter) was undertaken at twenty nine locations using a Dando 3000 rig. At eighteen other proposed borehole locations, because of the obvious presence of outcropping bedrock in the vicinity and occasionally due to prohibitive access issues posed by boggy or undulating terrain, hand digging was carried out through the very shallow overburden soils. The borehole numbers are prefixed BH3/_ and extended to depths of between 0.10m and 10.50m bgl. Boring commenced after scanning (CAT & Jenny) to verify the presence or absence of service ducts. Disturbed bulk samples were recovered at 1m intervals or change of strata during boring and these are denoted 'B' on the engineering logs.

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. BH3/17 at 1.0m where N=21). 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. BH3/06 at 0.50m where N=50/75mm). In accordance with Eurocode 7, the SPT hammer has been calibrated and the energy ratio (Er) value is incorporated on the engineering logs. It is highlighted that the SPT N-Values reported on the engineering logs are uncorrected for energy ratio.

Descriptions of the soils encountered, in-situ tests undertaken and samples recovered are presented on the borehole records in Appendix 1. Details of groundwater strikes and hard strata boring (i.e. chiselling) are also presented on the aforementioned records. A standpipe was installed in one of the boreholes (BH3/21) to establish an equilibrium groundwater level. The standpipe (50mm diameter uPVC with proprietary 1mm slots and filter sock) incorporated a pea gravel filter pack and cement/bentonite grout seal. A protective stand-up headwork cover was concreted in place. Measured groundwater levels are detailed in Appendix 12.

2.3 Hand-excavated pits at Cable Percussive Borehole locations

Hand-digging was deployed at cable percussive borehole locations where shallow bedrock was anticipated and occasionally where access issues were faced in trying to achieve rig access. In all eighteen hand-dug pits were carried out at borehole locations. At three of these locations (BH3/15, BH3/31 and BH3/35), cable percussive boring (200mm diameter) was ultimately undertaken using a Dando 3000 rig. Here rig set-up was undertaken only after shallow rockhead was not thought intercepted to a depth of 1.20m / 1.30m in the pit. The hand-dug pits extended to depths of between 0.30m and 1.30m bgl. Disturbed bulk samples recovered during pit excavation are denoted 'B' on the engineering logs. Photographs were taken as the pits progressed and these are presented in Appendix 2.

2.4 Rotary Core Drillholes

Rotary core drilling (coreholes denoted BH3/_R) was carried out across the site using three different drill rigs. The terrain largely dictated which rig was used where. A track-mounted Casagrande C6 rig, a rubber-wheeled Unimog-mounted Knebel rig and a smaller rubber-tracked Comacchio GEO 205 were all used at various times throughout the contract period. Across all rigs symmetrex drilling was utilized within the superficial deposits with conventional coring techniques used in the bedrock. The rotary drilling in bedrock produced 79mm (T6-H core bit) and 71.7mm (T2-86) diameter cores using air mist flush. The smaller diameter drill bit was utilized in the very strong granite bedrock to effect penetration.

The cores were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

The core log records are presented in Appendix 3 and this includes engineering geological descriptions, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run. Core photographs are also presented in Appendix 3 and these illustrate the structure and fracture state of the bedrock.

Groundwater monitoring standpipes were installed in numerous coreholes as specified by the client's representative on site. The installed well standpipes consist of 50mm diameter HDPE pipework with proprietary 1mm slots and incorporated a pea gravel filter pack and cement/bentonite grout seal. Stand-up headwork covers were concreted in place with protective post-and-rail timber fencing erected about the well heads. The groundwater reading measurements are presented in Appendix 12. Monthly dip readings are to be taken for a period of 12 months from the end of the contract period.

In the case of BH3/30R, a small trial excavation was initially excavated to ensure that symmetrex open-hole drilling did not push through possible asbestos-containing soils from ground level to 1.60m. Possible asbestos fragments were thought intercepted during the construction of cable percussive borehole BH3/30*. The rotary casing was lowered into the excavation prior to machine-backfilling of the inspection pit. Photographs of the excavation are presented in Appendix 4.

*Environmental testing with asbestos screening later failed to identify asbestos material in the sampled soils at BH3/30

2.5 Trial Pits & Hand-excavated pits at Trial Pit locations

The majority of trial pits were excavated on site using an 8ton tracked excavator. Pitting was also undertaken using a 13ton tracked excavator (TP3/30). In addition to machine-excavation, handdigging was deployed in the case of five trial pits. Where hand-digging was used, poor access to trial pits was generally a deciding factor coupled with the knowledge that shallow (<1.20m) overburden existed in the area. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930 (1999+A2:2010). Bulk disturbed samples (typically 30 to 40 kg) were taken as the pits progressed. The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing. The trial 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 5 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls. Appendix 6 presents the hand-dug pit log for TP3/43. This trial pit was scheduled in place of BH3/05 after it was agreed that access to the location would not be possible with a cable percussive boring rig.

2.6 Soakaway Tests

Two infiltration tests were performed to assess the suitability of the sub-soils for dispersion of storm water through a soakaway system. The infiltration tests were performed in accordance with BRE Digest 365 'Soakaway Design'. To obtain a measure of the infiltration rate of the sub-soils, water is poured into each test pit, and records taken of the fall in water level against time. This procedure is repeated twice more to ensure saturation of the sub-soils. The infiltration rate is the volume of water dispersed per unit of exposed area per unit of time, and is generally expressed as metres / minute or metres / second. Designs are based on the slowest infiltration rate, which is generally calculated from the final cycle. The soakaway design logs are presented in Appendix 7.

2.7 Falling Head Permeability Testing

Four falling head permeability tests were performed in 50mm diameter groundwater wells installed over the course of the contract. The wells identified by the client's representative were BH3/35R, BH3/46R, BH3/47R and BH3/48R. In addition to performing variable head permeability tests in the aforementioned corehole installations, one further permeability test was conducted. This was an existing 4" diameter well (MW3) located in Lackagh Quarry. It was drilled several years ago by the operators of the quarry. The records for the permeability tests are presented in Appendix 8.

2.8 Plate Bearing Tests

Four number plate bearing tests were conducted along the proposed road corridor. The depth of the four tests varied from beneath shallow peats at c.0.50m bgl to 1.20m bgl (TP3/23). All tests were undertaken to evaluate the modulus of sub-grade reaction (Ks) and equivalent CBR value. A 450mm diameter plate was used with kentledge provided by a tracked excavator. Two load cycle tests were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 9.

2.9 Window Sampling (Driven Sampling)

Window sampling was carried out at four locations using a Dando Terrier rig mounted upon a Kubota tracked dumper. Ground conditions varied from shallow blanket peat bog to soft organic clays. The rig was positioned atop the dumper in order to facilitate access to each of the four locations. The Terrier rig uses a 63.5kg weight to drive the window sampler and the material was retrieved in a semi-rigid plastic core liner. Depths were dictated by the level of very stiff to hard stratum or medium dense to dense stratum in the area. Termination depths were also influenced by coarse cobble and boulder material obstructing the sample drive.

The maximum depth achieved with window sampling was 4.0m bgl (WS3/04). Overall recovery of the subsurface soils was high and provides a good understanding of the composition, structure and

strength of the near surface materials. The window sample records are presented in Appendix 10 and include descriptions of the soils encountered and the total recovery per run.

2.10 Geophysical Surveying

Minerex Geoservices carried out the geophysical survey across the site. The key aim of the survey was to determine the depth to rockhead and to identify any anomalous ground conditions. A combination of techniques was utilized consisting of 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction Profiling. The findings of the geophysical survey are incorporated in Appendix 11.

2.11 Groundwater Monitoring

Groundwater monitoring was undertaken during the fieldworks period and at designated intervals following completion (monthly for a period of 12 months beyond the end of the contract term). Groundwater levels were measured using an electric dipmeter with measurements taken from the wells installed in boreholes and coreholes throughout the project. The levels recorded are shown in Appendix 12.

2.12 Surveying of Exploratory Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish Transverse Mercator and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with locations shown on the exploratory hole plan in Appendix 17.

3. LABORATORY TESTING

Geotechnical laboratory testing was carried out on selected borehole and trial pit samples. The soils testing was undertaken in accordance with BS 1377 (1990) and included particle size gradings, Atterberg limit, 5-point MCV, optimum moisture content plots, shear box, CBR, water soluble sulphate and pH testing. The geotechnical laboratory test results are contained in Appendix 13 with the chemical results presented separately in Appendix 14. Environmental testing performed on soil samples acquired from site are presented in Appendix 15.

Geotechnical laboratory testing was also carried out on selected rock cores. Point load strength index (PLSI), unconfined compressive strength (UCS), Los Angeles abrasion, slake durability and 10% fines analysis were conducted with the results presented in Appendix 16.

REFERENCES

- **1.0** BS 5930 (1999 + A2:2010) Code of Practice for Site Investigation, British Standards Institution (BSI).
- 2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.
- 3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)
- **4.0** N6 Galway City (2015). *Emerging Preferred Route Options Brochure*. Retrieved March 30, 2016 from the N6 Galway City website http://www.n6galwaycity.ie/wp-content/uploads/2015/05/GCOB-4.03-17.3.3-004_PC-No.-3_Brochure.pdf
- **5.0** Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

Appendix 1

Cable Percussive Borehole Logs

(including shallow hand-excavated pits at borehole locations)

Exploratory Hole Number	Method of Construction [Cable Percussive / Hand Dug]
BH3/03	HD
BH3/04	СР
BH3/06	СР
BH3/07	HD
BH3/08	СР
BH3/09	СР
BH3/10	HD
BH3/11	СР
BH3/12	СР
BH3/14	HD
BH3/15	HD
BH3/15 CP	СР
BH3/16	СР
BH3/17	СР
BH3/18	HD
BH3/19	HD
BH3/20	HD
BH3/21	СР
BH3/22	HD
BH3/23	СР
BH3/25	СР
BH3/26	СР
BH3/27	СР
BH3/28	HD
BH3/29	СР
BH3/30	HD
BH3/31	HD
BH3/31 CP	CP

BH3/32	СР
BH3/33	СР
BH3/33A	СР
BH3/34	СР
BH3/35	HD
BH3/35 CP	СР
BH3/36	HD
BH3/38	СР
BH3/39	СР
BH3/40	HD
BH3/41	CP
BH3/42	СР
BH3/43	HD
BH3/46	HD
BH3/47	CP
BH3/48	HD
BH3/52	CP
BH3/53	СР
BH3/54	СР

Note: Boreholes BH3/15, BH3/31 and BH3/35 were each hand dug initially and

then drilled using cable percussive methods



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INS	NSTALLATION DETAILS Date Tip Depth RZ Top RZ Base Type						Dat	te	H De	lole epth	Casing Depth	De W	epth to Vater	Cor	mmen	ts	
REI	MARKS	Borehol rotary fo	e backfilled bllow-on co	upon com ring.	pletion. Bore	hole s	cheduled	for		Samp D - Small B - Bulk I LB - Larg Env - Env	Die Legen I Disturbed (tub) Disturbed ge Bulk Disturbed vironmental Sar) ed mple (Jar	+ Vial + Tut)	UT - Un Sample P - Undi W - Wat	disturbed 100mm Diameter isturbed Piston Sample ter Sample	



REPORT NUMBER

CO	-ORDI	NATES	524	4,240.55 E		RIG TYP		ETED /	am)	Dando 30	000	SHEET DATE CO	OMMENO	Sheet 1 of 1 CED 27/01/2016	
GR	OUND	LEVEL (m AOD)	4,825.14 N 23.68		BOREHO	DLE DIAM	ETER (n H (m)	nm)	200 0.70		DATE CO	OMPLET	ED 27/01/2016	
CLI	ENT	Ga R AF	alway Co RUP	unty Counc	il	SPT HAN	MER REI (RATIO (୨	=. NO. 6)				BORED	BY SED BY	WC JL	
			-			_		-/			San	nples	-		
Depth (m)			C	escription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Grav	elly TOP	SOIL				<u>X Iz</u> <u>X Iz</u> <u>Y</u>	23.28	0.40						
	Loos	e to med VEL	ium dens	se light brow	wn silty very	sandy	$0 \times 0 \times 0 \times 0$	22.98	0.40	AA43886	в	0.50-0.70		N = 50/75 mm (16, 9, 37, 13)	
1	Obst End	ruction of Boreh	ole at 0.7	0 m		/									
2															
3															
_															
4															
5															
6															
7															
8															
9															
HA	ARD ST	FRATA B	ORING/C	HISELLING	6								WA	TER STRIKE DET	AILS
Fror	n (m)	To (m)	Time (h)	Commen	ts		Wate Strike	er Ca e De	sing epth	Sealed At	Ris To	e Ti (m	me nin) C	omments	
0).5	0.7	1				0.70	0	.70	No	0.50	0 2	20	Seepage	
													GRC	OUNDWATER PRO	GRES
INS							Dat	e	Hole Depth	Depth	De W	oth to ater	Commen	ts	
	Date		ptn RZ 1	ор к∠ Ва	ise fy	pe									
RE	MARK	S Boreh rotary	ole backf follow-on	illed upon o coring. Wa	completion. I aiting on follo	Borehole s owing posi	cheduled tion from	for 10:30	D - Smal	Die Legen I Disturbed (tub) Disturbed	d	iiiii	UT - Un Sample	disturbed 100mm Diameter	



REPORT NUMBER

1	1														
CO	NTRAC	T N6	Galway C	ity Transpor	t Project - Ph	ase 3						BOREHO SHEET	OLE NO	. BH3/07 Sheet 1 of 1	
CO GR	-ORDIN	ATES _EVEL (n	524,5 725,0 1 AOD)	504.62 E 005.37 N 36.22	RI BC BC	g typ Dreho Dreho	e Dle Diam Dle Dept	ETER (ˈH (m)	mm)	Hand Du	g	DATE C	OMMEN OMPLE	ICED12/02/2016TED12/02/2016	
		Ga	way Cour	ity Council	SP			F. NO.				BORED		AC	
		740	51		2.0						San	nnles			
Depth (m)			De	scription			Legend		Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	TOPS	OIL				/		36.12	0.10	AA49476	D	0.10-0.30)		
	Soft b	lack to d	ark brown	fibrous PEA	λT	/		35.92		AA49477 AA49478	D B	0.10-0.30			
3	Obstri End o	<u>angular</u> uction - F f Boreho	COBBLE Possible W le at 0.60	/eathered G	<u>LDERS of gra</u>	ead									
- 8															
HA	ARD STI	RATA BO	RING/CH	SELLING				1 .					w	ATER STRIKE DET	AILS
Froi	om (m) To (m) Time Comments							er C e Γ	asıng Depth	Sealed At	Ris To	e T) (n	ime (nin) (Comments	
)						Slow	
															CREAR
									Hole	Casing		oth to	GR	JUNDWATER PRO	GRESS
Date Tip Depth RZ Top RZ Base Type						Dat	te	Depth	Depth	M	later	Comme	nts		
RE	MARKS	Hand d	ug pit at lo	cation of Bł	 3/07				D - Sma B - Bull LB - La Env - E	ple Legen all Disturbed (tub Disturbed rge Bulk Disturbed nvironmental Sa	nd) ed mple (Jar	+ Vial + Tub)	UT - L Samp P - Ur W - W	Jndisturbed 100mm Diameter le disturbed Piston Sample /ater Sample	



REPORT NUMBER

0-		NATES	524 725	,620.87 E ,068.66 N	RIG TYP BOREHO	E DLE DIAMI	ETER (m	nm) 2	Dando 30 200	000	DATE CO		CED 26/01/2016	
GR	ENT	Ga	m AOD) alway Cou	41.74 Inty Council	SPT HAN	MER REF	H (m) ^F . NO.	(0.70		BORED	BY	WC	
ENG	SINEE	R AF	RUP		ENERGY	' RATIO (%	6)			Sam		SSED BY	′ JL	
Depth (m)			D	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	Grav	elly TOP	SOIL			$\frac{\sqrt{1}}{\sqrt{1}} \frac{\sqrt{1}}{\sqrt{1}} \frac{\sqrt{1}}{\sqrt{1}} \frac{\sqrt{1}}{\sqrt{1}}$	44.04	0.50						
1	Dark coar som	brown c se GRAV e cobbles	ayey/silty EL-sized	very sandy angula fragments of Grar	ar fine to hite with		41.04	0.50	AA43885	В	0.50-0.70		N = 50/75 mm (10, 15, 28, 22)	
2	Obst End	ruction - of Boreh	Possible l ble at 0.70	Rockhead) m										
3														
-4														
5														
6														
7														
8														
9														
	RD S.	IRATA B		HISELLING										
нл	n (m)	To (m)	Time	Comments		Wate	r Ca	sing	Sealed	Rise	e Ti	ime C	comments	AILO
HA Fror	· ·	0.7	<u>(n)</u> 1			Strike	e De	ptn	At	10	(n	<u>nin) </u>	No water strike	
HA Fror	.5					L								
Fror 0	.5							Hole	Casing	Der	oth to	GRO	DUNDWATER PRO	GRESS
HA Fror 0	.5 TALL	ATION DI	PTAILS	op RZ Base	Туре	Dat	e [Hole Depth	Casing Depth	Der W	oth to ater	GRC Commer	DUNDWATER PRO	GRESS



REPORT NUMBER

1	1															
со	NTRAC	T N6	Galway Ci	ty Transport	t Project - Phas	se 3						BOREH SHEET	OLE N	0.	BH3/09 Sheet 1 of 1	
CO GR	-ORDIN	ATES	524,9 725,3 1 AOD)	52.19 E 05.97 N 47.38	RIG BOR BOR	TYPE REHO REHO	E LE DIAM LE DEPT	ETER (r H (m)	nm)	Dando 30 200 0.40	000	DATE C DATE C	OMME	NCED	28/01/2016 28/01/2016	
		Gal	way Coun JP	ty Council	SPT	HAM	IMER REI	F. NO.				BORED	BY SSED I	ВҮ	WC JII	
								<i>,</i>			Sar	nples				
Depth (m)			Des	scription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recoverv		Field Test Results	Standpipe Details
0	PEAT						<u> <u> </u></u>									
	Soft lig SILT	ght grey l	orown very	/ sandy grav	elly slightly pea	aty	/ <u>, , </u>	46.98	0.40	AA43887	D	0.50				
1	Loose	to mediu	um dense	mottled grey	y brown		×	46.38	1.00	AA43888	в	1.00-1.3	0			
	clayey Obstru End o	//silty very uction f Borebol	y sandy G	RAVEL				40.00	1.30	AA43889	D	1.30			N = 50/85 mm (2, 4, 15, 35)	
- 2		Dorento	e al 0.40 i													
-																
3																
4																
- 5																
-																
6																
. 7																
8																
-																
9																
-																
			Time	SELLING			Wate	er Ca	asina	Sealed	Ris	se T	۱ ime	NATE		AILS
ror	rom (m) To (m) (h) Comments							e D	epth	At	То) c	min)	Com	nents	
														No ۱	water strike	
													G	ROUN	DWATER PRO	GRESS
INSTALLATION DETAILS						Dat	e	Hole Depth	Casing Depth	l De V	epth to Vater	Comm	ents			
	Date	Tip Dep	oth RZ Top	RZ Base	Туре				·							
RE	MARKS	Borehol	le backfille	d upon com	pletion			I	Sam	I Iple Leger	nd		117	- Undieture	ned 100mm Diamotor	
									B - Sm B - Bul LB - La Env - F	an Disturbed (tub k Disturbed irge Bulk Disturb invironmental Sa	ed Imple (.lar	+ Vial + Tub)	Sar P - W -	nple Undisturbe Water Sa	ed Piston Sample	
											, .= (oui					



REPORT NUMBER

1																		
со	NTRAC	T N6	Galway C	City Trans	sport F	Project - F	Phase 3							BOREH	IOLE I	NO.	BH3/10 Sheet 1 of 1	
CO GR	-ORDIN	IATES LEVEL (r	,525, 725, n AOD)	320.57 E 603.65 N 66.5	<u>=</u> N 1		RIG TYPI BOREHC BOREHC	e)Le diam)Le dept	ETER (ˈH (m)	mm)	H 0.	land Duo .30	g	DATE (DATE (COMM	ENCI _ETE	ED 11/02/2016 D 11/02/2016	
	IENT GINEER	Ga AR	lway Coui UP	nty Coun	cil	\$	SPT HAN	MER REI	F. NO.					BORED) BY	BY	AC	
		. ,											San	nples		-	UL I	
Depth (m)			De	escription	1			Legend	Flevation	Denth (m)		Ref. Number	Sample Type	Depth (m)		Kecovery	Field Test Results	Standpipe Details
0	TOPS	SOIL						71 1X XIV X	66.21	0.3	30							
1 2 3 4 5 6 7 8	Obstr End o	uction - F	Possible g	ranite ro m	ckhea	ıd												
_																		
HA	ARD ST	RATA BO	DRING/CH	ISELLIN	G			\\/ota	ar C	asing	- C	aled	Pio		Timo	WA	TER STRIKE DET	AILS
Fro	m (m) To (m) IIme Comments						Strik	e D	epth		At	Tc)) (min)	Co	omments		
								0.30)							S	Seepage	
															(GRO	UNDWATER PRO	GRESS
INS	TALLA	TION DE	TAILS					Dat	te	Hole Depti	e ∣ h ∣	Casing Depth	De W	pth to /ater	Comr	nent	S	
	Date	Tip De	pth RZ To	p RZ B	ase	Туре	9											
RE	MARKS	Hand c	lug pit at l	ocation o	of BH3	3/10			I	Sa D-S B-E LB- Env	Small D Small D Bulk Dis Large	e Legen Disturbed (tub) sturbed Bulk Disturbe onmental San	d) ed mple (Jar	+ Vial + Tub)	U S P W	T - Undi ample - Undis / - Wate	isturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

CONTRACT N6 Galwa CO-ORDINATES 52 GROUND LEVEL (m AOD)	y City Transport Projec	t - Phase 3						BOREHO	LE NO.	BH3/11	
CO-ORDINATES 5. 72 GROUND LEVEL (m AOD)								SHEET		Sheet 1 of 1	
	25,831.24 N) 54.37	RIG TYP BOREH BOREH	Pe Ole diam Ole dept	ETER (n 'H (m)	nm)	Dando 30 200 2.60	000	DATE CO DATE CO	MMENC	ED 21/01/2016 ED 22/01/2016	
CLIENT Galway C ENGINEER ARUP	ounty Council	SPT HA	MMER REI Y RATIO (%	F. NO. %)				BORED E	BY SED BY	WC JL	
							San	nples			
Depth (m	Description		-egend	Elevation	Depth (m	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
Gravelly TOPSOIL			<u></u>								
Vary ooft dork brown	condu grovelly CLAV		1, 1, 1,	53.97	0.40	_					
	sandy gravelly CLAY			53.57	0.80						
Soft dark brown black	k slightly gravelly pseud al wood fragment	lofibrous	10/ 1/1 0 1/ 1/0 1/1/ 10/ 1/1/ 0			AA43876 AA43877	B D	1.00-1.45 1.00		N = 6 (0, 0, 1, 1, 0, 4)	
			1/ 1/6 1/1	52.57	1.80						
² Medium dense to der ² clayey/silty sandy fine medium cobble conte	nse dark brown slightly e to coarse GRAVEL wi ent	th a		<u>51.97</u>	2.40	AA43878 AA43879	D B	2.00 2.00-2.45		N = 39 (3, 4, 7, 7, 9, 16)	
End of Borehole at 2	60 m			01.11	2.00	-					
4											
5											
-											
7											
- 8											
-											
- 9											
HARD STRATA BORING	CHISELLING								WA		AILS
From (m) To (m) Time	Comments		Wate	er Ca	sing	Sealed	Ris	e Tir	ne Co	omments	
2.4 2.6 1.5			1 20	<u>e De</u>) 1	20	AI	10	(m	<u>(11)</u>	Seepade	
			1.90) 1.	.90	No	0.9	5 2	0 N	Aoderate	
									GRO	UNDWATER PRO	GRESS
INSTALLATION DETAILS			Dat	te ,	Hole	Casing	De	oth to C	commen	ts	
Date Tip Depth RZ	Top RZ Base T	уре			Depin		VV				
DEMARKS Barabala haa		Borobolo	chodulod	for	Com						
rotary follow-c	n coring.	BUIENDIE	scheduled	101	D - Small	Disturbed (tub)	u)		UT - Uno Sample	disturbed 100mm Diameter	
,	-				LB - Larg	e Bulk Disturbe	d mplo (lor -	Viol + Tub)	P - Undi W - Wat	sturbed Piston Sample	



REPORT NUMBER

со	NTRAC	T NE	Galway	City Transport Project	- Phase 3						BOREHO	LE NO	BH3/12	
со	-ORDIN	ATES	525	,909.63 E	RIG TYP	Έ			Dando 30	00	SHEET		Sheet 1 of 1	
GR	OUND	_EVEL (725 m AOD)	5,923.39 N 53.99	BOREHO	ole diam Ole dept	ETER (n ˈH (m)	nm)	200 2.20		DATE CC	OMPLE	TED 22/01/2016	
	IENT GINEER	Ga	alway Cou	unty Council	SPT HAN	MMER RE	F. NO. %)				BORED E	BY SED B	WC Y .II	
		, , ,								San	nples	020 0		
Depth (m)			D	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Very s	soft blac	k slightly	gravelly organic SILT		×o × ×	52.40	0.50						
-1	Loose many	e dark br cobbles	own sligł	tly silty sandy GRAVE	L with		52.60	1.30	AA43880 AA43881	D B	0.50 0.50-0.95		N = 2 (2, 2, 1, 0, 1, 0)	
	Loose	e light br	own grey	silty sandy GRAVEL		$ \begin{array}{c} $	52.09	1.30	AA43882 AA43883	D B	1.50 1.50-1.95		N = 5 (0, 0, 0, 0, 1, 4)	
2	Obstr	uction			/	2222	51.89 51.79	2.10						
	End o	f Boreh	ole at 2.2	0 m	/									
3														
4														
5														
-														
- 6														
-														
7														
-														
- 8														
-														
• • •														
H/ From	m (m)	RATA B	DRING/C	Comments		Wate	er Ca	sing	Sealed	Ris	e Tir	me (ATER STRIKE DET	AILS
2	2.1	2.2	<u>(h)</u> 1			1.30	e De	.30	At	10	<u> </u>	iin) `	Seepage	
						1.90) 1	.90	No	1.10	0 2	:0	Moderate	
										1 -		GR	OUNDWATER PRO	GRESS
INS	TALLA		TAILS			Dat	te	Hole Depth	Casing Depth	De W	oth to ater C	Comme	nts	
	Date	Tip De	pth RZ T	op RZ Base T	уре	_								
RE	MARKS	Boreh	ble backfi	lled upon completion			I	Samp D - Smal B - Bulk	I Disturbed (tub) Disturbed (tub)	d	I	UT - U Samp	Jndisturbed 100mm Diameter le disturbed Picton Sociale	
								LB - Larg Env - En	je Bulk Disturbe vironmental San	a nple (Jar +	+ Vial + Tub)	P - Un W - W	laisturbed Piston Sample /ater Sample	



REPORT NUMBER

1	-	/															
со	NTRA	CT N	16 Ga	alway Ci	ty Transpor	rt Project	- Phase 3						BOREH SHEET	IOLE N	0.	BH3/14 Sheet 1 of 1	
CO GR	-ordi ound	NATES	(m A	526,4 726,3 (OD)	67.41 E 92.59 N 55.52		RIG TYP BOREHO BOREHO	e Dle Diam Dle Dept	ETER (r Ἡ (m)	nm)	Hand Du 0.70	g	DATE C DATE C	OMME	NCED ETED	18/02/2016 18/02/2016	
CLI	ENT GINEE	R A	Galwa RUP	ay Count	y Council		SPT HAN	MMER RE	F. NO. %)	1		0.00	BORED PROCE	BY SSED I	BY	JD JL	
Depth (m)				Des	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recoverv		Field Test Results	Standpipe Details
0 1 2 3 6 7 8	TOP Light medi Grav Obst End	SOIL t brown ium cob rel is any ruction of Borel	claye ble c gular	ey/silty vo ontent. S to suba at 0.70 r	ery sandy G Sand is fine ngular coar n	GRAVEL v to mediu rse.	with a	14-31-3 9-0 0-250 4-50 4-50 4-50 5-5	55.42	0.70) AA39959)) B	0.10-0.7	70			
HA _			BOR	ING/CHI	SELLING			Wate	er Ca	asina	Sealed	Ris	e 1	۱ Time	NATE	R STRIKE DET	AILS
ror	n (m)	10 (m)		(h) C	omments			Strik	e D	epth	At	Tc		min)	No	ments water strike	
												l		G	ROUN	IDWATER PRO	GRESS
INS	Date	ATION D	DETA Pepth	ILS RZ Top	RZ Base	Ту	/pe	Dat	te	Hole Depth	Casing Depth	I De W	pth to ater	Comm	ents		
RE	MARK	S Hand	l dug	pit at lo	cation of Bl	 H3/14				D - Sm B - Bul LB - La Env - E	nple Leger all Disturbed (tub k Disturbed arge Bulk Disturbe Environmental Sa	nd o) ed imple (Jar	+ Vial + Tub)	UT Sar P - W -	- Undistur nple Undisturb Water Sa	bed 100mm Diameter ed Piston Sample ample	



REPORT NUMBER

1															
co	NTRAC	T N6	Galway C	ity Transpor	t Project - F	Phase 3						BOREHO SHEET	OLE NO	BH3/15 Sheet 1 of 1	
CO GR	-ordin Ound L	ATES .EVEL (n	526,5 726,4 n AOD)	580.27 E 193.82 N 59.00		rig typ Boreh(Boreh('e Dle diam Dle dept	ETER (r ˈH (m)	nm)	Hand Dug 1.30	g	DATE CO DATE CO	OMMEN OMPLE	ICED19/02/2016TED19/02/2016	
		Ga	lway Cour	ty Council	:	SPT HAI		F. NO.				BORED	BY SED B	JD Y II	
		743	01		•						San	noles			
Depth (m)			De	scription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	TOPS	OIL with	rootlets				<u>, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,</u>	58 80	0.20						
	(Loose high c	e) Dark b obble co	orown clay ontent. Sar	ey/silty sand id is coarse.	ly GRAVEL Cobbles a	with a re	0 0	58.60	0.40	AA39960 AA39961	B	0.20-0.40)		
1	(Loose GRAV	ered of g e) Light k 'EL with	pranite. prown sligl a high cob	ntly silty/clay ble content.	ey slightly : Sand is co	sandy barse.	₹0.00× 0.00× 0.0× 0.0×	57.70	1.30	AA39962	В	0.80-1.20)		
	Grave Cobbl	l is angu es are w	lar to suba eathered	angular fine of granite.	of granite.										
2	GRAV suban Obstru End o	'EL. San gular co uction - F f Boreho	d is fine. (arse. Possible R le at 1.30	ockhead / B	gular to										
3															
- 4															
- 5															
-															
- 6															
-															
- 8															
- 9 -															
-															
HA	ARD STE	RATABO	Time	SELLING			Wate	er Ca	sina	Sealed	Ris		W	ATER STRIKE DET	AILS
Fror	m (m)	Γο (m)	(h)	Comments			Strik	e D	epth	At	To	<u>) (n</u>	nin)	Comments	
							1.20)						Slow	
								I	I	I			GR	OUNDWATER PRO	GRESS
INS	TALLA	TION DE	TAILS				Dat	te	Hole	Casing	De	pth to	Comme	ents	
	Date	Tip Dep	oth RZ To	p RZ Base	Туре	e			рерги						
RE	MARKS	Hand d	lug pit at lo	ocation of BH	H3/15				Sam D - Sma B - Bulk	Die Legen	id))		UT - U Samp	Undisturbed 100mm Diameter	
									LB - Larg Env - En	ge Bulk Disturbe vironmental Sar	ed mple (Jar⊸	+ Vial + Tub)	P - Úr W - W	ndisturbed Piston Sample Vater Sample	



REPORT NUMBER

1	/																
со	NTRAC	Γ Ν6	6 Galway Cit	y Transpor	t Project - Pha	se 3							BOREH SHEET	IOLE N	10.	BH3/15 CF Sheet 1 of 1	0
CO GR	-ordin Ound L	ATES .EVEL (I	526,59 726,49 m AOD)	95.30 E 95.59 N 58.49	RIG BOF BOF	type Reho Reho	E LE DIAM LE DEPT	ETER (H (m)	(mm)	С 2 0)ando 30 200 1.60	000	DATE C	COMM COMPL	ENC _ETE	ED 15/03/2016 ED 15/03/2016	
		Ga	alway Count	y Council	SPT	HAM		F. NO.					BORED	BY	DV	WC	
EIN	JINEER	AP	KUP			RGI	RATIO (7	/o)	_			Son		39ED	ום	JL	
_ آء									_	Ē		San	npies		_		e
Depth (I			Des	cription			Legend		Elevatio	Depth (r	Ref. Number	Sample Type	Depth (m)		Kecover	Field Test Results	Standpiķ Details
0	Grave	IIy TOP	SOIL				711 . VII . 7	58.29	9 0	.20							
	Soft to	firm da	ark brown sa	ndy gravel	ly CLAY		<u> </u>	58.09	<u>9 0</u>	.40			0.50.06				
	Obstru End of	Iction -	Driller repor	ts LIMES I	ONE fragments	<u> </u>		01.00		.00			0.30-0.0				
1	LIIUU	Dorent	Die al 0.00 II	1													
2																	
3																	
4																	
_																	
5																	
6																	
7																	
8																	
-																	
9																	
HA	ARD STR		ORING/CHIS	SELLING		I									WA	TER STRIKE DET	AILS
Fror	m (m) -	Го (m)	Time C	omments			Wate	er C	asing) S	Sealed	Ris	e 1	Time min)	Co	omments	
C).5	0.6	0.5						Jopui		7.0	10				la uuatan atuilea	
																lo water strike	
														C	GRO	UNDWATER PRO	GRESS
INS	TALLA	FION DE	TAILS				Dat	te	Hol	e th	Casing	De	pth to	Comr	nent	S	
	Date	Tip De	pth RZ Top	RZ Base	Туре				рел	เท	Depth		alei				
			F														
סרי	MADYO	2hrc c			ont to hereb-	oloc	ation 15	hre		0.000-	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
κE	WARKS	∠nrs getting	earing plant	anu equipn	ient to porenol	6 1003	auon. 1.5	IIIS	D D	- Small I	Disturbed (tub))		U	T - Und	listurbed 100mm Diameter	
									LE	3 - Large	Bulk Disturbe ronmental Sa	ed mple (Jar -	+ Vial + Tub)	P	- Undis	sturbed Piston Sample er Sample	
_																	



REPORT NUMBER

1	1														
со	NTRACT	N6	Galway	City Transpo	ort Project - Pl	hase 3						BOREHO SHEET	ole no.	. BH3/16 Sheet 1 of 1	
CO GR	-ordina Ound Le	TES EVEL (n	526 726 n AOD)	,754.60 E ,635.82 N 58.47	R B B	IG TYP OREHO OREHO	E DLE DIAM DLE DEPT	ETER (r ˈH (m)	mm)	Dando 30 200 0.50	000	DATE CO	OMMEN	CED 29/01/2016 TED 29/01/2016	
	ENT GINEER	Gal	lway Cou UP	nty Council	S	PT HAN NERGY	MER REI	F. NO. %)				BORED	BY SSED BY	WC Y JL	
											Sar	nples			
Depth (m)			D	escription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	PEAT						<u> </u>	58.17	0.30)					
	Angula	GRAV	'EL- and	COBBLE-siz	zed fragments	s of		57.97	0.50)					
1	Obstrue End of	tion Boreho	le at 0.50) m		/									
2															
3															
4															
5															
6															
7															
8															
.9															
HA	RD STR	ATA BC	RING/CH	ISELLING									W		AILS
Fror	m (m) T	o (m)	Time (h)	Comments			Wate	er Ca	asing epth	Sealed At	Ris	se Ti	ime nin) C	Comments	
C).4	0.5	0.5				0.30) ()	0.30	No	0.2	20 2	20	Seepage	
													GR	OUNDWATER PRO	GRESS
INS	TALLAT	ON DE	TAILS				Dat	te	Hole	Casing	De	epth to	Comme	nts	
	Date	Tip Dep	oth RZ T	op RZ Base	е Туре				Deptn			valei			
REI	MARKS	1.5hr ge upon co coring.	etting rig	and tools of a. Borehole s	f BH location. scheduled for	Boreh rotary	ole backfi follow-on	lled	D - Sm B - Bull LB - La Env - E	all Disturbed (tub k Disturbed rge Bulk Disturbed nvironmental Sam	nd)) ed mple (Jar	+ Vial + Tub)	UT - U Sampl P - Un W - W	Jndisturbed 100mm Diameter le idisturbed Piston Sample /ater Sample	



REPORT NUMBER

1	\square													
со	NTRAC	T N6	Galway Cit	y Transport	Project - Phase 3						BOREHO SHEET	DLE NO.	BH3/17 Sheet 1 of 1	
CO GR	-ordin Ound L	ATES .EVEL (r	527,02 726,80 m AOD)	23.54 E)4.98 N 65.54	BOREH BOREH	Pe ole diam ole dept	ETER (n 'H (m)	nm)	Dando 30 200 2.80	000	DATE CO DATE CO	OMMENO	Ded14/03/2016ED14/03/2016	
CLI EN	ENT GINEER	Ga AR	lway County	y Council	SPT HA	MMER RE Y RATIO (9	F. NO. %)	1			BORED I	BY SED BY	WC JL	
(c								<u> </u>		San	nples		_	Q
Depth (n			Desc	cription		Legend	Elevation	Depth (n	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpip Details
- 0	Soft to	o firm da	rk brown sa	ndy gravelly	CLAY with a		5							
	Mediu	m coppi	e content e dark browi	n silty sandy	GRAVEL with		65.04	0.50	AA48880	в	0.50			
- 1	Mediu mediu	m dense m cobbl	e light browr e and bould	n silty sandy ler content	GRAVEL with a		64.54	1.00	AA48881	В	1.00-1.45		N = 21 (3, 4, 4, 5, 7, 5)	
2									AA48882	в	2.00-2.45		N = 15 (2, 8, 4, 3, 3, 5)	
Ē							62.74	2.80						
	End o	f Boreho	ole at 2.80 m	ı										
-														
-														
4														
- 5														
6														
-														
-														
8														
Ē														
Ē,														
H/	ARD ST	RATA BO	ORING/CHIS	ELLING								WA	TER STRIKE DET	AILS
Fror	m (m) -	To (m)	Time (h) C	omments		Wate Strik	er Ca e De	sing epth	Sealed At	Ris To	e Ti (m	me nin) C	omments	
2	2.7	2.8	0.5			2.70) 2	.70	No	2.4	0 2	20	Seepage	
												GRC	OUNDWATER PRO	GRESS
INS	TALLA	TION DE	TAILS			Dat	te	Hole Depth	Casing Depth	De W	pth to dater	Commen	ts	
	Date	Tip De	pth RZ Top	RZ Base	Туре	_			2 opur					
RE	MARKS	1.75hrs getting	s getting pla off position	nt and equi	pment to borehole	e location.	1hr	D - Small		d		UT - Un Semple	disturbed 100mm Diameter	
								LB - Larg Env - Env	e Bulk Disturbe vironmental Sar	ed nple (Jar ·	+ Vial + Tub)	P - Und W - Wa	isturbed Piston Sample ter Sample	



REPORT NUMBER

10		0													
со	NTRAC	T N6	Galway C	ity Transpor	t Project - Phase 3	3					BOREH SHEET	IOLE NO).	BH3/18 Sheet 1 of 1	
CO GR	-ORDIN	ATES .EVEL (r	,527 726 n AOD)	254.91 E 392.24 N 70.75	RIG TY BOREH BOREH	pe Iole Diam Iole Dept	ETER (n 'H (m)	nm)	Hand Dug 0.70	g	DATE C	COMMEN		22/02/2016 22/02/2016	
		Ga AR	lway Coui	nty Council	SPT HA		F. NO.				BORED) BY	RV.	JD	
			01		ENERG		/0)			San	nles			JL	
Jepth (m)			De	scription		egend	Elevation	Depth (m)	Ref. Number	Sample	Depth	tecovery	Fi	eld Test Results	standpipe Details
	TOPS							-	+				_		0.0
	Dark k GRAV angula	orown cla /EL with ar of grai	ayey/silty s a high col nite.	andy fine to bble content	coarse angular Cobbles are		70.55	0.20	AA39965	в	0.50				
- 1	End o	uction f Boreho	le at 0.70	m											
3															
- 5															
- 6															
- 9															
HA	ARD STI	RATA BO	DRING/CH	ISELLING								v	VATER	STRIKE DET	AILS
Fror	m (m) -	To (m)	Time (h)	Comments		Wate Strik	er Ca e De	ising epth	Sealed At	Ris To	e 1	Гіте min)	Comm	ents	
												,	No wa	ater strike	
												GF	ROUND	WATER PRO	GRESS
INS	STALLA	TION DE	TAILS			Dat	te	Hole Depth	Casing Depth	De W	pth to ater	Comme	ents		
	Date	Tip Dep	oth RZ To	p RZ Base	Туре										
RE	MARKS	Hand d	lug pit at l	ocation of Bl	H3/18		-	D - Small B - Bulk I LB - Larg Env - Env	Die Legen I Disturbed (tub Disturbed e Bulk Disturbe vironmental Sar	d) mple (Jar -	+ Vial + Tub)	UT - Sam P - L W - 1	Undisturbe ple Jndisturbed Water Samp	1 100mm Diameter Piston Sample ble	



REPORT NUMBER

1	1																
со	NTRACI	N6 C	Galway Cit	y Transport	Project - Phase	e 3							BOREH SHEET	IOLE	NO.	BH3/19 Sheet 1 of 1	
CO GR	-ordin/	ATES EVEL (m	527,39 727,01 AOD)	96.47 E 15.87 N 61.67	RIG T BORE BORE	YP EHC EHC	e Dle Diam Dle Dept	ETEF H (m)	R (mi)	⊢ m) 1	land Du	g	DATE C DATE C	COMN COMP	/IENC PLETE	ED 23/03/2016 23/03/2016	
CLI	ENT	Galv	vay Count	y Council	SPT H	IAI	MMER REI	F. NO).				BORED	BY		JD	
EN	GINEER	ARU	Р		ENER	۲G	<mark>(RATIO (</mark> ?	%)			1		PROCE	SSE	DBY	JL	
Э Ш									L	Ê		San	npies		2		be
Jepth (Des	cription			egend		Elevatio	Jepth (Ref. Numbe	Sample	Depth		ecover	Field Test Results	standpi Details
0	TOPS	DIL					<u> </u>		ш 						R		00
1 2 3 4 5 6 7 8	boulders are angular to subangular of granite. Firm light brown and dark brown silty sandy GRAVE with a high cobble and boulder content. Cobbles and boulders are angular to subangular of granite. Obstruction - Possible weathered rock / boulder End of Borehole at 1.20 m							<u>60.</u>	47	0.50	AA39978 AA39979	B	0.30-0.5	50 200			
9																	
HA	ARD STR	ATA BO	RING/CHIS	ELLING				·				1			WA	TER STRIKE DET	AILS
ror	m (m) T	o (m)	Time (h) C	omments			Wate Strik	er	Cas Der	ing S oth	Sealed At	Ris To	e 1	Гіте min)	Co	omments	
							0.80		1							Slow	
															GRO	UNDWATER PRO	GRESS
INS	TALLAT		AILS				Dat	te	н П	-lole epth	Casing Depth	De W	pth to ater	Com	nment	ts	
	Date	Tip Dept	h RZ Top	RZ Base	Туре					орит	Берш						
RE	MARKS	Hand du	g pit at loc	ation of BH	3/19				<u> </u>	Sampl D - Small I B - Bulk Di LB - Large	le Legen Disturbed (tub isturbed Bulk Disturbe	Id)) ed			UT - Und Sample P - Undis	tisturbed 100mm Diameter sturbed Piston Sample	
									Env - Envi	ronmental Sa	mple (Jar	+ Vial + Tub)		W - Wate	er Sample		



REPORT NUMBER

1	1																	
co	NTRAC	T N6	Galway (City Tran	isport	Project - P	hase 3							BOREH SHEET	IOLE I	NO.	BH3/20 Sheet 1 of 1	
CO GR	-ordin Ound I	ATES _EVEL (r	527 727 m AOD)	212.43 670.35 51.4	E N 6	F E	RIG TYP BOREHO BOREHO	'e Ole diam Ole dept	ETER H (m)	(mm	⊢) 1	land Dug .00	g	DATE C DATE C	OMM	IENCI LETE	ED 23/03/2016 23/03/2016	
		Ga	alway Cou	nty Cour	ncil	S			F. NO.					BORED	BY	BY	AC	
						 •			/0)				San	nnles	JUL		JL	
Depth (m)			De	escriptio	n			Legend	Ē	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)		Recovery	Field Test Results	Standpipe Details
0	TOPS	OIL					/	0-0-	51.30	6	0.10	AA49485	в	0.10-0.4	5			
	Dark	grey blac	ck clayey/	silty very	' sand	ly organic			51.0	1	0.45							
1	Orang GRAV GRAV	e brown EL with EL with	slightly c a high co angular c	layey/sili bble cor of granite	ty fine ntent.	e to coarse Cobbles ar	sandy re		50.60 50.40	6	0.80 1.00	AA49486 AA49487	В	0.50-0.8	0			
	Brown GRAV angula	n slightly /EL with ar of gra	clayey/sil a high co nite.	ty very s bble cor	andy ntent.	fine to coa Cobbles ar	rse re											
2	Obstru pit	uction - S	Slow prog	ress due	e to m	any cobble	es in											
	End o	f Boreho	ble at 1.00	m														
3																		
4																		
- 5																		
. 6																		
7																		
8																		
- 9																		
HA	ARD STI	RATA BO	ORING/CH	ISELLIN	IG											WA	TER STRIKE DET	AILS
Fror	m (m) [·]	To (m)		Wate Strik	er C e [Casir Dept	ng S h	Sealed At	Ris To	ie T	⊺ime min)	Co	omments					
																N	lo water strike	
															(GRO	UNDWATER PRO	GRESS
INS	TALLA	TION DE	TAILS					Dat	te	Ho De	ole pth	Casing Depth	De W	pth to /ater	Com	ment	s	
	Date	Tip De	pth RZ To	op RZ E	Base	Туре	9			08	201	Doput						
RE	MARKS	Hand o	dug pit at l	ocation	of BH	13/20					D - Small [D - Small [B - Bulk Di LB - Large	e Legen Disturbed (tub isturbed Bulk Disturbe	d)		L S F	JT - Und Sample - Undis	isturbed 100mm Diameter	
											Env - Envii	ronmental Sar	mple (Jar	+ Vial + Tub)	V	v - Wate	er Sample	



REPORT NUMBER

co		CT NE	Galway	City Transpor	Project - Phase 3						BOREHO		BH3/21	
	000		- Gaiway)E		г	Jando 30	200	SHEET		Sheet 1 of 1	
GR		LEVEL (527 726 m AOD)	,143.84 E ,344.76 N 37.76	BOREH	ole diam Ole dept	ETER (n 'H (m)	n m) 2	200 1.80	000	DATE CO DATE CO	MMENC MPLET	ED16/02/2016ED16/02/2016	
		Ga D A D	alway Cou	inty Council	SPT HA		F. NO.				BORED B		WC	
	JINEE	K Ar	(UP		ENERG		/0)			San	nples		JL	1
Depth (m)			D	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	Soft	to firm da	ark brown	sandy very gr	avelly PEAT	<u>101 . 111 . 6</u>								
	Ligh	t brown s	andy GRA	AVEL		00000	37.26	0.50	-	В	0.50			
	Ligh	t brown si	ilty sandy	GRAVEL with	n many cobbles	×	00.00	0.00		в	1.00-1.45		N = 13	
	Firm	cream ve	ery sandy	gravelly CLA	Y		36.46	1.30 1.70	_				(0, 1, 2, 3, 4, 4)	
.2	Red	dish brow VEL	n slightly	silty very sand	dy fine to medium	<u>89 · 88 ·</u>	35.96	1.80	7	В	1.70-1.80			
	End	of Boreho	ole at 1.80) m										
3														
4														
5														
6														
7														
8														
9														
H/	ARD S	TRATA B	ORING/C	HISELLING		Wate	er Ca	sina s	Sealed	Ris	e Tin	WA ne	TER STRIKE DET	AILS
nor-	n (m)	1 o (m)	(h)	Comments		Strik		epth 70	At	To	(mi	n) C	Slow	
		1.0	0.70			1.70			110	1.0		-	0.011	
												GRC	UNDWATER PRO	GRESS
INS	TALL	ATION DE	TAILS			Dat	te	Hole Depth	Casing Depth	De W	pth to C	ommen	ts	
16	Date -02-16	Tip De 3 1.80	pth RZ T	op RZ Base 0 1.80	Type 50mm SP									
RE	MARK	S 2.5hr g	etting rig	on to positior	from BH3/38. Dril	ler reports	wet	Samp	le Legen	ld				
		ground field, r	d from 1.5 einstating	0m. 4.5hr get field and clea	ting rig and tracked aning down road. T	d dumper (racked	out of	D - Small B - Bulk D LB - Large	Disturbed (tub Disturbed Bulk Disturbe) ed	- A 6-1 - T	UT - Un Sample P - Und	aisturbed 100mm Diameter isturbed Piston Sample	
		excava	ator used	to assist rig a	ccess / egress fror	n field. Mo	ve to	Env - Env	ironmental Sa	mpie (Jar	+ Vial + Tub)	W - Wa	ter Sample	



REPORT NUMBER

1	1														
co	NTRAC	F N6 (Galway Cit	y Transpor	t Project -	Phase 3						Boreho Sheet	DLE NO.	BH3/22 Sheet 1 of 1	
CO GR	-ordin/ Ound L	ATES EVEL (m	527,54 727,12 AOD)	8.26 E 6.52 N 49.40		RIG TYP BOREHO BOREHO	Pe Ole Diam Ole Dept	IETER (n ſH (m)	nm)	Hand Du	g	DATE CO DATE CO	OMMEN OMPLET	CED 12/02/2016 TED 12/02/2016	
CLI	IENT	Galv	way County	/ Council		SPT HAI	MMER RE	F. NO.				BORED I	BY	AC	
EN	GINEER	ARU	IP			ENERG	Y RATIO (9	%) ∣		1	Sam	PROCES	SED BY	/ JL	
Depth (m)			Dese	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample	(m)	Secovery	Field Test Results	Standpipe Details
0	TOPS	OIL					<u></u>	49.10	0.30						
	Brown GRAV angula	slightly c EL with a r of gran	layey/silty high cobb ite.	sandy fine le content.	to coarse Cobbles	are /	995°2×	48.90	0.50	AA49472	В	0.30-0.50			
- 2	Obstru End of	ction - Po Borehold	ossible We e at 0.50 m	athered G	ranite Roo	ckhead									
3															
4															
- 5															
- 6															
- 7															
- 8															
- 9															
-															
H/	ARD STF	RATA BO	Time	ELLING			Wate	er Ca	isina	Sealed	Rise	e Ti	me .	ATER STRIKE DET	AILS
⊢roi	m (m) 1	o (m)	(h) C	omments			Strik		epth	At	То	(n	nin) C	Slow	
							0.45							SIUW	
													GRO	OUNDWATER PRO	GRESS
INS	TALLA Date	TION DET	TAILS	RZ Base	Тур	De	Dat	te	Hole Depth	Casing Depth	De W	oth to ater	Commer	nts	
RE	MARKS	Hand du	lg pit at loc	ation of BH	13/22				Samp D - Small B - Bulk I LB - Larg	Die Legen Disturbed (tub Disturbed e Bulk Disturbe	id))		UT - Ul Sample P - Un	ndisturbed 100mm Diameter e disturbed Piston Sample	
									Env - Env	monmental Sa	mpie (Jar +	r viai + Tub)	vv - vva	ater Sample	


REPORT NUMBER

CONTRACT N6 Galway City Transport Project	- Phase 3						Boreho Sheet	OLE NO	BH3/23 Sheet 1 of 1	
CO-ORDINATES 527,770.91 E 727,345.14 N GROUND LEVEL (m AOD) 26.78	RIG TYPE BOREHOLI BOREHOLI	e diame E depti	ETER (m H (m)	m) 2	Dando 30 200 3.70	00	DATE CO DATE CO	OMMEN	CED 05/02/2016 TED 05/02/2016	
CLIENT Galway County Council	SPT HAMM		ະ. NO.				BORED		WC	
						San	noles			
Description		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
⁰ Firm dark brown sandy gravelly CLAY with a medium cobble and boulder content	low to		25.78	1.00						
¹ Medium dense brown silty very sandy GRAV some cobbles	EL with				AA32640	В	1.00-1.45	i	N = 15 (2, 3, 3, 3, 4, 5)	
² Medium dense light brown clayey/silty very si GRAVEL with a low to medium cobble and b content	andy % oulder 0	3 < 0 < 0 < 0 < 0 < 0 < 0 < 0 < 0 < 0 <	24.48	2.30	AA32641	В	2.00-2.45	i	N = 15 (3, 3, 2, 3, 4, 6)	
³ End of Borehole at 3 70 m	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<u>)</u> 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	23.08	3.70	AA32643	В	3.00-3.45		(3, 4, 3, 4, 4, 5)	
- 5 - 6 - 7 - 8										
9										
		Wate:	r Co	sina a	Sealed	Rice	<u>а т</u> ;	W. me	ATER STRIKE DET	AILS
From (m) To (m) (h) Comments		Strike	b De	pth	At	То	(n	nin)	Comments	
3.6 3.7 0.75		3.70	3.	70	No	3.20	0 2	20	Slow	
					<u> </u>	-		GR	OUNDWATER PRO	GRESS
INSTALLATION DETAILS	vne	Date	e [Hole Depth	Casing Depth	De W	oth to ater	Comme	nts	
	<u>у</u> чу			6						
REMARKS 0.5hr moving boulders obstructing acc rig and tracked dumper from borehole boulders to block entrance.	cess to plot. 0 e including rep).5hr mo placeme	oving ent of	D - Small B - Bulk D LB - Large Env - Env	le Legen Disturbed (tub) Disturbed Bulk Disturbe ironmental San	d d nple (Jar +	+ Vial + Tub)	UT - U Sampi P - Un W - W	Indisturbed 100mm Diameter le disturbed Piston Sample /ater Sample	



REPORT NUMBER

0			Calvery Cit		t Ducie et Di							BODEH) DU2/25	
	OFFICI	N6	Galway Ci	y Iranspor	t Project - Pr	ase 3				Dorada Of		SHEET		Sheet 1 of	1
GR	-ORDINA OUND L	ATES EVEL (r	528,73 727,83 n AOD)	32.55 E 34.69 N 12.60	B	OREHO OREHO	: Le diam Le dept	ETER (r H (m)	nm) 2	Dando 30 200 3.80	000	DATE C DATE C	OMMEN OMPLE	NCED 01/02/2010 TED 01/02/2010	6 6
		Ga	lway Count	y Council	SI			F. NO.				BORED	BY	WC	
EINC	JINEER	АК	UP			NERGI	KATIO ()	/0)			San	nples	SSED E		
Depth (m)			Des	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	Gravel	ly TOPS	SOIL				<u>x 1. x 1. x</u>	12 30	0.30						
- - - - - - 1	Firm lig GRAV	ght grey EL with	mottled brosome cobb	own silty ve les	ry sandy			2.00	0.00	AA43893 AA43894	В	0.50-1.0	5	N = 16 (3, 3, 4, 3, 4, 5)	
2	Firm b gravell	ecominç y SILT.	g firm to stif Gravel is a	f light brow ngular.	n slightly sar	ndy >	0 50 6 <u>0 0 70</u> (0 × 0 (0 × 0 (× 0 (× 0 (× 0 (× 0 (× 0)) (× 0) (×	11.00	1.60	 AA43895	В	2.00-2.4	.5	N = 18 (4, 4, 3, 4, 5, 6)	
3	Firm b gravell	ecomino y SILT v	g firm to stif with many c	f light brow obbles. Gra	n slightly sar avel is angul	ndy the second s		9.60	3.00	- AA43896	В	3.00-3.4	5	N = 20 (3, 3, 4, 4, 4, 8)	
- 4 - 5 - 5 - 7 - 7 - 8 - 9 - 9	Obstru End of	ction Boreho	ole at 3.80 n	n			0.00	3.80					VATER STRIKE DE	ETAILS	
Fror	m (m) T	o (m)	Time C	comments			Wate	er Ca	ising s	Sealed	Ris	e T	ime	Comments	
3	.7	3.8	0.75						ະ ມ ແມ	<u> </u>	10	, ()		No water strike	000550
10.1-	TALL								Hole	Casing	De	oth to	GF		OGRESS
INS	T ALLAT Date	Tip De	T AILS	RZ Base	Туре		_ Dat	te	Depth	Depth	M	ater	Comme	ents	
RE	MARKS	Boreho rotary f	ble backfille follow-on cc	d upon con ring.	pletion. Bore	ehole so	heduled	for	D - Small B - Bulk D LB - Larg Env - Env	Disturbed (tub Disturbed (tub Disturbed e Bulk Disturbe rironmental Sar	d) ed mple (Jar	+ Vial + Tub)	UT - Sam P - L W - 1	Undisturbed 100mm Diamete ple Indisturbed Piston Sample Water Sample	r



REPORT NUMBER

co			a Cal		ty Transpor	t Project	Phase 3						BORFHO		<u>ר</u>	BH3/26	
			o Ga			I FIOJECI		-			Danala 20		SHEET			Sheet 1 of 1	
CO GR	-ordii Ound	NATES LEVEL (m A0	528,8 727,92 OD)	15.44 E 22.07 N 14.67		BOREHO	e Dle Diami Dle Dept	ETER (n H (m)	nm)	Dando 30 200 0.40	000	DATE CO DATE CO	ommei omple	NCED ETED	01/02/2016 01/02/2016	
CLI	ent Gineei	Ga R Af	alway RUP	y Count	y Council		SPT HAN ENERGY	/IMER REF 7 RATIO (%	F. NO. %)	1	Ι	Sam	BORED PROCES	BY SSED E	BY	WC JL	1
Depth (m)				Des	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	F	Field Test Results	Standpipe Details
0	Soft medi	dark brov ium boule	wn sa der c	andy gra ontent	avelly CLA	Y with a lo	ow to		14.27	0.40							
- 1 - 2 - 3 - 3																	
9																	
НА		ΓΡΔΤΔ Β			SELLING												
Fror	n (m) To (m) Time Comments							Wate	er Ca	sing	Sealed	Rise	e Ti	ime	Comn	nents	AILO
0).4	0.4	0	<u>n)</u>).5				Strike		epin	AL	10	(n	nin)	No w	vater strike	
														G	ROUNI	OWATER PRO	GRESS
INS	TALLA	ATION DI	ETAI	LS				Dat	e	Hole Depth	Casing	De	oth to	Comm	ents		
	Date	Tip De	epth	RZ Top	RZ Base	Ту	/pe			σορίπ		V					
RE	MARK	S 0.75hr Boreh rotary	r gair ole b follo	ning acc backfille w-on co	cess to field d upon com pring	l and mov npletion. I	ving to BH Borehole s	location. cheduled	for	Sam D - Sma B - Bulk LB - Lai Env - Ei	ple Legen all Disturbed (tub Disturbed ge Bulk Disturbe nvironmental Sar	d) ed mple (Jar +	· Vial + Tub)	UT - Sam P - U W -	Undisturb ple Jndisturbee Water San	ed 100mm Diameter d Piston Sample nple	



REPORT NUMBER

1	-															
со	NTRAC	T N6	6 Gal	way City	/ Transpor	t Project -	Phase 3						BOREHO SHEET	DLE NO	BH3/27 Sheet 1 of 1	
CO GR	-ORDIN	IATES LEVEL (I	m AC	528,96 728,13 DD)	0.51 E 0.68 N 8.94		RIG TYP BOREHO BOREHO	'e Dle Diame Dle Depti	ETER (n H (m)	nm)	Dando 30 200 1.40	000	DATE CO DATE CO	OMMEN OMPLE	ICED 17/02/2016 TED 18/02/2016	
CLI EN(IENT GINEER	Ga R AR	alway RUP	County	Council		SPT HAN	MMER REF (RATIO (%	=. NO. 6)	1	1		BORED	BY SSED B	WC Y JL	
Depth (m)				Desc	ription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Soft d	lark brov	vn sa	andy gra	velly CLA	Y			8.54	0.40						
1	Firm I a meo	brown sli dium cob	ightly ble a	v sandy s and boul	slightly gra Ider conter	avelly CLA nt	Y with		0.04	0.40	AA48872 AA48873	B	0.50 1.00-1.45	;	N = 50/180 mm (2, 2, 4, 8, 38)	
2 3 4 5 6 7 8	Obstruction End of Borehole at 1.40 m															
H/	ARD ST	RATA B	ORIN	IG/CHIS	ELLING									w		AILS
Fror	m (m)	To (m)	Tir /F	me Co	omments			Wate	er Ca	sing	Sealed	Ris	e Ti	me (Comments	
1	1.4	1.4	0.	.5				Gund		- pr st 1	, u			,	No water strike	
										I				GR	OUNDWATER PRO	GRESS
INS	TALLA	TION DE	TAIL	S				Date	e I	Hole Depth	Casing Depth	De W	pth to ater	Comme	ents	
_	Date	Tip De	pth F	RZ Top	RZ Base	Тур	De									
RE	MARKS	3 2.5hr g used to and tra	gettin o ass ack m	g rig on sist rig ac nachine	to positior ccess / egi from field.	n from BH ress from	3/21. Trac field. 3hr	cked excav removing	vator rig	D - Sma D - Sma B - Bulk LB - Lar Env - Er	Die Legen II Disturbed (tub Disturbed ge Bulk Disturbe wironmental Sar	i d) ed mple (Jar ·	+ Vial + Tub)	UT - U Samp P - Ur W - W	Jndisturbed 100mm Diameter ole ndisturbed Piston Sample Vater Sample	



REPORT NUMBER

1	1														
со	NTRAC	T N6	Galway (City Transp	ort Project ·	- Phase 3						BOREHO SHEET	OLE NO	D. BH3/28 Sheet 1 of	1
CO GR	-ordin Ound L	ATES .EVEL (m	529, 728, 1 AOD)	132.46 E 217.63 N 18.82		RIG TYP BOREHO BOREHO	'e Ole diam Ole dept	ETER (r H (m)	mm)	Hand Dug	g	DATE CO	ommei omple	NCED 18/02/2016	6 6
		Gal	way Coui	nty Counci	il	SPT HAI		F. NO.				BORED	BY SSED F	JD 3Y II	
		,						 			San	noles		02	
Depth (m)			De	scription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	TOPS	OIL					V. 14. V. 14. V	18.62	0.20		<u> </u>				
	Firm b	rown slig	htly sanc	y gravelly	SILT	/		18.52	0.30	AA39957	В	0.20-0.30			
	Firm b	rownish	grey sligh	ntly silty sa	ndy gravelly	/ CLAY	-A c	18.12	0.70	_					
2	Obstru Rockh End o	iction - L ead f Borehol	arge BOU e at 0.70	JLDER / P	ossible Lim	estone									
3															
4															
- 6															
- 7															
8															
9															
H	ARD STR	RATA BO	RING/CH	ISELLING	i								v	VATER STRIKE DE	TAILS
Fro	m (m) -	Го (m)	Time	Comment	S		Wate	er Ca	asing	Sealed	Ris	e Ti	ime	Comments	
		, ,	<u>(n)</u>				Strik		epin	AL	10	<u>, (n</u>	1111)	No water strike	
								1	1	I		I	GF	ROUNDWATER PR	OGRESS
INS			TAILS				Dat	te	Hole	Casing	De	pth to	Comm	ents	
	Date	Tip Dep	th RZ To	p RZ Bas	se Ty	ре			Depth	Depth		ater			
RE	MARKS	Hand d	ug pit at l	ocation of	BH3/28				D - Sma B - Bulk LB - Lai Env - E	ple Legen all Disturbed (tub Disturbed rge Bulk Disturbe nvironmental Sar	id)) ed mple (Jar	+ Vial + Tub)	UT - Sam P - U W - '	- Undisturbed 100mm Diameter ple Undisturbed Piston Sample Water Sample	



REPORT NUMBER

		- N				•					POPEUC			
			6 Galway	City Transport Pro	oject - Phase	3			Danda 20	200	SHEET	JLE NO	Sheet 1 of 1	
CO GR	-ordin Ound	IATES	529 728 (m AOD)	0,489.29 E 0,334.05 N 13.73	BOREH BOREH	PE IOLE DIAM IOLE DEPT	ETER (n 'H (m)	nm)	Dando 30 200 2.70	000	DATE CO DATE CO	OMMEN	ICED01/02/2016TED01/02/2016	
CLI EN(ENT GINEER	G Al	alway Cou RUP	unty Council	SPT HA	AMMER REI BY RATIO (%	F. NO. %)				BORED B PROCES	BY SED B	WC Y JL	
										San	nples			
Depth (m)			D	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Soft to	o firm liq mediui	ght brown n cobble a	sandy gravelly Cl and boulder conte	LAY with a ent		12.93	0.80						
1	Firm t mediu	o stiff li Im cobb	ght brown ble and lov	silty sandy GRAN v to medium boul	/EL with a der content				AA43890	В	1.00			
									AA43891	В	1.50-1.95		N = 32 (4, 7, 7, 8, 8, 9)	
2							11.33	2.40						
	Stiff li with n Obstr	ght brow nany co uction	wn slightly bbles	sandy slightly gra	avelly CLAY		11.03	2.70	AA43892	В	2.50-2.70		N = 50/105 mm (8, 11, 16, 34)	
4 5 6														
7														
8														
9														
			Time			Wate	er Ca	ising	Sealed	Ris	e Ti	me /	Comments	AILO
2	2.6	2.7	(h) 0.5			Strik	e De	epth	At	<u> </u>	<u>) (m</u>	<u>in) (</u>	No water strike	
												GR	OUNDWATER PRO	GRESS
INS	TALLA	TION D	ETAILS			Dat	te	Hole Depth	Casing Depth	De W	pth to ater	Comme	ents	
	Date	Tip De	epth RZ T	op RZ Base	Туре				20001					
RE	MARKS	Hand Reins	dug inspe tating field	ction pit excavate upon completion	ed to commend n (0.5hr). Move	ce hole (1.5 e gear to Bl	ihr). H3/26	Sam D - Sma B - Bulk	I Disturbed (tub Disturbed (tub Disturbed	d)	I_	UT - L Samp	Jndisturbed 100mm Diameter le disturbed Piston Sample	
		sched	uled for ro	stary follow-on co	ring.	DOLGHOIG		Env - En	vironmental Sar	nple (Jar⊡	+ Vial + Tub)	W - W	Vater Sample	



REPORT NUMBER

1																
со	NTRACT	N6 Galway	y City Transpo	rt Project - Phase	e 3							BOREH SHEET	OLE N	10.	BH3/30 Sheet 1 of 1	
CO GR		TES 53 72 VEL (m AOD)	31,041.18 E 28,509.06 N 23.76	RIG T BORE BORE	ehc Ehc	e Dle Diami Dle Dept	ETER (n H (m)	nm)	н 0	land Dug .50	9	DATE C DATE C	:OMMI :OMPL	ENCE	D 23/02/2016 D 23/02/2016	
		Galway Co	ounty Council	SPT I			F. NO.					BORED	BY	BY	JD "	
	GINEER	ANUF				KATIO (/	'o)				San	nles	JJED		JL	
Depth (m)			Description			Legend	Elevation	, , -+ C	Deprin (m)	Ref. Number	Sample Type	Depth (m)		Kecovery	Field Test Results	Standpipe Details
0 -1 -2 -3 -4 -5 -6 -7 -8 -9	TOPSO Brown c occasion pipe, tim tarmac/I End of E	Imper, troot state, plastic and possible tarmac/bitumen (MADE GROUND) End of Borehole at 0.50 m					23.61	0.	15	AA39968 AA39969 AA39970	BENV	0.15-0.5 0.15-0.5 0.15-0.5				
HA	ARD STRA	TA BORING/	CHISELLING											WAT	ER STRIKE DET	AILS
Fror	m (m) To	(m) Time	Comments		Wate	er Ca	sing	S	Sealed	Ris	e T	Time	Cor	nments		
		<u> </u>					<u>ະກເບ</u>		AL	10		<u>(()(())</u>	No	o water strike		
													0	ROU	NDWATER PRO	GRES
INS	Date 1	ON DETAILS	Top RZ Base	Туре		Dat	e	Hole Dept	e h	Casing Depth	De W	pth to ater	Comr	nents		
RE	MARKS H	land dug pit a o presence of	at location of B f possible asbe	H3/30. Pit termin stos roofing frag	nate Imei	d at 0.50n nts.	n due	Sa D - B - LB Env	Small E Bulk Dis - Large / - Envir	e Legen Disturbed (tub) sturbed Bulk Disturbe conmental San	d d nple (Jar	+ Vial + Tub)	U Si P W	T - Undis ample - Undistu ' - Water	turbed 100mm Diameter Irbed Piston Sample Sample	



REPORT NUMBER

1	-																
со	NTRAC	N6 G	alway City	/ Transport	Project - Phase	e 3							BOREH SHEET	OLE	NO.	BH3/31 Sheet 1 of 1	
CO GR	-ORDIN	ATES EVEL (m	531,27 728,42 AOD)	2.27 E 5.74 N 11.44	RIG T BORE BORE	YPI EHC EHC	E DLE DIAM DLE DEPT	ETER (H (m)	mn	H n) 1	land Du	g	DATE C DATE C	OMM OMPI	ENC	ED 23/02/2016 23/02/2016	
CLI		Galw	ay County	/ Council	SPT H			F. NO.					BORED	BY	DV	JD	
EIN	JINEER	ARUI			ENER	GT	KATIO (7	/o)				San	PROCE	SSED	זסי	JL	
Depth (m)			Desc	cription			Legend	Elevation		Depth (m)	Ref. Number	Sample Type	(m)		Recovery	Field Test Results	Standpipe Details
0	TOPS	JIL					<u>7, 1^X. 7, 1^X. 7</u>		-	0.00				+ '	-		
1	Firm lig gravel Sand i suban Firm g with a	ght brown y SILT wit s fine to n gular coar rey mottle medium to	and dark th a low to nedium. G se. d brown s o high cob	brown sligh medium co ravel is ano lightly sano ble conten	ntly sandy slightl obble content. gular to ly gravelly SILT t. Sand is	ly		10.84		0.60	AA39971 AA39972	B	0.30-0.6 0.60-1.2	0			
2	Cobble Cobble End of	e. Gravel is es are of li Borehole	s angular f imestone. at 1.20 m	to subangu	lar coarse.												
3 4																	
5																	
6																	
7																	
8																	
9																	
HA	KD STF	AIABOF	Time	ELLING			Wate	er C	asi	nals	Sealed	Rie	еТ	ime	WA'	IER STRIKE DET	AILS
-ror	n (m) 1	o (m)	(h) C	omments		Strike)ep	th	At	Tc) (I	min)	Co	omments		
							1.20								S	seepage	
														(GRO	UNDWATER PRO	GRESS
INS	Date	TION DET	AILS 1 RZ Top	RZ Base	Туре		Dat	ie	H De	ole epth	Casing Depth	De W	pth to ater	Com	ment	s	
RE	MARKS	Hand du	g pit at loc	ation of BH	13/31			I_		D - Small E B - Bulk Di LB - Large Env - Envir	e Legen Disturbed (tub sturbed Bulk Disturbe ronmental Sar) ed mple (Jar	+ Vial + Tub)	U S P	IT - Und ample • - Undis V - Wate	isturbed 100mm Diameter sturbed Piston Sample er Sample	



REPORT NUMBER

														_
co	NTRAC	T N6	6 Galway C	ity Transport Pr	oject - Phase 3	3					BOREHO SHEET	OLE NC	D. BH3/31 CI Sheet 1 of 1	Þ
CO GR	-ordin Ound I	ATES _EVEL (I	,531, 728, m AOD)	272.27 E 425.74 N 11.44	RIG TYI BOREH BOREH	pe ole diam ole dept	ETER H (m)	(mm)	Dando 30 200 4.20	000	DATE CO DATE CO	OMMEN OMPLE	NCED 02/03/2016 TED 02/03/2016	
		Ga	alway Cour	ity Council	SPT HA		F. NO.				BORED	BY SED B	WC	
		7.4			ENERG					Sam	ricond			
Depth (m)			De	scription		Legend		Elevation Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
0	Firm of low to	lark brov mediun	wn sandy s n cobble ai	lightly gravelly S nd boulder conte	SILT with a ent	× × × ×	40.7	4 0 7	AA48875	в	0.50			
- 1	Firm a sandy	and firm slightly	to stiff ligh gravelly S	t brown and gre LT with a mediu	y slighlty ım cobble		10.7	4 0.70	AA48876	в	1.00-1.45	5	N = 16	
	contei	nt											(2, 4, 5, 6, 2, 5)	
2						× × × × × × × × × × × × × × × × × × ×			AA48877	В	2.00-2.45	5	N = 13 (3, 4, 4, 3, 3, 3)	
3	Driller	notes w	vet ground	from 3.0m					AA48878	в	3.00-3.45	5	N = 28 (3, 4, 7, 8, 7, 6)	
4	End o	f Boreho	ole at 4.20	m			7.24	4.20) AA48879	в	4.00-4.45	5	N = 50/75 mm (16, 9, 37, 13)	
- 5														
-														
- 6														
- 7														
- 8														
-														
- 9														
: H/	ARD STI	RATA B	ORING/CH	ISELLING								w	ATER STRIKE DET	AILS
Fror	m (m)	To (m)	Time	Comments		Wate	er (Casing	Sealed	Rise	e Ti	me	Comments	
4	1.1	4.2	0.5			3.00)	Берш		10			Seepage	
												GR	ROUNDWATER PRO	GRESS
INS	TALLA	TION DE	TAILS		_	Dat	e	Hole Depth	Casing Depth	De W	oth to ater	Comme	ents	
	Date	Tip De	pth RZ To	p RZ Base	Туре	_								
RE	MARKS	3.0hrs excava	getting rig ator deploy	and tracked dui ed to assist in m	mper on and o noving equipme	ff field. Tra ent.	cked	San D - Sm B - Bul LB - La Env - F	nple Legen nall Disturbed (tub lk Disturbed arge Bulk Disturbed	d) mple (.lar +	+ Vial + Tub)	UT - Samj P - U W - V	Undisturbed 100mm Diameter ple Indisturbed Piston Sample Water Samole	



REPORT NUMBER

CO-			531 728 m AOD)	,971.12 ,317.72 24	2 E 2 N .43	Ri Bi Bi	G TYPE DREHO	E LE DIAM	ETER H (m)	t (mm	ן 1) 2 1	Dando 30 200 10.50	000	SHEET DATE (DATE (ENC ETE	Sheet 1 of 2 ED 02/02/2016 ED 03/02/2016	
	ENT GINEEF	Ga R AR	alway Cou RUP	unty Co	uncil	SI	PT HAM NERGY	MER REI RATIO (%	F. NO ‰					BOREI	D BY ESSED	BY	WC	
			-					- (-	-, 				Sam	ples				
Depth (m)			D	escripti	on			Legend		Elevation	Depth (m)	Ref. Number	Sample Type	Depth		Kecovery	Field Test Results	Standpipe Details
0	TOPS	SOIL						$\overline{r_{f}}$, $\overline{r_{f}}$, $\overline{r_{f}}$	24.2	23	0.20							
	Firm low to	light brov mediun	vn slightly 1 cobble a	y sandy and bou	gravelly ulder cor	y SILT with ntent	a	® × × × × × × × × ×				AA48851	в	0.50				
1							2					AA48852	В	1.00-1.	45		N = 16 (3, 4, 3, 4, 4, 5)	
2							> (> \$	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				AA48853	В	2.00-2.	45		N = 17 (4, 7, 5, 4, 4, 4)	
3												AA48854	в	3.00-3.	45		N = 14 (2, 2, 3, 4, 3, 4)	
-4	Firm	Firm orange brown sandy gravelly silty CLAY							20.2	23	4.20	AA48855	В	4.00-4.	45		N = 23 (3, 3, 3, 4, 8, 8)	
+	Ctiff I	abt grov	and grov		clightly		thy X	× <u> </u>	19.9	93	4.50	AA48856	D	4.50				
5	grave	Stiff light grey and grey brown slightly sandy slightl gravelly laminated SILT/CLAY					iuy >		-			AA48857	В	5.00-5.	45		N = 28 (3, 4, 6, 7, 7, 8)	
6	Stiff o	lark brov	vn slightly	v sandy	slightly	gravelly SII	_T >	× × × × × × × × × × × × × × ×	18.4	13	<u>6.00</u>	AA48858	В	6.00-6.	45		N = 29 (4, 6, 6, 7, 8, 8)	
7							> · ·					AA48859	В	7.00-7.	45		N = 28 (5, 6, 6, 7, 7, 8)	
8							>	×°××× ×°××× ×°××××××××××××××××××××××××				AA48860	В	8.00-8.	45		N = 28 (4, 5, 6, 6, 7, 9)	
9	Stiff r grave	nottled li	ght browr ⁄	n grey s	lightly sa	andy slightl	y .	× × × × × × × × × × × × × × × × × × ×	15.4	13	9.00	- AA48861	В	9.00-9.	45		N = 32 (6, 6, 7, 8, 8, 9)	
							-		14.4	13	10.00							
HA	AND ST	KATA B	URING/C	HISELL	ING			Wate	r	Casi	na l 🤇	Sealed	Rie	<u> </u>	Time	WA'	TER STRIKE DET	AILS
ron	n (m)	To (m)	(h)	Comn	nents			Strike	e	Dept	th	At	To		(min)	Co	omments	
3 10	.7).3	3.85 10.5	0.75 0.5														lo water strike	
															(GRO	UNDWATER PRO	GRES
INS	TALLA	TION DE	TAILS	•				Dat	te	H		Casing	De	oth to	Comr	nent	S	
[Date	Tip De	pth RZ T	op RZ	Base	Туре		03-02	-16	9	.00	9.00	4	4.10	Start of	Shift		
REN	MARK	3 2hrs re Boreho	emoving r ble BH3/3	ig from 2 sche	BH3/26 duled fo th of 10r	i field and a r rotary foll	ow-on c	ig BH3/32 oring tak	2. ing it		Samp D - Small B - Bulk D L B - Large	Le Legen Disturbed (tub) Disturbed Bulk Disturbed	d d		U S P	T - Und ample - Undis	listurbed 100mm Diameter	



REPORT NUMBER

CO	-ORDIN	ATES	531 728	,971.12 E ,317.72 N	RIG TYP BOREHO	PE Ole diam	ETER (m	ן חm) 2	Dando 30 200	000	SHEET		Sheet 2 of 2 NCED 02/02/2016 02/02/2016 02/02/2016	
GR		EVEL (m AOD)	24.43	BOREHO		H (m)		10.50				TED 03/02/2016	
	GINEER	AF	alway Cou RUP		ENERG	Y RATIO (%	6)				PROCES	SED B	YVC Y JL	
epth (m)			D	escription		egend	evation	epth (m)	lumber	Sam Abe Abe	epth	scovery	Field Test Results	tandpipe etails
10	Stiff b	ecoming	g very stiff	dark brown slightly	/ sandy	ت × × × × ×	Ш		AA48862	ы В В	10.00-10.4	5	N = 50/170 mm (10, 13, 16, 18, 16)	ΩΩ
	Driller	reports	hard stra	ta		^ .x ^{.o} . x	13.93	10.50	-					
- 11 - 12	End o	f Boreho	ble at 10.5	90 m										
13														
14														
15														
16														
17														
18														
19														
HA			ORING/Cl Time	HISELLING		Wate	er Ca	sing	Sealed	Rise	e Ti	me	ATER STRIKE DET	AILS
3	3.7 0.3	3.85 10.5	(h) 0.75 0.5	Comments		Strik	e De	epth	At	<u> </u>	(n	<u>nin)</u>	No water strike	
							,					GR	OUNDWATER PRO	GRESS
INS	STALLA Date	TION DE	PTAILS	op RZ Base	Туре	Dat		Hole Depth	Casing Depth	De W	oth to ater	Comme	ents	
RE	MARKS	2hrs re Boreho	emoving ri	g from BH3/26 field	d and access arv follow-on	ing BH3/3	2. ina it	Samp	le Legen Disturbed (tub)	d		UT - I	Undisturbed 100mm Diameter	



REPORT NUMBER

1	/													
со	NTRAC	r N6 (Galway City	/ Transport	Project - Phase 3						BOREHO SHEET	DLE NO.	BH3/33 Sheet 1 of 1	
CO GR	-ORDIN	ATES EVEL (m	532,10 728,30 AOD)	1.71 E 7.46 N 35.60	RIG TYP BOREH BOREH	Pe Ole diam Ole dept	ETER (n Ἡ (m)	nm)	Dando 30 200 2.70	000	DATE CO		CED 04/02/2016 TED 04/02/2016	
CLI	ENT	Galv	vay County	/ Council	SPT HA		F. NO.				BORED	BY	WC	
EN	GINEER	ARU	Р		ENERG	Y RATIO (S	%) 				PROCES	SED BY	r JL	
epth (m)			Desc	cription		gend	evation	epth (m)	ef. umber	ample	abth epth (c	covery	Field Test Results	andpipe stails
ڐ						Le Le	, ů	ă	йź	°Š∱	٥Ŀ	Re		D St
D	Gravel Firm lig a med	ly TOPS(ght browr ium cobb	DIL i /grey sligl le and bou	ntly sandy g Ider content	ravelly SILT with t		35.45	0.15	 AA48863	в	0.50			
	Mediu	m dense	light brown	ı silty very s	andy GRAVEL		34.60	1.00	AA48864	В	1.00-1.45	i	N = 16 (2, 3, 4, 4, 5, 3)	
2									AA48865	В	2.00-2.45		N = 36 (3, 3, 7, 8, 10, 11)	
	End of	Borehole	e at 2.70 m			m m m m	32.90	2.70	-					
3														
4														
5														
6														
7														
8														
9														
H/			Time			Wate	er Ca	sing	Sealed	Ris	e Ti	me	ATER STRIKE DET	AILS
2	2.5	2.7	(h) C	Uniments		Strik	e De	epth	At	To	<u>) (n</u>	nin)		
													No water strike	
												GR	OUNDWATER PRO	GRESS
INS	TALLA	ION DET	AILS			Da	te	Hole Depth	Casing Depth	De W	pth to ater	Comme	nts	
	Date	Tip Dept	h RZ Top	RZ Base	Туре	_								
RE	MARKS	Pit termi re-setup	nated at 2. adjacent t	70m on obs o hole.	struction. Borehole	e BH3/33A	<u> </u>	D - Small B - Bulk I LB - Larg	I Disturbed (tub Disturbed Disturbed Bulk Disturbed	id)) ed	I	UT - U Sampl P - Un	Indisturbed 100mm Diameter le disturbed Piston Sample	
								Env - Env	vironmental Sar	mple (Jar	+ Vial + Tub)	W - W	ater Sample	



REPORT NUMBER

COI	NTRA	CT NO	3 Galway	City Tra	anspor	t Project -	Phase 3						BORE	IOLE NO	0.	BH3/33A	
0	ORDI	NATES	532	2,100.62	2 E 9 N				ETER (r	nm)	Dando 30	000	DATE (COMME	NCED	Sheet 1 of 1 04/02/2016	
GR	DUND	LEVEL (m AOD)	35	5.57		BOREH	OLE DEPT	Ή (m)		2.50		DATE	COMPLE	ETED	04/02/2016	
		Ga	alway Co	unty Co	uncil		SPT HA		F. NO.				BORE) BY	v	WC	
		K Ar	KUP				ENERG		/0)			San	nples	233ED 1	51	JL	
Depth (m)			C	Descript	ion			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth	Recovery	Fi	eld Test Results	Standpipe Details
0	Grav	elly TOP	SOIL					<u></u>	35.37	0.20							
	Firm a me	light brov dium cob	wn /grey oble and	slightly boulder	sandy conter	gravelly S nt	SILT with		34 57	1.00							
1	Med	ium dens	e light br	rown silt	y very :	sandy GF	RAVEL			1.00							
2									33.07	2.50							
	End	of Boreh	ole at 2.5	50 m													
3																	
4																	
5																	
6																	
7																	
8																	
9																	
HA	RD S	TRATA B	ORING/C	HISELL	ING				ar Co	sing	Sealed	Pic		V Time	VATER	STRIKE DET	AILS
-ron	n (m) .4	To (m)	(h) 0.5	Comn	nents			Strik	<u>e D</u> e	epth	At	To) ((min)	Comme	ents	
-															No wa	ater strike	
										Hole	Cacina		nth to	G	ROUND	WATER PRO	GRESS
INS					Baso	T./	ne	Dat	te	Depth	Depth		ater	Comm	ents		
					. Dase	iy	he the										
RE	/IARK	S Boreh obstru	ole BH3/3 ction. 2.0	33A set)hr movi	up adja ing rig	out of fiel	H3/33 fol d with tra	lowing sha cked dump	allow per.	D - Sma B - Bulk LB - Lar Env - Fi	ple Leger all Disturbed (tub Disturbed rge Bulk Disturbed nyironmental Sa	nd >) ed mple (Jar ·	+ Vial + Tub	UT San P-I) W-	- Undisturbed nple Undisturbed Water Samp	l 100mm Diameter Piston Sample Ie	



REPORT NUMBER

1																	
co	NTRAC		6 Ga	lway Cit	y Transpor	t Project -	Phase 3						BOREH SHEET	OLE N	0.	BH3/34 Sheet 1 of 1	
CO GR	-ordin Ound	NATES LEVEL (1	m A	532,40 728,27 OD)	04.52 E 76.63 N 32.53		BOREH	'e Ole diam Ole dept	ETER (m 'H (m)	nm)	Dando 30 200 2.60	000	DATE C DATE C	omme ompli	NCEI	08/02/2016 09/02/2016	
		Ga R AF	alwa RUP	y Count	y Council		SPT HA	MMER RE	F. NO.				BORED	BY SSED F	BY	WC	
		. , .										San	nples			0L	
Depth (m)				Des	cription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Secoverv		Field Test Results	Standpipe Details
0	Soft o	dark brov	vn s	andy gra	avelly CLA	Y			-	0.40					·		
	Firm	light brov	wn s	lightly s	andy grave	lly SILT		× × ×	32.13	0.40	AA48866	В	0.50				
1								× × × × × × × × × × × ×			AA48867	В	1.00-1.4	5		N = 12 (2, 2, 3, 2, 4, 3)	
	Firm	very ligh	t brc	own sligt	ntly sandy g	gravelly S	ILT with	×° × × ×	30.63	1.90	 AA48868	В	2.00-2.4	5		N = 28	
	a low	to medi	um o	cobble a	nd boulder	content.			29.93	2.60						(1, 2, 4, 5, 7, 12)	
- 3	End o	of Boreho	ole a	at 2.60 n	ו												
-																	
4																	
-																	
- 5																	
-																	
- 6																	
-																	
- 7																	
-																	
- 8																	
-																	
9																	
HA	ARD ST	RATA B	ORI	NG/CHIS	BELLING								·	Į,	NATE	ER STRIKE DET	AILS
From	m (m)	To (m)	T (ime (h) C	omments			Wate Strik	er Ca e De	sing epth	Sealed At	Ris To	e T <u>(r</u>	ime nin)	Corr	nments	
2	2.6	2.6	(0.5											No	water strike	
										I				G	ROUI	NDWATER PRO	GRESS
INS	TALLA	TION DE	TA	ILS				Dat	te I	Hole	Casing Depth	De	pth to /ater	Comm	ents		
	Date	Tip De	pth	RZ Top	RZ Base	Ту	ре				Bopur						
RE	MARKS	3 3hr ge	tting	g rig on t	o borehole	. 0.50hr re	einstating	top field.	I	D - Sma B - Bulk LB - Lar	I Disturbed (tub Disturbed (tub Disturbed ge Bulk Disturbed	d) ed	+ \/jal ± Tk.\	UT San P -	- Undistu nple Undistur	urbed 100mm Diameter bed Piston Sample	
										EIIV - Eľ	monimental Sal	uhie (Jal, .	• vial + IUD)	vv -	maid! S	ampio	



REPORT NUMBER

1											DODE			
CO	NTRAC	Г N6 С	Salway Ci	ity Transport	Project - Phase 3						BOREH SHEET		D. BH3/35 Sheet 1 o	f 1
CO GR	-ORDIN	ATES EVEL (m	532,8 728,2 AOD)	50.77 E 25.98 N 17.52	RIG TYF BOREH BOREH	PE OLE DIAM OLE DEPT	ETER (n `H (m)	nm)	Hand Du	g	DATE C	OMME	NCED 19/02/201 ETED 19/02/201	6 6
		Galv	vay Coun	ty Council	SPT HA		F. NO.				BORED	BY	JD BY II	
	JINEEK	ARU			ENERG		/0/			San		JJED I		
Depth (m)			Des	scription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recoverv	Field Test Results	Standpipe Details
- 0	TOPS Firm li gravel and lo angula Firm n	OIL ght brown y SILT wi w boulder ir to suba nottled bro	th a low t content. ngular co own slight	brown slight o medium co Sand is coa arse. tly sandy gra	ly sandy slightly obble content irse. Gravel is avelly CLAY	× × × × × × × × × × × × × × × × × × ×	17.32 16.52 16.32	0.20 1.00 1.20	AA39963 AA39964	B	0.50			
	Obstru Rockh End of	ead Borehole	e at 1.20 r	eathered Lin	nestone									
Fror	n (m)	o (m)	Time	Comments		Wate	er <u>C</u> a	sing	Sealed	Ris	e 1	lime	Comments	
		<u> </u>	(h)			Strik	e De	epth	At	Tc		min)	No water strike	
<u> </u>								Holo	Casina		nth to	G	ROUNDWATER P	ROGRESS
INS	TALLA Date	TION DET	AILS h RZ Top	RZ Base	Туре	Dat	te	Hole Depth	Depth	De W	pth to ater	Comm	ents	
REI	MARKS	Hand du	g pit at lo	cation of BH	13/35			D - Smal B - Bulk I LB - Larg Env - Env	Die Legen I Disturbed (tub Disturbed e Bulk Disturbed vironmental Sam	I d)) ed mple (Jar	+ Vial + Tub)	UT San P - W -	- Undisturbed 100mm Diamet nple Undisturbed Piston Sample Water Sample	er



REPORT NUMBER

CO-	ORDI	NATES	532 532 728 m AOD)	2,852. 3,223.	.21 E .09 N 17.70		RIG TYP BOREH BOREH	PE OLE DIAM OLE DEPT	ETER H (m)	(mm)	[2 8	Dando 30 200 3.90	000	SHEET DATE (DATE (COMME	ENC	ED 29/03/2016 30/03/2016	-
	ENT	Ga	alway Co	unty C	Council				F. NO.					BORED	BY	DV	WC	
ENG	INEE		KUP				ENERG	r RATIO (%	/o)			1	Sam		:99ED	ы	JL	
Depth (m)			C	escri	ption			Legend	ī		uepm (m)	Ref. Number	Sample Type	Depth (m)		Recovery	Field Test Results	Standpipe Details
0	Soft	dark brov	vn sandy	grave	elly CLAY	/		<u> </u>	17.4	0 0.	30							
	Firm CLA	becomin ⁄ with a r	g stiff ligl nedium c	nt bro obble	wn slight e and bou	ly sandy gr Ilder conte	ravelly nt		16.7	0 1	00	AA1	В	0.50				
	Stiff a low	ight brov to medi	vn/grey sl um cobbl	ightly e con	r sandy gr tent	ravelly SIL	T with		10.7	0 1.	00	AA2	В	1.00-1.4	45		N = 10 (1, 2, 2, 2, 3, 3)	
2												AA3	В	2.00-2.4	45		N = 19 (2, 2, 3, 4, 6, 6)	
3								8° 8° 9° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8° 8				AA4	В	3.00-3.4	45		N = 37 (5, 7, 4, 8, 11, 14)	
1								$ \begin{array}{c} $				AA5	В	4.00-4.4	45		N = 26 (3, 3, 5, 7, 6, 8)	
5									AA6	В	5.00-5.4	45		N = 39 (6, 7, 7, 9, 11, 12)				
7	Stiff to very stiff dark brown mottled grey brown slightly sandy slightly gravelly SILT with a medium cobble and boulder content						um	**************************************	11.80	0 5.	90	 AA7	в	6.50-6.9	95		N = 45 (8, 5, 9, 11, 12, 13)	
3	Stiff	orange b	rown san	dy gra	avelly CL	AY	with a		9.40 9.20) <u>8.</u>) <u>8.</u>	<u>30</u> 50	AA8	В	8.00-8.4	45		N = 31 (4, 6, 7, 11, 7, 6)	
9	Stiff dark grey brown sandy gravelly CLAY Stiff dark grey brown sandy gravelly silty CLAY w medium cobble and boulder content End of Borehole at 8.90 m								8.80) 8.	<u>90</u>							
HA	RD S1	RATA B	ORING/C	HISE	LLING											WA	TER STRIKE DET	AILS
ron	n (m)	To (m)	Time	Con	nments			Wate	er C	Casing	5	Sealed	Ris	e 7	Time	Co	omments	
6 8	.3 .8	6.5 8.9		Suik		Jepui			10		<u></u>	N	lo water strike					
													-		G	RO	UNDWATER PRO	GRES
INS [.]	TALL/ Date	Tip De	epth RZ 1	op F	RZ Base	Туре	e	Dat	e	Hole Dept	e h	Casing Depth	De W	pth to ater	Comn	nent	ts	
Date Tip Depth RZ Top RZ Base Type P Image: Second											le Legen Disturbed (tub Disturbed e Bulk Disturbed ironmental Sar	d)	+ Vial + Tuh)	UT Sa P W	T - Und ample - Undis	tisturbed 100mm Diameter sturbed Piston Sample er Sample		



REPORT NUMBER

co	-ORDINA	NO G	533,12 728,20	4.66 E 4.71 N	RIG BOR	TYP	E DLE DIAM	ETER (r	nm)	Hand I	Dug	- SHEE DATE	COMN	NENCE	Sheet 1 of 1 12/02/2016	
GR	OUND LI	EVEL (m A	AOD)	51.78	BOR	EHC	DLE DEPT	Ή (m) `	,	0.50		DATE	COMP	PLETE	D 12/02/2016	
		Galwa	ay County	Council	SPT	HAN	MMER REI	F. NO.				BORE	D BY	BY	AC	
		74(0)									Sa	amples	LOOL		52	
Depth (m)			Desc	ription			Legend	Elevation	Depth (m)	Ref.	Sample	Depth	(L)	Recovery	Field Test Results	Standpipe Details
0 1 2 3 6 7 8	TOPSC Firm br mediur Obstruc End of	DIL own sand n cobble c ction - Lar Borehole	y slightly content. C ge BOUL at 0.50 m	gravelly SI obbles are DERS of li	LT with a low to			51.68	0.10) AA494)	479 В	0.10-0	0.50			
HA	ARD STR	ATA BOR	ING/CHIS	ELLING				I						WAT	TER STRIKE DET	AILS
Fror	m (m) T	o (m) 📔	Time (h)	omments			Wate Strik	er Ca e Do	ising epth	Sealeo At	1 R	ise Fo	Time (min)	Co	mments	
														N	o water strike	
										Casi	na -			GROL	JNDWATER PRO	GRESS
INS	Date	ION DETA	NLS RZ Top	RZ Base	Туре		Dat	ie in the second	Hole Depth	Dep	ng E	epth to Water	Com	ment	5	
RE	MARKS	Hand dug	pit at loc	ation of BH	13/36		I	I	D - Sr B - Bu LB - L Env -	nple Leg nall Disturbed lk Disturbed arge Bulk Dis Environmenta	(tub) (tub) turbed I Sample (J	ar + Vial + Tu	 b)	UT - Undi Sample P - Undist W - Wate	sturbed 100mm Diameter turbed Piston Sample r Sample	



REPORT NUMBER

1	-													
со	NTRAC	T N6	6 Galway C	ity Transpor	t Project - Phase 3	3					BOREH SHEET	OLE NO	D. BH3/38 Sheet 1 of 1	
CO GR	ORDIN	ATES _EVEL (I	,534 ,727, m AOD)	249.34 E 540.83 N 45.27	RIG TYI BOREH BOREH	pe Iole Diam Iole Dept	IETER (r 「H (m)	nm)	Dando 30 200 0.40	000	DATE C DATE C	OMMEN	ICED09/02/2016TED09/02/2016	
CLI EN	IENT GINEER	Ga AR	alway Cour RUP	ity Council	SPT HA	MMER RE	F. NO. %)				BORED	BY SSED B	WC Y JL	
Depth (m)			De	scription		Legend	Elevation	Depth (m)	Ref. Number	Sam Type	Dept Dept	Recovery	Field Test Results	Standpipe Details
0	Soft lig	ght brow	/n sandy g	ravelly CLAY	(<u> </u>	44 87	0.40						
- 7 - 8 - 9	Obstru End o	uction - f Boreho	Possible R ole at 0.40	ockhead m										
H	ARD STI	RATA B	ORING/CH	ISELLING								N	IATER STRIKE DET	AILS
Fro	m (m)	To (m)	lime (h)	Comments		Wate Strik	er Ca a D	asing epth	Sealed At	Ris To	e T	ıme min)	Comments	
().4	0.4	0.5										No water strike	
												GR	OUNDWATER PRO	GRESS
INS	STALLA Date	TION DE	TAILS	p RZ Base	Туре	Dai	te	Hole Depth	Casing Depth	De W	pth to ater	Comme	ents	
RE	MARKS	1hr mo field af	oving to loc ter works.	ation with tra	acked dumper. 0.5	5hr reinstat	ing	D - Sma B - Bull LB - La Env - E	I Iple Legen all Disturbed (tub Disturbed rge Bulk Disturbe nvironmental Sar	id) ed mple (Jar +	+ Vial + Tub)	UT - Samp P - U W - V	Undisturbed 100mm Diameter ole ndisturbed Piston Sample Vater Sample	



REPORT NUMBER

1	-															
со	NTRACT	N6 (Galway C	ity Transpo	rt Project -	Phase 3						BOREH SHEET	IOLE NO).	BH3/39 Sheet 1 of 1	
CO GR	-ordin/ ound l	ATES EVEL (m	534,3 727,4 A OD)	860.45 E 102.19 N 41.88		RIG TYP BOREHC BOREHC	e)le diami)le dept	ETER (r H (m)	nm)	Dando 30 200 0.40	000	DATE C DATE C	COMMEI		10/02/2016 10/02/2016	
CLI	ENT GINEER	Galv ARL	way Coun JP	ty Council		SPT HAN ENERGY	MER REF RATIO (%	F. NO. %)	1		0.00	BORED PROCE	BY SSED E	BY	WC JL	
Depth (m)			De	scription			-egend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery		Field Test Results	Standpipe Details
0	Driller	reports G	GRAVEL I	nardstandin	g (MADE		_	41.48	0.40							07 🗆
1 2 3 4 5 6 7 8	End of	Borehol	e at 0.40	m												
HA	ARD STR	ATA BO	RING/CH	SELLING									v			AILS
Fror	m (m) T	o (m)	Time (h)	Comments			Wate	er Ca	asing epth	Sealed At	Ris	ie 1	Fime min)	Comr	nents	
C).4	0.4	0.5											No v	vater strike	
													GF	ROUN	DWATER PRO	GRESS
INS	TALLAT	ION DET	AILS				Dat	e	Hole Depth	Casing Depth	De W	pth to /ater	Comme	ents		
	Date	Tip Dep	th RZ To	p RZ Base	Ту	pe										
RE	MARKS	0.50hr n	noving rig	and tracke	d dumper	to BH3/39)		D - Sma B - Bulk LB - Lai Env - E	ple Legen all Disturbed (tub) Disturbed rge Bulk Disturbe nvironmental Sar	d) nple (Jar	+ Vial + Tub)	UT - Sam P - U W - '	Undisturb ple Jndisturbe Water Sar	bed 100mm Diameter 2d Piston Sample mple	



REPORT NUMBER

1	1																
CO	NTRACT	. N6 G	Salway City	y Transport	t Project - Pha	ase 3							BOREH SHEET	OLEN	10.	BH3/40 Sheet 1 of 1	
CO GR	-ordin/ ound li	ATES EVEL (m	534,43 727,29 AOD)	9.24 E 5.41 N 42.35	RIG BO BO	REHC	e)Le diam)Le dept	ETER (ˈH (m)	mm)	H 0.	and Du <u>ç</u> .80	g [DATE C DATE C	OMMI OMPL	ENCE .ETE	ED 11/02/2016 D 11/02/2016	
CLI	ENT	Galw	ay County	/ Council	SP			F. NO.					BORED	BY		AC	
ENG	SINEER	ARU	Ρ		EN	ERGI	RATIO (7	/o)					PROCE	33ED	ы	JL	
Depth (m)			Desc	cription			Legend	Flevration	Denth (m)		Ref. Number	Sample Type	Depth (m)		Kecovery	Field Test Results	Standpipe Details
0 1 1 2 3 4 5 -6 -7 -8	TOPS(Brown GROU Firm da to med Firm bi high cc boulde Obstru rockhe End of	DIL (MAD grey sand ND) ark grey s ium cobb own sligh rown sligh rs are any ction - La ad Borehole	E GROUN dy fine to r lightly san le content tily sandy boulder c gular of lin rge BOUL at 0.80 m	ID) nedium GF dy gravelly . Cobbles a slightly gra ontent. Col nestone. DERS / Po	RAVEL (MAD	E low ha ered		42.30 42.20 41.85 41.55		05_/ 15_/ 50_/ 80	AA49469 AA49470	B	0.15-0.5				
HA		ATA BOF	RING/CHIS	ELLING			147 1		!	1 ~		D .		- Inc	WAT	ER STRIKE DET	AILS
-ror	n (m) T	o (m)	(h) C	omments			Strik	e D	asing)epth	S	At	Ris To		min)	Co	mments	
															N	o water strike	
														G	GROL	JNDWATER PRO	GRESS
INS	TALLAT		AILS				Dat	te	Hole		Casing	De	pth to	Comr	nents	6	
	Date	Tip Dept	h RZ Top	RZ Base	Туре				Dept	h	Depth		/ater				
REI	MARKS	Hand du	g pit at loc	ation of BH	13/40				Sa D-3 B-1 LB- Env	Small D Bulk Dis Large I	e Legen Disturbed (tub) sturbed Bulk Disturbe onmental Sar	d) mple (Jar	+ Vial + Tub)	U Sa P W	T - Undis ample - Undist / - Water	sturbed 100mm Diameter turbed Piston Sample r Sample	



REPORT NUMBER

CO GR	ORDII	NATES	534, 727, n AOD)	580.56 E 065.87 N 41.38	RIG BOR BOR	TYPE REHOI REHOI	LE DIAME LE DEPTI	ETER (n H (m)	nm)	Dando 30 200 0.50	000	SHEET DATE C DATE C	omme ompli		Sheet 1 of 1 10/02/2016 10/02/2016	
CLI	ENT SINEEI	Ga R AR	ilway Cou UP	nty Council	SPT	HAM	MER REF RATIO (%	5. NO. 6)				BORED	BY SSED I	BY	WC JL	
oth (m)			De	escription	I		end	vation	pth (m)	f. mber	Sam eldu el	nples	overv	F	ield Test Results	ndpipe ails
De							Leg	Elev	Dep	Ref	Sar Typ	Der Der	Rec			Star Deta
1 2 3 3 4 6 6 7 7 8	Obst End	ruction -	Possible F ole at 0.50	Rockhead m				41.08								
9																
HA		RATA B	ORING/CH	IISELLING									1	NATER		AILS
Fror	n (m)	To (m)	Time (h)	Comments			Wate Strike	r Ca e De	epth	Sealed At	Rise To	e T (r	ime nin)	Comm	nents	
0	.3	0.3	0.5											No w	ater strike	
INS			TAILS				Date	e	Hole	Casing	De	pth to	Comm	ents	MAIERPRU	JGRE3
	Date	Tip De	pth RZ To	p RZ Base	Туре			-	Depth	Depth	W	ater	551111			



REPORT NUMBER

			534 534	4,727.5	ansport 4 E	Project	- Phase 3	PE			Dando 30	000	SHEET		Sheet 1 of 1	
GR	OUND	LEVEL (726 m AOD)	5,825.9 31	7 N 1.36		BOREH	OLE DIAM OLE DEPT	ETER (r 'H (m)	nm)	200 0.30		DATE CO DATE CO	OMMEN	NCED 22/03/2016 TED 22/03/2016	
CLI EN(IENT GINEER	Ga AF	alway Co RUP	unty Co	ouncil		SPT HA	MMER RE Y RATIO (S	F. NO. %)				BORED PROCES	BY SSED B	WC B Y JL	
_									Í			Sam	ples			
Depth (m)			C)escript	tion			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPS	OIL: So	ft dark br	own sa	andy gra	velly CL	AY	<u></u>	31.06	0.30						
$\begin{bmatrix} -1 \\ -2 \\ -3 \\ -4 \\ -5 \\ -6 \\ -7 \\ -8 \end{bmatrix}$	End c	uction - f Boreh	Driller rejole at 0.3	oorts P 0 m	OSSIDIE	Kockne	ao									
9																
HA	ARD ST	RATA B	ORING/C	HISELI	LING									N		TAILS
Fror	m (m)	To (m)	Time (h)	Com	ments			Wate	er Ca	sing	Sealed At	Rise	e Ti (n	me hin)	Comments	
C).3	0.3	0.75											,	No water strike	
										Hele	Casin	5	- 41- 4 -	GF	ROUNDWATER PRO	OGRESS
INS	TALLA		TAILS					Dat	te	Hole Depth	Depth	De	ater	Comme	ents	
	Date	Tip De	pth RZ 1	op RZ	Z Base	Ту	/pe									
RE	MARKS	1.5hrs	getting p	lant an	nd equip	ment to	borehole	location		D - Sma B - Bulk LB - La Env - E	Iple Legen all Disturbed (tub Disturbed rge Bulk Disturbe nvironmental Sar	d) mple (Jar +	Vial + Tub)	UT - Sam P - U W - V	Undisturbed 100mm Diameter iple Indisturbed Piston Sample Water Sample	



REPORT NUMBER

CONTRACT N6 Galway City Transport Project - Phase 3 BOREHOLE NO. BH3/43 Sheet 1 of CO-ORDINATES 534,627.31 E 726,780.71 N GROUND LEVEL (m AOD) 32.77 RIG TYPE BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) O.60 DATE COMMENCED 22/02/201 DATE COMPLETED 22/02/201 CLIENT Galway County Council ENGINEER ARUP SPT HAMMER REF. NO. ENERGY RATIO (%) BORED BY PROCESSED BY JL JD O TOPSOIL (Possible MADE GROUND) Samples Field Test Results Soft to firm dark grey and brown slightly sandy gravelly SILT with a low to medium cobble content (Possible MADE GROUND) Adjust to the amedium cobble content (Possible MADE GROUND) May Sightly Soft to firm dark brown slightly sandy slightly gravelly SILT with a medium cobble content (Possible MADE GROUND) B 0.200.030 Adjust to the amedium cobble content (Possible MADE GROUND) Samples End of Borehole at 0.60 m 2 Adjust to the amedium cobble content	Standpipe
CO-ORDINATES 534,627.31 E 726,780.71 N GROUND LEVEL (m AOD) RIG TYPE 726,780.71 N BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) Hand Dug 0.60 Date commences Date comm	Standpipe Details
CLIENT ENGINEER Galway County Council ARUP SPT HAMMER REF. NO. ENERGY RATIO (%) BORED BY PROCESSED BY JD U Description Image: Second secon	Standpipe Details
ENGINEER ARUP ENERGY KATIO (%) PROCESSED BY JL 0 Description 0<	Standpipe Details
Image: Section Image: Sectio	Standpipe
0 TOPSOIL (Possible MADE GROUND) 32.57 0.20 Soft to firm dark grey and brown slightly sandy gravelly SILT with a low to medium cobble content (Possible MADE GROUND) 32.57 0.20 Firm brown and dark brown slightly sandy slightly gravelly SILT with a medium cobble content 32.17 0.60 Obstruction End of Borehole at 0.60 m 1 1	
Soft to firm dark grey and brown slightly sandy gravelly SILT with a low to medium cobble content (Possible MADE GROUND) Firm brown and dark brown slightly sandy slightly gravelly SILT with a medium cobble content Obstruction End of Borehole at 0.60 m	
3 3 4	
·9	
HARD STRATA BORING/CHISELLING WATER STRIKE DI	TAILS
From (m) To (m) Time Comments Water Casing Sealed Rise Time Comments	
Output Surve Deput At TO (IIIII) 0.50 0.50 0.50 0.50 0.50 Seepage	
GROUNDWATER PF	OGRESS
INSTALLATION DETAILS Date Hole Casing Depth to Water Comments	
Date Tip Depth RZ Top RZ Base Type	
REMARKS Hand dug pit at location of BH3/43 B - Small Disturbed (tub) B - Buik Disturbed LB - Large Buik Disturbed Env. Fervironmental Sample (Jar + Vial + Tub) W - Water Sample W - Water Sample P - Undisturbed Piston Sample W - Water Sample P - Undisturbed Piston P	



REPORT NUMBER

12	9													
со	NTRAC	T N6	Galway Ci	ty Transport	t Project - Phase	3					BOREH SHEET	OLE NO	D. BH3/46 Sheet 1 of	1
CO GR	-ordin Ound I	ATES _EVEL (m	531,7 728,3 A OD)	51.37 E 90.26 N 29.88	RIG TY BOREH BOREH	pe Iole Diam Iole Dept	ETER (n 'H (m)	nm)	Hand Dug 0.60	g	DATE C DATE C	ommei omple	NCED 23/03/201 TED 23/03/201	6 6
CLI		Gal	way Count	y Council	SPT HA		F. NO.				BORED	BY	JD	
	JINEER	ARU	JP		ENERG		7o)				PROCE	59ED E		
Depth (m)			Des	cription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Dept Dept	Recovery	Field Test Results	Standpipe Details
0	TOPS conte	OIL with	rootlets an 20m bal. (d a high co Cobbles and	bble and boulder boulders are of	$\frac{\underline{x}^{1} I_{2}}{1} \cdot \underline{x}^{1} I_{2} \cdot \underline{x}^{1}}$			AA39980	В	0.00-0.6	0		
	limest	one.					29.28	0.60	_					
2	End o	f Borehol	e at 0.60 r	n										
4														
- 5														
- 7														
- 8														
- 9														
HA	ARD STI	RATA BO	RING/CHI	SELLING								V	VATER STRIKE DI	ETAILS
Fror	m (m)	To (m)	Time (h)	Comments		Wate Strik	er Ca e De	sing epth	Sealed At	Ris To	e T (r	ïme nin)	Comments	
													No water strike	
										-		GF	ROUNDWATER PR	ROGRESS
INS	TALLA Date	TION DE	TAILS th RZ Top	RZ Base	Туре		te	Hole Depth	Casing Depth	De W	pth to ater	Comme	ents	
RE	MARKS	Hand di	ug pit at lo	cation of BH	13/46	1		Sam D - Sma B - Bulk LB - Lar Env - Er	Il Disturbed (tub Disturbed (tub Disturbed ge Bulk Disturbed vironmental Sar	i d)) ed mple (Jar +	+ Vial + Tub)	UT - Sam P - U W - '	Undisturbed 100mm Diamete ple Jndisturbed Piston Sample Water Sample	r



REPORT NUMBER

1	1															
CO	NTRACT	N6	Galway Ci	ty Transpor	t Project -	Phase 3						BOREH SHEET	OLE N	0.	BH3/47 Sheet 1 of 1	
CO-ORDINATES 533,058.02 E RIG TY 728,289.22 N BOREH GROUND LEVEL (m AOD) 37.02						RIG TYP BOREHO BOREHO	e Dle diam Dle dept	ETER (n ˈH (m)	nm)	Dando 30 200 4.00	000	DATE COMMENCE DATE COMPLETE			22/03/2016 22/03/2016	
CLIENT Galway Council SPT HAN									BORED BY			WC				
	JINEER	ARU	JP			KATIO ()	/0)			San	nnles	SSED I		JL		
Ê	Ê							5	Ê		San		2	~		be
Depth (Description						Legend	Elevatio	Depth (Ref. Numbe	Sample Type	Depth (m)	Recover		Results	Standpi Details
0	Soft da	k brow	n sandy gr	avelly CLA	Y		<u> </u>	36 72	0.30							
-	Firm lig with a n	ht brow nedium	n slightly s cobble an	andy slight d boulder c	ly gravelly ontent	SILT	*0 × × × × × × ×			AA48890	в	0.50				
1										AA48891	В	1.00-1.4	15		N = 8 (2, 2, 2, 2, 2, 2)	
2	Firm to gravelly	stiff mo CLAY	ttled brow	n slightly sa	ndy slight	ly	○×	35.02	2.00	AA48892	В	2.00-2.4	5		N = 12 (2, 3, 3, 2, 3, 4)	
3								5		AA48893	в	3.00-3.4	15		N = 20 (3, 3, 4, 5, 5, 6)	
4	Obstruc	tion						33.02	4.00	_					N = 50/20 mm (25, 50)	
	End of I	Borehol	le at 4.00 r	n												
5																
- 6																
- 7																
- 8																
9																
-																
HA	RD STR/	ATA BC	Time	SELLING			\M/ot	ar Co	sing	Seeled	Dia	ت ا	l Timo	WATE	R STRIKE DET	AILS
Fror	n (m) To	o (m)	(h) (h)	Comments			Strik		epth	At	To		min)	Com	iments	
3	.9	4	0.75											No	water strike	
									I	I		I	G	ROUN	NDWATER PRO	GRESS
INS	TALLATI			R7 Base	Tur		Dat	te	Hole Depth	Casing Depth	De W	pth to /ater	Comm	nents		
		пр рер			ı yŀ											
RE	MARKS	1.5hrs (getting pla	nt and equip	oment to b	orehole l	ocation		D - Smal B - Bulk LB - Larg Env - Env	Die Legen I Disturbed (tub Disturbed Je Bulk Disturbed vironmental Ser	d) mple (.lar	+ Vjal + Tub)	UT Sar P - W -	- Undistu mple Undisturi	rbed 100mm Diameter bed Piston Sample ample	
									= C11	ommornai odi	יומטן פיקי.	•			P	

eta
IGSL

REPORT NUMBER

со	NTRAC	T N6	Galwav C	itv Transpor	t Proiect - Phase	e 3							BOREH		NO.	BH3/48	
<u> </u>		ATE0	504 (Hand Dug						SHEET			Sheet 1 of 1			
727,197.18 N GROUND LEVEL (m AOD) 40.72 BOREHO BOREHO							.e diam .e dept	ETER (I "H (m)	mm) 0	1.60	y	DATE COMMENCE			D11/02/2016D11/02/2016	
CLIENT Galway County Council SPT HAM								F. NO.					BORED BY			AC	
ENG	GINEER	AR	UP		ENER		RATIO (S	%) 				Sar	PROCE	SSED	BY	JL	
Depth (m)			De	scription			Legend	Elevation		Depth (m)	Ref. Number	Sample Type	Depth (m)		Kecovery	Field Test Results	Standpipe Details
- 1 - 2 - 3	Firm d slightly conter Brown Obstru limesta End of	OIL ark grey y gravelly t. Cobbi grey cla uction - E one rock f Boreho	occasion: y SILT witt es are of I ayey angul 3OULDER head le at 0.60	ally light brow in a low to mu- imestone. ar COBBLE S / Possible m	wn slightly sandy edium cobble S of limestone weathered			40.62		0.10 0.50 0.60	/ AA49471	B	0.10-0.5				
HA	ARD STF	RATA BO	ORING/CH	SELLING											WAT	ER STRIKE DET	AILS
Fror	m (m) 1	Го (m)	Time (h)	Comments			Wate	er Ca	asin	ig S	Sealed	Ris	e T	Time min)	Со	mments	
							Curre				7			<u>,</u>	N	o water strike	
								· ·		, 	0	-		(GROL	INDWATER PRO	GRESS
INS	Date	TION DE	TAILS oth RZ To	p RZ Base	Туре		Dat	te	Hc De	ole pth	Casing Depth	De	epth to Vater	Comr	ments	3	
RE	MARKS	Hand d	ug pit at lo	ocation of Bł	- 		1			Sampl D - Small I B - Bulk Di LB - Large Env - Envi	e Legen Disturbed (tub isturbed Bulk Disturbe ronmental Sar	d) ed mple (Jar	+ Vial + Tub)	U S P W	IT - Undis ample - Undisti / - Water	sturbed 100mm Diameter urbed Piston Sample Sample	



REPORT NUMBER

1	_															
CO	NTRAC	T N6	6 Galway	City Transpor	rt Project -	Phase 3						BOREH SHEET	OLE NO	. BH3/52 Sheet 1 of 1		
GR	GROUND LEVEL (m AOD) 15.45 BOREHOL								ו (nm	Dando 30 200 3.80	000	DATE COMMENCED 16/03/2016 DATE COMPLETED 16/03/2016				
CLI	CLIENT Galway County Council SPT HAMN ENGINEER ARUP ENERGY R							F. NO. 6)			Son	BORED PROCES	BY SSED B	WC Y JL		
Depth (m)			D	escription			Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details	
- 0	0 TOPSOIL: Soft dark brown sandy gravelly CLAY 30 Soft to firm becoming firm light brown slightly sandy gravelly CLAY with a medium cobble and boulder content 30							15.15	0.30	AA48884 AA48885	В	0.50	5	N = 10		
- 2	Firm I SII T	ight grey	/ brown s	ightly sandy s	slightly gra	velly		13.45	2.00		в	2.00-2.45	5	(1, 2, 2, 3, 3) N = 15 (2, 2, 3, 3, 4, 5)		
- 3	Stiff li	ght grey	and brov	/n silty sandy	GRAVEL		$ \begin{array}{c} \widehat{\bigcirc} \times & \widehat{\circ} \\ \times & \times & \widehat{\circ} \\ \times & \times & \widehat{\circ} \\ \times & \times & \widehat{\circ} \\ \ast & \times & \widehat{\circ} \\ \ast & \times & \widehat{\circ} \\ \ast & & & & & & \\ \ast & & & & & & \\ \ast & & & &$	12.45	3.00	- AA48887	В	3.00-3.45	5	N = 23 (2, 2, 3, 5, 6, 9)		
4	Obstr End c	uction f Boreho	ble at 3.80) m												
HA		RATA B	ORING/C Time	HISELLING			Wate	er Ca	sing	Sealed	Ris	e T	ime	ATER STRIKE DET	AILS	
41/8/91 100 3	inform (m) information Comments 3.7 3.8 0.75						Strike	e De	pth	At	To	<u>) (n</u>	nin)	No water strike		
													GR	OUNDWATER PRO	GRESS	
18903.GPJ 10	TALLA Date	TION DE	ETAILS	op RZ Base	Тур)e	Dat	e	Hole Depth	Casing Depth	De W	pth to ater	Comme	nts		
REI	MARKS	2hrs go getting	etting pla off positi	nt and equipr on.	nent to bor	ehole loc	ation. 1.0	hr	Sample Legend UT - Undisturbed 100mm Diameter D - Small Disturbed Sample B - Bulk Disturbed Sample LB - Large Bulk Disturbed P - Undisturbed Piston Sample Envi- Environmental Sample (Jar + Vial + Tub) W - Water Sample							



REPORT NUMBER

					- I			B110/50			
- Phase 3						BOREHC SHEET	JLE NO.	BH3/53 Sheet 1 of 1			
CO-ORDINATES 528,433.41 E 727,696.60 N RIG TYPE BOREHOLI GROUND LEVEL (m AOD) 10.31 BOREHOLI CLIENT Galway County Council SPT HAMM ENGINEER ARUP ENERGY R							DATE COMMENCED 21/03/2016 DATE COMPLETED 21/03/2016				
							BY SED BY	WC			
LINEIKOI		0)			San	nles					
	Legend	Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details		
0 Soft dark brown sandy gravelly CLAY with a low 1 boulder content											
RAVEL	® Oxo Oxo	9.51	0.80	AA48888	В	0.50					
Medium dense to dense light grey brown silty sandy GRAVEL with some cobbles					В	1.00-1.45		N = 44 (4, 6, 8, 11, 11, 14)			
	X D OB	8.11	2.20	_				N = 50/75 mm (19, 6, 43, 7)			
	· · · · ·			·			W	ATER STRIKE DET	AILS		
	Wate Strike	r Ca De	sing pth	Sealed At	Ris To	e Ti	me c	Comments			
								No water strike			
							GR	OUNDWATER PRO	GRESS		
	Date	e r	Hole Depth	Casing Depth	De W	pth to dater	Commei	nts			
уре											
borehole l	ocation		D - Small B - Bulk I LB - Larg Env - Env	Disturbed (tub) Disturbed e Bulk Disturbed vironmental Sam	ple (Jar -	+ Vial + Tub)	UT - U Sampl P - Un W - W	indisturbed 100mm Diameter e disturbed Piston Sample ater Sample			
	RIG TYP BOREHO BOREHO SPT HAN ENERGY	RIG TYPE BOREHOLE DIAME BOREHOLE DEPT SPT HAMMER REF ENERGY RATIO (% RAVEL 'sandy 'sa	RIG TYPE BOREHOLE DIAMETER (m SPT HAMMER REF. NO. ENERGY RATIO (%) OW 9.81 RAVEL 9.81 Sandy 9.81 Set of the s	RIG TYPE BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) SPT HAMMER REF. NO. ENERGY RATIO (%) ow 9.81 ow 9.81 Sandy 9.81 Solution 8.11 Sandy 8.11 Subscription Subscription Subscription Subscription	RIG TYPE BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) 200 SPT HAMMER REF. NO. ENERGY RATIO (%)	RIG TYPE BOREHOLE DIAMETER (mm) Dando 3000 BOREHOLE DEPTH (m) 2.20 SPT HAMMER REF. NO. ENERGY RATIO (%) San 0W 9.81 0.50 RAVEL 9.81 0.50 RAVEL 9.81 0.80 Sandy 9.51 0.80 A448888 B sandy 9.51 0.80 A448889 B San 9.51 0.80 Sandy 9.51 0.80 A448889 B Sandy 9.51 0.80 Sandy 9.51 <	Rig TYPE BOREHOLE DIAMETER (mm) Dando 3000 2.20 SHEET DATE CC DATE CC SPT HAMMER REF. NO. ENERGY RATIO (%) BORED I PROCES Image: Second Control (%) Image: Second Control (%) Image: Second Control (%) Image:	SHEET Dando 3000 BOREHOLE DLAMETER (mm) 2.00 DATE COMMEN BOREHOLE DEPTH (m) 2.20 BORED BY SPT HAMMER REF. NO. BORED BY PROCESSED BY PROCESSED BY Water 9.81 0.50 A48888 B 0.50 RAVEL 9.81 0.50 Sandy 9.81 0.50 Sandy 9.81 2.20 Sandy 9.51 0.80 Sandy 8.11 2.20 Sandy 8.11 2.20 Sandy 9.51 0.80 Sandy 9.51 0.80 Sandy 9.51 0.81 Sandy<	SHEET Sheet 1 of 1 Dands 3000 BOREHOLE DIAMETER (mm) Dands 3000 BOREHOLE DEPTH (m) Dands 3000 SPT HAMMER REF. NO. BORED BY PROCESSED BY JL PROCESSED BY JL OW Date 0.50 Samdy 0.61 0.50 RAVEL 0.61 0.80 Samdy 0.62 0.81 0.50 Samdy 0.62 0.81 0.20 Samdy 0.62 0.81 0.20 Samdy 0.60 0.81 0.80 Based to the tother		



REPORT NUMBER

1	1													
CO	NTRAC	r N	6 Galway C	ity Transport	t Project - Phase 3						BOREH SHEET	OLE N	O. BH3/54 Sheet 1 o	l of 1
CO-ORDINATES 528,601.86 E RIG TYP 727,756.28 N BOREHO GROUND LEVEL (m AOD) 8.05						PE OLE DIAMI OLE DEPT	ETER (m H (m)	ım)	Dando 30 200 3.70	000	DATE C DATE C	16 16		
CLIENT Galway County Council SPT HAN					MMER REF				BORED	BY	WC			
		7.4			ENERG					San	nples			
Depth (m)	Description						Elevation	Depth (m)	Ref. Number	Sample Type	(m)	Recovery	Field Test Results	Standpipe Details
 TOPSOIL with COBBLES and BOULDERS and some dark grey brown slightly slightly slightly sandy GRAVEL (Possible MADE GROUND) 							7.35	0.70	AA9	в	0.50		-	
1	mediu	m cóbb	le content	y -					AA10	В	1.00-1.4	15	N = 40 (6, 9, 12, 14, 8,	6)
2									AA11	В	2.00-2.4	15	N = 49 (5, 7, 8, 11, 14, 1	16)
.3							4.35	3.70	AA12	В	3.00-3.4	15	N = 50/200 mr (3, 4, 6, 17, 27	n ')
4	End of	f Boreh	ole at 3.70	m										
5														
- 6														
7														
8														
9														
HA		2474 Β		SELLING										
							er Ca	sing	Sealed	Ris	e T	Time	Commonte	
3	Tom (m) To (m) (h) Comments 3.7 3.7 0.75						e De	pth	At	To) (1	<u>min)</u>	No water strike)
												G		ROGRESS
INS	TALLA	TION DI	ETAILS	p RZ Base	Туре	Dat	e l	Hole Depth	Casing Depth	De W	pth to ater	Comments		•
DE		1.05-	aottina -la	t and activity	mont to harshale !!			0						
	бЛЛАн	1.000	geung piar	anu equipr		JoauOII		D - Sma B - Bulk LB - Lar Env - Er	PIE LEGER Il Disturbed (tub Disturbed ge Bulk Disturb wironmental Sa	ed mple (Jar	<u>+ Vial + </u> Tub)	UT Sar P - W -	- Undisturbed 100mm Diame mple Undisturbed Piston Sample - Water Sample	eter

Appendix 2

Hand-excavated Pit Records at Cable Percussive Borehole Locations

BH3/03 BH3/07 BH3/10 BH3/14 BH3/15 BH3/18 BH3/19 BH3/20 BH3/22 BH3/28 BH3/30 BH3/31 BH3/35 BH3/36 BH3/40 BH3/43 BH3/46 BH3/48












LOCATION PROJECT PROJECT REF. DATE	Hand Dug Pit Log (Cable Percussive BH Location) See BH Log also
L23/03/2016	
PHOTOS Hand Dug Pit at BH3/19 Spoil Heap at BH3/19	<image/>
LOG	
0.0	0 0.30 TOPSOIL 0 0.50 Loose dark brown clavey/silty sandy GRAVEL with cobbles and boulders of
0.5	granite
0.5	granite
1.2	U Obstruction - Possible weathered rock / boulder
SAMPLES	B 0.30 to 0.50 AA39978 B 0.50 to 1.20 AA39979
GROUNDWATER	Ground water entering pit at 0.80m













LOCATION PROJECT PROJECT REF. DATE BH3/36 <u>GCTP Phase 3 Co</u> 18963 12/02/2016	Hand Dug Pit Log (Cable Percussive BH Location) See BH Log also Intract 1
PHOTOS Hand Dug Pit at BH3/36	
LOG 0.0 0.1 0.5 SAMPLES GROUNDWATER	0 0.10 TOPSOIL 0 0.50 Firm brown sandy slightly gravelly SILT with occasional cobbles of limestone 0 OBSTRUCTION - Large boulders of limestone B 0.10 to 0.50 AA49479 Dry Dry





LOCATION BH3/46 GCTP Phase 3 Co BPO JECT DEC	Hand Dug Pit Log (Cable Percussive BH Location) See BH Log also
DATE 18963 23/03/2016	
PHOTOS Hand Dug Pit at BH3/46	
Spoil Heap at BH3/46	
LOG 0.0	00 0.60 TOPSOIL with rootlets and many limestone cobbles and boulders from 0.20m 00 Obstruction - Possible weathered rock
SAMPLES	B 0.00 to 0.60 AA39980
GROUNDWATER	Dry

	Hand Dug Pit Log (Cable Percussive BH Location) See BH Log also
PROJECT	BH3/48 GCTP Phase 3 Contract 1
PROJECT REF. 1 DATE 1	18963 11/02/2016
<u>P</u> Hand Dug P	PHOTOS Pit at BH3/48
Spoil Heap a	at BH3/48
-	
	0.10 0.50 Firm dark grey occasionally light brown slightly sandy slightly gravelly SILT with
	Occasional cobbles of limestone 0.50 0.60 Brown grey clayey angular COBBLES of limestone
l t	0.60 OBSTRUCTION - Large boulders, Possible Weathered Rockhead
<u>s</u>	SAMPLES B 0.10 to 0.50 AA49471
G	GROUNDWATER Dry

Appendix 3

Rotary Core Drillhole Records and Photographs

BH3/03R	BH3/29R
BH3/04R	BH3/30R
BH3/06R	BH3/31R
BH3/07R	BH3/32R
BH3/08R	BH3/33R
BH3/10R	BH3/34R
BH3/11R	BH3/35R
BH3/13R	BH3/36R
BH3/16R	BH3/38R
BH3/17R	BH3/39R
BH3/18R	BH3/40R
BH3/19R	BH3/41R
BH3/20R	BH3/42R
BH3/22R	BH3/43R
BH3/23R	BH3/46R
BH3/24R	BH3/47R
BH3/25R	BH3/48R
BH3/26R	BH3/52R
BH3/27R	BH3/53R
BH3/28R	BH3/54R



REPORT NUMBER

CONTRACT NS Galways (Dity Transport Project - Phase 3 DBILLIAOLE NO BH3 (2010) CORDINATES \$233,119.26 E \$24,217.70 N Status (2010) Status (2010) Status (2010) CROUND LEVEL (moD) 40,50 (2010) 40,50 (2010) File (1010) Date Loogee D 0804/2016) ENNIREET Rig TYPE FLUSH Catagrand Arrivet (2010) Distance Device (1000) 0804/2016) ENNIREET Rig TYPE FLUSH Catagrand Arrivet (2000) 0804/2016) ENNIREET Rig TYPE FLUSH Catagrand Arrivet (2000) Distance Device (1000) If	12		7																		
COORDINATES 523.119.29E T24.217.70 N GROUND LEVEL (mOD) 40.59 CORE DIAMETER (mOD) 40.59 CORE DIAMETER (mm) 80 ENGINEER ARUP IGSL ENGINEER ARUP IGSL IGGED BY IGSL I	CO	NTR/	АСТ	N	16 Ga	alway City	/ Transp	ort P	roject -	Phase 3	hase 3					E NO	BH: Shee	3/03R et 1 of	1		
CLIENT Galway Councy Council INCLINATION (deg)	CO GR	-ORE OUN	DINA D LE	TES EVEL	(mO	523,11 724,21 D)	9.29 E 7.70 N 40.59)		RIG TYPE FLUSH			Casagrar Air/Mist	nde DAT	re dril Fe log	LED GED	06/0 06/0	4/2016 4/2016	3		
Image: status Status Fracture Space Status Fracture Space Status Status </td <td>CLI ENC</td> <td>ent Gine</td> <td>ER</td> <td>G A</td> <td>alwa RUP</td> <td>ay County</td> <td>Counci</td> <td>l</td> <td></td> <td>INCLINATION CORE DIA</td> <td>ON (deg) METER (mi</td> <td>n)</td> <td>-90 80</td> <td>DRI LOI</td> <td>LLED E GGED E</td> <td>BY BY</td> <td>IG D.</td> <td>SL O'She</td> <td>ea</td>	CLI ENC	ent Gine	ER	G A	alwa RUP	ay County	Counci	l		INCLINATION CORE DIA	ON (deg) METER (mi	n)	-90 80	DRI LOI	LLED E GGED E	BY BY	IG D.	SL O'She	ea		
0	Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	cture cing og m) 500 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)		
2 2 2 2 2 4 7 Fresh to locally slightly weathered. Discontinuities are medium to closely space. You focally smooth, panar. Apertures are tight to partly open, very thin brown clay smearing. 3 100 96 65 +++ +++	0	0.90								SYMMETI as peat SYMMETI as weathe Very stron mottled p	RIX DRILLI RIX DRILLI ered rock ng, thickly to orphyritic, r	NG: No reco NG: No reco o thinly band	overy, obs overy, obs led, browr	erved by erved by pink gre	driller driller en ANITF	0.50	40.09				
3 100 98 85 +++ 4 100 83 83 +++ 5 5.20 35.39 5.20 35.39 7 100 83 83	2	2.40	100	87	61			X @ >		Dips are 2 closely sp are tight to	mottled, porphyritic, medium to coarse-grained, GRANITE, fresh to locally slightly weathered. Dips are 20° to locally 70°. Discontinuities are medium to closely spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing.										
1 100 83 83 1 <td>3</td> <td>3.70</td> <td>100</td> <td>98</td> <td>85</td> <td></td> <td></td> <td>880</td> <td></td> <td></td> <td colspan="10"></td>	3	3.70	100	98	85			880													
-8 Image: Casing Sealed To Mater Strike Details -9 Vater Strike Details Molecular Strike Interview Vater Strike Details Molecular Strike Interview Vater Strike Details INSTALLATION DETAILS Date Date Tip Depth RZ Top RZ Base Type Image: Type Image: Type Image: Type	-4 -5	5.20	100	83	83											5.20	35.39				
-9 Image: Second Strike Image: Second Str	- 6									End	of Borehole	e at 5.20 m									
INSTALLATION DETAILS Date Tip Depth RZ Top RZ Base Type Date Tip Depth RZ Top RZ Base Type	9 REI Hol	MAR e cas	KS sed (0.00-0	0.90r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Tim (mir	WA e D) Cc	TER SI	TRIKE ts	DETAILS		
GROUNDWATER DETAILS INSTALLATION DETAILS Date Hole Depth Casing Depth Depth Comments Date Tip Depth RZ Base Type Image: Comments Comments Comments																	lo wate	er strike	e recorded		
INSTALLATION DETAILS Date Hole Depth Casing Depth to Depth Depth Water Comments Date Tip Depth RZ Top RZ Base Type Image: Casing Depth Water Image: Casing Depth Water Comments												Lala	Cooine	Davit	to	GR	DUNDV	VATEF	RDETAILS		
Date Tip Depth RZ Top RZ Base Type	INS	TAL	LATI	ON D	ETA	ILS					Date	Depth	Depth	Wate	r Co	omment	S				
		Date		Tip D	epth	RZ Top	RZ Bas	ie 🗌	Ту	De											



REPORT NUMBER

со	NTR	ACT	N	16 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DRILI	HOLE	NO	BH	3/04R	2
			TES		523.64	5 55 E		,	-	SHEET						She	et 1 of	1
GR		D LE	VEL	(mO	724,28 D)	6.79 N 36.82			RIG TYPE FLUSH			Knebel Air/Mist	DATE	DRILL	ED	15/0 16/0	2/2016 2/2016	3 3
CL EN	ENT GINE	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRILI LOGO	LED BY	(S. D	. Peter	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	oture cing og m) 0 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0								<u>***</u>	SYMMET as peaty 1 SYMMET	RIX DRILLI FOPSOIL. RIX DRILLI	NG: No reco	overy, obs	erved by dr	iller	0.30	36.52		
- 1	0.80	100	96	84			6 2 2 7		Very stron pink/red/b medium to slightly we	ng, thickly to rown/grey/v coarse-gra eathered.	o thinly band white/orange ained, GRAI	ed, light e mottled, NITE, fres	porphyritic, h to locally		0.80	36.02	0 0	
2	1.90	100	100	100		7	750		Dips are 3 medium s Apertures smearing,	35° to locall paced, roug are tight to slightly iror	y 80°. Disco gh to locally partly open n-oxide stair	ntinuities smooth, p , very thin ned.	are widely t blanar. brown clay	0			0 0 0 0 0 0	
- 3	2.90	100	100	100														
- 4	3.70	100	100	93													0 0 0 0	
-	4.30 4.70	100	100	100		ī	/50										° 0	
- 5		100	100	100														
	5.60							<u>+ '</u>	End	of Borehole	at 5.60 m				5.60	31.22		
- 7																		
		Ke													14/4-			
Ho	e ca	sed (0.00-0	0.80r	n.					Water	Casing	Sealed	Rise	Time		mmen	ts	DETAILO
										0.30	0.30	At N/S	0.30	<u>(min)</u> 5	S	eepag	IE	
											Hole	Casing	Denth to	-	GRO	OUND\	VATER	RDETAILS
INS	Data	LATI	ON D		R7 Top	R7 Base		Tur		Date	Depth	Depth	Water	Con	nment	s		
16	-02-1	16	5.0	0	1.00	5.60	-	50mm	n SP									



REPORT NUMBER

SHEET Sheat CO-ORDINATES 524,242.31 E 724,826.60 N SHEET Sheat GROUND LEVEL (mOD) 23.09 RIG TYPE Casagrande FLUSH DATE DRILLED 26/0 DATE LOGGED 26/0 CLIENT Galway County Council ENGINEER ARUP CORE DIAMETER (mm) 80 DRILLED BY ICC (III) (III) (IIII) (IIIIIIII) (IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	et 1 of 1 22/2016 22/2016 22/2016 SSL O'Shea O'Shea N N N N N N N N N N N N N
Image: Construction of the construc	Standpipe Details O'Shea O'Shea SPT (N Value) SPT (N Value)
CLIENT Galway County Council INCLINATION (deg) -90 DRILLED BY IC ENGINEER ARUP INCLINATION (deg) -90 DRILLED BY IC U U U ARUP INCLINATION (deg) -90 DRILLED BY IC U U U ARUP INCLINATION (deg) -90 DRILLED BY IC U U U INCLINATION (deg) -90 Description IC U U INCLINATION (deg) -90 Description IC U V	Standpipe Details O, Shea SPT (N Value)
(iii) (iiii) (iii) (iiii) (iii) <	Standpipe Details SPT (N Value)
0 0	
+ Very strong, trickly to thinly banded, dark brownish purple	
2 2.20 100 77 61 1 Firsh to locally slightly weathered. Dips are 20° to locally 80°. Discontinuities are widely to	
3 3.20 100 32 25 medium spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing.	
4 4.20 100 77 42 $4 + + + + + + + + + + + + + + + + + + $	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
7.50 333 100 100 100 7.50 15.59 8 9 9 10 100 100 100 15.59	
REMARKS WATER ST Hole cased 0.00-1.20m. Water Casing Sealed Rise Time Common	
Strike Depth At To Comment No wate	is Fr strike recorde
GROUNDY	NATER DETAILS
INSTALLATION DETAILS Date Depth Depth Water Comments Date Tip Depth RZ Top RZ Base Type 2.60 0.80 2.80 50mm SP Image: Source of the source	



REPORT NUMBER

1	2	/																
CON	ITR/	АСТ	N	6 Ga	alway City	/ Transpo	ort Pr	oject -	Phase 3	3 DRILLHOI SHEET						BH: Shee	3/07R et 1 of	1
CO-0	ORE	DINA [.]	tes Vel	(mO	524,50 725,01 D)	2.21 E 5.04 N 36.41			RIG TYPE FLUSH			Casagra Air/Mist	nde DAT	TE DRI	ILLED GGED	07/0 08/0	4/2016 4/2016	5
CLIE ENG		ER	G A	ialwa RUP	ay County	Council			INCLINATI CORE DIA	ON (deg) METER (m	m)	-90 80	DRI LOC	LLED GGED	BY BY	IG D.	SL O'She	a
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	cture cing og m) ^{0 500}	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2 2 3 3 3 3 5 5 6 6 6	2.60 3.60 5.60	100 100 100 100	46 96 76 100 85	32 90 76 100 79			830 500.000		SYMMET as peat SYMMET as weathe Very stror mottled, p fresh to lo Dips are 2 closely sp are tight t 2.60-3.15 3.71-5.02 6.60-6.74	RIX DRILLI RIX DRILLI ered rock orphyritic, r cally slight aced, roug o partly ope m - Modera m - Modera	NG: No reco NG: No reco nedium to c y weathered y 70°. Disco h to locally s n, very thin ttely weathe ttely weathe	bvery, obs bvery, obs bvery, obs led, brown oarse-gra i. mooth, pl brown cla red, slight red, slight red, slight	served by served by n pink gre ined, GR/ are mediu anar. Ape y smearir weakenir weakenir	driller driller en ANITE ing. ng.	1.30 2.60	35.11		
- 8 - 9 REM Hole	7.60 MARI 2 cas	KS sed ().00-2	2.60r	n.				End	of Borehole Water Strike	Vater Casing Sealed R Strike Depth At				7.60 WA1 ne Co in) N	28.81 FER SI mmen o wate	T RIKE ts	DETAILS
W 188												Casing	Darth	to	GRO	DUNDV	VATEF	DETAILS
INST			ON D	ETA	ILS	D7 D		T		Date	Depth	Depth	Wate	r C	comment	S		
L	Jaie		ים קו	ерш	π <u>z</u> τυμ	INZ Das		1 9	55									



REPORT NUMBER

со	NTR	АСТ	N	l6 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DR	ILLHOL	E NO	BH	3/08R	
со	-ORE	DINA	TES		524,622	2.58 E			SHEET							She	et 1 of	1
GR	OUN	D LE	VEL	(mOl	725,06 ⁻ D)	7.54 N 42.05			RIG TYPE			Knebel Air/Mist	DA	TE LOG	GED	17/0	2/2016) j
CLI EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATIO	ON (deg) METER (mi	n)	-90 80	DR LO	ILLED E GGED E	SY SY	S D	. Peters . O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0	0.90	100	96	91			<u> </u>		SYMMETI as peaty T SYMMETI as brownis SYMMETI as brownis Very stron pink/red/b medium to	RIX DRILLI OPSOIL. RIX DRILLI sh pink wea RIX DRILLI sh pink roci g, thickly to rown/grey/v o coarse-gr	NG: No rec Athered roc NG: No rec K o thinly ban white/orang ained, GRA	covery, ob covery, ob k covery, ob ded, light e mottled NITE, fre	served by served by served by , porphyrit sh to loca	driller driller driller ic, lly	0.30	41.75 41.35 41.15		
2	2.60	100	97	87					Dips are 3 medium s	athered. 5° to locall paced, roug are tight to	y 80°. Disco gh to locally partly oper	ontinuities / smooth, n. verv thi	are widel planar. n brown c	y to av				
3	3 90	100	92	81			/ .		smearing,	slightly iro	n-oxide stai	ned.						
4	4.75	100	100	80	E												0 0	
5	5.75	100	100	100			§10										0 0 0 0	
- 6 		100	100	92	-1		560											
- 8	7.30 8.50	100	100	88														
9	9.80	100	100	100		6	580 560								9.80	32.25		
RE	Mar	KS							End o	of Borehole	at 9.80 m				WA	TER S	 	DETAILS
Ho	le ca	sed (0.00-0	0.90r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min	1 (ommen No wate	ts er strike	erecorded
															GR	OUND\	NATER	DETAILS
INSTALLATION DETAILSDateTip DepthRZ TopRZ BaseT17-02-169.004.009.8050r									Date Hole Depth Casing Depth Depth to Water Comments ype 17-02-16 9.80 0.90 0.90 Water level measured 10 mi drilling						10 mins a	after end of		



REPORT NUMBER

12	2	7															
	NTR/	ACT	Ν	16 Ga	alway City	/ Transpo	rt Proj	ect - Phase 3	3 DRILLHO SHEET						E NO BH3/10R Sheet 1 of 2		
CO- GR(ORE	DINA	TES VEL	(mO	525,32 725,60 D)	0.57 E 3.65 N <u>66.5</u> 1		RIG TYP	E		Casagran Air/Mist	de DAT	E DRILL	ED ED	04/0 06/0)4/2016)4/2016	
	ENT SINE	ER	G	alwa RUP	ay County	Council		INCLINA CORE DI	TION (deg) AMETER (m	m)	-90 80	DRIL LOG	LED B	((IC D	SSL . O'Shea	
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing 5g m) 500	Non-intact Zone	Legend		Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
1	1.20							++ SYMME ++ SYMME ++ SYMME ++ + ++ + ++ Very stro mottled,	TRIX DRILL TRIX DRILL nered rock ong, thickly t porphyritic,	ING: No rec ING: No rec o thinly band medium to c	overy, obs overy, obs ded, brown coarse-grai	erved by c erved by c pink gree ned, GRA	riller riller n NITE,	0.10 1.20	66.41		
2	2.70	100	99	95		6	i10	++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++	locally slight 20° to local paced, roug to partly ope	ly weathered ly 70°. Disco h to locally s en, very thin	d. ontinuities a smooth, pla brown clay	are mediu anar. Aper y smearing	n to tures J.				
, t ,	4.20	100	99	94				++ ++ ++ ++ ++ ++ ++ ++ ++ ++									
;	5.70	100	94	94				+ '									
	7.20	100	100	100		7	20	· + - + + -									
;	8.70	100	99	96		7	/50	+ '									
9		100	97	97		5	;20	' + + + + + + + + + + + + +	-							0 0 0 0 0 0	
	NAR	KS sed () በበ-	1 201	m				Water	Casing	Sealed	Rise	Time	WA'	IERS		TAILS
1016	e cas	sea	0.00-	ı.∠Uľ	11.				Strike	Depth	At	To	(min)	Co N	ommen lo wate	er strike r	ecorded
														GRO		WATER D	DETAILS
NS'	TAL	LATI		DETA	ILS				Date	Hole	Casing	Depth to	Con	nment	s		
[Date		Tip D	epth	RZ Top	RZ Base	•	Туре	_	Deptn	Depth	vvaler					
06-	-04-1	Ю	10.0	JU	5.50	11.00	5	umm SP									



REPORT NUMBER

12	0	/																			
со	NTR	АСТ	N	16 Ga	alway City	/ Transpo	rt Pro	ject -	Phase 3	se 3					DRILLHOLE NO			D BH3/10R Sheet 2 of 2			
CO GR		DINA D LE	TES EVEL	(mO	525,32 725,60 D)	0.57 E 3.65 N 66.51			RIG TYPE FLUSH			Casagra Air/Mist	nde D	ATE C ATE L	DRILLI LOGGI	ED ED	04/0 06/0	4/2016 4/2016	3 3		
CL EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATI CORE DIA	ON (deg) METER (m	m)	-90 80	D	RILLE DGGE	ED BY ED BY	,	IG D	SL O'She	ea		
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 0 500	Non-intact Zone	Legend			Descript	ion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)		
- 10 	10.20	100	99	98			10		Very stror mottled, p fresh to lo Dips are 2 closely sp are tight to (continued	ng, thickly to orphyritic, i cally slightl 20° to locall aced, roug o partly ope t)	o thinly band medium to c ly weathered y 70°. Disco h to locally s en, very thin	ded, brow coarse-gra d. ontinuities smooth, p brown cla	n pink gi iined, Gl are meo lanar. Aj ay smeal	reen RANI [®] dium f pertur ring.	TE, to res						
- 12	13.20	100	100	100		5	40.0000	+ + + + + + + + + + + + + + + + + + +													
- 14	14.70	100	100	100	-	1	590		- - - -												
- 15	16.20	100	100	100																	
	16.70	100	98	86				-+		of Dorohold	at 16 70 m					16.70	49.81				
17											, at 10.70 m										
RE Ho	MAR le ca	KS sed (0.00-	1.20r	n.					Water	Casing	Sealed	Rise		Time		mmen	ts	DETAILS		
										Strike	Depth	At	To		(<u>min)</u>	N	o wate	er strike			
	TAL	LATI		ETA	ILS					Date	Hole	Casing	Dept	h to	Com	ment	S	VAIE	DETAILS		
06	Date -04-1	16	Tip D 10.0	epth	RZ Top 5.50	RZ Base 11.00	;	Typ 50mn	n SP		Depth	Depth	Wa	ıer			-				
2																					



REPORT NUMBER

1	0	1																
СС	NTR/	ACT	N	6 Ga	lway City	Transpo	rt Pro	oject -	Phase 3				DRI She		NO	BH: She	3/11R et 1 of	1
GR	ORE	DINA [.]	TES	(mOl	525,784 725,830 D)	4.67 E 0.02 N 54.24						Comacch	DAT DAT	e drill E logo	ED ED	02/0 10/0	2/2016 2/2016	3
CL EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRI LOC	LLED B' GED B'	Y Y	IG D	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi 0 ²⁵⁰	ture cing og m) 	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMETI as grey br SYMMETI as weathe	RIX DRILLI own clayey RIX DRILLI ered rock	NG: No reco sandy grav NG: No reco	overy, obs el overy, obs	served by	driller driller	0.70	53.54		
2	1.80 2.00 2.30	100 100	0	0		K			Possible v basalt.	veathered r	ock - recove	ered as ar	ngular gra	vel of	1.80	52.44		
- 3	3.30	100	93	46					Strong to grained, v phenocrys locally slig	very strong ery dark gr sts), Possib htly weathe	, thickly ban eenish purp le BASALTI ered.	ded, fine le (with ar C ANDES	to coarse ngular crea SITE, fresh	am i to	2.60	51.64		
- 4	4.00 4.30 4.60	100 100 100	45 0 100	45 0 100		<			Dips are 1 smooth, p smearing,	0°. Discont lanar. Aper slightly iroi	tinuities are tures are tig n-oxide stair	widely to ht, very th ned.	medium s nin brown	paced, clay				
- 5	5.00	100 100	60 100	0 70														
- 6	5.80 6.50	100	100	100			k . , k											
- 7	7.10 7.50	100 100 100	93 100 100	93 100 100		-	X • X								7 80	46 44		
- 8	7.00					=		<u>/</u> V.	End	of Borehole	at 7.80 m				1.00	-0	~~/~	
RE	MAR	KS													WAT	TER ST	RIKE	DETAILS
Ho	le ca	sed (0.00-4	1.60r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
										1.00						Slow		
															GRO		VATER	R DETAILS
10	STAL		ОМ D Гір De	ETA epth	ILS RZ Top	RZ Base	•	Typ 50mm	De 1 SP	Date 10-02-16	Hole Depth 7.80	Casing Depth 4.60	Depth Wate 0.40	to Con Wate drillin	nment r level m	S easured	10 mins a	after end of
	10-02-16 2.50 1.80 2.70 50mm SP							. 01										



REPORT NUMBER

0						Tranana	rt Dr	nicot	Dhago 2				DRI			BU,	3/13D	
				IO Ga			IL PI	Ject -	Phase 5				SHE	ET		She	et 1 of 2	
CO GR	-ORE	DINA D LE	TES	(mO	526,07 726,03 D)	8.57 E 6.12 N 58.65			RIG TYPE FLUSH			Casagraı Air/Mist	nde DAT	e drili E logo	_ED GED	21/0 22/0	3/2016 3/2016	
CLI EN	IENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI CORE DIA	ON (deg) METER (m	m)	-90 80	DRI LOG	LLED B	Y Y	IG D	SL . O'Shea	l
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	oture cing og m) 0 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMET as clayey	RIX DRILL gravel	ING: No rec	overy, obs	served by	driller	0.70	57.95		
- 1	1.10	100	00	00		e e e e e e e e e e e e e e e e e e e	600		SYMMET as weathe Very stror mottled, p	RIX DRILL ered rock ng, thickly to orphyritic, i	ING: No rec thinly band medium to c	overy, obs ded, dark l coarse-gra	brownish p ined, GRA	ourple	1.10	57.55		
2	2.10	100	96	96	E				fresh to lo Dips are 2 medium s	cally slight 20° to locall paced, rou	y weathered y 80°. Disco gh to locally	d. ontinuities y smooth, j	are widely planar.	' to			0	
3	3.10	100	97	97					smearing.	are ugnt to	, paruy oper	i, very mir	I DI UWU Cla	ау			0 0	
	4.10	100	98	98		ſ	1070											
4		100	100	100		E	330										o o o o	
5	5.10	100	100	100													0 0 0 0	
6	6.10	100	100	100	_		399.9999											
7	7.10	100	100	100			570										0 0 0 0	
8	8.10	100	100	100			530.0000										0 0 0 0 0 0	
- 9	5.10	100	100	100														
RE	MAR	KS		1 10-	~					Water	Casing	Sealed	Rise	Time	WA	TER ST	FRIKE D	ETAILS
HO	e ca:	sed (J.UU-'	1.10r	11.					Strike	Depth	At	То	(min)	Co N	ommen lo wate	ts er strike i	recorded
INC	TA1	۱۸۳۱								Data	Hole	Casing	Depth 1	0 000	GRO		VATER I	DETAILS
INS	Date		Tip D	epth	RZ Top	RZ Base	9	Tvr	De	Date	Depth	Depth	Water	Cor	rment	5		
22	-03-1	16	9.0	0	6.00	10.10		50mm	ו SP]								



REPORT NUMBER

10000	1															
CONTRAC	TN	l6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				DRIL SHEI	LHOLE ET	NO	BH: She	3/13R et 2 of	2
GROUND	IATES LEVEL	(mO	526,078 726,030 D)	8.57 E 6.12 N 58.65			RIG TYPE			Casagrar Air/Mist	nde DATE	e drill E logg	ED ED	21/0 22/0	3/2016 3/2016	3 3
CLIENT ENGINEEF	C R A	Galwa	ay County	Council		1	INCLINATI	ON (deg) METER (m	n)	-90 80	DRIL LOG	LED BY GED BY	r r	IG D.	SL . O'She	ea
Downhole Depth (m) Core Run Depth (m)	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500 500	Non-intact Zone	Legend			Descript	lion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10 <u>10.10</u> 11 12 13 14 15 16 17 18 19							End	of Borehole	e at 10.10 m	1			10.10	48.55		
	3	1.10						Watar	Cooing	Sociad	Pico	Timo	WA	TER ST	FRIKE	DETAILS
Hole case	d 0.00-	1.10r	n.					strike	Depth	Sealed At	rise To	(min)	Co	mmen	ts	
													N	lo wate	er strike	e recorded
									Hole	Casing	Denth tr		GRO	DUND	NATEF	RDETAILS
INSTALLATION DETAILS						ne	Date	Depth	Depth	Water	Con	nment	S			
22-03-16	Date Tip Depth RZ Top RZ Base Type 22-03-16 9.00 6.00 10.10 50mm SP						n SP	-								



REPORT NUMBER

со	NTR	ACT	N	16 Ga	alway City	/ Transpo	rt Pro	oject -	Phase 3				DRI	LLHOLI	E NO	BH	3/16R	
со	-ORI	DINA	TES		526,76 726,61	4.74 E 1.40 N			RIG TYPE			Casadra	nde SHE	ET E DRIL	LED	She 23/0	et 1 of 1 3/2016	
			G G	(mO Galwa	D) ay County	61.66 Council				ON (deg)		Air/Mist -90	DAT		GED SY	24/0 IG	SSL	
		ER	A	RUP					CORE DIA	METER (M	n)	80		GED B				a
Downhole Depth (n	Core Run Depth (m	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0									SYMMET as clayey SYMMET as weathe	RIX DRILLI gravel RIX DRILLI rred rock	NG: No rec NG: No rec	overy, ob	served by	driller	1.50	60.16		
2	2.50											· · · · ·			2.50	59.16		
3	3 50	100	86	64			< - <u>.</u>		Very stron mottled, p fresh to lo Dips are 2	ig, thickly to orphyritic, r cally slightl 20° to locall	v 80°. Disco	ded, dark coarse-gra d. ontinuities	brownish p ained, GRA	v to				
4	4.50	100	35	35					medium s Apertures smearing. 2.50-5.80r clay-smea	paced, rou are tight to m - Slightly ired, peneti	gh to locally partly oper to locally m rative iron-c	v smooth, n, very thi noderately oxide stair	planar. n brown cla v weatherea ing, slight	ay d,				
5	5.80	62	16	0				+ + + + + + + + + + + + + + + + + + +	weakenin	y.								
6	7.00	100	93	73	È												0 0 0 0	
7	8 50	100	97	97													0 0 0 0 0 0 0 0 0	
9	10.00	100	99	99	-	1	150								10.00	51.66	0 0 0 0 0 0 0 0 0	
RE	MAR	KS	1	1				⊨ ∔l	End	of Borehole	at 10.00 m	1	D :		WA	TER S		ETAILS
Hol	e ca	sed	0.00-	1.10r	m.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min) Co	mmen	ts	
																lo wate	er strike	recorded
															GRO		VATER	DETAILS
INS	TAL	LATI		ETA	ILS					Date	Hole	Casing	Depth Water	O Co	mment	s		
24	Date -03-1	16	Tip D 10.0	epth)0	RZ Top 6.00	RZ Base 10.00	•	Typ 50mm	e SP									



REPORT NUMBER

1		/																	
со	NTR/	ACT	N	l6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3					DRILL	HOLE Г	NO	BH: She	3/17R et 1 of :	2
CO GR	ORE	d Le	TES EVEL	(mO	527,02 726,80 D)	1.46 E 4.57 N 65.33			RIG TYPE FLUSH			Casagra Air/Mist	ande	DATE I DATE I	DRILLI LOGGI	ED ED	10/0 11/0	3/2016 3/2016	;
CL EN	IENT GINE	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (m	m)	-90 80		DRILL LOGG	ED BY ED BY	, ,	IG D	SL . O'She	a
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descrip	tion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2 3 4 4 5 6 7 8 9 9 9 9 18/14 1 9 9 9 18/14 10 9 7 8	5.70 6.70 8.20 9.70 MAR le cas	100 100 KS sed (26 88 100	0 68 91 5.20r					SYMMETI as clayey SYMMETI as gravell SYMMETI as weather Very stron porphyritic locally slig Dips are 2 closely sp are tight to	RIX DRILLI gravel RIX DRILLI y clay RIX DRILLI y clay RIX DRILLI red rock g, thickly to , medium 1 htly weath 20° to locall aced, roug o partly ope	ING: No real ING: No real ING: No real to coarse-g ered. y 70°. Disc h to locally an, very thir Casing Depth	covery, ob covery, ob ded, dark rained, Gl ontinuities smooth, p brown cl brown cl Sealed At	serve serve greer RANII s are r planar. ay sm	d by dril d by dril d by dril a mottlec E, frest nedium Apertu earing.	ller ller d, n to res	2.70 5.00 5.70	62.63 60.33 59.63		DETAILS
PJ IGSL.																N	lo wate	er strike	e recorded
63.G																			
189											· · · · ·					GRO	DUND	VATER	DETAILS
	STAL	LATI	ON D	ETA	ILS					Date	Hole	Casing		epth to Vater	Com	ment	s		
II III III	Date Tip Depth RZ Top RZ Base Type 11-03-16 10.20 3.00 10.20 50mm SP							oe 1 SP											



REPORT NUMBER

CONTRAC	T NG	6 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DRIL	.LHOLE ET	NO	BH: Shee	3/17R et 2 of	2
CO-ORDIN	ATES		527,02 726,80	1.46 E 4.57 N			RIG TYPF			Casagrar	DAT		ED	10/0	3/2016	6
GROUND L	EVEL (mOl	D)	65.33			FLUSH			Air/Mist	DAT	E LOGG	ED	11/0	3/2016	5
	Ga	alwa RUP	y County	Council				ON (deg) METER (mr	n)	-90 80	DRIL	LED B	Y Y	IG D	iSL O'She	a
									.,		1-00					
Downhole Depth (r Core Run Depth (m T C R %	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 250	ture cing og m) 	Non-intact Zone	Legend			Descripti	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- ¹⁰ 10.20 ¹⁰	0 92	92				+ ·	End (of Borehole	at 10 20 m				10.20	55.13	°⊟°	
11 12 13 14 15 16 17 18 19																
REMARKS			1				1				_		WA	FER ST	RIKE	DETAILS
Hole cased	0.00-5	.20n	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
												/	N	o wate	er strike	e recorded
									Hole	Casing	Denth +		GRO	DUNDV	VATER	DETAILS
							20	Date	Depth	Depth	Water	Con	nment	S		
11-03-16	Date Tip Depth RZ Top RZ Base Type 1-03-16 10.20 3.00 10.20 50mm SP						n SP									



REPORT NUMBER

со	NTR	АСТ	N	16 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DRI	LLHOLE	E NO	BH	3/18F	2
со	-ORI	DINA	TES		527,25 726,89	4.48 E 3.52 N						Knobol	DAT	et Edrili	ED	She 24/0	et 1 of)2/2016	3 6
GR	OUN	D LE	VEL	(mO	D)	70.64			FLUSH			Air/Mist	DAT	ELOGO	GED	26/0	2/2016	6
CL EN	IENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (m	m)	-90 80	DRI LOC	LLED B GED B	Y Y	S D	. Peter . O'Sh	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	cture cing og m)	Non-intact Zone	Legend			Descrip	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	4.00 5.00 5.60 7.20 7.70 9.00	100 100 100 100	94 100 99 98 98	84 100 68 80 48 73 84			770		SYMMETI as peaty 1 SYMMETI as brown SYMMETI as pink vo SYMMETI as pink ro Very strom pink/red/b medium to slightly we Dips are 3 medium s smearing,	RIX DRILLI FOPSOIL. RIX DRILLI sandy peat RIX DRILLI eathered ro RIX DRILLI ck rown/grey// p coarse-gr eathered. 35° to locall paced, roug are tight to slightly iro	NG: No rec y gravel NG: No rec y gravel NG: No rec ck NG: No rec o thinly ban white/orang ained, GRA y 80°. Disc ganto locally partly ope n-oxide sta	covery, ob: covery, ob: covery, ob: covery, ob: ded, light e mottled NITE, fre: ontinuities / smooth, n, very thin ned.	served by served by served by served by served by porphyriti sh to locall are widely planar. n brown cla	driller driller driller c, y to ay	0.40 3.60 3.90 4.00	67.04		N = 35 (2, 4, 6, 6, 9, 14) N = 50/85 mm (8, 14, 41, 9)
RE	MAR	KS						<u>+ , +</u>							WA	TER S	I <u>P H</u> P TRIKE	DETAILS
Ho	le ca	sed (0.00-4	4.00	m.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmer	its	
										JUIKE	Берш	<u> </u>	10			lo wate	er strik	e recorded
															GR		NATER	RDETAILS
INS	TAL	LATI		ETA	ILS					Date	Hole	Casing	Depth	to Cor	nment	s		
	Date		Tip D	epth	RZ Top	RZ Base	>	Тур	e		Deptn	Depth	vvale					
26	-02-1	16	4.0	0	0.50	4.00		50mm	n SP									



REPORT NUMBER

0		ACT				Tran	0005	Draia	at Dhasa	2			DRI			DU	2/100)
0		ACT	IN	lb Ga	alway City	/ Tran	spor	Proje	ct - Phase	3			SHI	EET		She	et 2 of	3
CO GR	-ORE	DINA D LE	TES EVEL	(mOl	527,25 726,89 D)	4.48 E 3.52 N 70.	≣ N .64		RIG T	/PE		Knebel Air/Mist	DA ^T	re drili re logo	_ED GED	24/0 26/0)2/2016)2/2016	3 3
CLI EN	IENT GINE	ER	G	alwa RUP	y County	Cour	ncil		INCLIN CORE	NATION (deg) DIAMETER (mi	m)	-90 80	DRI LO	LLED B GGED B	Y Y	S D	. Peters . O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	cture cing og m)	500	Non-intact Zone	regena		Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.30	100	100	100			670	+ + + - + - - - - - - - - - - - - - - -	+ Verys pink/r + slight - Dips a mediu	strong, thickly to ed/brown/grey/ um to coarse-gr ly weathered. are 35° to locall um spaced, roug	o thinly ban white/orang ained, GRA y 80°. Disc gh to locall	ded, light je mottled ANITE, fre ontinuities y smooth,	, porphyrit sh to local are widel planar.	ic, ly y to				
- 12	12.70	100	100	100					+ Apert + smea + + +	ures are tight to ring, slightly iro	o partly ope n-oxide sta	n, very thi ined. <i>(con</i>	n brown cl <i>tinued)</i>	ay				
- 13	13.70	100	96	88			11'		+ + + + +									
14 14 15	15.20	100	100	95	F			+ + + + + + + + + + + +	+ + + + +									
16	16 60	100	99	99			85) 	+ 	+ + + + + + + - -+								0 0 0 0 0 0 0 0	
17	17.50	100	98	82					+								0 0 0 0 0 0	
18	18.90	100	97	91			69		+ 10001 + + + + +									
- 19		100	97	93			14	[+ - - -	· + + + + +									
RE Hol	MAR le ca	KS sed (0.00-4	4.00r	n.					Water	Casing	Sealed	Rise	Time			I RIKE	DETAILS
				1						Strike	Depth	At	То	(min)) CC	lo wate	er strike	e recorded
	TA :									Dete	Hole	Casino	I Denth	to	GR	OUND\	NATEF	RDETAILS
Date Tip Depth RZ Top RZ Base Type 2 26-02-16 4.00 0.50 4.00 50mm SP							26-02-16	Depth 16.60	<u>Depth</u> 4.00	2.50	r Cor Wate	riment er level m	s neasured	start last	day drilling			
1						1												



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со	NTR	ACT	N	16 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				DRIL	LHOLE	NO	BH	3/18R	
со	-ORI		TES		527 25	4 48 F							SHE	ET		She	et 3 of	3
GR	OUN	D LE	EVEL	(mO	726,89 D)	3.52 N 70.64			RIG TYPE FLUSH			Knebel Air/Mist	DAT	e drill E logg	ED ED	24/0 26/0	2/2016 2/2016	5 5
CL	ENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRIL LOG	LED B	((S. D	Peters O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20	20.40							- +	Very stron pink/red/b	ig, thickly to rown/grey/\	o thinly band white/orange	ed, light e mottled,	porphyritic),				
	20.90	100	100	100		8	590		medium to slightly we	o coarse-gra eathered.	ained, GRA	NITE, fre	sh to locally	/				
21	21.50	100	100	100	_				Dips are 3 medium s Apertures	5° to locall paced, roug are tight to	y 80°. Disco gh to locally partly open	ntinuities smooth, , verv thir	are widely planar. ı brown cla	to v			0 0	
22	23.00	100	100	100	-		2500		smearing,	slightly iroi	n-oxide stair	ned. <i>(con</i> t	tinued)					
24	24.50	100	100	100					End o	of Borehole	at 24.50 m				24.50	46.14		
25																		
27																		
28																		
29																		
DE															14/4 7			
Ho	e ca	sed (0.00-4	4.00r	n.					Water	Casing	Sealed	Rise	Time	Co	mmen	ts	JE I AILS
										JUINE					N	o wate	er strike	e recorded
									Data	Hole	Casino	Depth to		GRO	DUNDV	VATER	R DETAILS	
Installation DetAils Date Tip Depth RZ Top RZ Base Type						be	Date	Depth	Depth	Water	Con	nment	S					
26-02-16 4.00 0.50 4.00 50mm SP						n SP												



REPORT NUMBER

00		-		~ ~		-							DBI			DU		•
00	INTR	ACT	N	6 Ga	aiway City	ranspor	τPro	ject -	Phase 3				SHE	ET		Shee	et 1 of	2
CO GR	ORE	d Le	TES	(mO	527,39 727,01 D)	5.72 E 5.07 N 61.46			RIG TYPE FLUSH			Knebel Air/Mist	DAT DAT	e drili E logo	ED GED	03/0 07/0	3/2016 3/2016	3 3
CL EN	IENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATION	ON (deg) METER (mr	n)	-90 80	DRI	LED B	Y Y	S. D.	Peter O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0								<u>\17</u> \ 17 \17	SYMMET as TOPSO	RIX DRILLI DIL.	NG: No rec	overy, ob	served by	driller	0.40	61.06		
- 1								00000	SYMMETI as brown	RIX DRILLI sandy grav	NG: No rec el	overy, ob	served by	driller	1.20	60.26		
								- + + +	SYMMET as weathe	RIX DRILLI ered rock	NG: No rec	overy, ob	served by	driller	1.70	59.76		
2	2.20								SYMMET as rock	RIX DRILLI	NG: No rec	overy, ob	served by	driller	2.20	59.26		
		100	100	96				+ + + + + + + + + + + + + + + + + + +	Very stron mottled, p fresh to lo	ng, thickly to orphyritic, r cally slightly	o thinly band nedium to c y weathered	ded, brow coarse-gra d.	n pink gree ined, GRA	en NITE, m to				
	3.50								closely sp are tight to	aced, rough partly ope	n, very thin	smooth, p brown cla	lanar. Ape ay smearin	rtures g.				
- 4	5.00	100	100	94		77	70	+ ' - - + - - + - - + -										
5	6.05	100	100	85	E													
- - - - - - 7 - - -	7.55	100	100	93	Ē													
- 8	8.55	100	100	92				- + · - + · - + · - + · - + ·										
9		100	100	94	Ę													
2 0 RF	9.95 MAR	KS	<u> </u>					- +							WA-	TER ST	RIKF	DETAILS
Ho	le ca	sed (0.00-2	2.20r	n.					Water	Casing	Sealed	Rise	Time	Co	mmen	ts	
0.0FJ 100L.0										0.50	0.50	N/S	0.30	5	, N	loderat	e	
1020											l		-		GRO	OUNDV	VATEF	R DETAILS
	STAL Date		ON D Tip D	ETA epth	ILS RZ Top	RZ Base		Тур	De	Date 07-03-16	Hole Depth 9.20	Casing Depth 2.20	Depth t Water 0.20	O Cor	nment er level m	S leasured	start last	day drilling



REPORT NUMBER

		<u> </u>	–									DUI		
CONTRAC	N6	Galway City	y Transpoi	t Project	- Phase 3				SHEE	T	NO	Shee	et 2 of	2
CO-ORDIN	ATES EVEL (m	527,39 727,01 I OD)	5.72 E 5.07 N 61.46		RIG TYPE			Knebel Air/Mist	DATE DATE	DRILLI LOGG	ED ED	03/03 07/03	3/2016 3/2016	;
CLIENT ENGINEER	Gal ^ı ARl	way County JP	/ Council		INCLINATI CORE DIA	ON (deg) METER (mr	n)	-90 80	DRILL LOGO	ED BY	,	S. D.	Peters O'She	sen ea
Downhole Depth (m) Core Run Depth (m) T C R %	S.C.R.%	Frac Spa Lu (m	cture icing og im) 0 500	Non-intact Zone Legend			Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	0 100 1	00	1-		Very stror mottled, p fresh to lo Dips are 2	ng, thickly to orphyritic, r ocally slightly 20° to locally	o thinly band nedium to co y weathered y 70°. Discou	ed, brown barse-grai ntinuities a	pink green ned, GRAN are medium	IITE, 1 to				
11 10	0 100 1				are tight to (continued	o partly ope	n, very thin l	prown clay	y smearing.	lies				
10 13 13.50	ο 93 ε	8			-									
14 10	95 9	1									15 10	46.26		
15 <u>13.10</u> - 16 - 16 - 17 - 17 - 17 - 17 - 17 - 17 - 19 - 19					End	of Borehole	at 15.10 m				13.10	40.30		
REMARKS Hole cased	0.00-2.2	 0m.				Water Strike 0.50	Casing Depth 0.50	Sealed At N/S	Rise To 0.30	Time (min) 5	WAT Co M	ren st mment	RIKE s e	DETAILS
INSTALLA		AILS				Date	Hole	Casing	Depth to	Com	ment	SUNDA	VAIER	DETAILS
Date	Tip Dep	th RZ Top	RZ Base	Ty	/pe	-			vvaler					



REPORT NUMBER

CONTRACT N6 Galway City Tr	ansport Projec	t - Phase 3				DRILI Shee	-HOLE T	NO	BH3 Shee	3/20R et 1 of 2	
CO-ORDINATES 527,214.1 727,669.1 GROUND LEVEL (mOD)	0 E 0 N 51.63	RIG TYPE			Casagran Air/Mist	DATE	DRILLE LOGGE	ED ED	29/0 31/0	3/2016 3/2016	
CLIENT Galway County Co ENGINEER ARUP	ouncil	INCLINATI	ON (deg) METER (mr	n)	-90 80	DRILI LOGO	ED BY		IG D.	SL O'Shea	
Core Run Depth (m) Core Run Depth (m) T.C.R.% Post Come Run Depth (m) Fost Come Run Depth (m)	Non-intact Zone	,		Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
		SYMMETI as sandy	RIX DRILLI gravelly cla RIX DRILLI ered rock	NG: No reco y with occas	overy, obs sional cobb overy, obs	erved by dr	iller	1.20	50.43		
4 4.10 100 45 34		SYMMETI as rock Strong to grained, v	RIX DRILLI very strong ery dark gru sts), Possib	NG: No reco , thickly ban een (with ar le BASALTI	overy, obs ded, fine t igular crea C ANDES	erved by dr o coarse m ITE, fresh t	iller	<u>3.20</u> 4.10	48.43 47.53		
5 5.10 100 66 31		 Ocally slig Dips are 2 closely sp are tight to 	gntly weathe 20° to locall aced, rougi o partly ope	ered. y 70°. Disco n to locally s n, very thin	ntinuities a mooth, pla brown cla	are medium anar. Aperti y smearing.	n to ures				
7 7.10 77 66											
8 8.10 100 86 71	700 V 520 V									0 0 0 0 0 0	
9 9.10 91 86 9 9.10 100 92 88										0 0 0 0 0 0 0 0	
2 REMARKS	/ * ·	71						WAT	ER ST		TAILS
Hole cased 0.00-4.10m.			Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co N	mmen o wate	ts r strike r	ecorded
۲۵ ۲				Hole	Casing	Depth to		GRC	JUNDV	VATER	DETAILS
INSTALLATION DETAILSDateTip DepthRZ TopRZ31-03-1614.006.001	Z Base 7 15.00 50n	ype nm SP	Date	Depth	Depth	Water	Com	ments	5		



REPORT NUMBER

12		7																		
со	NTR/	АСТ	N	l6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				DRIL SHE	lhole et	E NO	BH: Shee	3/20R et 2 of	2		
CO-ORDINATES 527,214.10 E 727,669.10 N 727,669.10 N GROUND LEVEL (mOD) 51.63									RIG TYPE Casagrande FLUSH Air/Mist				nde DATI	e drill E logo	_ED GED	D 29/03/2016 D 31/03/2016				
CLI EN	CLIENT Galway County Council ENGINEER ARUP								INCLINATI	ON (deg) -90 DRILLED B METER (mm) 80 LOGGED B						rí IGSL rí D. O'Shea				
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (mi	ture cing og m) 500	Non-intact Zone	Legend			Depth (m)	Elevation	Standpipe Details	SPT (N Value)						
- 10	10.10	100	91	81					Strong to grained, v phenocrys locally slig	very strong ery dark gr sts), Possib phtly weathe	l, thickly ban een (with an le BASALTI ered.	to coarse am SITE, fresh	to							
- 11 - - - - -	12.10	100	90	90			699.9999		Dips are 2 closely sp are tight to <i>(continuec</i>	20° to locall aced, roug o partly ope t)	y 70°. Disco h to locally s en, very thin	ntinuities mooth, pl brown cla	are mediul anar. Aper y smearing	n to tures J.			• • • •			
- 12	12.10	100	89	81	F		750		, , ,											
- 13	14.10	100	86	81			740		, , ,											
- 14 - - - - - - - - - - - - - - - - - - -	15.00	100	97	84					End	of Borehole	e at 15.00 m				15.00	36.63				
16										Γ										
RE	REMARKS										Casing	Seeled	Rice	Time	WA	TER ST	RIKE	DETAILS		
Hole cased 0.00-4.10m.										Water Casing Stated Rise Time Comments Strike Depth At To (min) Comments						e recorded				
	T • • •		011 -							Def	GROUNDWATER DETA						RDETAILS			
	Date			enth	RZ Ton	R7 Bas	e	Tvr)e	Date	Depth	Depth	Water	Cor	nment	5				
31	-03-1	6	14.0)0	6.00	15.00		50mn	n SP	1										



REPORT NUMBER

0	/																		
CONTRA	СТ	N	6 Ga	alway City	/ Transpo	rt Pr	oject - F	Phase 3				DRI She	LLHOLE	E NO	BH3 Shee	3/22R et 1 of	2		
CO-ORDINATES 527,606.92 E 727,191.08 N GROUND LEVEL (mOD) 43.46								RIG TYPE Casagrande FLUSH Air/Mist					e drili E logo	LED GED	05/03/2016 010/03/2016				
CLIENT	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRI LOC	LLED B GGED B	Y Y	IG D.	ea			
Downhole Depth (m) Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 0 500	Non-intact Zone	Legend	Description						Depth (m)	Elevation	Standpipe Details	SPT (N Value)		
0								SYMMETF as clayey	RIX DRILLI gravel	NG: No reco	overy, obs	erved by	driller						
2								SYMMETR as weathe	RIX DRILLI pred rock	NG: No reco	overy, obs	erved by	driller	1.70	41.76				
2.70 3 4 4.20	100	99	81					2.70 40.76 Very strong to strong, thickly to thinly banded, light green/grey/white mottled, porphyritic, medium to coarse-grained, GRANITE, fresh to locally slightly weathered. 40.76 Dips are 20° to locally 70°. Discontinuities are medium to closely spaced, rough to locally smooth, planar. Apertures 40.76											
5 5.70 _	100	97	81			<		Venuetron	a to strong	thickly to the	hinly band		y.	5.60	<u>)</u> 37.86				
6 7 7.20	100	97	77	Ē				Dips are 2 closely spare tight to	c, fine-grain y weathere 20° to locall aced, rough o partly ope	ad, GRANI d. y 70°. Disco n to locally s n, very thin	ntinuities mooth, pl brown cla	o locally are mediu anar. Ape y smearin	im to rtures g.						
8 8.70	100	97	90																
9	100	77	61	Ł		6		8.73-8.79r 8.88-8.99r	m - Modera m - Modera	tely weather	red, slight red, slight	weakenir weakenir	ig. ig.						
	(S		. 70	~					Water	Casing	Sealed	Rice	Time	WA	FER ST	RIKE	DETAILS		
lole cas	ed (0.00-2	2.70r	n.					Water Casing Sealed Rise Time Co Strike Depth At To (min) Co							Comments			
	A								Data	Hole	Casing	Depth	GROUNDWATER DETAILS						
Date	AII ר		enth	RZ Top	R7 Rasa	•	Type	<u>e</u>	Date	Depth	Depth	Water		nment	5				
Date Tip Depth RZ Top RZ Base Typ							.,,,,,	-											



REPORT NUMBER

12	_	/																		
CO	NTR/	ACT	N	6 Ga	alway City	/ Transpo	rt Projec	t - Phase 3	se 3					NO	BH3/22R Sheet 2 of 2					
CO GR	ORE	DINA [.] D LE	tes Vel	(mO	527,60 727,19 D)	6.92 E 1.08 N 43.46		RIG TYPE			Casagrar Air/Mist	nde DATE	E DRILL E LOGG	ED ED	D 05/03/2016 D 10/03/2016					
CLI ENC	CLIENT Galway County Council ENGINEER ARUP								INCLINATION (deg) -90 I CORE DIAMETER (mm) 80						IGSL D. O'Shea					
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture cing og m) 500 500	Non-intact Zone	5		Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)			
- 10 	10.20	100	95	81		5		+ Very stror porphyrition + Dips are 2 closely sp are tight t + Very stror	Very strong to strong, thickly to thinly banded, dark green, porphyritic, fine-grained, GRANITE, fresh to locally moderately weathered. Dips are 20° to locally 70°. Discontinuities are medium to closely spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing. (continued) 11.60 31.86											
- 12 - 13 - 13	13.20	100	100	93		5	40 + + + 70 + +	+ green/gre + coarse-gr + weathere + Dips are 2 + closely sp + are tight t	green/grey/white mottled, porphyritic, medium to coarse-grained, GRANITE, fresh to locally slightly weathered. Dips are 20° to locally 70°. Discontinuities are medium to closely spaced, rough to locally smooth, planar. Apertures are tight to partly open, very thin brown clay smearing.											
- - - - - - - - - - - - - - - - - - -	14.70	100	97	97	E			+] +] +] +]												
15 16 17 18 19 REI	15.30 MAR	100 KS	100	87				+End	of Borehole	e at 15.30 m	Secled	Pige	Timo	15.30 WAT	28.16	RIKE	DETAILS			
Hol	e ca	sed ().00-2	2.70r	m				Water Casing Sealed Rise Time (min)						Comments No water strike recorded					
									GROUNDWATER						DETAILS					
	TAL Date		ON D	ETA epth	ILS RZ Top	RZ Base	-	уре	Date	Depth	Depth	Depth to Water	Water Comments							



REPORT NUMBER

со	NTR	АСТ	N	6 Ga	alway City	r Transpo	ort Pro	oject -	Phase 3				DR	ILLHOL	E NO	BH	3/23R		
со	CO-ORDINATES 527,773.63 E 727,346.05 N									RIG TYPE Casagrande						Sheet 1 of 2) 24/02/2016) 24/02/2016			
CLIENT Galway County Council									FLUSH Air/Mist INCLINATION (deg) -90					ILLED E	BY	IGSL			
EN	ENGINEER ARUP						CORE DIA	METER (m	m)	80	LO	GGED E	ЗҮ	D	. O'She	a			
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing pg m) 500	Non-intact Zone	Legend			Description					Elevation	Standpipe Details	SPT (N Value)	
- 0									SYMMETI as clayey	RIX DRILLI gravelly co	NG: No rec bbles	overy, ob	served by	driller	2.80	24.13			
- 3									SYMMETI as sandy (SYMMETI as greenis	RIX DRILLI gravelly cla RIX DRILLI	NG: No rec y with occa NG: No rec	overy, ob sional col	served by obles served by	driller driller	3.70	_23.23			
- 4	4.20	100	31	14		, , ,			Very stron green/grey coarse-gra weathered Dips are 2 medium s	g to strong y/white mot ained, GRA 1. 20° to locall paced, roug	, thickly to t ttled, porphy NITE, fresh y 80°. Disco gh to locally	hinly band vritic, mec to locally ontinuities smooth,	ded, light lium to moderate are widel planar.	ely y to	4.20	_22.73			
- - 7	7.20	100	95	91					4.20-5.30	m - Modera	tely weathe	ered, sligh	t weakeni	ng.					
8	8.70	100	100	93	-	6	60 												
9		100	100	100		1	100												
RE	MAR	KS sed (00_/	1 201	n					Water	Casing	Sealed	Rise	Tim	e a	TER S		DETAILS	
	11010 Subbu 0.00 T.EVIII.									Strike	Depth	At	To	(mir	n) Co	ommen No wate	its er strike	erecorded	
														GROUNDWATER DETAILS					
INS	TAL	ATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Depth Wate	to er Co	comments				
24	Date Tip Depth RZ Top RZ Base Type -02-16 5.50 3.50 5.70 50mm SP																		


REPORT NUMBER

10	00	5/																
со	NTR	ACT	N	l6 Ga	alway City	Transpo	ort Pr	oject -	Phase 3				DRIL SHEI	lhole et	NO	BH: She	3/23R et 2 of	2
CO GR	-ORI	DINA [.]	TES	(mO	527,77 727,34 D)	3.63 E 6.05 N 26.93			RIG TYPE			Casagran	de DATE	E DRILL E LOGG	ED ED	24/0 24/0	2/2016 2/2016	3 3
CLI EN	IENT GINE	ER	G	salwa RUP	y County	Council			INCLINATI	ION (deg) METER (m	m)	-90 80	DRIL LOG	LED B	((IG D	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.20							++	End	of Borehole	at 10 20 r	n			10.20	16.73		
11 12 12 13 13 14 14 15 15 16 16 17 17 17 17 18 18 18 18 18 18 18 18 18 18 18 18 18																		
99																		
RE	MAR	KS			1					\ \ /_1	Carling	Contral	Disa	T :	WA	TER ST	RIKE	DETAILS
Hol	e ca	sed ().00-4	4.20r	n.					vvater Strike	Casing Depth	Sealed At	Rise To	i ime (min)	Co	mmen	ts	
															N	lo wate	er strike	e recorded
2											Hole	Casing	Denth to		GR	OUND	VATER	RDETAILS
					R7 Top	R7 Boo	_	Τ\#	ne	Date	Depth	Depth	Water	´ Con	nment	S		
24	-02-	16	5.5	0	3.50	5.70		50mn	n SP									



REPORT NUMBER

1	-	/																
co	NTR	АСТ	N	16 Ga	alway City	rranspoi	rt Pro	oject -	Phase 3				DRIL SHE	.LHOLI ET	E NO	BH: She	3/24R et 1 of	1
CO GR	-ore oun	d Le	TES EVEL	(mO	528,030 727,520 D)	6.05 E 0.61 N 25.16						Knebel	DAT DAT	e drili E logo	LED GED	03/0 03/0	3/2016 3/2016	;
CLI	ent Gine	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (m	m)	-90 80	DRIL LOG	LED B	SY SY	S. D	. Peters . O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0	1.30	100	95	51					SYMMET as TOPSO SYMMET as brown SYMMET as weathe SYMMET as rock Very stror green/dar	RIX DRILL DIL. RIX DRILL gravelly sa RIX DRILL ered rock RIX DRILL ng to strong	ING: No reco ING: No reco ING: No reco ING: No reco ING: No reco Indication of the second Indication of the second Indica	overy, obs overy, obs overy, obs overy, obs ninly banc	served by c served by c served by c served by c led, light	Iriller Iriller Iriller Iriller	0.20 0.40 0.70 1.30	24.96 24.76 24.46 23.86		
3	2.60 3.40	100	100	55					Dips are 2 closely sp are tight to 2.57-2.66	rained, GF d. 20° to locall aced, roug o partly ope m - Clay-fil	ANITE, fres y 70°. Disco h to locally s en, very thin led fracture	ntinuities mooth, pl brown cla	are mediu are mediu anar. Aper ay smearing	m to tures J.				
1	4.30	100	76	52	E				•									
5	5.80	100	100	79	E	77	70										0 0 0 0	
5	7.00	100	93	78		69	90			of Dorohold	ot 7 00 m				7.00	18.16		
9									End		a <i>r</i> .00 m							
REI Hol	MAR e cas	KS sed (0.00-	1.30r	n.					Water	Casing	Sealed	Rise	Time	WA	TER S		DETAILS
			0.00-							Strike	Depth	At	To	(min) Co	lo wate	ts er strike	
NS	ΤΔΙ)ETA	ILS					Date	Hole	Casing	Depth t		GR(SOND/	WATER	DETAILS
03	Date -03-1	6	<u>Tip D</u> 6.5	epth 0	RZ Top 2.50	RZ Base 7.00		Tyr 50mm	pe n SP		Depth	Depth	Water					



REPORT NUMBER

10		/																	
со	NTR/	АСТ	N	6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3					DRILLI SHEE1	HOLE ſ	NO	BH: Shee	3/25R et 1 of	2
CO GR	-ORE	DINA ⁻	res Vel	(mOl	528,73 727,83 D)	4.81 E 3.14 N 12.85			RIG TYPE FLUSH			Comaco Air/Mist	hio	DATE I DATE I	DRILLI	ED ED	26/0 29/0	2/2016 2/2016	3 3
CLI EN	ENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATIO	ON (deg) METER (mi	n)	-90 80		DRILLI LOGG	ED BY	, ,	IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500	Non-intact Zone	Legend			Descrip	lion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 1 - 2 - 3	4.10 5.10 6.70 8.30 9.90	100 100 100	100 93 100	100 73 100			440 		SYMMETF as made g SYMMETF as weathe Very stron grained, L and styloli Dips are 2 medium s Apertures smearing.	RIX DRILLI ground cons red rock g, thick to to IMESTONE tes), fresh 20° to locall paced, roug are tight to	NG: No rec sisting of S NG: No rec thinly bedd E (locally fo to slightly w y 40°. Disc gh to locally partly ope	covery, ob hell & Aug covery, ob ed, blueisl ssiliferous /eathered ontinuities / smooth, n, very thi	serve ger ma serve h dark s, loca · ; are v plana n brov	d by dril aterial	ler ne nert	<u>3.80</u> 4.10	9.05		
RE	MAR	KS														WAT	TER ST	RIKE	DETAILS
Ho	e ca	sed C	0.00-4	1.10r	n.					Water Strike	Casing Depth	Sealed At	Ri:	se o	Time (min)	Co	mmen	ts	
										Cuino	Coput	<i>,</i>		-	<u></u>	N	o wate	er strike	e recorded
																GRO	DUNDV	VATER	R DETAILS
INS	TAL		ON D	ETA	ILS					Date	Hole	Casing		epth to Nater	Com	ment	s		
 	Date	1	Tip D	epth	RZ Top	RZ Base	•	Тур	e										



REPORT NUMBER

10	09	5																
со	NTR	АСТ	N	6 Ga	alway City	/ Transpo	ort Pr	oject -	Phase 3				DRIL SHEE	LHOLE ET	NO	BH: Shee	3/25R et 2 of	2
CO GR	-ORI	DINA	TES	(mO	528,73 727,83 D)	4.81 E 3.14 N 12.85			RIG TYPE			Comacch Air/Mist	nio DATE	E DRILL E LOGG	ED ED	26/0 29/0	2/2016 2/2016	3
CLI EN	ENT GINE	ER	G A	ialwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRIL LOG	LED BY GED BY	(IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture cing og m)	Non-intact Zone	Legend			Descript	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.30	100	100	100					- End	of Borobolo	ot 10 30 m				10.30	2.55		
11																		
13																		
- 15																		
16																		
17																		
18																		
-																		
RE	MAR	KS		I	I				I						WAT	TER ST	RIKE	DETAILS
Ho	e ca	sed ().00-4	4.10r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen o wate	ts er strike	erecorded
											Hole	Casing	Depth to		GRO	DUND	VATER	RDETAILS
INS	Date		ON D	epth	ILS RZ Top	RZ Bas	e	Ту	pe	Date 29-02-16	10.30	<u>Depth</u> 4.10	9.60	Y Com	nments level m	Seasured	10 mins :	after end of



REPORT NUMBER

		/				-							001					
cc	ONTR	ACT	N	6 Ga	alway City	/ Transpo	rt Pro	oject -	Phase 3				SHE	ET	= NO	BH: She	3/26R et 1 of	2
CC	D-ORI		TES	(528,81 727,92	6.97 E 0.32 N			RIG TYPE			Comacch		e drili E logo	LED	15/0 25/0	2/2016 2/2016	3
CL	IENT		G	(mo ialwa	y County	Council			FLUSH	ON (deg)		Air/Mist -90	DRI	LLED B	Y	IG	SL	-
EN	GINE	ER	A	RUP	1				CORE DIA	METER (mr	n)	80	LOC	GED B	Y	D.	O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	eture cing pg m) 500	Non-intact Zone	Legend			Descript	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMET as made g SYMMET	RIX DRILLI ground cons RIX DRILLI	NG: No rec sisting of sh NG: No rec	covery, obs nell & auge covery, obs	erved by er material served by	driller driller	0.40	14.02		
- 1									as rock									
Ē							/		Medium s	trong to ver	v strong, th	nick to thinl	v bedded		1.40	13.02		
Ē	1.90	100	82	26			/		blueish da fossiliferoi	ark grey, fin us. localize	e grained, l d chert and	LIMESTON	VE (locally slightly to	, D				
2									locally mo	derately we	eathered.	, , , , , , , , , , , , , , , , , , ,	, , ,					
-		100	100	84					Dips are h	orizontal to	locally ver	tical. Disco h to locally	ontinuities	are olanar				
- 3			100	01		-			to occasio	nally undul	ose. Apertu	ures are tig	ht to wide	, ,)				
Ē	3.50					-		<u> </u>		y graver mit	su, robully c			.).				
Ē	3.70	100	100	100		F												
4						Ē												
		100	94	81														
-	5 10																	
- 5	5.10						/											
-		100	100	78				<u> </u>										
- 6	6 20					5	50											
-	6 60	100	100	100	-													
Ē	0.00																	
7																		
Ē		100	98	84				╞┼┰										
Ē.																		
Ē	8.20																	
Ē	8 90	100	97	77														
- 9	9.10	100	100	100		-												
Ē		67	47	47		4			9.30-9.83r	m - Clay/gra	avel-filled fr	racture - so	ome grave	l is				
16	10.00)				4			i lounded.									
/8/21		KS	2 00 /	1 40	~					Water	Casing	Sealed	Rise	Time	WA	TER ST	RIKE	DETAILS
	le ca	sea	J.00-	1.401	n.					Strike	Depth	At	То	(min	j Co	mmen	ts	
spj igsi															N	o wate	er strike	e recorded
8963.6																ייםאו וכ		
MOL INS	STAL	LATI	ON D	ETA	ILS					Date	Hole	Casing	Depth	to Coi	nment	S		
C EI	Date		Tip D	epth	RZ Top	RZ Base	•	Тур	De		Depth	Depth	vvate					
IGSL F																		



REPORT NUMBER

10		55																
co	NTR	ACT	N	16 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DRILI SHEE	lhole T	NO	BH: She	3/26R et 2 of	2
CO GR	ORI	dina Id Le	TES EVEL	(mO	528,81 727,92 D)	6.97 E 0.32 N 14.42			RIG TYPE			Comacch Air/Mist	DATE	DRILLI LOGG	ED ED	15/0 25/0	2/2016 2/2016	3 3
CL EN	IENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mi	n)	-90 80	DRILI	LED BY GED BY	, ,	IG D	SL . O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 0 500	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10		_			-				10.40-10.	60m - Clay/ of Borehole	′gravel-fille at 10.70 r	d fracture n			<u>10.70</u>	3.72		
13																		
- - - - - - - - - - - - - - - - - - -																		
- 17 - 17 - 18 - 18 - 19																		
										1								
RE	MAR	RKS	2.00	1 40	~					Water	Casing	Sealed	Rise	Time	WAT	TER ST	FRIKE	DETAILS
Ho	ie ca	ised (J.00-	1.40r	n.					Strike	Depth	At	To	(min)	Co N	mmen o wate	ts er strike	e recorded
:											Holo	Casing	Donth t-	.	GRO	DUND	VATEF	RDETAILS
	STAL Date	LATI	ON D	epth	ILS RZ Top	RZ Base	9	Ту	pe	Date 25-02-16	Depth 10.70	Depth 1.40	6.80	Water	iments level m	S easured	10 mins	after end of
L						1				1	1		1					



REPORT NUMBER

12		1															
со	NTR	ACT	N	l6 Ga	alway City	Transpo	rt Pro	oject - Phase 3				DRII SHE	.LHOLE ET	NO	BH: She	3/27R et 1 of	2
CO GR		DINA D LE	TES EVEL	(m0	528,960 728,133 D)	0.43 E 3.26 N 9.10		RIG TY	PE		Casagrar Air/Mist	ide DAT	E DRILL E LOGG	ED	12/0 13/0	4/2016 4/2016	5 5
CL EN	IENT GINE	ER	G A	alwa RUP	ay County	Council		INCLINA CORE I	ATION (deg) DIAMETER (mi	m)	-90 80	DRI	LED B	Y Y	IG D	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing og m) 500	Non-intact Zone	Legend		Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0	1.00							SYMM as clay 	ETRIX DRILLI	NG: No reco	overy, obs	erved by o	driller driller	0.80	8.30 8.10		
		93	93	93		1	350	As weather	thered rock n strong to ver dark grey, fin erous, localize ered.	ry strong, thi e grained, L d chert and	ck to thinly IMESTON stylolites),	y bedded, IE (locally slightly	/				
- 2	2.50				-		(Dips and to med Apertu smeari 2 90-3	re 20° to locall ium spaced, ro res are tight to ng. 00m - Clav-fill	y 40° & 80°. ough to loca partly open	Discontin lly smooth , very thin	uities are ı, planar. brown cla	widely iy				
- 4	4.00	100	87	87		9	130		oom - Olay-Illi								
	5.00	100	84	64			(<u>-</u>)(4.31-4	53m - Clay-fill	ed fracture							
6	6.00	100	85	76	E.	7	20 Kar	5.72-5	86m - Clay-fill	ed fracture							
- 7	7.00	100	91	82				6.36-6.	51m - Clay-fill 32m - Clay-fill	ed fracture ed fracture							
8	8.00	90	75	70	_	1	080										
	9.00	100	80	30			K : . /	8.59-8	71m - Clay-fill	ed fracture							
		20	20	20		4		9.24-1	1.05m - Clay-fi	illed fracture							
RE	MAR	KS												WA	TER ST	RIKE	DETAILS
Ho	le ca	sed (0.00-	1.00r	n.				Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co N	o wate	ts er strike	e recorded
	TA1								D-1-	Hole	Casing	Depth t	0 0	GRU			
	Date		Tip D	epth	RZ Top	RZ Base	•	Туре		Depth	Depth	Water	Con	liment	5		
5																	

1	A	1													R	EPORT	NUM	BER
(V)	571 165)		(GEOT	ECI	HNIC	CAL CO	RE LOG	RECO	RD				1	896	3
СС	ONTR	АСТ	N	16 Ga	alway City	/ Transpo	ort Pr	oject -	Phase 3					HOLE	NO	BH3 Shee	3/27R	2
CC GR)-ORI	dina Id Le	TES	(mO	528,96 728,13 D)	0.43 E 3.26 N 9.10			RIG TYPE			Casagrand	de DATE	DRILLE LOGGE	ED ED	12/04 13/04	4/2016 4/2016	2 }
CL EN	IENT GINE	ER	G	alwa RUP	ay County	/ Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRILL LOGG	ED BY		IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture icing og im) 0 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.50	92	58	58	-		750								11 00	0.70		
E 10	11.80								End	of Borehole	at 11.80 m	1			11.80	-2.70		
13 14 15 16 17 17 18																		
^{1/8/2}		KS	0.00	1 00	1			1		Water	Casing	Sealed	Rise	Time	WAT	FER ST	RIKE	DETAILS
18963.GPJ IGSL.GDT	ie ca	sed	0.00-	1.001	п.					Strike	Depth	At	To	(min)	Co N GRC	o wate	ts r strike VATEF	e recorded
	STAL	LAT		ETA	ILS					Date	Hole Depth	Casing Depth	Depth to Water	Com	ment	S		
IGSL RC F	Date	e	Tip D	epth	RZ Top	RZ Bas	e	Ту	pe									



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12	-	/																	
со	NTR	ACT	N	16 Ga	alway City	/ Transpo	ort Pr	oject -	Phase 3				DF SH	RILLH IEET	OLE	NO	BH3 Shee	3/28R et 1 of	1
CO GR	-ORE OUN	d Le	TES EVEL	(mO	529,13 728,22 D)	0.20 E 1.35 N 18.86			RIG TYPE FLUSH			Casagrar Air/Mist	nde DA	TE DI	RILLE	ED ED	11/04 12/04	4/2016 4/2016	6 6
CLI EN	ENT GINE	ER	G A	Galwa RUP	ay County	/ Council			INCLINATION CORE DIA	ON (deg) METER (mr	n)	-90 80	DF	RILLE	D BY D BY	, ,	IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture icing og im) 0 500	Non-intact Zone	Legend			Descrip	tion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0									SYMMETI as gravelly SYMMETI as gravelly	RIX DRILLI y clay RIX DRILLI y cobbly cla	NG: No red NG: No red y	covery, obs	erved by	/ drille / drille	ər ər	1.20	17.66		
3									SYMMETI as weathe	RIX DRILLI ered rock	NG: No red	covery, obs	erved by	/ drille	er	3.00	15.86		
5	4.10 5.60	97	97	94	P		540 X :=		Medium s blueish da fossiliferou weathered Dips are 2 to medium Apertures	trong to ver ark grey, fin us, localize d. 20° to locall n spaced, ro are tight to	y strong, the grained, d chert and y 40° & 80° ough to loc partly ope	nick to thin LIMESTON d stylolites) °. Discontir ally smooth n. very thir	y bedde NE (local , slightly nuities ar n, planar brown o	d, ly e wide	ely	4.10	14.76		
6	7.20	100	100	89			550.000		smearing. 4.64-4.78r	m - Clay-fill	ed fracture								
8	8.70	100	100	100			1330												
9	9.60	100	84	57					8.98-9.01r End d	m - Clay-fill	ed fracture at 9.60 m					9.60	9.26		
RE	MAR	KS	1	1	1			1			-					WAT	ER ST	RIKE	DETAILS
Hol	e ca	sed	0.00-4	4.10r	m.					Water Strike	Casing Depth	Sealed At	Rise To	(r	ime min)	Co	mment o wate	ts r strike	e recorded
										l						GRO	OUNDV	VATER	R DETAILS
INS	TAL Date		ON D Tip D	ETA epth	ILS RZ Top	RZ Bas	e	Тур	De	Date	Hole Depth	Casing Depth	Depth Wat	i to er	Com	ments	6		



REPORT NUMBER

CONTRACT	N6 (Galway City	/ Transpor	t Projec	t - Phase 3				DRIL SHE	LHOLE ET	NO	BH3 Shee	3/29R et 1 of	1
CO-ORDINA	ATES EVEL (m	529,48 728,33 CD)	9.29 E 4.05 N 13.73		RIG TYPE			Comacch	nio DATE	E DRILL E LOGG	ED ED	11/0 12/0	2/2016 2/2016	5
CLIENT	Galv ARU	vay County P	/ Council		INCLINATI	ON (deg) METER (mr	n)	Air/Mist -90 80	DRIL LOG	LED B	r r	IG D.	SL O'She	ea
Downhole Depth (m) Core Run Depth (m) T.C.R.%	S.C.R.%	Frac Spa Lo (m	cture cing og im) 0 500	Non-intact Zone	2		Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 0 1 2 2 3 3 4 4 4 4 10 4 4 4 10 4 4 10 4 4 10 10 4 4 10 10 6 6 6 3 10 10 10 10 10 10 10 10 10 10	0 97 90 0 93 60 0 93 61 0 73 33 0 85 83 0 63 44 0 63 44 0 63 44 0 0.00-2.80 30				SYMMET as made of SYMMET as rock Medium s blueish da blueish da blueish da blueish da blueish da blueish da blueish da slightly we Undulose moderatel slight iron	RIX DRILLI ground cons RIX DRILLI trong to ver ark grey, fin us, localize sathered. horizontal to bsely space to locally pl y open, wit -oxide stain	NG: No reco sisting of she NG: No reco y strong, thi e grained, L d chert and s o locally verti ed, rough to anar. Apertu h very thin b ing.	overy, obs ell & auge overy, obs ck to thinl IMESTON stylolites), cal. Disco occasiona ires are tig rown clay	erved by d er material served by d y bedded, JE (locally fresh to loc pontinuities a ally smooth ght to r smearing, r smearing, Rise To	riller riller ocally are , Time (min)	2.70 2.80 6.90	11.03 10.93 6.83	RIKE I	DETAILS
SPJ IGSL											N	o wate	r strike	e recorded
963.6														
18(11-1-	Casim			GRO	DUNDV	VATER	DETAILS
	ION DET	AILS				Date	Hole Depth	Casing	Depth to Water	Con	nment	S		
Date	Tip Dept	h RZ Top	RZ Base		Гуре	12-02-16	6.90	2.80	3.70	Wate drillin	r level m g	easured	10 mins a	after end of



REPORT NUMBER

	-	/																
cc	DNTR	АСТ	N	6 Ga	alway City	[,] Transpo	rt Pro	oject -	Phase 3				DRI She	LLHOLI ET	e no	BH: Shee	3/30R et 1 of	1
GR)-ORI	DINA D LE	TES	(mO	531,04 728,50 D)	1.18 E 9.06 N 23.76						Casagrar	nde DAT	e drili E logo	LED GED	29/0 29/0	2/2016 2/2016	3
CL EN	IENT GINE	ER	G A	ialwa RUP	y County	Council		_	INCLINATIO	ON (deg) METER (mi	n)	-90 80	DRI	LLED B GED B	SY SY	IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMETI as made <u>c</u>	RIX DRILLI ground con	NG: No rec sisting of co	overy, obs oncrete cla	erved by o y and wire	driller 9	1.60	22.16		
2									SYMMETI as gravelly	RIX DRILLI y cobbly cla	NG: No rec	overy, obs	erved by	driller	2.40	21.36		
	2.70 3.30	83	32	0					SYMMETI as weathe Possible v and cobbl	RIX DRILLI ered rock veathered r es of limes	rock - recov	overy, obs ered as ar	served by o	ariller vel	2.70 3.30	21.06		
Ē	3.80	0	0	0					No recove	ery - driller r	notes clay b	and			3.80	19.96		
4	4.20	100	85	52					Very stron grained, L and styloli	ig, thick to t IMESTONI ites), fresh	thinly bedde E (locally fo to slightly w	ed, blueish ssiliferous eathered.	dark grey , localized	, fine chert				
5	5.70	67	54	51	F	4			Dips are 2 medium s Apertures smearing. 4.16-4.40r 4.57-5.01r	20° to locall paced, roug are tight to m - Clay-fill m - Clay-fill	y 40°. Disco gh to locally partly oper ed fracture	ontinuities v smooth, p n, very thin	are widely blanar. brown cla	y to ay				
6	7.00	100	93	89			<i>k</i>											
- 7	8.00	100	56	56		4			7.22-7.75	m - Clay-fill	ed fracture				8.00	15.76		
9 9										or borehole	ະ at 8.00 M							
1/8/1	MAR	KS			1						0	0	D:	 .	WA	TER ST	RIKE	DETAILS
8963.GPJ IGSL.GDT HO	le ca	sed ().00-4	4.20r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min		o wate	ts er strike	
	STAI	וד	ם אט	FTA	II S					Date	Hole	Casing	Depth t		mment			DETAILS
	Date		Tip D	epth	RZ Top	RZ Base	•	Ту	De		Depth	Depth	Water		minerit			
<u>u</u>										1	1		1					



REPORT NUMBER

CONTRAC	T N	6 Ga	lway City	Transpo	ort Pro	oject - F	Phase 3				DR	ILLHOL	E NO	BH	3/31R	
CO-ORDIN	ATES		531,274	4.12 E							SH			She	et 1 of 1	1
GROUND L	.EVEL ((mOl	728,424)	4.27 N 11.08			RIG TYPE FLUSH			Casagra Air/Mist	nde DA	TE DRIL	GED	25/0 25/0	2/2016	
CLIENT ENGINEER	G Al	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (mn	n)	-90 80	DR LO	ILLED E GGED E	BY BY	IG D	SL . O'She	а
Downhole Depth (m) Core Run Depth (m) T C R %	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 	Non-intact Zone	Legend			Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 1 2 3 5 5.70 10	0 84	63			<u> </u>		SYMMETR as gravelly SYMMETR as grey sil SYMMETR as weathe Medium st blueish da fossiliferot locally mo	RIX DRILLII y clay RIX DRILLII ty gravelly of RIX DRILLII ty gravelly of trong to ver irk grey, find us, localized derately we	NG: No recc NG: No recc clay NG: No recc th clay band y strong, thi e grained, L1 d chert and s athered.	very, obs very, obs very, obs s s ck to thin MESTOI stylolites)	served by served by served by ly bedded NE (locall l, slightly t	driller driller driller	2.70 5.20 5.70	5.88	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
7 7.20 8 10	0 63	45			590		Dips are h medium to to occasio locally clay 6.17-6.40r 7.34-7.74r 7.93-8.20r	orizontal to o closely spa nally undulo y/gravel fille m - Clay/gra m - Clay/gra m - Clay/gra	locally verti aced, rough ose. Apertur d. avel-filled fra avel-filled fra	cal. Disc to locally es are tig icture icture icture	ontinuities / smooth, ght to wide	s are planar e,			0 0 0 0 0 0 0 0 0 0 0 0 0 0	
9 9 10.00	0 48	29					8.54-8.58r 9.00-9.46r 9.70-10.00	m - Clay-fille m - Clay/gra 0m - Clay/gr	ed fracture avel-filled fra ravel-filled fr	octure racture			10.00	1.08		
REMARKS			•	I.			End o	f Borehole	at 10.00 m	Costa		T :	WA	TER S		DETAILS
Hole cased	0.00-5	ō.70r	n.					vvater Strike	Depth	Sealed At	Kise To	(mir		ommen lo wate	ts er strike	recorded
									Hole	Casing	Donth	to	GR	OUND	VATER	DETAILS
INSTALLA		ETA		07.0		-		Date	Depth	Depth	Wate	er Co	omment	s		
Date	9.00	epth D	5.00	10.00	;	50mm	e SP									



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10		/																
со	NTR	АСТ	N	16 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				DRIL SHEE	LHOLE ET	NO	BH: She	3/32R et 1 of	3
CO GR		DINA ID LE	TES	(mO	531,97 728,31 D)	1.12 E 7.72 N 24.43			RIG TYPE FLUSH			Knebel Air/Mist	DATE	DRILL	ED ED	18/0 19/0	2/2016 2/2016	5
CL EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRIL	LED B GED B	((S. D	. Peters . O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing 9g m) 500	Non-intact Zone	Legend			Descript	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 1 2 3 4 5 6 7 8 9 9 18/2/1 1 1 1 1 1 1 1 1 1 1 1 1 1	MAR le ca		2.00-2	24.60	Dm.				Hole com	RIX DRILLI ground cons	Shell & Aug	per drilling overy, obs nell & Augu	erved by d er material	riller	5.40 WA	19.03		DETAILS
Ho	le ca	sed (0.00-2	24.60)m.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
										16.50 24.00	16.50 24.00	21.00 N/S	15.80 19.80	5 5	N	Slow lodera	te	
8963.0																יחואוור		
≍ ≥//INIC	STA1		ם אט	FT4	IIS					Date	Hole	Casing	Depth to					DETAILS
	Date			epth	RZ Top	RZ Base		Tvr	be	Date	Depth	Depth	Water		ment	3		
ראר 19 פצר אר)-02-	16	14.0)0	7.00	15.00	-	50mn	n SP									



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1	-	/																
со	NTR	ACT	N	l6 Ga	alway City	r Transpo	rt Pro	oject -	Phase 3				DRII SHE	LHOLE ET	NO	BH: She	3/32R et 2 of	3
CO GR	-ORI	d Le	TES EVEL	(mO	531,97 728,31 D)	1.12 E 7.72 N 24.43			RIG TYPE FLUSH			Knebel Air/Mist	DAT DAT	e drill E logg	.ED GED	18/0 19/0	2/2016 2/2016	3 3
CLI	ENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRII LOG	LED B	Y Y	S. D	. Peters . O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10									SYMMETI as made ((continued SYMMETI as brown SYMMETI as orange	RIX DRILLI ground cons t) RIX DRILLI grey sandy RIX DRILLI brown silty	NG: No rec sisting of SI NG: No rec gravelly cla NG: No rec clay	overy, obs nell & Aug overy, obs ay overy, obs	served by c er material served by c served by c	driller driller driller	<u>10.50</u> 11.20	13.93 13.23		
- 12																	0 0 0 0 0 0 0 0	N = 50/240 mm (5, 8, 11, 16, 15, 8)
- 14																		N = 50/220 mm (7, 11, 15, 19, 16)
- 16									SYMMETI as brown	RIX DRILLI sandy silt	NG: No rec	overy, ob	served by c	driller	15.60	8.83		(9, 14, 17, 21, 12)
- 17								× × × × × × × × × × × × × × × × × × ×										N = 35 (4, 6, 7, 7, 9, 12)
- 18																		N = 50/210 mm (6, 7, 9, 13, 28) N = 50/230 mm (7 10 10 14
RE	MAR	KS	1	L	I										WA	TER S		DETAILS
Hol	e ca	sed (0.00-2	24.60)m.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
										16.50 24.00	16.50 24.00	21.00 N/S	15.80 19.80	5 5 5	N	Slow Iodera	te	
										l					GR		VATER	RDETAILS
INS	TAL	LATI		ETA	ILS					Date	Hole	Casing	Depth t	O Cor	nment	s		
19	Date -02- ′	16	Tip D 14.0	epth)0	RZ Top 7.00	RZ Base 15.00	•	Тур 50mm	e I SP	-			vvalel					



REPORT NUMBER

CONTRACT	F N6 G	alway City	/ Transpo	rt Pro	ject -	Phase 3				DRIL SHE	.LHOLE ET	NO	BH: Shee	3/32R et 3 of	3
CO-ORDIN	ATES EVEL (mC	531,97 728,31 DD)	1.12 E 7.72 N 24.43			RIG TYPE FLUSH			Knebel Air/Mist	DATI	e drill E logg	ED ED	18/0 19/0	2/2016 2/2016))
CLIENT ENGINEER	Galw ARUI	ay County ⊃	/ Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRIL LOG	LED BY GED BY	((S. D.	Peters O'She	sen ea
Downhole Depth (m) Core Run Depth (m) T.C.R.%	S.C.R.% R.O.D.%	Frac Spa Lo (m	cture icing og im) 0 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20 21 21 22 23						SYMMETI as dark gr	RIX DRILLI ey slightly s	NG: No rec ilty clay	overy, obs	erved by d	Iriller	20.40	4.03		17, 9) N = 50/155 mm (9, 13, 22, 25 3) N = 50/170 mm (11, 14, 17, 26, 7)
24 24.60 25 67	· 55 48		K			SYMMETI as grey ro Medium s blueish da fossiliferoi locally mo	RIX DRILLI ick trong to ver ark grey, find us, localized iderately we	NG: No rec y strong, th e grained, l d chert and eathered.	overy, obs ick to thinl IMESTON stylolites),	erved by d y bedded, IE (locally slightly to	Iriller	<u>23.80</u> 24.60	0.63		
25.80						Dips are 4 locally sm very thin b 25.01-25. End o	40°. Discont ooth, plana orown clay s 66m - Grave of Borehole	inuities are r. Aperture smearing. el-filled frac at 25.80 m	n medium s s are open xture	paced, rou to partly o	igh to pen,	25.80	-1.37		
REMARKS						•		O a size	Casta	D:	T '	WA	TER ST	RIKE	DETAILS
Hole cased	0.00-24.6	0m.					vVater Strike 16.50 24.00	Casing Depth 16.50 24.00	Sealed At 21.00 N/S	Rise To 15.80 19.80	l ime (min) 5 5	Co N	ommen Slow Ioderat	ts te	
								Holo	Casing	Donth 4		GRO	DUNDV	VATER	DETAILS
Date 19-02-16	TION DETA Tip Depti 14.00	AILS RZ Top 7.00	RZ Base 15.00	: 	Тур 5 0mm	be 1 SP	Date 19-02-16	25.80	Depth 24.60	14.65	Com Water	nment: · level m	S easured	start last	day drilling



REPORT NUMBER

со	NTR/	ACT	N	6 Ga	alway City	Transpor	rt Proi	ect - Ph	nase 3				DRI	LLHOLE	E NO	BH	3/33R	2
0			TES		532 10	2 03 E							SHE	ET		Shee	et 1 of	2
GR		DLE	EVEL	(mO	728,30 D)	6.15 N 35.63		R FI	IG TYPE LUSH			Knebel Air/Mist	DAT DAT	e drill E logo	.ED SED	17/0 18/0	2/2016 2/2016	6 6
CL EN	IENT GINE	ER	G A	ialwa RUP	y County	Council		IN C	ORE DIA	ON (deg) METER (mr	n)	-90 80	DRI	LLED B GED B	Y Y	S. D.	Peter O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMETF as TOPSC SYMMETF as brown (SYMMETF	RIX DRILLI DIL. RIX DRILLI grey silty sa	NG: No rec NG: No rec andy gravel NG: No rec	overy, obs overy, obs overy, obs	served by o	driller driller	0.30 2.70	35.33		
3	5.10	100	97	88		2			as possible andy grav SYMMETF as rock Medium st blueish da ossiliferou ocally mo	e weathere vel with col RIX DRILLI rrong to ver rk grey, fin us, localize derately we	ed rock reco obles NG: No reco y strong, th e grained, L d chert and eathered.	overy, obs ick to thin IMESTOI stylolites)	served by o served by o y bedded, NE (locally , slightly to	y silty driller	4.40	.31.23 .30.53		N = 50/235 mm (11, 14, 26, 19, 5, 0)
7	6.60 8.10	100	94	72					Dips are h nedium to o occasio ocally clay	orizontal tc o closely sp nally undul y-filled.) locally vert aced, rough ose. Apertu	ical. Disc n to locally res are tiç	ontinuities v smooth, p pht to wide	are blanar ,				
9	9.60	100	100	95			40.00000											
	MAR	KS	0 00 4	5 10-		.				Water	Casing	Sealed	Rise	Time	WA	TER ST	RIKE	DETAILS
		seu (0.00-0	5. 101						Strike	Depth	At	To	(min)	N	ommen lo wate	ts er strike	e recorded
1896											1				GRO	DUNDV	VATEF	R DETAILS
	STAL	LATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Depth t Water	O Cor	nment	s		
IGSL RC F	Date		Tip D	epth	RZ Top	RZ Base		Туре										



REPORT NUMBER

со	NTR	ACT	N	l6 Ga	alway City	r Transpoi	rt Proj	ect -	Phase 3				DRI	LHOLE	NO	BH3	3/33R	
со	-ORE	DINA	TES		532,10	2.93 E							SHE DAT	ET E DRILL	ED	Shee 17/0	et 2 of 2/2016	2
GR	OUN	D LE	VEL	(mO	728,300 D)	6.15 N 35.63			RIG TYPE FLUSH			Knebel Air/Mist	DAT	E LOGG	ED	18/0	2/2016	6
CLI ENC	ENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mi	m)	-90 80	DRII LOG	LED B	(S. D.	Peters O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.60	100	100	92					Medium si blueish da fossiliferoi locally mo	trong to ver ark grey, fin us, localize derately we	ry strong, thi e grained, L d chert and eathered.	ck to thin IMESTON stylolites)	ly bedded, NE (locally , slightly to	1				
- 11	11.90	100	98	94	F				Dips are h medium to to occasio locally clay	orizontal to closely sp nally undul y-filled. <i>(co</i>	o locally vert baced, rough lose. Apertu <i>ntinued)</i>	ical. Disco to locally res are tig	ontinuities smooth, p ght to wide	are Ilanar				
12	13.10	100	100	88		58	80											
- 14	14.70	100	73	63					13.80-14.(08m - Mode	erately weat	hered, sli	ght weaker	ning.				
- 15	16.00	100	88	77		62	20.00000	000000	14.88-15.0	04m - Clay-	-filled fractu	e						
- 16	17.00	100	99	90		77	79.99999								17.00	18.63		
- 17 - 18 - 18 - 19									End	of Borehole	e at 17.00 m							
REI	MAR	KS		I						101-4	Casta	One la la la	Disc	T :	WAT	FER ST	RIKE	DETAILS
Hol	e ca:	sed (0.00-5	5.10r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co N	o wate	ts r strike	
INS	TAL	LATI	ON D	ETA	ILS					Date	Hole	Casing	Depth t	⁰ Con	ment	S		DE I MILO
Date Tip Depth RZ Top RZ Base Typ									be	18-02-16	11.90	10.60	5.10	Water	r level m	easured	start last	day drilling



REPORT NUMBER

	NTR	АСТ	N	6 Ga	alwav Citv	Transpo	ort Pro	piect -	Phase 3				DRI	LHOLE	NO	BH	3/34R	2
:0-	-ORF		TES		532.40	4 98 F		,	-				SHE	ET		She	et 1 of	2
GRO		DLE	VEL	(mO	728,27 D)	5.25 N 32.57			RIG TYPE FLUSH			Casagraı Air/Mist	nde DAT	e drill E logo	ED ED	18/0 23/0	2/2016 2/2016	8 8
	ent Sine	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mi	n)	-90 80	DRI LOC	LLED B	Y Y	IG D	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 2 3 3 4 5 6 7 8	2.80 4.30 5.80 7.30	100 100 100	100 100 100	95 87 94 95			710 590.0000 4 3 2 4 1460		SYMMETI as clayey SYMMETI as rock Medium si blueish da fossiliferou locally mo Dips are h medium to to occasio locally clay	RIX DRILLI gravelly co RIX DRILLI trong to ver ark grey, fin us, localize derately we horizontal to b closely sp mally undul y-filled.	NG: No reco bbles NG: No reco ry strong, thi e grained, L d chert and eathered. o locally vert aced, rough ose. Apertu	overy, obs ck to thinl IMESTON stylolites) ical. Disco to locally res are tig	served by y bedded, vE (locally smooth, j ht to wide	driller driller are olanar	2.30	. 30.27	Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y / A Y /	
9 RFN	MAR	100	100	94											WAT	IFR ST	0 0 0 0	DETAILS
Hole	e cas	sed ().00-2	2.80r	n.					Water Strike	Casing	Sealed	Rise	Time	Co	mmen	ts	
										JUINE			10	(11111)	N	lo wate	er strike	e recorded
													1		GRO		VATEF	RDETAILS
NS'	TALI	LATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Depth Water	O Cor	nment	s		
[23-	Date -02-1	16	Tip De 16.0	epth 0	RZ Top 8.50	RZ Base 17.40	e	Typ 50mm	ne SP									
	XO XO XI INI (u) utden eloquitivon 0 1 2 3 4 5 6 7 8 9 El dol NS 3 4 5 6 7 8 9 El dol	CONTRA CONTRA	CONTRACT COORDINA FROUND LE INGINEER (III) (III) (III) (IIII) (III) (IIII) (III) (IIII) (III) (IIII) (IIII) (IIIII) (IIII) (IIIIII) (IIII) (IIIIII) (IIII) (IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	CONTRACT N ROUND LEVEL G ROUND LEVEL G IENT G NGINEER A (iii) (iii) (iii) (iii) (iii) (iii) (iii) (iii) (iii) II (iiii) (iiii) (iiii) (iiii) 1 (iiiii) (iiii) (iiii) (iiii) 2 2.880 (iiiii) (iiiii) (iiii) 3 100 100 100 4 4.30 (iiii) (iiii) 5 100 100 100 4 8.80 (iiii) (iiii) 9 100 100 100 7 7.30 (iiii) (iii) 8 100 100 100 9 Date Tip Diate Tip Diate 100 100 100 100 9 Date Tip Diate Tip Diate 100 100 100 100 100 100 1	CONTRACT N6 Ga ROUND LEVEL (mO ROUND LEVEL (mO IENT Galwa NG Participation Salwa NG Participation Salwa Salwa NG Participation Salwa Salwa NG Participation Salwa Salwa Salwa Salwa NG Participation Salwa Salwa Salwa Salwa	CONTRACT N6 Galway City CO-ORDINATES 532,40 FROUND LEVEL (mOD) Same conty SGINEER ARUP Image: Signed conty Signed conty SGINEER ARUP Image: Signed conty Signed conty Image: Signed conty Image: Signed conty <tr< td=""><td>CONTRACT N6 Galway City Transport CO-ORDINATES 532,404.98 E SROUND LEVEL (mOD) 32.57 LIENT Galway County Council NGINEER ARUP (1) (1) (1) (2) (1) (2) (2) (2) (1) (2) (2) (2) (2) (2) (1) (2) (2) (2)</td><td>SONTRACT N6 Galway City Transport Pro IO-ORDINATES 532,404.98 E FROUND LEVEL (mOD) 32.57 ILENT Galway County Council INGINEER ARUP ILIENT Galway County Council ILIENT Galway County Council INGINEER ARUP ILIENT Galway County Council ILIENT Second ILIENT Second ILIENT Second ILIENT ILIENT ILIENT</td><td>SONTRACT N6 Galway City Transport Project - CO-ORDINATES 532,404.98 E 728,275.25 N SROUND LEVEL (mOD) 32.57 ELENT Galway County Council INGINEER ARUP Image: State of the s</td><td>No Galway City Transport Project - Phase 3 CO-ORDINATES 532,404.98 E Rig TYPE Rig TYPE Rig TYPE Rig TYPE Rig TYPE Rig TYPE No Galway County Council No Galway County Council No CORE DA No Core DA O Core DA Symmetria O Core DA O Core DA</td><td>CONTRACT N6 Galway City Transport Project - Phase 3 IO-ORDINATES 532,404.98 E 728,275.25 N Fracture RUP ILLENT Galway County Council INCLINATION (deg) CORE DIAMETER (mod) INCLINATION (deg) CORE DIAMETER (mod) Image: Strain of the strain of th</td><td>SONTRACT NG Galway City Transport Project - Phase 3 CO-ORDINATES 532.404.98 E 728.275.25 N ROUND LEVEL (mOD) RIG TYPE FLUSH INCLINATION (deg) CORE DIAMETER (mm) LIENT Galway County Council ARUP RIG TYPE FLUSH INCLINATION (deg) Descripting CORE DIAMETER (mm) Uii Uii Strature B d d d d d d d d d d d d d d d d d d d</td><td>SONTRACT NG Galway City Transport Project - Phase 3 SO-ORDINATES S22,404.98 E T28,275.26 N Rig TYPE Fullsh Casing ransport Project - Phase 3 RIO TYPE LIENT Galway County Council Galway County Council CORE DIAMETER (mm) BO NGINEER Rup Casing ransport Project - Phase 3 NGINEER Galway County Council Galway Galway Galway</td><td>DONTRACT N6 Galway City Transport Project - Phase 3 PRI CO-RDINATES 532.404.98 E 728.272.52 N RIG TYPE 728.272.52 N Casagrande Al/Mist Dat ROUND LEVEL (mOD) 32.57 RIG TYPE FLUSH Casagrande Al/Mist Dat NOINEER Galway County Council CORE DIAMETER (mm) 80 LOC E E E E Fracture Log 0 E</td><td>DORTRACT NG Galway City Transport Project - Phase 3 DRILLATON DRILLATO</td><td>DOTTACT NG Galway City Transport Project - Phase 3 OR DRILHOLE NO OR 30.ORDINATES 53.2404.98 E T28.275.25 N Rig TYPE Casagrande AirMat NONEER ARUP SCORDINATES 53.27 NonKER AirMat DATE LOGGED NONEER ARUP CORE DIAMETER (nm) 30 Description Rig TYPE Casagrande AirMat NONEER ARUP CORE DIAMETER (nm) 30 Description Rig Type Rig Type</td><td>DORTRACT NG Galway City Transport Project - Phase 3 DRILLHOLE NO DRILLHOULE NO <thdrilhoule no<="" th=""> <thdrillhoule no<="" th=""></thdrillhoule></thdrilhoule></td><td>DORTRACT No Galway City Transport Project - Phase 3 DRUHOLE NO BH3/34 SOCROMATES S32.404.99 E Transport Project - Phase 3 Steel 10 DhTE DRULED Steel 10 Ste</td></tr<>	CONTRACT N6 Galway City Transport CO-ORDINATES 532,404.98 E SROUND LEVEL (mOD) 32.57 LIENT Galway County Council NGINEER ARUP (1) (1) (1) (2) (1) (2) (2) (2) (1) (2) (2) (2) (2) (2) (1) (2) (2) (2)	SONTRACT N6 Galway City Transport Pro IO-ORDINATES 532,404.98 E FROUND LEVEL (mOD) 32.57 ILENT Galway County Council INGINEER ARUP ILIENT Galway County Council ILIENT Galway County Council INGINEER ARUP ILIENT Galway County Council ILIENT Second ILIENT Second ILIENT Second ILIENT ILIENT ILIENT	SONTRACT N6 Galway City Transport Project - CO-ORDINATES 532,404.98 E 728,275.25 N SROUND LEVEL (mOD) 32.57 ELENT Galway County Council INGINEER ARUP Image: State of the s	No Galway City Transport Project - Phase 3 CO-ORDINATES 532,404.98 E Rig TYPE Rig TYPE Rig TYPE Rig TYPE Rig TYPE Rig TYPE No Galway County Council No Galway County Council No CORE DA No Core DA O Core DA Symmetria O Core DA O Core DA	CONTRACT N6 Galway City Transport Project - Phase 3 IO-ORDINATES 532,404.98 E 728,275.25 N Fracture RUP ILLENT Galway County Council INCLINATION (deg) CORE DIAMETER (mod) INCLINATION (deg) CORE DIAMETER (mod) Image: Strain of the strain of th	SONTRACT NG Galway City Transport Project - Phase 3 CO-ORDINATES 532.404.98 E 728.275.25 N ROUND LEVEL (mOD) RIG TYPE FLUSH INCLINATION (deg) CORE DIAMETER (mm) LIENT Galway County Council ARUP RIG TYPE FLUSH INCLINATION (deg) Descripting CORE DIAMETER (mm) Uii Uii Strature B d d d d d d d d d d d d d d d d d d d	SONTRACT NG Galway City Transport Project - Phase 3 SO-ORDINATES S22,404.98 E T28,275.26 N Rig TYPE Fullsh Casing ransport Project - Phase 3 RIO TYPE LIENT Galway County Council Galway County Council CORE DIAMETER (mm) BO NGINEER Rup Casing ransport Project - Phase 3 NGINEER Galway County Council Galway Galway	DONTRACT N6 Galway City Transport Project - Phase 3 PRI CO-RDINATES 532.404.98 E 728.272.52 N RIG TYPE 728.272.52 N Casagrande Al/Mist Dat ROUND LEVEL (mOD) 32.57 RIG TYPE FLUSH Casagrande Al/Mist Dat NOINEER Galway County Council CORE DIAMETER (mm) 80 LOC E E E E Fracture Log 0 E	DORTRACT NG Galway City Transport Project - Phase 3 DRILLATON DRILLATO	DOTTACT NG Galway City Transport Project - Phase 3 OR DRILHOLE NO OR 30.ORDINATES 53.2404.98 E T28.275.25 N Rig TYPE Casagrande AirMat NONEER ARUP SCORDINATES 53.27 NonKER AirMat DATE LOGGED NONEER ARUP CORE DIAMETER (nm) 30 Description Rig TYPE Casagrande AirMat NONEER ARUP CORE DIAMETER (nm) 30 Description Rig Type Rig Type	DORTRACT NG Galway City Transport Project - Phase 3 DRILLHOLE NO DRILLHOULE NO <thdrilhoule no<="" th=""> <thdrillhoule no<="" th=""></thdrillhoule></thdrilhoule>	DORTRACT No Galway City Transport Project - Phase 3 DRUHOLE NO BH3/34 SOCROMATES S32.404.99 E Transport Project - Phase 3 Steel 10 DhTE DRULED Steel 10 Ste



REPORT NUMBER

10	0	/																		
со	NTR	ACT	N	l6 Ga	alway City	/ Transpo	rt Proj	ect -	Phase 3				DRI SHI	llholi Eet	E NO	BH: She	3/34R et 2 of	2		
CO GR		DINA ID LE	TES VEL	(mOl	532,40 728,27 D)	4.98 E 5.25 N 32.57			RIG TYPE FLUSH			Casagra Air/Mist	nde DAT	e dril E log	LED GED	18/0 23/0	2/2016 2/2016) }		
CL EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (m	m)	-90 80	DRI LO	LLED B GGED B	BY BY	D	SL . O'She	ea		
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)		
- 10	10.30	100	100	97	E				Medium s blueish da fossiliferor locally mo Dips are h medium to	trong to ve ark grey, fin us, localize derately we norizontal to closely sp	ry strong, th le grained, l d chert and eathered. o locally ver baced, roug	ick to thin IMESTON stylolites) tical. Disconto to locally	y bedded NE (locally , slightly t ontinuities	, o are planar						
- 12	11.80	100	87	83			70.00000		to occasio locally cla 12.45-12.	y-filled. <i>(co</i>	lose. Apertu ntinued) erately wea	thered. slip	pht to wide	ning.			0 0 0 0 0 0			
- 13	13.30)					00				,	, ~,	,							
14	14.80	100	100	97	-	7	70													
16	16.30	100	100	100	-	7	40.0000										0 0 0 0 0 0 0 0 0 0			
17	17.40	100	100	100		9	 59.99999 	9999997	End	of Borehole	e at 17.40 m	1			17.40	15.17	0 0 0 -			
- 18																				
RE	MAR	KS	1		1		I		·				-		WA	TER S	RIKE	DETAILS		
Ho	le ca:	sed (0.00-2	2.80r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min	e Co N	lo wate	ts er strike			
	TAI	וד א	ם אט	FTA	IIS					Data	Hole	Casing	Depth	to	mment		VAIER	DETAILS		
	Date	16	Tip Do 16.0	epth	RZ Top 8.50	RZ Base 17.40	5	Typ i0mm	n SP		Depth	Depth	Wate	r ^{Co}	mment	3				
2	-																			



REPORT NUMBER

со	ONTR	АСТ	N	l6 Ga	alway City	r Transpo	rt Pro	oject -	Phase 3				DRI	LLHOLE	NO	BH	3/351	R
CO			TES	(m0)	532,85 728,22	0.77 E 5.98 N			RIG TYPE			Knebel	DA1	e drill E drill E logg	.ED	23/0 24/0	2/201 2/201	6 6
CL		ER	G	alwa RUP	y County	Council			FLUSH INCLINATI CORE DIA	ON (deg) METER (mi	m)	Air/Mist -90 80	DRI LOC	LLED B GGED B	Y Y	S	. Pete . O'Sh	rsen nea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 0 500	Non-intact Zone	Legend			Descript	lion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0 		_							SYMMET as TOPSO SYMMET as silty sa	RIX DRILLI DIL. RIX DRILLI ndy graveli	NG: No rec NG: No rec y cobbly cla	covery, ob: covery, ob: ay	served by	driller driller	0.50	17.02		
- 2									SYMMET as silty cla	RIX DRILLI ayey sand	NG: No rec	covery, ob:	served by	driller	2.40	15.12		N = 50/135 mm (11, 14, 17, 33)
4								× × × × × ×										N = 50/10 mm (25, 50) N = 50/195
6									SYMMET as silty cla	RIX DRILLI ayey sand v	NG: No rec vith cobbles	covery, obs and boul	served by ders	driller	6.80	12.22		mm (5, 11, 20, 13, 17) N = 50/0 mm (25, 50)
- 7									SYMMET as silty cla	RIX DRILLI ayey sand v	NG: No rec vith many b	covery, ob: oulders	served by	driller				N = 50/10 mm (25, 50)
9																		N = 50/40 mm (15, 10, 50)
	MAR	KS	0.00	01.00)m					Water	Casing	Sealed	Rise	Timo	WA	TER S	FRIKE	DETAILS
HO	ie ca	sed	0.00-2	21.60	JM.					Strike 4.30 18.50	<u>Depth</u> 4.30 18.50	At 4.40 N/S	15.50	(min) 5	Co S N	ommen Seepag Iodera	ts le te	
8903.1																	***	
	3741	1 1 1		ET 4	11 5					Data	Hole	Casing	Depth	to Cor				N DETAILS
	Date -02-) 16	Tip D 18.0	epth 00	RZ Top 10.50	RZ Base 19.50		Typ 50mm	oe 1 SP		Depth	Depth	Wate					
3																		



REPORT NUMBER

1		/																
со	NTR	ACT	N	l6 Ga	alway City	Transpo	ort Pr	oject -	Phase 3				DRIL SHE	.LHOLE ET	NO	BH She	3/35F et 2 of	R 3
CO GR	-ORI	dina D Le	TES	(mO	532,85 728,22 D)	0.77 E 5.98 N 17.52			RIG TYPE			Knebel Air/Mist	DAT DAT	e drill E logo	.ED SED	23/0 24/0)2/2016)2/2016	5 5
CL EN	IENT GINE	ER	G	alwa RUP	ay County	Council			INCLINATI CORE DIA	ON (deg) METER (mr	m)	-90 80	DRIL LOG	LED B	Y Y	S D	. Peter . O'Sh	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 500	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SYMMET as silty cla	RIX DRILLI ayey sand w	NG: No rec vith many b	covery, obs oulders (C	served by c ontinued)	Iriller				N = 50/85 mm (16, 9, 36, 14)
- 12																		N = 50/15 mm (9, 16, 50)
- 14									- SYMMET as weathe	RIX DRILLI ered rock	NG: No rec	covery, obs	served by c	Iriller	14.50	3.02	0 0 0 0 0 0 0 0 0 0	N = 50/10 mn (25, 50)
- 16																	0 0 0 0 0 0 0 0 0 0	N = 50/15 mm (25, 50)
- - - - - - - - - - - - - - - - - - -																		N = 50/50 mm (21, 4, 50)
- 19																		N = 50/95 mm (16, 9, 42, 8)
RE	MAR	KS		·	1				l						WA	TER S	TRIKE	DETAILS
Ho	le ca	sed	0.00-2	21.60)m.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	ommer	its	
										4.30 18.50	4.30 18.50	4.40 N/S	15.50	5	S N	Seepaç Aodera	je te	
															GR		NATER	RDETAILS
INS	STAL	LATI		ETA	ILS					Date	Hole	Casing	Depth to	D Cor	nment	ts		
24	Date -02-	16	Tip D 18.0	epth 00	RZ Top 10.50	RZ Base 19.50	e	Typ 50mn	oe n SP	-			vvalel					
2										1			1					



REPORT NUMBER

со	NTR	ACT	N	16 Ga	alway City	Transpo	rt Pro	oject -	Phase 3				DRI	LLHOLE	E NO	BH	3/35R	2	
со	-ORI	DINA	TES		532,85 728,22	0.77 E 5.98 N			RIG TYPE			Knebel	DAT		ED	23/0	et 3 of 2/2016	3	
GR		DLE	EVEL	(mO	D)	17.52 Council			FLUSH			Air/Mist	DAI		JED V	24/0	2/2016) 	
EN	GINE	ER	A			Council			CORE DIA	METER (mr	m)	-90 80	LOC	GED B	Y	D.	O'She		
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing pg m) 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)	
20									SYMMETI as weathe	RIX DRILLI	NG: No reco	overy, obs	erved by	driller	20.90	-3.38		N = 50/10 mm (25, 50)	
21	21.60								Very stron	ng (where cark grey, fin	ompetent), r e grained, L	medium to	thinly be	dded,	21.60	-4.08			
- 22	23.10	33	23	15					fossiliferou locally hig Dips are h medium to to occasio	us, localize hly weather norizontal to closely sp mally undul	d chert and red contribu locally 45°. aced, rough ose. Apertu	stylolites) ting to cor Discontir to locally res are wi	, slightly to eloss. nuities are smooth, µ de, locally	olanar					
- 24		7	7	7					clay-filled. 22.00-23.0 23.10-24.8	00m - No re 50m - No re	ecovery, pos ecovery, pos	sible clay sible clay	-filled frac -filled frac	ture ture					
25									End	of Borehole	e at 24.60 m								
RE Ho	MAR e ca	KS sed	0.00-	21.6	Dm.					Water	Casing	Sealed	Rise	Time		mmen	RIKE	DETAILS	
										Strike 4.30 18.50	Depth 4.30 18.50	At 4.40 N/S	То 15.50	(min) 5	S M	eepag loderat	e te		
INC	TN I	1								Data	Hole	Casing	Depth t	0 00	GRO		VATER	RDETAILS	
24	Date -02-1	16	Tip D 18.0	epth 00	RZ Top 10.50	RZ Base 19.50	:	Тур 50mm	be n SP		Depth	Depth	Water						
1							1				1								



REPORT NUMBER

со	NTR	ACT	N	16 Ga	alway City	/ Transpoi	rt Proje	ot - Phase 3				DRII SHE	LHOLE	NO	BH: Shee	3/36R et 1 of 2	
CO GR	-ORE	DINA	TES EVEL	(m0	533,12 728,20 D)	4.66 E 4.71 N 51.78		RIG TYPE			Knebel Air/Mist	DAT DAT	e drill E logg	ED iED	19/0 22/0	2/2016 2/2016	
CLI ENG	ent Sine	ER	G A	alwa RUP	ay County	Council		INCLINATI CORE DIA	ION (deg) METER (mi	n)	-90 80	DRII LOG	LED B	((S. D.	Peterse O'Shea	en a
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	oture cing og m)	Non-intact Zone			Descript	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0								SYMMET as TOPS SYMMET as weathe	RIX DRILLI OIL. RIX DRILLI ered rock	NG: No rec NG: No rec	overy, obs overy, obs	served by o	driller driller	0.50	51.28		
2	2.20							SYMMET as rock	RIX DRILLI	NG: No rec	overy, obs	served by o	driller	1.90 2.20	49.88 49.58		
3	3.80	100	88	57	E			grained, L and stylol Dips are h medium to to occasio	IMESTONI ites), fresh norizontal to o closely sp onally undul	E (locally for to slightly w locally vert aced, rough ose. Apertu	ssiliferous eathered. ical. Disco to locally res are tig	, localized ontinuities / smooth, p ght to wide	chert are blanar				
- 4	5.00	100	95	39	F			3.50m - E	widence of	honeycomb	solution v	weathering					
6	6 50	100	99	87	Ē	60		→ 5.00-8.20	ni - Subven		2						
- 7		100	95	87													
- 8	8.00	100	98	79	-												
REI	9.50 MAR	KS				51			1					WAT	FER ST		ETAILS
Hol	e ca	sed (0.00-2	2.20r	n.				Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
														N	o wate	er strike	recorded
														GRO	DUNDV	VATER	DETAILS
INS	TAL	LATI		ETA	ILS				Date	Hole Depth	Casing Depth	Depth t Water	o Con	nment	S		
23	Date -02-1	16	Tip D 19.0	epth 00	RZ Top 11.50	RZ Base 19.75	50	Type mm SP									



REPORT NUMBER

10		2																	
со	NTR	ACT	N	l6 Ga	alway City	rranspo	rt Pro	ect - P	hase 3					DRILL SHEE	HOLE T	NO	BH She	3/36R et 2 of	2
CO GR	ORE	DINA ID LE	TES EVEL	(mOl	533,12 728,20 D)	4.66 E 4.71 N 51.78		F	RIG TYPE FLUSH			Knebel Air/Mist		DATE DATE	DRILLI LOGG	ED ED	19/0 22/0	2/2016 2/2016	3 3
CL EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (m	m)	-90 80		DRILL LOGG	ED BY	, ,	S D	. Peter	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500 500	Non-intact Zone	Legend			Descrip	tion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	11.00	100	91	91		7	99.99999		Very stron grained, L and styloli Dips are h	ng, thick to IMESTON ites), fresh norizontal to	thinly bedd E (locally fo to slightly v o locally ve	ed, blueis ossiliferou veatherec rtical. Dise	h dark s, loca l. contini	c grey, f alized ch uities ar	ine nert re				
- 11	12.50	100	100	100	-	1	910		medium to to occasio locally cla	o closely sp onally undu y-filled. <i>(co</i>	paced, roug lose. Apert ntinued)	jh to local ures are t	ly smc ight to	ooth, pla wide,	inar			× > 0 0 0	
- 13	14.00	100	84	84		6	99.9999												
- 14 - 15	15.50	100	93	93		6	20.0000												
- 16	17 10	100	94	94		1	370											0 0 0 0 0 0 0 0	
- 17	18.50	100	100	100		8	29.99999												
- 19	<u>19.75</u>	100	100	100		1	850		End	of Borehole	e at 19.75 r	n				19.75	32.03		
RE	MAR	KS	1	1	I			I								WAT	TER S	I FRIKE	DETAILS
Ho	le ca	sed (0.00-2	2.20r	n.					Water Strike	Casing Depth	Sealed At	Ri T	se o	Time (min)	Co	mmen o wate	ts er strike	e recorded
INS	STAL	LATI	ON D	ETA	ILS					Date	Hole	Casin	g D	epth to	Com	ment	S		
23	Date -02-	- 16	Tip Do 19.0	epth)0	RZ Top 11.50	RZ Base 19.75	5	Type 0mm \$	e SP	-		Deptr		alei					
4							1								1				



REPORT NUMBER

CONTRACT No Galway City Transport Project - Priase 3 DBILLENCE NO BH2ET Shee1 1 of 2 CO-ORDINATES S34,248.34 E T27,540.35 E GROUND LEVEL (mOD) A62.7 Rig TYPE FLUSH Casagrane ArMist Date Lodge D Dist Lodge D 1002.016 Dist Lodge D 1002.016 ENDREE ARUP Construction 45.2 CORE DAMETER (mm) 80 DRILLED BY ICSL DISLED BY </th <th>12</th> <th>0</th> <th>1</th> <th></th>	12	0	1															
CO-CREDINATES 53.4 28.34 E 727.54.08.3 N GROUND LEVEL (mOD) RIG TYPE 45.27 Casagrance FLUSH Date LoggeD FLUSH Date LoggeD FLUSH CUENT ENGINEE Astup Casagrance FLUSH AirMat Date LoggeD FLUSH Date LoggeD FLUSH <td< td=""><td>со</td><td>NTR</td><td>ACT</td><td>N</td><td>6 Ga</td><td>alway City</td><td>Transpor</td><td>rt Project</td><td>- Phase 3</td><td></td><td></td><td></td><td>DRI She</td><td>_LHOLE ET</td><td>NO</td><td>BH: Shee</td><td>3/38R et 1 of 2</td><td>2</td></td<>	со	NTR	ACT	N	6 Ga	alway City	Transpor	rt Project	- Phase 3				DRI She	_LHOLE ET	NO	BH: Shee	3/38R et 1 of 2	2
CLUENT Calway County Council INCLINATION (deg) -50 DRILLED BY IGSL PENNERE ARUP CORE DIAMETER (mm) 80 LOGGED BY D. COSHea 0 0 0 Description 0 Description 0 <td>CO GR</td> <td></td> <td>DINA[.]</td> <td>TES</td> <td>(mOl</td> <td>534,24 727,54 D)</td> <td>9.34 E 0.83 N 45.27</td> <td></td> <td>RIG TYPE</td> <td></td> <td></td> <td>Casagra Air/Mist</td> <td>nde DAT</td> <td>e drill E logg</td> <td>.ED iED</td> <td>17/0 18/0</td> <td>2/2016 2/2016</td> <td></td>	CO GR		DINA [.]	TES	(mOl	534,24 727,54 D)	9.34 E 0.83 N 45.27		RIG TYPE			Casagra Air/Mist	nde DAT	e drill E logg	.ED iED	17/0 18/0	2/2016 2/2016	
Image: Section of the sectio	CLI EN	IENT GINE	ER	G	ialwa RUP	y County	Council		INCLINATI	ON (deg) METER (mi	n)	-90 80	DRI LOC	LED B	Y Y	IG D	SL O'She	a
0 0	Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500	Non-intact Zone Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
3 100 93 88 9 9 120-1.66m Noderately weathered, slight weakening. 2.20-1.66m Noderately weathered, slight weakening. 3.23-3.41m Moderately weathered, slight weakening. 5 5.70 100 100 94 9	- 0	1.20	87	64	42		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		SYMMETI as clayey SYMMETI as weathe Very stron grained, L and styloli Dips are 2 to medium	RIX DRILLI gravel RIX DRILLI ered rock ng, thick to t IMESTONE tes), fresh 20° to locall n spaced, ru	NG: No rec NG: No rec hinly bedde (locally fos to slightly w y 40° & 80°. bugh to loca	overy, obs overy, obs d, blueish ssiliferous eathered. Discontii illy smoot	served by served by a dark grey by localized huities are h, planar.	driller driller , fine chert widely	1.00	44.27 44.07		
s 100 100 94 100	- 3	4.20	100	93	88				Apertures smearing. 1.20-1.661 3.23-3.411	are tignt to m - Modera m - Modera	tely weathe tely weathe	red, sligh red, sligh red, sligh	t weakenir t weakenir	g. g.			0 0 0 0 0 0	
6 100 0		5.70	100	100	94													
8 100	- 6	7.20	100	100	100		10										0 0 0 0 0 0	
Image: second	- 8	8.70	100	100	100		15	570										
NEIMARKS Water Casing Depth Sealed At Rise To (min) Comments Hole cased 0.00-2.70m. Water Casing Depth Sealed At To Comments Value Strike Depth At To Image: No water strike recorded INSTALLATION DETAILS Date Hole Depth Casing Depth to Depth Depth to Water Comments 18-02-16 8.30 2.80 10.30 50mm SP Image: No water strike recorded Image: No water strike recorded	9		100	100	100		6			I								
Instruction Octome Octome Instruction Comments Strike Depth At To (min) Comments Instruction Strike Depth At To (min) Comments Instruction Strike Depth At To (min) Comments Instruction Instruction Instruction Instruction Instruction Instruction	RE	MAR	KS	00 1	2 70-	n				Water	Casing	Sealed	Rise	Time	WA	IER S		DETAILS
GROUNDWATER DETAILS INSTALLATION DETAILS Date Hole Depth Casing Depth Depth to Water Comments Date Tip Depth RZ Top RZ Base Type Vater Vater Comments 18-02-16 8 30 2 80 10 30 50mm SP Vater Vater Vater			seu (J.UU-2	∠. <i>1</i> Ur					Strike	Depth	At	To	(min)	Co N	ommen lo wate	ts er strike	recorded
INSTALLATION DETAILS Date Hole Depth Casing Depth to Depth Depth to Water Comments Date Tip Depth RZ Top RZ Base Type Image: Comments Image: Comments Image: Comments 18-02-16 8 30 2 80 10 30 50mm SP Image: Comments Image: Comments															GRO	DUND	VATER	DETAILS
Date Tip Depth RZ Top RZ Base Type	INS	TAL	LATI	ON D	ETA	ILS				Date	Hole Depth	Casing	Depth Water	O Con	nment	s		
	Date Tip Depth RZ Top RZ Base Ty 18-02-16 8.30 2.80 10.30 50mr							Ty 50mi	/pe m SP	-								



REPORT NUMBER

10	09	5/																
со	NTR	ACT	N	6 Ga	alway City	Transpo	rt Pro	oject -	Phase 3					LHOLE ET	NO	BH: Shee	3/38R et 2 of	2
CO GR	-ore oun	DINA [.] D LE	TES	(mOl	534,249 727,540 D)	9.34 E 0.83 N 45.27			RIG TYPE FLUSH			Casagrar Air/Mist	DATE	DRILL	ED ED	17/0 18/0	2/2016 2/2016) }
CLI EN	ENT GINE	ER	G A	ialwa RUP	y County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRILI	LED BY GED BY	, ,	IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lo (mi	ture cing vg m) 500	Non-intact Zone	Legend			Descrip	tion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.30								End	of Borehole	at 10.30 n	ו			10.30	34.97	0 0 0	
RE	MAR	KS													WAT	FER ST	RIKE	DETAILS
Ho	e ca	sed (0.00-2	2.70r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
															N	o wate	er strike	e recorded
	TA1			ET A						Data	Hole	Casing	Depth to	Com	GRO		VATER	RDETAILS
TINS.	Date		Tip D	epth	RZ Top	RZ Base	•	Tyr	De	Date	Depth	Depth	Water	Com	ments	5		
18	Date Inp Depin RZ Top RZ Base Inp 18-02-16 8.30 2.80 10.30 50m								n SP									



REPORT NUMBER

1	-	/																	
со	NTR	ACT	N	16 Ga	alway City	/ Transpo	ort Pr	oject -	Phase 3				ا ؛	DRILLH SHEET	IOLE	NO	BH: Shee	3/39R et 1 of	2
CO GR	-ORI	DINA D LE	TES	(mO	534,36 727,40 D)	0.45 E 2.19 N 41.88						Casagra	nde	DATE D DATE L	RILL .0GG	ED ED	16/0 17/0	2/2016 2/2016	3 3
CL EN	IENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mi	n)	-90 80	1	DRILLE	ED BY	, (IG D.	SL . O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture cing og m)	Non-intact Zone	Legend			Descript	ion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0	1 10								SYMMETI as made g SYMMETI as weathe	RIX DRILLI ground con: RIX DRILLI ered rock	NG: No rec sisting of cla NG: No rec	overy, obs ayey grave overy, obs	served el served	by drill by drill	er er	0.40	41.48		
- 1	2.60	100	96	76			<u>(</u>		Very stron grained, L and styloli Dips are h spaced, ro undulose.	ng, thick to t IMESTONI ites), fresh norizontal. I bugh to loca Apertures	thinly bedde E (locally fo to slightly w Discontinuiti ally smooth, are tight to	ed, blueish ssiliferous reathered. ies are me , planar to wide, loca	a dark (, locali edium t occas illy clay	grey, fir zed ch o close ionally <i>-</i> filled.	ne ert ely	1.10			
- 3	2.00	100	91	88	-		530												
- 4	5.30	100	100	97			320 <u>(</u>												
6	6.80	100	100	100			560												
- 7	8.20	100	100	100	-		1130												
- 9	9.70	100	100	100			559.9999 340												
PF		100 KS	100	80					1							\ <u>\</u> \\\	 		
Ho	e ca	sed ().00-	1.20r	n.					Water	Casing	Sealed	Rise	e -	Time		mmen	te	
										Strike	Depth	At	To	(min)	N	o wate	er strike	e recorded
											Hole	Casing	Der	oth to	-	GRO	DUNDV	VATEF	RDETAILS
INS	Date		он D Гір D	epth	ILS RZ Top	RZ Base)	Ту	De	Date	Depth	Depth	W	ater	Com	ment	S		



REPORT NUMBER

1º		/																	
CON	NTR/	аст	N	6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3					DRILLI	HOLE r	NO	BH: She	3/39R et 2 of	2
CO-0	ORE	DINA [.] D LE	tes Vel	(mO	534,36 727,40 D)	0.45 E 2.19 N 41.88			RIG TYPE			Casagra Air/Mist	ande	DATE I DATE I	DRILL LOGG	ED ED	16/0 17/0	2/2016 2/2016))
CLIE ENG	ENT	ER	G A	ialwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80		DRILLI LOGGI	ED BY ED BY	((IG D	SL . O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	eture cing og m)	Non-intact Zone	Legend			Descrip	tion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10 1	0.10							<u> </u>	End	of Borehole	at 10.10 n	n				10.10	31.78		
11 12 13 14 15 16 17 18 19	MAR	KS														WAT	FER S1	FRIKE	DETAILS
E Hole	e cas	ks sed ().00-1	1.20r	n.					Water	Casing	Sealed	Ris	se	Time		mmon	te	DETAILS
963.GPJ 1GSL.GD										Strike	Depth	At	T	0	(min)	N	lo wate	er strike	e recorded
×			 -								Hole	Casing	ים נ	enth to	6	GRO	DUNDV	VATEF	RDETAILS
<u></u> ⊈ INS1 ≖				ETA	ILS	D7 D		T		Date	Depth	Depth		Vater	Com	nment	S		
	Date Tip Depth RZ Top RZ Base Type																		



REPORT NUMBER

со	NTR	ACT	N	6 Ga	alway City	/ Transpo	rt Pro	oject -	Phase 3				DRIL		NO	BH	3/40R	2
CO GR	-ORE	DINA D LE	TES	(mOl	534,439 727,299 D)	9.24 E 5.41 N 42.35			RIG TYPE			Knebel Air/Mist	DAT	E DRILL	ED	29/0)2/2016)2/2016	<u>}</u>
CLI ENG	ent Sine	ER	G A	alwa RUP	y County	Council			INCLINATION CORE DIA	ON (deg) METER (mi	n)	-90 80	DRII LOG	LED B	Y Y	S D	. Peters . O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	2.80 4.30 5.90 7.40	100 100 100	100 100 100 100	94 95 100 100					SYMMETI as peaty T SYMMETI as possibl clay bands SYMMETI as rock Very stron grained, L and styloli Dips are 2 medium si Apertures smearing. 5.19-5.211	RIX DRILLI FOPSOIL. RIX DRILLI le weathere s RIX DRILLI Ig, thick to to IMESTONI tes), fresh 20° to locall paced, roug are tight to m - Clay-fill	NG: No rec NG: No rec d rock - rec NG: No rec thinly bedde (locally for to slightly w y 40°. Disco gh to locally partly oper ed fracture	overy, obsorvered as overy, obsorvered as overed as overed as overed as overed as a solution of the same set of the set of the set of the set over the set of the set	served by o served by o s boulders s boulders are widely planar. n brown cla	driller with driller , fine chert to yy	0.40	41.95		
REI Hol	MAR e cas	KS sed (0.00-2	1 2.80r	n.					Water	Casing	Sealed	Rise	Time	WA	TER S		DETAILS
										Strike	Depth	At	То	(min)	N	lo wate	er strike	e recorded
															GRO		NATER	DETAILS
INS	TALI	LATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Depth t Water	^o Con	nment	s		
29	Date -02-1	16	Tip De 9.50	epth 0	RZ Top 2.50	RZ Base 10.10	:	Typ 50mm	e I SP	-	Doput	20001						



REPORT NUMBER

10	00	5																
со	NTR	АСТ	N	l6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				DRIL SHEE	LHOLE ET	NO	BH: Shee	3/40R et 2 of	2
CO GR		DINA [.] ID LE	TES	(mO	534,439 727,299 D)	9.24 E 5.41 N 42.35			RIG TYPE			Knebel Air/Mist	DATE DATE	DRILL	ED ED	29/0 29/0	2/2016 2/2016	5 5
CLI EN	IENT GINE	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mi	n)	-90 80	DRIL	LED BY GED BY	, (S. D.	Peter O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing 9g m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.10								End	of Borehole	at 10.10 m	1			10.10	32.25	o o	
11 12 13 13 14 14 15 15 16 17 17 18 18 19 19 19 19 19 19 19 19 19 19 19 19 19																		
RE	MAR	KS	1	I	1			1	1			<u> </u>			WA	TER ST	RIKE	DETAILS
Ho	le ca	sed (0.00-2	2.80r	n					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
															N	lo wate	er strike	
	147	^								Data	Hole	Casing	Depth to	Com	GR		VATER	COETAILS
	Date Tip Depth RZ Top RZ Base Type									Date	Depth	Depth	Water		ment	3		
29	Date IIp Depth RZ Top RZ Base Type 29-02-16 9.50 2.50 10.10 50mm SP								n SP									



REPORT NUMBER

						_							DD				0/445	
CONT	FRA	АСТ	N	6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				SH	EET	LENO	BH She	3/41R et 1 of	1
CO-O GROL)rd Une	INA [.] D LE	res Vel	(mOl	534,579 727,069 D)	9.87 E 5.42 N 41.52			RIG TYPE			Casagra Air/Mist	nde DA	re drii Fe log	LLED GGED	15/0 16/0	2/2016 2/2016	3 3
	NT NEE	ĒR	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (m	m)	-90 80	DR LO	LLED GGED	BY BY	IC D	SSL . O'She	ea
Downhole Depth (m)	Core Kun Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing yg m) 	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
	.20								SYMMET as clayey SYMMET as weathe	RIX DRILL gravel RIX DRILL ered rock	ING: No rec ING: No rec	overy, obs	served by	driller driller	0.40	41.12		
- 2	70	100	61	14					Medium s blueish da fossilifero weathered Dips are h medium to	trong to ve ark grey, fin us, localize d. norizontal to closely sp	ry strong, th le grained, L ed chert and p locally 45° paced, rough	ick to thin IMESTOI stylolites) . Discontin to locally	ly bedded NE (locall , fresh to nuities are / smooth,	, / slightly e planar	y	-		
3	.20	100	81	38					to occasio clay-smea 1.20-3.60 3.20-3.34	maily undu ared. m - Mediun m - Modera	iose. Apertu n to thinly be ately weathe	res are w edded red, sligh	ide, iocali t weakeni	y ng.				
- 5	.70	100	95	95	E													
- 6	20	100	100	100		6	90 970											
- 7.	.50	100	100	100					End	of Borehole	e at 7.50 m				7.50	34.02		
9																		
REM/	AR	(S								\M/otor	Cooina	Social	Piece	T ime	WA	TER S	TRIKE	DETAILS
Hole (cas	ed (0.00-1	1.20r	n.					Strike	Depth	At	Kise To	(mi	in) Co	ommer	ts er strike	e recorded
											Hele	Casing	Dert	to	GR	OUND	NATER	RDETAILS
INST	ALL	ATI	ON D	ETA	ILS					Date	Depth	Depth	Wate	r C	omment	s		
Da 16-02	ate 2-1	6	ip De 6.30	epth C	RZ Top 2.50	RZ Base 7.50	•	Typ 50mn	pe n SP									



REPORT NUMBER

со	NTR	ACT	N	l6 Ga	alway City	Transpoi	rt Pro	ject -	Phase 3				DRI	LLHOLE	E NO	BH	3/42R	
со	-ORE	DINA	TES		534,75	6.39 E							SHE		ED	She	et 1 of	1
GR	OUN	D LE	VEL	(mO	726,839 D)	9.91 N 32.65			RIG TYPE			Knebel Air/Mist	DAT	E LOGO	GED	11/0	3/2010	
CL EN	IENT GINE	ER	G	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRI LOC	LLED B GED B	Y Y	S. D	Peters O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing bg m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0							-		SYMMETI as TOPSC SYMMETI as brown SYMMETI as possibl	RIX DRILLI DIL. RIX DRILLI clay with co RIX DRILLI e weathere	NG: No rec NG: No rec bbles and NG: No rec d rock	overy, ob overy, ob boulders overy, ob	served by served by served by	driller driller driller	0.20 1.00 1.80 2.00	32.45 31.65 30.85 30.65		
- 2	2.30 3.90	100	89	38	F				as rock wi SYMMETH as rock Very stron grained, L and styloli Dips are 2 medium s	g, thick to t IMESTONE tes), fresh t 20° to localli paced, roug	hinly bedde finly bedde (locally fo o slightly w y 40°. Disco gh to locally partly oper	ed, blueist ssiliferous reathered.	are widely a brown da	driller , fine chert	2.30	30.35		
5	5.45	100	100	100	Ē	5	10		smearing.		p, cp.c.	., ,		- J			×/////////////////////////////////////	
6	6.90	100	100	100													0 0 0 0 0 0	
8	8 45	100	100	100													0 0 0 0 0 0	
9	9.85	100	100	100											9.85	22.80		
RE	MAR	KS	I	I	I				End o	of Borehole	at 9.85 m				WA			DETAILS
Ho	le ca:	sed ().00-2	2.30r	n.					Water Strike 2.30	Casing Depth 2.30	Sealed At N/S	Rise To 2.20	Time (min) 20	Co	eepag	ts e	
INS	STAI I		ח סא	EΤΔ	ILS					Date	Hole	Casing	Depth	0 Cor	GR(SUNDA	VAIER	DETAILS
Date Tip Depth RZ Top RZ Base Type								Тур	be	Date	Depth	Depth	Water					
11	-03-1	16	9.8	5	5.35	9.85		50mm	1 SP									



REPORT NUMBER

CONTR	RACT	' N	16 Ga	alway City	Transpo	rt Proj	ect - Phas	ise 3				DRIL	.lhole et	NO	BH: She	3/43R et 1 of	2
CO-OR	nd Li	TES	(mO	534,62 726,78 D)	7.31 E 0.71 N 32.77		RIG FLU	G TYPE USH			Knebel Air/Mist	DAT DAT	e drill E logg	ED ED	10/0 10/0	3/2016 3/2016	3 3
CLIEN ENGIN	T EER	A	alwa RUP	ay County	Council		INC COF		DN (deg) /IETER (mr	n)	-90 80	DRIL LOG	LED BY	((S.	Peter O'She	sen ea
Downhole Depth (m) Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m)	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
2							SY as SY as	/MMETR TOPSO /MMETR brown c	RIX DRILLII IL. RIX DRILLII ay with co	NG: No rec NG: No rec bbles and t	overy, obs overy, obs ooulders	erved by c	lriller Iriller	0.20	32.57		N = 25
3						\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	SYL SYL SYL SYL SYL SYL SYL SYL SYL SYL	/MMETR brown c	RIX DRILLI	NG: No rec bbles and b	overy, obs boulders	erved by c	Iriller	3.00	29.77		(3, 4, 4, 6, 8, 7) N = 50/195 mm (6, 11, 15, 19,
4 5.00	0						SY SY A SY A SY A SY A SY A SY A SY A S	MMETR rock	RIX DRILLI	NG: No rec	overy, obs	erved by c	fine	4.30	28.47		16)
6 6.4	100	100	100	L			gra anc Dip Dip Me Ape	ained, Ll id stylolite ps are 20 edium sp pertures a nearing.	MESTONE es), fresh t D° to locally paced, roug are tight to	 (locally for o slightly w / 40°. Disco gh to locally partly oper 	ssiliferous eathered. ontinuities smooth, p , very thin	, localized are widely blanar. i brown cla	chert to y				
7	100	100	100		6	10		-									
8 9 9.4(100	94	90														
	100	92	92		7	60.00000	000002										
REMA	RKS								Mator	Casing	Coolod	Diag	Time	WA	TER ST	RIKE	DETAILS
iole ca	ased	0.00-	5.001	n.				-	Strike 4.50	Depth 4.50	At N/S	To 4.00	(min) 20	Co	mmen Slow	ts	
														GRO	DUND	VATE	R DETAILS
NSTA			DETA	ILS R7 Top	R7 Bass	_	Type		Date	Hole Depth	Casing Depth	Depth to Water	Con	nment	S		
Dal		ם קוז	Spul				туре										



REPORT NUMBER

1º	00	2																
со	NTR	АСТ	N	16 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				DRIL	LHOLE Et	NO	BH: Shee	3/43R et 2 of	2
CO GR	-ORE OUN	DINA ID LE	TES	(mO	534,62 726,78 D)	7.31 E 0.71 N 32.77			RIG TYPE FLUSH			Knebel Air/Mist	DATE DATE	DRILLI	ED ED	10/0 10/0	3/2016 3/2016	;
CLI ENC	ent Gine	ER	G A	alwa RUP	ay County	Council			INCLINATI CORE DIA	ON (deg) METER (mn	n)	-90 80	DRIL LOG	LED BY	,	S. D.	Peters O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.05								End	of Borehole	at 10.05 m				10.05	22.72		
11 12 13 14 15 16 17 18 Hol	MAR	KS		5.00						Water	Casing	Sealed	Rise	Time	WAT	FER S1	TRIKE	DETAILS
Hol	e ca	sed (0.00-	5.00r	m.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	mmen	ts	
										4.50	4.50	N/S	4.00	20		Slow		
-											Holo	Casing	Donth t-		GRO	DUNDV	VATER	DETAILS
INS	TAL Date		ON D Tip D	epth	ILS RZ Top	RZ Base	•	Ту	pe	Date	Depth	Depth	Water	Com	iment	S		



REPORT NUMBER

со	NTR	ACT	N	16 Ga	alway City	/ Transpo	rt Pro	oject -	Phase 3				[5	ORILLH	IOLE	NO	BH: She	3/46R et 1 of 2	
CO GR		DINA	TES	(mO	531,74 728,39 D)	9.54 E 1.61 N 29.81			RIG TYPE FLUSH			Casagraı Air/Mist	nde C	DATE D DATE L	ORILLE	ED ED	14/0 15/0	3/2016 3/2016	
CL EN	IENT GINE	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80		ORILLE	ED BY	,	IG D	SL O'Shea	1
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500 500	Non-intact Zone	Legend			Descripti	on				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0								0-0-0 0-0	SYMMET as clayey	RIX DRILLI gravel	NG: No rec	overy, obs	served	by drill	er	0.50	29.31		
									SYMMETI as rock	RIX DRILLI	NG: No rec	overy, obs	served	by drill	er				
- 1	1.20	100	91	61	Ŀ		, , , , , , , , , , , , , , , , , , ,		Very stron grained, L and styloli	ng, thick to t IMESTONE tes), fresh t	hinly bedde E (locally fos to slightly w	d, blueish ssiliferous eathered.	dark g , localiz	rey, fir zed ch	ne ert	1.20	28.61		
2	2.70								Dips are 2 medium s Apertures smearing.	20° to locall paced, roug are tight to	y 40°. Disco gh to locally partly oper	dely to I clay							
3	4.20	100	92	56	F														
- 5	5.70	100	97	93	E														
6	7.20	100	99	93			(ia)/												
8	8.70	100	100	92															
9		100	100	100															
RE Ho	MAR le ca	KS sed (0.00-	1.20r	n.					Water	Casing	Sealed	Rise		Time	WA1 Co	mmen	TRIKE D ts	ETAILS
										SILIKE	Deptn	Αί	10		<u>(1111)</u>	N	o wate	er strike	recorded
											Holo	Casing	Der	th to		GRO	DUND\	VATER	DETAILS
INS	Data				ILS R7 Top	R7 Base		Tur		Date	Depth	Depth	Wa	ater	Com	ment	S		
15	-03-1	16	16.0)0	11.50	16.40		50mm	n SP										



REPORT NUMBER

12	0	/																
со	NTR	АСТ	N	6 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DRII SHE	.LHOLE ET	NO	BH She	3/46R et 2 of	2
CO GR	ORE	DINA [.]	TES	(mO	531,74 728,39 D)	9.54 E 1.61 N 29.81			RIG TYPE FLUSH			Casagrai Air/Mist	nde DAT	e drill E logg	.ED ED	14/0 15/0	3/2016 3/2016	3
CL EN	IENT GINE	ER	G A	ialwa RUP	ay County	Council			INCLINATI CORE DIA	ON (deg) METER (m	m)	-90 80	DRII LOG	LED B	Y Y	IG D	SL . O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture cing og m) ^{0 500}	Non-intact Zone	Legend		·	Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10 	10.20	100	89	89			(.v.)		Very stron grained, L and styloli Dips are 2 medium s Apertures smearing. 11.60-11.4	ng, thick to IMESTONI tes), fresh 20° to locall paced, rou are tight to <i>(continueo</i> 82m - Clay	thinly bedde E (locally fo to slightly w y 40°. Disco gh to locally partly oper // gravel-filled	ed, blueish ssiliferous eathered. ontinuities r smooth, i n, very thir I fracture	dark grey , localized are widely planar. brown cla	, fine chert to y				
12	13.20	100	95	95			690											
- - - - - - - - - - - - - - - - - - -	14.70	100	65	41			719.9999	99999999									0 0 0 0 0 0 0 0 0 0	
- 15	16.20	100	100	100														
- 17	16.40	100	100	100					End	of Borehole	e at 16.40 m	I			16.40	13.41	0	
- 18																		
RE	MAR	KS		1.00	I		1	1	I	Matar	Cooing	Sociad	Piec	Time	WA	TER S	RIKE	DETAILS
Ho	le ca	sed ().00-1	1.20r	n.					Strike	Casing Depth	At	Kise To	I ime (min)	Co N	o wate	ts er strike	e recorded
	TA1	1		ET 4						Data	Hole	Casing	Depth t		GRO		VATEF	RDETAILS
	Date			epth	RZ Top	RZ Bas	e	Tvr	De	Date	Depth	Depth	Water	Cor	mient	5		
15	-03-1	16	16.0	00	11.50	16.40		50mn	n SP	1								


REPORT NUMBER

1		7																	
co	NTR	ACT	N	l6 Ga	alway City	Transpo	ort Pro	oject -	Phase 3				Di Si	RILLH HEET	IOLE I	NO	BH She	3/47R et 1 of :	2
CO GR		DINA D LE	TES	(mO	533,06 728,28 D)	2.37 E 6.02 N 37.74			RIG TYPE FLUSH			Casagra Air/Mist	nde D	ATE D ATE L	RILLE	ED ED	16/0 21/0	3/2016 3/2016	
CL EN	IENT GINE	ER	G A	alwa RUP	y County	Council			INCLINATI	ON (deg) METER (mi	m)	-90 80	DI	RILLE DGGE	D BY		D	SL . O'She	a
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m 0 250	ture cing bg m) 500 500	Non-intact Zone	Legend			Descripti	on				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0 1 1 2 3 4 9 9	5.60 6.60 7.60 8.60 9.60	100 100 100	87 75 95 93	87 75 75 83					SYMMETI as gravelly SYMMETI as clayey SYMMETI as weather Very stron grained, L and styloli Dips are 2 to medium Apertures smearing.	RIX DRILLI y clay RIX DRILLI cobbles RIX DRILLI ered rock IMESTONI tes), fresh 20° to locall n spaced, re are tight to	NG: No reco NG: No reco NG: No reco NG: No reco to slightly we y 40° & 80°. ough to loca partly open	overy, obs overy, obs overy, obs overy, obs eathered. Discontin Ily smoot , very thir	served b served b served b served b nuities a h, planan h planan h brown	y drille y drille y drille ey, fin ed che re wid r. clay	er er er ert ely	4.20 4.50 5.60	33.54 33.24 32.14	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
RE Ho	MAR le ca:	KS sed (0.00-4	 4.50r	n.					Water	Casing	Sealed	Rise	T	Time	WA1 Co	FER S mmen	I <mark>≏ ⊟∘ </mark> FRIKE I	DETAILS
												11	10			N	o wate	er strike	erecorded
020																GRO	ירואטכ		
		Γστι	ם אס	ETA	ILS					Date	Hole	Casing	Dept	h to	Com	ment	S		JETALO
	Date		Tip D	epth	RZ Top	RZ Base	•	Tvr	e		Depth	Depth	Wa	ter	00111		-		
21	21-03-16 12.00 7.00 13.50 50m							50mm	n SP	1									



REPORT NUMBER

12	-	7																
CO	NTR	АСТ	N	6 Ga	alway Cit	y Transp	ort Pr	oject -	Phase 3				DRIL SHEI	lhole Et	NO	BH: She	3/47R et 2 of	2
CO GR	-ORE	DINA [®] D LE	TES	(mOl	533,06 728,28 D)	2.37 E 6.02 N 37.74	1		RIG TYPE			Casagran	de DATE	E DRILL E LOGO	.ED SED	16/0 21/0	3/2016 3/2016	6
CLI EN	IENT GINE	ER	G A	ialwa RUP	ay County	/ Counci	I		INCLINATI	ON (deg) METER (mi	n)	-90 80	DRIL LOG	LED B' GED B'	Y Y	IG D	SL . O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture icing og im)	- o Non-intact Zone	Legend			Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.60	100	100 100	100	-		590 770.000 549 999		Very stror grained, L and styloli Dips are 2 to mediun Apertures smearing.	ng, thick to the IMESTONI IMESTONI ites), fresh 20° to locall n spaced, ro are tight to (continued	thinly bedded E (locally fos to slightly we y 40° & 80°. bugh to loca partly open)	d, blueish siliferous, eathered. Discontin lly smooth , very thin	dark grey, localized uities are v , planar. brown cla	fine chert videly y			0 0 0 0 0 0 0 0	
-12	12.60	100	100	100			660											
13	<u>13.50</u>	100	100	100					End	of Borehole	e at 13.50 m				13.50	24.24	000	
15																		
16 - 17																		
- 18 - 19																		
RE	MAR	KS													WAT	TER ST	RIKE	DETAILS
Hol	e ca:	sed ().00-4	4.50r	n.					Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Co	ommen lo wate	ts er strike	e recorded
															GRO	OUND	VATER	
INS	TAL	LATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Depth to Water	Cor	nment	s		
21	Date -03-1	16	Tip Do 12.0	epth)0	RZ Top 7.00	RZ Bas 13.50	se	Ty 50mn	pe n SP	_								
										1	1	1	1					



REPORT NUMBER

СО	NTR	АСТ	 N	6 Ga	alway City	/ Transpo	rt Pro	oject - I	Phase 3				DRI	LLHOLE	E NO	BH	3/48R	
со	-ORI	DINA	TES		534,39	6.60 E							SHE	ET	ED	She	et 1 of 3	3
GR	OUN	D LE	VEL	(mO	727,19 D)	7.18 N 40.72			RIG TYPE FLUSH			Casagraı Air/Mist	nde DAT	E LOGO	GED	04/0	4/2016	
CLI EN	IENT GINE	ER	G A	ialwa RUP	y County	Council			INCLINATI	ON (deg) METER (mi	m)	-90 80	DRI LOC	LLED B GED B	Y Y	IG D	SL . O'She	а
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	eture cing bg m) 	Non-intact Zone	Legend			Descripti	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0									SYMMET as gravelly SYMMET	RIX DRILLI y clay RIX DRILLI	ING: No rec	overy, obs	served by	driller driller	0.70	40.02		
- 1	1.30	100	85	54					Medium s blueish da fossiliferoi weathered Dips are h medium to	trong to ver ark grey, fin us, localize d. norizontal to o closely sp	ry strong, th le grained, L d chert and b locally 45° baced, rough	ick to thini IMESTON stylolites) . Discontin	y bedded, vE (locally , slightly nuities are	planar	1.30	39.42		
- 3	4.30	100	89	83			i40		to occasic clay-filled. 2.22-2.26i 3.91-4.11i	m - Clay-fill m - Clay-fill m - Clay-fill	lose. Apertu led fracture led fracture	res are w	de, locally	·				
- 5	5.80	100	97	92		8 	i30 {		5.40-5.58	m - Clay-fill	ed fracture							
- 6	7.30	100	91	55	Ē													
8	8.80	100	95	93		9 - 7 -	30											
9		100	100	100		9	i39.9999 140.0000											
RE Ho	MAR e ca	KS sed (0.00-	1.30r	n.					Water	Casing	Sealed	Rise	Time	WA	TER ST		ETAILS
		554 (Strike	Depth	At	To	(min)) Co N	lo wate	ts er strike	recorded
			ם אט	FTA	IIS					Date	Hole	Casing	Depth t		GRO		VATER	DETAILS
05	Date	16	Tip Do	epth	RZ Top 10.00	RZ Base 20.30	•	Тур 50mm	e SP		Depth	Depth	Water		ment	3		
	05-04-16 20.00 10.00 20.30 50m							2.										



REPORT NUMBER

1	-	/																	
со	NTR	ACT	N	6 Ga	alway City	/ Trans	port	Project	- Phase 3				ء ع	SHEET	HOLE	NO	BH: She	3/48R et 2 of	3
CO GR	-ore oun	DINA D LE	TES	(mOl	534,39 727,19 D)	6.60 E 7.18 N 40.7	l 72		RIG TYPE			Casagra Air/Mist	inde [DATE I DATE I	DRILLI LOGGI	ED ED	04/0 05/0	4/2016 4/2016	5 5
CLI ENG	ent Sine	ER	G A	ialwa RUP	y County	Coun	cil		INCLINATI CORE DIA	ON (deg) METER (mi	m)	-90 80	[[DRILLI LOGGI	ED BY ED BY		IG D	SL . O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	cture cing og m)	500	Non-Intact Zone Legend			Descript	lion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.30 11.80	100	100	100			104 520		Medium s blueish da fossilifero weathered Dips are h medium to to occasic clay-filled.	trong to ver ark grey, fin us, localize d. norizontal to o closely sp onally undul . <i>(continued</i>)	ry strong, the e grained, l d chert and b locally 45 ^c baced, roug lose. Apertu	hick to thir LIMESTO I stylolites '. Disconti h to locall ures are w	Ily bedd NE (loc), slightl nuities y smool ride, loc	led, ally ly are th, pla ally	nar				
12	13.30	100	100	100			800											0 0 0 0 0 0	
14	14.80	100	100	100			510		- - - - - - - - - - - - - -										
15	15.80	100	100	100	-		143		-									0 0 0 0 0 0	
16	17.30	100	100	100			859											0 0 0 0 0 0 0 0 0 0	
18	18.80	100	100	100			859											0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
19		100	100	93												\ M /AT			
Hol	e ca	sed ().00-1	1.30r	n.					Water	Casing	Sealed	Rise	;	Time		mmen	ts	DETAILO
				1						Strike	Depth	At	То		(min)	N	o wate	er strike	e recorded
		–									Hole	Casino		th to		GRO	DUND	VATER	R DETAILS
INS		LATI		ETA	ILS	חדם	200	T	100	Date	Depth	Depth		ater	Com	ment	S		
05-04-16 20.00 10.00 20.30 50n						50mi	n SP												



REPORT NUMBER

CONTRACT N6 Galway City Transport Project - Phase 3 CO-ORDINATES 534,396.60 E 727,197.18 N RIG TYPE Case GROUND LEVEL (mOD) 40.72 FLUSH Air/ CLIENT Galway County County County County County County County	isagrande /Mist)	DRILLHO SHEET DATE DF DATE LO		BH: Shee	3/48R et 3 of	3
CO-ORDINATES 534,396.60 E 727,197.18 N RIG TYPE Case GROUND LEVEL (mOD) 40.72 FLUSH Air/ CLIENT Galway County Council INCLINIATION (dec) Council	isagrande /Mist)	DATE DF	RILLED	04/0		-
CLIENT Galway County Council INCLINATION (doc))		OGGED	04/0	4/2016	3 3
ENGINEERARUPCORE DIAMETER (mm)80		DRILLED	D BY D BY	IG D	SL . O'She	ea
Dewnhole Depth (m) Core Run Depth (m) T.C.R.% A.D.D. Paratine Sbacing Tod Non-intact Zone Legend Legend Legend Legend Log (mm) Description			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
20 20.30			20.3	0 20.42	0 0	
21 22 23 24 25 26 27 28 29						
REMARKS			WA	TER ST	 	DETAILS
Hole cased 0.00-1.30m. Water Casing Sea	aled Ris	se Ti	ime min) C	ommen	ts	
			1	No wate	er strike	e recorded
	l		GR		VATER	RDETAILS
INSTALLATION DETAILS Date Hole C Depth D	Casing De Depth V	epth to Water	Commen	ts		
Date Tip Depth RZ Top RZ Base Type 05-04-16 20.00 10.00 20.30 50mm SP						



REPORT NUMBER

C	1																
CONTR	ACT	N	l6 Ga	alway City	r Transpo	rt Pr	oject -	Phase 3				DRI SHE	LLHOLE ET	NO	BH: Shee	3/52R et 1 of	2
CO-ORI		TES	(mO	528,27 727,64 D)	7.05 E 8.55 N 15.42			RIG TYPE			Knebel Air/Mist	DAT DAT	e drill E logo	.ED GED	09/0 09/0	3/2016 3/2016	6
CLIENT	ER	G	alwa RUP	ay County	Council			INCLINATI CORE DIA	ON (deg) METER (mr	n)	-90 80	DRI LOC	lled B' Ged B'	Y Y	S. D.	Peter O'She	sen ea
Downhole Depth (m) Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	eture cing og m)	Non-intact Zone	Legend			Descript	ion			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0							<u>x¹1_z</u>	SYMMET as TOPS(RIX DRILLII DIL.	NG: No rec	overy, obs	erved by	driller	0.30	15.12		
1								SYMMET as light gr SYMMET as light gr	RIX DRILLI ey silty sand RIX DRILLI ey silty grav	NG: No rec dy clay NG: No rec relly clay wi	driller driller slay	2.50	12.92		N = 32 (4, 5, 9, 10, 6, 7)		
4																	N = 50/90 mm (9, 16, 39, 11)
5																	N = 50/40 mm (25, 50)
7																	N = 50/185 mm (8, 13, 16, 19, 15)
8 8.60								SYMMET as rock	RIX DRILLI	NG: No rec	erved by	driller	8.40 8.60	7.02 6.82		N = 50/170 mm (7, 8, 21, 18, 11)	
9 9.90	100	89	74		-				I								
REMAR	KS	000	0.00	~					Water	Casing	Sealed	Rise	Time	WA'	TER ST	RIKE	DETAILS
oie ca	sed (J.UU-8	0.0Uľ	11.					Strike 8.50	Depth 8.50	At N/S	<u>To</u> 8.00	(min) 20	Co N	ommen Ioderat	ts te	
NOTA		<u></u>								Hole	Casing	Denth	0 0	GR(JUNDV	VAIEF	K DE LAILS
Date		Tip D	epth	RZ Top	RZ Base	•	Ту	pe	Date	Depth	Depth	Water	Cor	nment	S		



REPORT NUMBER

1	-	/																
со	NTR	АСТ	N	16 Ga	alway City	/ Transpo	ort Pro	oject -	Phase 3				DRILI SHEE	_HOLE	NO	BH: Shee	3/52R et 2 of	2
CO GR	-ORE	DINA	TES	(mO	528,27 727,64 D) _	7.05 E 8.55 N 15.42			RIG TYPE			Knebel Air/Miet	DATE DATE	DRILL	ED ED	09/0 09/0	3/2016 3/2016	; ;
CLI EN	ENT GINE	ER	G A	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mr	n)	-90 80	DRILI LOGO	LED BY	((S. D.	Peters O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	oture cing og m)	Non-intact Zone	Legend			Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10 - 11	11.20	100	100	100			1050		Very stron grained, L and styloli Dips are h medium to	ng, thick to t IMESTONE ites), fresh t norizontal to o closely sp	hinly bedded E (locally fos to slightly we b locally 45°. aced, rough	d, blueish siliferous, eathered. Discontin to locally	dark grey, localized o uities are smooth, pla	fine hert				
- 12	12 70	100	100	100			600.0000		to occasic clay-filled.	onally undul (continued	ose. Apertur)							
- 13	14.00	100	100	100			600											
- 14	15.30	100	100	100			1030		End	of Borehole		15.30	0.12					
16																		
- 19 - 19 - RE	MAR	KS sed (0.00-6	8 601	n					Water	Casing	Sealed	Rise	Time	WAT	FER ST	RIKE	DETAILS
		Jeu		0.001						Strike 8.50	Depth 8.50	At N/S	To 8.00	<u>(min)</u> 20	Co N	mmen loderat	ts te	
															GRO	DUNDV	VATER	DETAILS
INS	TAL	LATI	ON D	ETA	ILS					Date	Hole	Casing	Depth to Water	Con	nment	s		
	Date		Tip D	epth	RZ Top	RZ Base	9	Ту	be	-		Dopui						
1										1		1	1					



REPORT NUMBER

1	0	1															
cc	DNTR	ACT	N	6 Ga	alway City	/ Transpo	ort Pro	oject - Phase	3			DRIL SHE	lhole et	NO	BH: She	3/53R et 1 of	2
CC GF	D-ORE	DINA D LE	TES	(mOl	528,43 727,69 D)	1.27 E 7.66 N 10.06			YPE 1		Knebel Air/Mist	DATI DATI	e drill E logg	ED ED	08/0 08/0	3/2016 3/2016	6 6
CL EN	IENT GINE	ER	G A	ialwa RUP	y County	Council			NATION (deg) DIAMETER (mr	n)	-90 80	DRIL LOG	LED B	((S. D.	Peter O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing bg m) 500	Non-intact Zone	Legend		Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
1 1 2 3 4 4 5 6 7 7 8 9 9 1/8/1/1 1007/15	6.40 7.85 9.35 MAR Ie cas	100 100 KS ssed (100	100 95 5.40r	n.		569.9996 530 559.9996	SYMM as TC SYMM as ma bould SYMM as ma bould SYMM as not SYMM as not SYMM as not SYMM as not SYMM as not Dips a to me Apertu smeal	METRIX DRILLI PSOIL. METRIX DRILLI ade ground cons ers METRIX DRILLI ssible weathere METRIX DRILLI ssible weathere METRIX DRILLI ck with clay band strong, thick to t ed, LIMESTONE tylolites, common hered. are 20° to locally dium spaced, ro ures are tight to ring. Water Strike	NG: No reco NG: No reco sisting of cla NG: No reco drock NG: No reco drock NG: No reco drock NG: No reco ds hinly bedde (locally fos on quartz ve y 40° & 80°. Sugh to loca partly open	overy, obs povery, obs puse 804 i overy, obs overy, obs overy, obs d, blueish isilferous ining), fre Discontir Ily smoott , very thir Sealed At	served by d material an served by d material an served by d served by d dark grey, localized sh to slight nuities are v n, planar. brown cla	riller riller d riller riller fine chert ly videly y Time (min)	5.20 6.10 6.40 WA	4.86 3.96 3.66 TER ST	FRIKE ts	N = 24 (5, 6, 9, 4, 7, 4) (4, 5, 3, 9, 12, 7) N = 50/115 mm (8, 13, 27, 23) DETAILS
GPJ IGSL														N	lo wate	er strike	e recorded
3963.(
¥			<u></u>							Hole	Casing	Depth to		GR(JUNDV	VAIE	DETAILS
E IN\$								Turn c	Date	Depth	Depth	Water	Con	nment	S		
IGSL RC	Date			epin			7	туре									



REPORT NUMBER

1	-	/																
CO	NTR/	ACT	N	16 Ga	alway City	/ Transpo	rt Pro	ject -	Phase 3				DRIL SHE	LHOLE ET	NO	BH: Shee	3/53R et 2 of	2
CO GP				(m∩	528,43 727,69 D)	1.27 E 7.66 N			RIG TYPE			Knebel	DATI	e drill E logg	.ED ED	08/0 08/0	3/2016 3/2016	3 3
CLI	ENT	ER	G	alwa RUP	ay County	Council			INCLINATI	ON (deg) METER (mi	n)	Air/Mist -90 80	DRIL	LED B' GED B'	Y Y	S. D.	Peter O'She	sen ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lo (m	cture cing og m)	Non-intact Zone	Legend			Descriptio	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10	10.90	100	100	100		1	470		Very stron grained, L and styloli weathered	ig, thick to t IMESTONE tes, commo t.	hinly beddeo E (locally fos on quartz ve	d, blueish siliferous ining), fre	a dark grey, , localized esh to slight	fine chert ly				
- 11		100	100	98	_	9	180		Dips are 2 to medium Apertures smearing.	20° to locall a spaced, ro are tight to <i>(continued</i>)	y 40° & 80°. ough to loca partly open)	Discontir lly smootl , very thir	nuities are v h, planar. n brown cla	widely y				
- 13	12.35	100	79	79		- - - - - - - - - - - - - - - - - - -	230											
14	15.10	100	100	100			i80 i20		Fnd	of Borehole	at 15 10 m		15.10	-5.04				
- 16																		
17																		
- 19																		
RE	MAR	KS							1						WAT	rer st	RIKE	DETAILS
Hol	e ca	sed (0.00-6	6.40r	m.					Water	Casing	Sealed	Rise	Time	Co	mmen	ts	
										Suike	Depth	AL	10	((1111)	N	o wate	er strike	e recorded
INC	TA .		<u></u>							Dett	Hole	Casing	Depth to		GRO	JUNDV	VATEF	R DETAILS
INS	Date		Tip D	epth	ILS RZ Top	RZ Base	•	Ту	De	Date	Depth	Depth	Water	Con	nment	S		



REPORT NUMBER

со	NTR	АСТ	N	6 Ga	alway City	Transpo	rt Pro	oject - I	Phase 3				C	RILL	HOLE	NO	BH	3/54R	2
со	-ORE	DINA [.]	TES		528,60	1.20 E							S	HEET	DRILL	ED	Shee 31/0	et 1 of 3/2016	2
GR	OUN	D LE	VEL	(mOl	727,75 D)	7.95 N 8.29			RIG TYPE			Casagra Air/Mist	nde C	DATE L	OGG	ED	01/0	4/2016	3
CL	ENT		G	ialwa	ay County	Council			INCLINATI	ON (deg)		-90	C	RILLE	ED BY	(IG	iSL	
EN	GINE	ER	A	RUP					CORE DIA	METER (mi	n)	80	L	OGGE	ED BY		D.	. O'She	ea I
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spac Lc (mi	ture cing og m) 500	Non-intact Zone	Legend			Descript	ion				Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 0								0	SYMMET		NG: No rec	overy, ob	served	by drill	ler				
Ē								Ð	as gravelly	y ciay									
-																			
- 1								<u>Q</u>	SVMMET	ו ו ווסח עום			onvod	by drill	lor	1.20	7.09		
_									as sandy o	gravelly cla	y with occa	sional cob	bles	by unit	lei				
-								2											
2																			
								<u> </u>											
3								<u></u>	SYMMET		NG [.] No rec	overv ob	served	by drill	ler	3.20	5.09		
									as weathe	ered rock		, ,,	bolvou	oy ann					
-																			
- 4	4.20								Medium st	trona to vei	rv strona. th	ick to thin	lv bedd	ed.		4.20	4.09		
-									blueish da	ark grey, fin	e grained, l		NE (loca	ally					
		100	94	94					weathered		u chert anu	stylolites	, siigitu	у					
. 5									Dips are 2	0° to locall	y 40° & 80°	. Discontii	nuities a	are wio	dely				
-	5.70						(<u>.</u>		to medium Apertures	n spaced, ro are tight to	ough to loca partly oper	ally smoot 1. verv thir	h, plana ו brown	ar. clav					
									smearing.	Ū									
		100	07	07		(6.11-6.35r	m - Clay-fill	ed fracture								
		100	97	97			10												
7	7 20					D	10												
	1.20																		
						6	60												
8		100	99	99															
						94	40												
-	8.70																		
- 9																			
_		100	99	99		7	70.0000	0000001											
RE	MAR	KS														WAT	TER ST	RIKE	DETAILS
Ho	e ca	sed (0.00-4	4.20r	n					Water Strike	Casing Depth	Sealed At	Rise To		Time (min)	Co	mmen	ts	
																N	o wate	er strike	e recorded
																GRO	DUNDV	VATER	R DETAILS
INS	TAL	LATI	ON D	ETA	ILS					Date	Hole Depth	Casing Depth	Dep W#	th to ater	Com	nment	S		
	Date		Fip D	epth	RZ Top	RZ Base		Тур	е										



REPORT NUMBER

1	-	/																
со	NTR	АСТ	N	16 Ga	alway City	/ Transpo	rt Pro	ject -	Phase 3				DRIL	LHOLE ET	NO	BH3 Shee	3/54R et 2 of	2
CO GR		d Le	TES	(mO	528,60 727,75 D)	1.20 E 7.95 N 8.29						Casagrar	nde DATE	e drill E logg	ED ED	31/0 01/0	3/2016 4/2016	5
CLI EN	IENT GINE	ER	G A	Balwa RUP	ay County	Council			INCLINATIO	ON (deg) METER (mr	n)	-90 80	DRIL LOG	LED B' GED B'	((IG D.	SL O'She	ea
Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Frac Spa Lc (m	ture cing og m) 0 500	Non-intact Zone	Legend			Descripti	on			Depth (m)	Elevation	Standpipe Details	SPT (N Value)
- 10 	10.20	100	92	92		6	00 50		Medium si blueish da fossiliferou weathered Dips are 2 to medium Apertures smearing.	trong to ver ark grey, fin us, localize d. 20° to locall n spaced, ro are tight to <i>(continued</i>)	y strong, thi e grained, L d chert and y 40° & 80°. bugh to loca partly open	ck to thinl IMESTON stylolites) Discontin Ily smooth , very thin	y bedded, JE (locally , slightly uities are v n, planar. brown cla	widely y				
12	13.20	100	94	94			99.9999		11.25-11.4	40m - Clay-								
- 14	14.20	100	100	100	-	2	430											
- 15	<u>15.20</u>	100	100	100					Endo	of Borehole	e at 15.20 m				15.20	-6.91		
- 16																		
- 18																		
- 19																		
RE	MAR	KS	0.00	4.00						Water .	Casing	Soolod	Rico	Time	WA	TER ST	RIKE	DETAILS
Ho	e ca	sed (0.00-4	4.201	m.					vvater Strike	Casing Depth	Sealed At	Rise To	(min)	Co N	o wate	ts r strike	
	TA1	ידא ו								Data	Hole	Casing	Depth to		GR		VAIER	DETAILS
	Date		Tip D	epth	RZ Top	RZ Base	•	Тур	De	Jale	Depth	Depth	Water			3		
- L						1	1			1	1	1	1					

BH3/03R Box 1 of 2



BH3/03R Box 2 of 2



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BH3/04R Box 1 of 2



BH3/04R Box 2 of 2



BH3/06R Box 1 of 3



BH3/06R Box 2 of 3



BH3/06R Box 3 of 3



BH3/07R Box 1 of 2



BH3/07R Box 2 of 2



BH3/08R Box 1 of 3



BH3/08R Box 2 of 3



BH3/08R Box 3 of 3



BH3/10R Box 1 of 6



BH3/10R Box 2 of 6



BH3/10R Box 3 of 6



BH3/10R Box 4 of 6



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BH3/10R Box 5 of 6



BH3/10R Box 6 of 6



BH3/11R Box 1 of 3



BH3/11R Box 2 of 3



BH3/11R Box 3 of 3



BH3/13R Box 1 of 3



BH3/13R Box 2 of 3



BH3/13R Box 3 of 3



BH3/16R Box 1 of 3



BH3/16R Box 2 of 3



BH3/16R Box 3 of 3



BH3/17R Box 1 of 2



BH3/17R Box 2 of 2



BH3/18R Box 1 of 8



BH3/18R Box 2 of 8



BH3/18R Box 3 of 8

BH3/18R Box 4 of 8



BH3/18R Box 5 of 8



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BH3/18R Box 6 of 8



BH3/18R Box 7 of 8



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BH3/18R Box 8 of 8



BH3/19R Box 1 of 5



BH3/19R Box 2 of 5



BH3/19R Box 3 of 5



BH3/19R Box 4 of 5



BH3/19R Box 5 of 5



BH3/20R Box 1 of 4



BH3/20R Box 2 of 4



BH3/20R Box 3 of 4



BH3/20R Box 4 of 4



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BH3/22R Box 1 of 5



BH3/22R Box 2 of 5



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BH3/22R Box 3 of 5



BH3/22R Box 4 of 5


BH3/22R Box 5 of 5



BH3/23R Box 1 of 2



BH3/23R Box 2 of 2



BH3/24R Box 1 of 3



BH3/24R Box 2 of 3



BH3/24R Box 3 of 3



BH3/25R Box 1 of 3



BH3/25R Box 2 of 3



BH3/25R Box 3 of 3



BH3/26R Box 1 of 4



BH3/26R Box 2 of 4



BH3/26R Box 3 of 4



BH3/26R Box 4 of 4



BH3/27R Box 1 of 4



BH3/27R Box 2 of 4



BH3/27R Box 3 of 4



BH3/27R Box 4 of 4



BH3/28R Box 1 of 2



BH3/28R Box 2 of 2



BH3/29R Box 1 of 2



BH3/29R Box 2 of 2



BH3/30R Box 1 of 2



BH3/30R Box 2 of 2



BH3/31R Box 1 of 2



BH3/31R Box 2 of 2



BH3/32R Box 1 of 1



BH3/33R Box 1 of 5



BH3/33R Box 2 of 5



BH3/33R Box 3 of 5



BH3/33R Box 4 of 5



BH3/33R Box 5 of 5



BH3/34R Box 1 of 5



BH3/34R Box 2 of 5



BH3/34R Box 3 of 5



BH3/34R Box 4 of 5



BH3/34R Box 5 of 5



BH3/35R Box 1 of 1



BH3/36R Box 1 of 7



BH3/36R Box 2 of 7



BH3/36R Box 3 of 7



BH3/36R Box 4 of 7



BH3/36R Box 5 of 7



BH3/36R Box 6 of 7



BH3/36R Box 7 of 7



BH3/38R Box 1 of 4



BH3/38R Box 2 of 4



BH3/38R Box 3 of 4



BH3/38R Box 4 of 4



BH3/39R Box 1 of 4



BH3/39R Box 2 of 4



BH3/39R Box 3 of 4



BH3/39R Box 4 of 4



BH3/40R Box 1 of 3



BH3/40R Box 2 of 3



BH3/40R Box 3 of 3



BH3/41R Box 1 of 3



BH3/41R Box 2 of 3



BH3/41R Box 3 of 3



BH3/42R Box 1 of 3



BH3/42R Box 2 of 3



BH3/42R Box 3 of 3



BH3/43R Box 1 of 2



BH3/43R Box 2 of 2



BH3/46R Box 1 of 6



BH3/46R Box 2 of 6



BH3/46R Box 3 of 6



BH3/46R Box 4 of 6



BH3/46R Box 5 of 6



BH3/46R Box 6 of 6



BH3/47R Box 1 of 3



BH3/47R Box 2 of 3


BH3/47R Box 3 of 3



BH3/48R Box 1 of 7



BH3/48R Box 2 of 7



BH3/48R Box 3 of 7



BH3/48R Box 4 of 7



BH3/48R Box 5 of 7



BH3/48R Box 6 of 7



BH3/48R Box 7 of 7



BH3/52R Box 1 of 3



BH3/52R Box 2 of 3



BH3/52R Box 3 of 3



BH3/53R Box 1 of 3



BH3/53R Box 2 of 3



BH3/53R Box 3 of 3



BH3/54R Box 1 of 4



BH3/54R Box 2 of 4



BH3/54R Box 3 of 4



BH3/54R Box 4 of 4



Appendix 4

Photographs of machine-excavated inspection pit at BH3/30R





BH3/30R - 2 of 4



BH3/30R - 3 of 4



BH3/30R - 4 of 4



Appendix 5

Trial Pit Logs and Photographs

Exploratory Hole Number	Method of Construction [Machine Excavated / Hand Dug]
TP3/01	ME
TP3/02	HD
TP3/03	ME
TP3/04	ME
TP3/05	ME
TP3/06	ME
TP3/07	ME
TP3/08	ME
TP3/09	ME
TP3/10	HD
TP3/11	HD
TP3/12	ME
TP3/13	ME
TP3/14	HD
TP3/15	ME
TP3/16	ME
TP3/17	ME
TP3/18	ME
TP3/19	ME
TP3/20	ME
TP3/21	ME
TP3/22	ME
TP3/23	ME
TP3/24	ME
TP3/25	ME
TP3/27	ME
TP3/28	ME
TP3/29	ME
TP3/30	ME

TP3/31	ME
TP3/32	ME
TP3/33	ME
TP3/34	ME
TP3/35	ME
TP3/36	ME
TP3/37	ME
TP3/39	ME
TP3/40	ME
TP3/41	ME
TP3/42	ME
TP3/43 (formerly BH3/05)	HD
TP3/44	ME
TP3/45	ME

1	A		REPORT NUMBER										
	3SL	TRIAL PIT RECORD									18963		
CON	ITRACT	N6 Galway City Transport Projec	t - Phase 3					TRIAL P	IT NO.	TP3	5/01		
LOG	GED BY	A.Chryst	CO-ORDINAT	ËS	521,34 722,58	46.87 E 39.22 N		DATE ST	TARTE	D 14/0 TED 14/0	1/2016 1/2016		
CLIE	ENT	Galway County Council	GROUND LEV	VEL (m)	10.10			EXCAVA		Hitad	chi Zaxis	80	
ENG		ARUP		1									
									Sample	es	a)	meter	
		Geotechnical Description				_	rike				st (KF	netro	
				lend	oth	vatior	ter St	nple	Ō	oth	le Te	nd Pe 'a)	
				Leg	(m)	Шe	Wa	Sar Ref	Typ	Dep	Var	(KP	
0.0	Dark bro	own/black sandy gravelly very fibro	us PEAT	10 16 1 10 11				AA37828	В	0.00-0.40			
-	Light are	av alavov/cilty vory sandy find to co	areo angular	<u>10/ 11/</u>	0.40	9.70							
-	GRAVE	L with many cobbles and occasion	al boulders										
				$\frac{1}{2}$									
1.0								AA37829	В	1.00			
-				Contraction Contra									
F	Obstruct End of T	tion - Possible Rockhead rial Pit at 1.40m			1.40	8.70							
-													
-													
- 2.0													
-													
-													
-													
3.0													
-													
-													
4.0													
-													
-													
-													
-													
- Drv	undwater (Conditions		1	I	I	1	1]			I	1	
1/0/07													
Goo	bility d												
Gen	eral Rema	rks											
0.50	hr Clearan	ice required to gain access to pit lo	ocation										

1										REPORT NUMBER		
No De	TRIAL PIT RECORD									18	963	
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	PIT NO.	TP3	8/02	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	521,33 722,75	34.47 E 52.56 N		DATE S	TARTE	D 25/0	et 1 of 1 1/2016 1/2016	
CLIE	INEER	Galway County Council ARUP	GROUND LEV	/EL (m)	17.84			EXCAVA METHO	ATION D	Han	d dug	
									Sample	es	a)	neter
		Geotechnical Description		egend	Jepth m)	Elevation	Vater Strike	Sample Ref	Type	Jepth	/ane Test (KP	Hand Penetror KPa)
0.0	TOPSO	IL		<u> </u>								10
-	Grey cla many co	yey/silty very sandy fine to coarse C bbles and boulders	GRAVEL with		0.30	17.54		AA44496	D	0.50		
-	Obstruc End of T	tion - Possible Rockhead Trial Pit at 0.70m			0.70	17.14		AA44497	В	0.50		
1.0 												
-												
-												
2.0												
-												
-												
- 3.0 - -												
-												
4.0												
-												
-												
Grou Dry	undwater (Conditions										
Stab	ility											
Good	d											
Gene 1.50 Rein	e ral Rema hr Taking stating wa	rks down stone wall. TP location inacce II.	essible with mac	hine due	to steep	o granite	outcrop	which em	erged d	luring cleari	ng works	6.



1	1								I	REPORT N	UMBER	
Colored Colored	BEL	т	RIAL PIT F	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project -	Phase 3						IT NO.	TP3	/04	
LOG	GED BY	A.Chryst	CO-ORDINATI	ES	523,64 724,28	45.55 E 36.79 N		DATE S	TARTED OMPLET	25/0° ED 25/0°	1/2016 1/2016	
CLIE ENGI	NT	Galway County Council ARUP	GROUND LEV	′EL (m)	36.82			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80
									Samples	6	a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KI	Hand Penetrc (KPa)
0.0 - -	TOPSOI Soft dari	L < brown black PEAT			0.15	36.67						
-	Grey bro cobbles	wn clayey/silty very gravelly SAND v and boulders. Gravel is angular fine	with many to coarse.		0.70	36.12	(Seepage)	AA44498 AA44499 AA44500 AA49501 AA49502	D D B D B	0.50 0.50 0.50 0.80 0.80		
_ 1.0 _ _ _	Obstruct End of T	ion - Possible Rockhead rial Pit at 1.00m			1.00	00.02						
- - -												
2.0												
3.0												
- - - 4.0												
-												
Grou Seep Stab	Groundwater Conditions Seepage at 0.70m											
Good Gene 0.25	Good General Remarks 0.25hr Clearance required to access trial pit location											

1	1									REPORT N	UMBER	
Colored Colored	TRIAL PIT RECORD 18963											
CON	TRACT	N6 Galway City Transport Project	- Phase 3						IT NO.	TP3	05	
LOG	GED BY	A.Chryst	CO-ORDINATE	ES	521,60 723,5	03.76 E 16.84 N		DATE S	TARTED	21/0 TED 21/0	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEV	'EL (m)	40.97			EXCAVA METHOI	ATION D	Hitad	chi Zaxis	80
									Sample	s	a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	₩ater Strike	Sample Ref	Type	Depth	Vane Test (KI	Hand Penetrc (KPa)
0.0	TOPSO				0.20	40.77	(Slow)					
-	Solitidan	Colowit librous P EAT			0.00	40.07		AA44473 AA44474 AA44475	D D B	0.50 0.50 0.50		
1.0	Grey slig GRAVE	htly clayey/silty very sandy fine to co _ with many cobbles of granite	oarse	90.50 0- <u>ді</u> ,0	1.10	40.07 39.87		AA44476	D	1.00		
-	Obstruc End of T	ion - Possible Rockhead rial Pit at 1.10m						AA44477	D	1.00		
-												
-												
2.0												
- - - - - - -												
- - - 4.0												
-												
Grou Ingre	Groundwater Conditions Ingress from surface											
Stabi	ility											
Gene	General Remarks 1.25hr Clearing route to trial pit, Difficult access (large granite boulders, steep granite outcrops, soft ground in places), 0.75hr Difficult track											
back	to main re	bad.			- op graf			. gi sunu ili	. piacos,		ua	

1	1									REPORT NU	JMBER	
00	TRIAL PIT RECORD 18963											
CON	FRACT	N6 Galway City Transport Project -	Phase 3					TRIAL P	IT NO.	TP3/	06	
LOG	GED BY	A. Chryst	CO-ORDINATE	ES	521,85 723,85	54.39 E 56.76 N		DATE ST	TARTED) 12/01 TED 12/01	/2016 /2016	
		Galway County Council	GROUND LEV	′EL (m)	48.76			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
ENGI	NEER	AKUP							Sample	s	(a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetron (KPa)
- 0.0	TOPSOI	L		<u>str</u> <u>str</u>	0.20	48.56						
-	Soft darł	k brown black fibrous PEAT			0.20			AA35350 AA37803	D B	0.50-0.50 0.50-1.10		
- 1.0 - - -	Brown g angular	rey slightly clayey/silty sandy fine to GRAVEL with many angular cobbles	coarse s of granite.		1.10	47.66	(Seepage)	AA37804 AA37805	D B	1.10-1.10 1.10-1.50		
 - -	Obstruct End of T	ion - Possible Granite bedrock rial Pit at 1.50m			1.50	47.26						
- - - - - - - - - - - -												
3.0 												
Grou Seep	ndwater C age at 1.3	Conditions 0m		·]								
Stabi Good	lity											
Gene	ral Remai	ks										

1										REPORT N	UMBER	
JG	SL	т	RIAL PIT F	RECO	RD					18	963	
CONT	RACT	N6 Galway City Transport Project -	Phase 3						IT NO.	TP3	/ 07	
LOGG	ED BY	A. Chryst	CO-ORDINATE	ES	521,7 <i>1</i> 723,62	18.09 E 27.37 N		DATE S	TARTED	12/0 ²	1/2016 1/2016	
	NT NEER	Galway County Council ARUP	GROUND LEV	'EL (m)	46.47			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
									Sample	S	(ac	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KI	Hand Penetrc (KPa)
0.0 	TOPSO Grey bro cobbles	L wwn silty very gravelly fine to coarse of granite.	SAND with	<u>112</u> <u>112</u> <u>12</u> <u>112</u> <u>12</u> <u>112</u> <u>12</u> <u>112</u> <u>12</u> <u>112</u> <u>12</u>	0.20	46.27		AA37806 AA37807	D B	0.20-0.50 0.20-0.50		
	Obstruct End of T	ion- Possible Granite bedrock rial Pit at 0.50m			0.50	45.97						
1.0												
-												
2.0												
-												
-												
3.0												
- 4.0 -												
-												
Dry	Dry											
Stabil Good	ity											
Gener 0.50h	r al Rema r Clearar	rks ice required in tracking machine to tr	ial pit location.	0.25hr R	leinstate	ment dur	ing trac	k out of fie	ld			



18963.GPJ IGSL.GDT

26/6/17

TP LOG IGSL 7

1	1									REPORT N	UMBER	
Colored Colored	TRIAL PIT RECORD 18963											
CON	TRACT	N6 Galway City Transport Project	Phase 3					TRIAL P	IT NO.	TP3	6/09	
LOG	GED BY	A.Chryst	CO-ORDINATE	ES	527,02 727,25	25.70 E 59.02 N		DATE S	TARTED	26/0 TED 26/0	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEV	EL (m)	65.80			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80
									Sample	s	a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	♦ ₩ater Strike	Sample Ref	Type	Depth	Vane Test (KF	Hand Penetro (KPa)
0.0	TOPSO Soft blac	IL ck to dark brown slightly gravelly PE	AT		0.15	65.65	(Rapid)					
-	Con blac			<u>1/ 1/6 1/</u>	0.50	65.20						
	COBBLE	ES and BOULDERS of granite		6 C	0.50	65.10		AA49503 AA49504	D D	0.50 0.50		
-	End of T	tion - Possible Rockhead Trial Pit at 0.70m						AA49505	В	0.50		
_ 1.0 _												
-												
-												
- 20												
_ 2.0												
-												
-												
-												
-												
-												
4.0												
-												
-												
-												
Grou	ndwater (Conditions										
T apr	a nigress i											
Stabi Good	Stability Good											
Gene 0.50h	e ral Rema nr Clearan	rks ace required in order to allow trackin	g to trial pit loca	tion. 0.7	5hr Reir	statemer	nt during	g track fror	n field			
		-	- •					-				

1	to									REPORT	IUMBER	
	TRIAL PIT RECORD 18963											
CON	ITRACT	N6 Galway City Transport Project	- Phase 3						IT NO.	TP	3/10	
LOG	GED BY	JL	CO-ORDINATI	ES	522,16 723,94	63.10 E 47.78 N		DATE S	TARTED) 12/0 TED 12/0	01/2016 01/2016	
CLIE ENG	INEER	Galway County Council ARUP	GROUND LEV	/EL (m)	56.56			EXCAVA METHO	ATION D	Han	d dug	
									Sample	s	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetrol (KPa)
0.0	Soft brov frequent	wn to dark brown sandy peaty organ rootlets	ic CLAY with									
	0 Soft brown to dark brown sandy peaty organic CLAY with frequent rootlets Loose brown clayey sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of granite. Cobbles are subangular to subrounded of granite. Obstruction - Possible Granite bedrock / boulders End of Trial Pit at 0.50m .0				0.40 0.50	56.16 56.06	(Seepage)					
4.0	3.0 -4.0											
Gro i Wat	undwater (er seepage	conditions at 0.50m			_				_		_	
Stab Mod	ility erate											
Gen Han leav	eneral Remarks and dug pit carried out due to lack of available access for track machine and abundant granite outcrops in area. 0.50hr accessing and aving site.											

1	REPORT NUMBER											
C DC	J.J. BSL		FRIAL PIT	RECO	RD					18	963	
CON	ITRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/11	
LOG	GED BY	A. Chryst	CO-ORDINAT	ËS	522,4 724,0	13.85 E 62.10 N		DATE S	TARTED) 13/0 ² TED 13/0 ²	1/2016 1/2016	
CLIE	INEER	Galway County Council ARUP	GROUND LEV	/EL (m)	51.74			EXCAVA METHO	ATION D	Hand	l dug	
									Sample	s	(F	neter
		Geotechnical Description		egend	lepth n)	levation	Vater Strike	ample tef	ype	lepth	ane Test (KPa	land Penetron (Pa)
0.0	TOPSO	IL				ш		S R	-		>	τ÷
- - -	Brown g GRAVE Obstruc	rey clayey/silty very sandy fine to c L with cobbles of granite. tion - Possible Granite bedrock	oarse angular		0.25 0.40	51.49 51.34	(Slow)	AA37814	В	0.25-0.40		
-	End of 1	rial Pit at 0.40m										
1.0												
-												
-												
2.0	.0											
-												
-												
- -												
3.0												
-												
-												
4.0												
-												
-												
-												
Grou Slow	i ndwater (/ ingress a	Conditions t 0.20m			-					I		
Stab Good	ility d											
Gene	eral Rema	rks	sing and leaving	site by f	oot							
		ACCESSION IN EXCAVATOR. THE ACCESS	and reaving	Site Dy I								

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1	L										REPORT NUMBER			
Con Con	BEL	Т	RIAL PIT	RECO	RD			18			963			
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/ 13			
LOG	GED BY	A.Chryst	CO-ORDINAT	ËS	522,88 724,20	83.59 E 66.07 N		DATE S	TARTED	20/0 ²	I/2016			
CLIE ENGI	NT	Galway County Council ARUP	GROUND LEV	/EL (m)	46.73			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80		
									Sample	s	a)	meter		
		Geotechnical Description		Legend	Depth (m)	Elevation	₩ater Strike	Sample Ref	Type	Depth	Vane Test (KF	Hand Penetro (KPa)		
0.0	TOPSO SILT/CL	IL - Dark brown black slightly sandy AY with many cobbles irm brown grev sandy slightly gravell	gravelly v SILT with	$\frac{1}{\sqrt{1}} \frac{1}{\sqrt{1}} \frac{1}{\sqrt{1}}$	0.30	46.43	(Rapid)	AA44458 AA44459	D B	0.10-0.30 0.10-0.30				
-	many co	bbles and occasional boulders	,					AA44460 AA44461	D B	0.50 0.50				
- 1.0	Obstruct End of T	tion - Possible Rockhead Frial Pit at 0.90m		<u>x) × </u>	0.90	45.83								
-														
-														
2.0														
-														
-														
_ 3.0 _ _														
-														
- - 4.0														
-														
-														
Grou Rapi	Indwater (d inflow of	Conditions f water from surface	<u> </u>	<u> </u>										
Stab	ility													
General Remarks														
0.401	nr Taking	uown stone wall. U.Sunr Keinstating	sione Wall.											

1	1										REPORT NUMBER			
Contraction of the second seco	J. BSL	Т	RIAL PIT I	RECO	RD					18963				
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/14			
LOG	GED BY	A. Chryst	CO-ORDINAT	ES	523,20 724,22	04.92 E 20.77 N		DATE S	TARTEI	D 13/0 TED 13/0	1/2016 1/2016			
CLIE	NT	Galway County Council ARUP	GROUND LEV	/EL (m)	39.73			EXCAVA METHO	ATION D	Hand	d dug			
			1						Sample	es	a)	neter		
		Geotechnical Description		-egend	Depth (m)	Elevation	<i>M</i> ater Strike	Sample Ref	Type	Jepth	/ane Test (KP	Hand Penetror (KPa)		
0.0 - 1.0 - 2.0 - 3.0 - 4.0	TOPSO Dark bro GRAVE Obstruc End of T	IL own black slightly clayey/silty sandy <u>L with cobbles of granite.</u> tion - Possible Granite bedrock Trial Pit at 0.40m	fine to coarse		0.20 0.40	ш 39.53 39.33	Siow)	<u>о́ й</u>	E.	0.20-0.40	~	ĬX		
-	undwater (Conditions												
Slow	ingress a	t 0.20m												
Stab i Good	ility d													
Gene Hanc leavin	eral Rema d dug pit c ng site by	rks arried out due to lack of available a foot without assistance of track mad	ccess for track r chine for clearar	nachine ance.	and abu	Indant gra	anite out	tcrops in a	rea. 0.5	i0hr accessi	ng and			

1	L									REPORT N	UMBER	
Co Co	BSL	т	RIAL PIT R	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project -	Phase 3					TRIAL P	PIT NO.	TP3	/ 15	
LOG	GED BY	A.Chryst	CO-ORDINATE	S	523,70 724,34	03.17 E 14.09 N		DATE S	TARTED	21/0 ⁻ TED 21/0 ⁻	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEVI	EL (m)	36.49			EXCAVA METHO	ATION D	Hitad	hi Zaxis	80
									Sample	s	Pa)	ometer
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (K	Hand Penetro (KPa)
0.0	TOPSO	IL - Dark brown black slightly gravell	y PEAT					AA44485 AA44486	D B	0.10-0.40 0.10-0.40		
	Obstruc End of T	tion - Possible Rockhead rial Pit at 0.40m		· <u>~~</u> . <u>~~</u> .	0.40	36.09						
- 1.0												
• • •												
2.0												
4.0												
Grou	ndwator (Conditions										
Dry	nuwater	sonations										
Stabi	ility											
Gene	eral Rema	rks										

1	1			REPORT NUMBER								
Con Con	BSL	т	RIAL PIT F	RECO	RD			18			963	
CON	TRACT	N6 Galway City Transport Project -	Phase 3						IT NO.	TP3	/ 16	
LOG	GED BY	A. Chryst	CO-ORDINATE	S	524,04 724,67	13.03 E 79.85 N		DATE S	TARTED	13/0 ²	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEV	EL (m)	29.81			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
									Sample	S)a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KI	Hand Penetrc (KPa)
0.0 	TOPSO Brown s GRAVE	IL lightly clayey/silty very sandy fine to L with cobbles of granite.	coarse		0.20	29.61		AA37816 AA37817	D B	0.20-0.50 0.20-0.50		
-	Obstruc End of 1	tion - Possible Granite bedrock rial Pit at 0.50m			0.50	29.31						
1.0												
- - -												
-												
-												
-												
3.0												
-												
-												
_ 4.0 _ _												
-												
-		Dana 1141 awa										
Grou	mawater (Jonultions										
Stab Good	ility											
Gene 1hr C	e ral Rema Clearing. [rks Difficult access (narrow laneway, gra	eep, lon	g distan	ce). 0.75l	hr Reins	statement.					

								REPORT N	UMBER	
IGSL	Т	RIAL PIT RE	CORD					18	963	
CONTRACT	N6 Galway City Transport Project	- Phase 3				TRIAL P	IT NO.	TP3	8/17	
LOGGED BY	A.Chryst	CO-ORDINATES	524,7 725,1	24.12 E 24.75 N		DATE S	TARTE	Shee D 21/0 TED 21/0	et 1 of 1 1/2016 1/2016	
	Galway County Council	GROUND LEVEL	(m) 44.04			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80
							Sample	es	(F	leter
	Geotechnical Description		egend)epth m)	levation	Vater Strike	ample Ref	ype	Jepth	/ane Test (KPa	land Penetrom KPa)
	DIL	<u>N 1/</u>			>	0112				10
Orange clayey/s	brown COBBLES and BOULDERS silty sandy gravel	with some		43.74		AA44487 AA44488	D B	0.50		
Obstruc	ction - Possible Rockhead		0.90	43.14		AA44489	В	0.50		
- End of	Trial Pit at 0.90m									
-										
2.0										
-										
-										
- - - 3.0										
-										
-										
4.0 										
-										
Groundwater	Conditions									
Dry										
Stability										
General Rema	arks									
0.50hr Cleara	nce required to gain access to pit loo	ation. 0.50hr Reins	tatement of a	access ro	ute follo	wing mach	nine exe	cavation at p	bit	

1										REPORT N	UMBER	
No Co	SSL	т	RIAL PIT I	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project -	Phase 3					TRIAL P	IT NO.	TP3	\$/ 18	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	525,08 725,40	81.67 E 07.94 N		DATE S	TARTEI OMPLE	D 14/0	1/2016 1/2016	
CLIE	INEER	Galway County Council ARUP	GROUND LEV	/EL (m)	49.67			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80
									Sample	es	Pa)	ometer
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (K	Hand Penetrc (KPa)
_ 0.0 _ _	TOPSO Soft blad	L - Dark brown black sandy gravelly k gravelly PEAT	SILT/CLAY	<u>112</u> <u>112</u>	0.15	49.52		AA37825	В	0.15		
- 1.0	Light gre GRAVE	ey/brown clayey/silty sandy fine to cc ₋ with many cobbles and occasional	barse boulders		0.50	49.17	(Moderate)	AA37826	В	1.00		
2.0	Obstruc End of 1	ion - Possible Rockhead irial Pit at 2.20m		A COL	2.20	47.47		AA37827	В	2.00		
4.0												
Grou	Indwater (Conditions										
Mode	erate wate	r ingress at 1.10m										
Stab	ility											
Gene 1hr t	e ral Rema racking in	rks total to and from trial pit location										

1	1									REPORT N	UMBER		
C.C.C.	SSL	1	RIAL PIT F	RIAL PIT RECORD							18963		
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	8/19		
LOG	GED BY	A.Chryst	CO-ORDINATI	ES	525,4 725,7	59.79 E 19.43 N		DATE S	TARTEI	Shee 22/0 TED 22/0	et 1 of 1 1/2016 1/2016		
		Galway County Council ARUP	GROUND LEV	/EL (m)	59.04			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80	
			1						Sample	es	a)	neter	
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetroi (KPa)	
0.0	TOPSO (Mediun with sor	IL n dense to dense) COBBLES and B ne dark brown clayey/silty very sand	OULDERS y gravel		0.15	58.89							
- - - - 1.0	Obstruc End of 1	tion - Possible Rockhead Trial Pit at 0.70m			0.70	58.34		AA44490 AA44491 AA44492	D B B	0.50 0.50 0.50			
-													
2.0													
-													
- - - 3.0													
- - - -													
- - -													
 - - - -													
Grou Dry	indwater (Conditions		<u> </u>	1	1	<u>I</u>	1	L		1	1	
Stab	ility												
Gene	eral Rema	rks											

1	And									REPORT N	JMBER			
C DO	JJJ BSL	т	RIAL PIT	RECO	RD					18963				
CON	ITRACT	N6 Galway City Transport Project	Phase 3					TRIAL P						
LOG	GED BY	A.Chryst	CO-ORDINAT	TES	525,60 725,7	02.13 E 56.44 N		DATE S		14/0 ⁴ TED 14/0 ⁴	1/2016 1/2016			
		Galway County Council	GROUND LE	VEL (m)	57.06			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80		
									Sample	5		eter		
		Geotechnical Description		gend	epth)	evation	ater Strike	imple sf	ed	spth	ine Test (KPa)	ind Penetrome Pa)		
0.0	TOPSOI	L (MADE GROUND)		Le Le	۳ ۳	Ē	Ň	S ar	Тy	ď	>	ΞŔ		
-	Dark bro	wn black very fibrous PEAT (MADE	GROUND)		0.15	56.91	1	AA37822	В	0.15-0.40				
- - - -	Dark bro timber, r pipe (MA	wn black very fibrous PEAT with co netal, glass, copper pipe, lead pipe a ADE GROUND)	ncrete, and ceramic		0.40	56.66	(Rapid)							
1.0	Dark bro	wn grey very sandy GRAVEL with c	oncrete,		1.00	56.06		AA37823	В	1.00				
-	timber, r pipe (MA	netal, glass, copper pipe, lead pipe ; \DE GROUND) ian_ Descible Backbaad	and ceramic		1.30	55.76		AA37824 AA37824	B Env	1.00-1.30				
-	End of T	rial Pit at 1.30m												
-														
2.0														
-														
-														
3.0														
-														
-														
-														
4.0														
-														
-														
Grou	undwater C	Conditions												
Rapi	d water in	gress at 0.40m												
Stab	ility													
Gen	eral Remai	ks	ment of route	way follow	ing over	avation								
0.50		y to and norm site including reinstate		vay iuliow	my exca	avation								

1	1									REPORT N	UMBER	
C.C.C.	3SL	1	RIAL PIT R		18963							
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/21	
LOG	GED BY	A.Chryst	CO-ORDINATE	S	526,36 726,28	61.74 E 34.13 N		DATE S DATE C	TARTED	Shee 22/0 ² TED 22/0 ²	et 1 of 1 1/2016 1/2016	
	INEER	Galway County Council ARUP	GROUND LEVE	EL (m)	60.01			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
									Sample	s	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetroi (KPa)
_ 0.0 _ _ _ _ _	TOPSOI (Medium brown bl Obstruct End of T	L n dense to dense) COBBLES with s lack clayey/silty sandy GRAVEL iion - Possible Rockhead rial Pit at 0.40m	ome dark	* * * * * * * * * * * * * * * * * * *	0.15 0.40	59.86 59.61		AA44493 AA44494 AA44495	D B B	0.15-0.40 0.15-0.40 0.15-0.40		
- - 1.0 - - -												
2.0												
3.0												
4.0												
Grou	Indwater C	Conditions										
Stab	ility											
Gene 1hr t	e ral Rema i racking in	rks total to and from trial pit location										

and									REPORT N	UMBER		
IGSL) 	RIAL PIT RE	COR	C				18963				
CONTRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/22		
LOGGED B	Y A.Chryst	CO-ORDINATES	53 72	33,29 28,31	7.22 E 1.06 N		DATE S	TARTED) 19/0 ² TED 19/0 ²	1/2016 1/2016		
	Galway County Council	GROUND LEVEL	. (m) 50	6.03			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80	
	AKUP							Sample	s		eter	
	Geotechnical Description		q		ion	Strike	ω			Test (KPa)	Penetrome	
			Legen	(m)	Elevat	Water	Sampl Ref	Type	Depth	Vane ⁻	Hand (KPa)	
0.0 TOPS	SOIL prown sandy slightly gravelly SILT	×0 ×0	$\times \xrightarrow{\langle 1 / 2 \rangle}{\times} 0.$.15	55.88		AA33946 AA33947	D B	0.15-0.45 0.15-0.45			
Obstr End o	ruction - Possible Bedrock of Trial Pit at 0.45m		0.	.45	55.56							
1.0												
-												
2.0												
- 3.0												
-												
- - -												
4.0												
-												
Groundwate	er Conditions											
Stability												
General Rei 1hr tracking	marks in total to and from trial pit location ind	clusive of reinstaten	nent									
1	EPORT N	UMBER										
---------------------------	--------------------------------	---	-------------------	---	------------------	--------------------	-------------	--------------------	-----------	---	-------------------------	--------------------------------
UC	BBL	I		NECO	ΠD					18	963	
CON	TRACT	N6 Galway City Transport Project	Phase 3					TRIAL P	IT NO.	TP3 Shee	/23 et 1 of 1	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	533,04 728,01	40.76 E 19.86 N		DATE ST	TARTED	19/0 ⁻ ED 19/0 ⁻	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LE	/EL (m)	46.26			EXCAVA METHOD	TION D	Hitac	hi Zaxis	80
			I						Samples		a)	leter
		Geotechnical Description		gend	pth	vation	iter Strike	mple	е	pth	ne Test (KPa	nd Penetrom ⁹ a)
0.0	TODCO			Lee	(n) De	Ele	Wa	Sai Re	Тур	De	Vai	Hai (KF
- - - -	Soft to f	iL rm light brown slightly sandy slightly	gravelly SILT	×o × × × × × × × × × × × × × × × × × ×	0.15	46.11						
- - -				× × × × × × × × × × × × × ×				AA33940 AA33941	B	0.50 0.50		
- 1.0 - - - -	Soft to fi with son	rm light brown/grey slightly sandy gr ne cobbles	avelly SILT	× × × × × × × × × × × × × × × × × × ×	1.10	45.16		AA33942 AA33943	D B	1.10 1.10		
- - - 2.0	Very stif some co	f light brown/grey slightly sandy grav bbles and occasional boulders	elly SILT with	× 0 × × × × × × × × × × × × × × × × × ×	1.80	44.46		AA33944	D	2 00		
-	Obstruc End of T	tion - Possible Rockhead rial Pit at 2.30m		**************************************	2.30	43.96		AA33945	В	2.00		
-												
3.0 - -												
-												
- 4.0 -												
-												
-												
Grou Dry	ndwater (Conditions										
Stab i Sligh	i lity tly unstab	le										
Gene Plate	e ral Rema bearing t	rks est carried out in pit at 1.20m bgl. 1ł	nr tracking in to	tal to and	from tri	al pit loca	tion.					

1	1			REPORT N	UMBER							
	3SL	I	RIAL PIT F	RECO	RD					18	963	
CON	ITRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	6/24	
LOG	GED BY	A.Chryst	CO-ORDINATE	ES	529,75 728,38	52.24 E 38.27 N		DATE S	TARTEI	Shee D 26/0 TED 26/0	et 1 of 1 1/2016 1/2016	
CLIE	INEER	Galway County Council	GROUND LEV	'EL (m)	13.69			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80
			1						Sample	es	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetror (KPa)
- 0.0 	TOPSO Angular some lig	IL COBBLES and BOULDERS of lime ht brown clayey/silty sandy GRAVE	estone with L		0.10	13.59		AA49456	D	0.50		
- - - - - - - - - - - - - - - - - - -	Obstruction - Possible Rockhead 0.70 12.99 AA49457 B 0.50 1.0 0.70 12.99 0.70 12.99 Image: Construction - Possible Rockhead 0.50 2.0 0.70 12.99 0.70 12.99 Image: Construction - Possible Rockhead 0.50 1.0 0.70 12.99 0.70 12.99 Image: Construction - Possible Rockhead 0.50 2.0 0.70 12.99 0.70 12.99 Image: Construction - Possible Rockhead 0.50 2.0 0.70 12.99 0.70 12.99 Image: Construction - Possible Rockhead 0.50 2.0 0.70 0.70 12.99 0.70 12.99 12.99 12.99 2.0 0.70 0.70 0.70 12.99 12.99 12.99 12.99 12.99 12.99 2.0 0.70 0.70 0.70 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99 12.99											
- - - - - - - - - - - - -												
- - - - - - - - -												
Grou Dry	undwater (Conditions										
Stab Goo	b ility d											
Gen 0.75	eral Rema hr Trackin	rks g to stone wall en route to trial pit lo	cation. 0.15hr Ta	aking do	wn ston	e wall. 0.9	50hr Re	instating w	vall upo	n trial pit co	mpletion	l.





26/6/17

1	The									REPORT NI	JMBER	
C DC	BSL	Т	RIAL PIT I	RECO	RD					189	963	
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/28	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	532,79 727,83	97.33 E 33.55 N		DATE S	TARTED	5nee 15/01 TED 15/01	/2016 /2016	
CLIE ENG	NT	Galway County Council ARUP	GROUND LE	/EL (m)	28.41			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
									Sample	s	a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (Kł	Hand Penetrc (KPa)
0.0	TOPSO			<u>11, 11, 11,</u>	0.20	28.21						
- - - -	cobbles	and occasional boulders	with some	× × × × × × × × × ×				AA37830 AA37831	D B	0.50-0.50 0.50-0.50		
- - - -				క్ర ్ర సార్ల్లో సి స్ట్రైల్లో సి				AA37832 AA37833	D B	1.00-1.00 1.00-1.00		
- - - - - - - - - -	Stiff to v SILT/CL	ery stiff light brown slightly sandy sli AY with many cobbles and occasion	ghtly gravelly al boulders		1.80	26.61		AA37834 AA37835	D B	2.00-2.00 2.00-2.00		
- - - - -	Fnd of T	īrial Pit at 3 30m			3.30	25.11		AA37836 AA37837	D B	3.00-3.00 3.00-3.00		
-												
4.0												
-												
-												
-												
Grou Dry	Indwater (Conditions										
Stab Good	ility											
Gene	eral Rema	rks										
FIL LE	anninated	at 5.50m due to very slow progress										



TRIAL PIT RECORD

REPORT NUMBER

18963

LOGGED BY JL CO-ORDINATES S2:16:02:74 E 723:484:35 N DATE STARTED 1201/2016 DATE SOMPLETED 1201/2016 DATE SOMPLETED 1201/2016 DATE SOMPLETED CLIENT ENGINEER Galvary County Council Galvary Council Galvary Council Fillenbilizari Geolechnical Description g <th>CON</th> <th>TRACT</th> <th>N6 Galway City Transport Project</th> <th>ot - Phase 3</th> <th></th> <th></th> <th></th> <th></th> <th>TRIAL P SHEET</th> <th>IT NO.</th> <th>TP3 Shee</th> <th>/29 t 1 of 1</th> <th></th>	CON	TRACT	N6 Galway City Transport Project	ot - Phase 3					TRIAL P SHEET	IT NO.	TP3 Shee	/ 29 t 1 of 1	
CLLENT ENGINEER Galway County Council GROUND LEVEL (m) 41.84 EXCAVATION METHOD Hilschi Zav 0 Geotechnical Description g g g g g g g g g g g g g g g g g g g	LOG	GED BY	JL	CO-ORDINAT	ES	521,6 723,4	62.74 E 34.36 N		DATE ST	TARTED	12/01 ED 12/01	/2016 /2016	
Geotechnical Description Samples Samples 00 Firm to spongy dark brown to black fibrous PEAT V	CLIE ENGI	INEER	Galway County Council ARUP	GROUND LEV	/EL (m)	41.84			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
Geotechnical Description B D D D 00 0.50m Mare glass bottle 0.50m Mare glass bottle 0.50m Mare glass bottle 0.60m Mary subangular to subrounded BOULDERS of Use S0m 0.60m Mary subangular to subrounded BOULDERS of Use S0m 0.60m Mary subangular to subrounded BOULDERS of Use S0m 0.60m Mary subangular to subrounded BOULDERS of Use S0m 0.60m Mary subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to subrounded GOULDERS of Use S0m 0.60m Mary Subangular to S0m 0.60m Mary Subangular to S0m 0.60m Mary Subangular to S0m 0.60m Mary Subangular										Samples		a)	neter
00 Firm to spongy dark brown to black fibrous PEAT 24 44 2 44 4 2 44 4 4 4 4			Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetror (KPa)
0.50m Rare glass bottle 0.60m Many subangular to subrounded BOULDERS of granatic tup to 600mm) 0.60 41.24 AA37808 D 0.50 10 Soft light brown mottled grey brown sandy gravelly slightly organic 2016ts and occasional lense of clayey/slity sandy gravel. Sand is fine to coarse. 0.60 41.24 AA37810 D 1.00 20 Soft brown grey brown and dark grey brown clayey/slity wery sandy GRAVEL with some cobbles. Sand is fine to coarse. 1.30 40.54 AA37811 D 1.00 20 Possible Highly Weathered Rockhead recovered as light grey COBBLES and GRAVEL of weathered granite 1.80 40.04 AA37813 D 1.60-1.80 30 4.0 Ind of Trial Pit at 2.10m 1.80 1.80 Indicating the second seco	0.0	Firm to	spongy dark brown to black fibrous	S PEAT									
10 Organic SiL I/LAY with some cobles, frequent decaying in and gark gravel. Sand is fine to coarse. A37810 D 1.00 9 Organic SiL i/LAY with some cobles, and gark gravel. Sand is fine to coarse. Image: Soft brown gravel. Sand is fine to coarse. Image:		0.50m 0.60m granite Soft lig	Rare glass bottle Many subangular to subrounded B (up to 600mm) ht brown mottled grey brown sandy	OULDERS of		0.60	41.24	(Seepage)	AA37808 AA37809	D B	0.50 0.50		
coarse. Gravel is subangular to subrounded of granite. AA37812 D 1.60-1.80 Possible Highly Weathered Rockhead recovered as light Image: CoBBLES and GRAVEL of weathered granite	1.0	organic organic gravel. Soft bro very sa	contects and occasional lense of cl sound is fine to coarse. Sand is fine to coarse. own grey brown and dark grey brown ndy GRAVEL with some cobbles. S	ayey/silty sandy //n clayey/silty Sand is fine to		1.30	40.54		AA37810 AA37811	D B	1.00 1.00		
2.10 39.74 End of Trial Pit at 2.10m 3.0 4.0 End of Trial Pit at 2.10m 4.0 Soundwater Conditions Seepage at 0.60m	2.0	Coarse. Possibl grey CO	Gravel is subangular to subrounde e Highly Weathered Rockhead rec DBBLES and GRAVEL of weathered	ed of granite. overed as light ed granite		1.80	40.04		AA37812 AA37813	D B	1.60-1.80 1.60-1.80		
4.0 4.0 Sroundwater Conditions Seepage at 0.60m	3.0												
4.0 4.0 A.0 A.0 A.0 A.0 A.0 A.0 A.0 A.0 A.0 A													
Groundwater Conditions Seepage at 0.60m	4.0												
Groundwater Conditions Seepage at 0.60m													
	Grou Seep	i ndwater bage at 0	Conditions .60m			<u> </u>		<u> </u>					
Stability Good	Stab Good	ility											
General Remarks 1hr tracking to and from location inclusive of selection of specific machine trackway and reinstatement upon completion	Gene 1hr t	eral Rema racking to	arks o and from location inclusive of sele	ection of specific ı	nachine	trackwa	y and reir	nstatem	ent upon c	ompletio	n		

1	T	REPORT N	UMBER									
N BC	3SL	1	RIAL PIT I	RECO	RD					18	963	
CON	ITRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/30	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	534,74 726,80	41.61 E 67.42 N		DATE S DATE C	TARTEI	22/03 TED 22/03	et 1 of 1 3/2016 3/2016	
CLIE	NT	Galway County Council	GROUND LEV	/EL (m)	31.74			EXCAV	ATION	Hitad	hi 13T	
ENG	INEER	ARUP							0			
									Sample	es	Pa)	ometer
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (K	Hand Penetr (KPa)
0.0	TOPSO	L wn slightly sandy gravelly SILT with	many angular	XUZ XUZ	0.10	31.64		AA49484	В	0.10-0.50		
-	cobbles	and boulders of limestone	inany angalai	× ×								
-	Obstruct End of T	tion - Possible Rockhead Trial Pit at 0.50m			0.50	31.24						
-												
1.0												
-												
-												
-												
2.0												
-												
-												
-												
- 3.0												
-												
-												
4.0												
-												
-												
Grou	undwater (Conditions										
Dry												
B Stab Goo	iility d											
03.GFJ	anal Di	den .										
Ben Pit te	eral Rema erminated	r ks on possible shallow rockhead										

E		TRIAL PIT	RECO	RD					REPORT N	UMBER	
JGSL									18	963	
CONTRACT	N6 Galway City Transport Pro	ject - Phase 3					TRIAL P	IT NO.	TP3 Shee	i/31 et 1 of 1	
LOGGED B	Y A.Chryst	CO-ORDINA	TES	532,6 728,2	02.82 E 53.70 N		DATE ST	TARTE OMPLE	D 27/0	1/2016 1/2016	
CLIENT ENGINEER	Galway County Council ARUP	GROUND LI	EVEL (m)	22.27			EXCAVA METHO	TION	Hitad	chi Zaxis	\$ 80
								Sample	es	a)	neter
	Geotechnical Description	on	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetrol (KPa)
0.0 TOPS Soft I cobbl	SOIL light brown slightly sandy gravelly S les and occasional boulders	SILT with many	x x x x x x x x x x x x x x x x x x x	0.20	22.07		AA49458 AA49459	D B	0.50 0.50		
2.0							AA49460 AA49461	D B	1.50 1.50		
3.0	to firm light brown grow olightly con	dy groupily SILT		3.10	19.17		AA49462 AA49463	D B	2.50 2.50		
4.0	many cobbles and boulders		\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$				AA49464 AA49465	D B	3.50 3.50		
End	of Trial Pit at 4.50m		× 0; × 0; × 0;	4.50	17.77						
Groundwate	er Conditions										<u> </u>
,											
Stability Slightly uns	table										
General Rei TM required	marks d to gain access to field gate (N17)	. 0.50hr Set up TN	Л. 0.50hr C	Clearing	access at	entrar	nce gate.				

REPORT NUMBER

1	1									REPORT N	UMBER	
	BSL	I	RIAL PIT	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	PIT NO.	TP3	8/32	
LOG	GED BY	A.Chryst	CO-ORDINAT	ËS	534,40 727,09	62.87 E 96.99 N		DATE S	TARTE	D 27/0	et 1 of 1 1/2016 1/2016	
CLIE	NT NEER	Galway County Council ARUP	GROUND LEV	VEL (m)	41.71			EXCAVA METHO	ATION D	Hitad	chi Zaxis	80
									Sample	es	a)	neter
		Geotechnical Description		-egend	Depth m)	Elevation	Nater Strike	Sample Ref	Lype	Depth	/ane Test (KP	Hand Penetro KPa)
_ 0.0	TOPSO	IL			0 15	41 56	-					
-	Soft dar	k brown sandy slightly gravelly SILT	with rootlets	ו × × ×	0.15	41.50						
-				×°× ×	0.60	41 11		AA49466 AA49467	D D	0.40 0.40		
-	Obstruc End of 1	tion - Possible Limestone Rockhead Frial Pit at 0.60m	Ł		0.00			AA49468	В	0.40		
- 1.0												
-												
-												
-												
-												
2.0												
-												
-												
-												
3.0												
-												
-												
-												
Ē												
4.0												
F												
-												
Ē												
Grou	ndwater (Conditions										
Stab Good	ility											
Gene TM r	eral Rema equired to	rks gain access to field gate (Briarhill .	Junction). 0.50h	r setting	up TM.							

-	42	-								REPORT N	UMBER	
Je	BEL	· · · ·		KECU	KU					18	963	
CON	TRACT	N6 Galway City Transport Project	- Phase 3						IT NO.	TP3	3/33	
LOG	GED BY	A. Chryst	CO-ORDINATE	ES	522,04 723,74	45.06 E 48.24 N		DATE S	TARTEI	D 12/0 TED 12/0	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEV	EL (m)	48.44			EXCAVA METHO	ATION D	Hita	chi Zaxis	80
									Sample	es	Pa)	ometer
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (K	Hand Penetro (KPa)
0.0	TOPSO	IL - Black gravelly sandy organic SI	_T/CLAY	<u>, 17</u> , <u>, 17</u> 17, , 17, , 1	0.20	48.24		AA35349	В	0.00-0.20		
2.0	Obstruc End of 1	tion - Possible Granite bedrock Trial Pit at 0.20m			0.20	48.24						
Geone	ndwater (ility aral Rema	Conditions										
0.75ł	nr Trackin	g to and from pit location										

and and	to		TRIAL PIT	RECO	RD					REPORT N		
00	BBL			- •						18	903	
CON	TRACT	N6 Galway City Transport Pro	oject - Phase 3					TRIAL P SHEET	IT NO.	TP3 Shee	3/34 et 1 of 1	
LOG	GED BY	A.Chryst	CO-ORDINA	TES	521,90 723,82	62.32 E 27.95 N		DATE S	TARTE OMPLE	D 20/0	1/2016 1/2016	
CLIE ENGI	NT	Galway County Council ARUP	GROUND LI	EVEL (m)	48.89			EXCAVA METHO	ATION D	Hita	chi Zaxis	80
									Sample	es	(8	leter
		Geotechnical Descripti	on	Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KPa	Hand Penetron (KPa)
- 0.0	TOPSO			<u>NIZ NIZ</u>	0.15	48.74	-		-			
-	Soft dar	k brown black PEAT			0.90	47.99	1	AA44464 AA44465 AA44466	D D B	0.50 0.50 0.50		
- 1.0 	Soft to fi SILT/CL	Irm grey brown slightly sandy sl AY with frequent cobbles	ightly gravelly				(Seepage	AA44467 AA44468 AA44471 AA44472	D B CBR CBR	1.00 1.00 1.00 1.00		
2.0	Grey cla with mai Obstruct	yey/silty sandy fine to coarse a ny cobbles and occasional boul tion - Possible Rockhead	ngular GRAVEL ders	0 0 0 0	1.70 2.10	47.19		AA44469 AA44470	D B	2.00 2.00		
- 3.0 - 3.0 	End of 1	Conditions										
Wate	er seepage	e at 0.90m										
Stab Good	ility d											
Gene Carri 0.75	eral Rema led out ne hr tracking	rks ar location BH3/01. Additional s ₉ to and from location.	samples acquired a	at 1.0m un	der instr	uction fro	om ARU	IP - sample	s taker	n for CBR ar	nalysis.	

1	1									REPORT N	UMBER	
C.C.C.	JC BSL	I	RIAL PIT F	RECO	RD					18	963	
CON	ITRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	PIT NO.	TP3	8/35	
LOG	GED BY	A.Chryst	CO-ORDINATI	ES	522,8 724,2	57.21 E 33.35 N		DATE S		Shee D 20/0	et 1 of 1 1/2016 1/2016	
CLIE	INT	Galway County Council	GROUND LEV	/EL (m)	46.89			EXCAVA	ATION	Hita	chi Zaxis	80
ENG		ARUP							Sample	es		ster
		Geotechnical Description		jend	pth	vation	ter Strike	uple	e	pth	ле Test (КРа)	nd Penetrome a)
0.0	TODOO				(m)	Ше		Sar Ref	Typ	Del	Vai	Е Д Ц
-	Soft dari granite	⊩ k brown black fibrous PEAT with bo	ulders of		0.20	46.69	(Rapid)	AA44462	D	0.50		
	Obstruct End of T	tion - Possible Granite bedrock Trial Pit at 0.90m		<u>27. 27.</u>	0.90	45.99		AA44463	В	0.50		
- - -												
- - -												
3.0												
- - -												
- 4.0 												
-												
Grou Rapi	undwater (id inflow of	Conditions f water from surface							1	1		
לי Stab	ility											
Gene Carr	eral Rema ied out nea	rks ar location BH3/02. 0.50hr reinstate	ment following c	completic	on of pit.							



1	A									REPORT N	UMBER	
Con Con	BEL	Т	RIAL PIT	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/37	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	521,38 722,67	59.17 E 14.44 N		DATE S	TARTED	14/04 TED 14/04	4/2016 4/2016	
CLIE ENGI	NT	Galway County Council ARUP	GROUND LE	VEL (m)	10.98			EXCAVA METHOI	ATION D	Hitad	chi Zaxis	80
									Sample	s	a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (Kl	Hand Penetro (KPa)
0.0	TOPSO	IL		1/ 1/ 1/								
-	Brown g GRAVEI content.	rey clayey/silty very sandy angular f L with a high cobble and low to med Cobbles and boulders are angular o	ine to coarse ium boulder of granite.		0.30	10.68		AA49488	В	0.50		
-	Brown v	ery sandy very gravelly CLAY		0	0.90	10.08	1					
-	Obstruct	tion - Possible Rockhead		<u> </u>	1.10	9.88	(Moderate)	AA49489	В	1.00		
-												
-												
2.0												
-												
- - -												
3.0												
-												
4.0												
-												
-												
Grou Mode	indwater (erate wate	Conditions or strike at 1.0m			<u> </u>	<u> </u>	<u> </u>					
0.1	1114											
Good	liity d											
Gene Pit te	eral Remainster	rks on possible shallow rockhead										

1	1									REPORT N	JMBER	
C.C.	JSL	т	RIAL PIT F	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project -	Phase 3					TRIAL P	IT NO.	TP3	/39	
LOG	GED BY	A.Chryst	CO-ORDINATI	ES	525,04 725,38	45.94 E 32.41 N		DATE S	TARTED	18/04 18/04	1/2016 1/2016	
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEV	/EL (m)	49.79			EXCAVA METHO	ATION D	Hitac	hi Zaxis	80
									Sample	s)a)	meter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KF	Hand Penetro (KPa)
0.0 - - - -	TOPSO Brown s GRAVE content	L lightly clayey/silty sandy angular fine _ of granite with a high cobble and b	to coarse oulder		0.20	49.59	(Seepage)	AA49491	В	0.50-1.00		
1.0	Grey an GRAVE content.	d brown very sandy angular fine to c ₋ of granite with a high cobble and b Cobbles and boulders are angular.	oarse oulder		1.10	48.69		AA49492	В	1.10-1.60		
content. Cobbles and boulders are angular. 0 = 0 Obstruction - Possible Rockhead 1.60 End of Trial Pit at 1.60m 1.60												
- 3.0 - - - -												
4.0												
Grou Seep	ndwater (age at 0.6	Conditions SOm										
Sligh	lity tly unstab	le										
Gene Pit te	r al Rema rminated	r ks on possible shallow rockhead										

1	L									REPORT N	UMBER	
C.C.C.	3SL		TRIAL PIT	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Projec	t - Phase 3					TRIAL P	IT NO.	TP3	/40	
LOG	GED BY	A.Chryst	CO-ORDINAT	ES	525,3 725,6	97.63 E 77.10 N		DATE S DATE C	TARTEI	C 18/04 TED 18/04	et 1 of 1 4/2016 4/2016	
CLIE	NT	Galway County Council	GROUND LEV	/EL (m)	59.65			EXCAV		Hitad	hi Zaxis	80
ENG	INEER	ARUP				1						
								Sampl		es	Pa)	ometer
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (K	Hand Penetro (KPa)
0.0	TOPSO	L		$\frac{1}{2}$								
	Brown c GRAVE	layey/silty very sandy angular fine L of granite with a low to medium c	to coarse obble and		0.25	59.40		AA49490	В	0.30-0.60		
-	Brown g	rey COBBLES and BOULDERS of	granite		0.60	59.05						
-	Obstruct	tion - Possible Rockhead			0.80	58.85						
1.0	End of I	rial Pit at 0.80m										
Ē												
F												
-												
2.0												
Ē												
-												
-												
-												
3.0												
-												
-												
F												
4.0												
-												
-												
F												
<u> </u>												
Grou Dry	undwater (Conditions										
5												
Stab Good	ility d											
Gene	eral Rema	rks										
Pit te	erminated	on possible shallow rockhead										

1	1									REPORT N	UMBER	
Colored Colored	BSL	т	RIAL PIT F	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project -	Phase 3						IT NO.	TP3	/ 41	
LOGGED BY		A.Chryst	CO-ORDINATE	INATES 529,897.01 E 728,377.37 N				DATE ST	TARTED	ETED 19/04/2016		
CLIE ENGI	NT NEER	Galway County Council ARUP	GROUND LEV	'EL (m)	22.57			EXCAVA METHO	ATION D	Hitad	hi Zaxis	80
									Sample	s	Pa)	ometer
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (K	Hand Penetro (KPa)
- 0.0 - -	TOPSOI	L		<u>112</u> <u>112</u> <u>12</u> <u>14</u> <u>1</u> 4								
-	Firm ora high cob are of lin	nge brown sandy slightly gravelly Cl ble and boulder content. Cobbles ar nestone.	AY with a doulders		0.40	22.17		AA43057 AA43058	B D	0.50 0.50		
- - 1.0	Possible COBBLE	Highly Weathered Rockhead recov S and BOULDERS of limestone	ered as Grey		0.80	21.77			_			
-	Obstruct	ion - Possible Rockhead			1.40	21.17						
- - -	End of T	rial Pit at 1.40m										
2.0												
-												
-												
- 												
-												
-												
4.0 -												
-												
-												
Dry	inawater C	onaltions										
Stab Good	ility											
Gene Pit te	eral Remains	'ks on possible shallow rockhead										

1	to									REPORT N	IUMBER	
	JSL	-	FRIAL PIT	RECO	RD					18	963	
CON	TRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TPS	3/42	
LOG	GED BY	A.Chryst	CO-ORDINAT	ËS	529,93 728,4	31.08 E 10.99 N		- SHEET DATE S DATE C	TARTEI	She D 19/0 TED 19/0	et 1 of 1 4/2016 4/2016	
CLIE	NT NEER	Galway County Council ARUP	GROUND LE	VEL (m)	23.89			EXCAVA METHO	ATION D	Hita	chi Zaxis	80
									Sample	es	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetroi (KPa)
0.0	TOPSO	IL		<u>Ally</u> <u>Ally</u>	0.00	00.00						
	Firm da rootlets	rk brown sandy gravelly CLAY/SILT	with frequent	-X0	0.20	23.69			_			
-	Firm lig	nt grey slightly sandy slightly gravel	y CLAY		0.50	23.39		AA43059	В	0.40		
- - - 1.0 -								AA43060 AA43061	B D	0.80 0.80		
2.0	Brown c	elayey/silty gravelly fine to coarse S	AND		1.40	22.49		AA43062	В	1.50		
								AA43063	В	2.50		
- 3.0 	Grey bro fine to c	own clayey/silty very sandy subang oarse GRAVEL	ular to rounded		3.20	20.69		AA43064	В	3.50		
4.0 - - -	End of 1	Frial Pit at 4.40m		$\begin{array}{c} 0 & \bullet \\ 0 & \bullet \\ \bullet \\ 0 & \bullet \\ 0 &$	4.40	19.49						
-												
Grou Dry	Indwater (Conditions										
5												
Stab Good	ility d											
Gene	eral Rema	rks										

2	D)	т	RIAL PIT	RECO	RD					189	лвек 963	
CON	NTRACT	N6 Galway City Transport Project	- Phase 3					TRIAL P	IT NO.	TP3	/43	
LOC	GED BY	J.Duggan	CO-ORDINAT	ES	524,1 ² 724,72	11.34 E 25.07 N		DATE ST		Shee 25/02 TED 25/02	t 1 of 1 2/2016 2/2016	
	ENT GINEER	Galway County Council ARUP	GROUND LEV	/EL (m)	19.85			EXCAVA	TION	REPORT NUMBER 18963 0. TP3/43 Sheet 1 of 1 TED 25/02/2016 PLETED 25/02/2016 IN Hand Dug nples (ex) 150,045 0. 0.15-0.45 0.15-0.45 B 0. 0.15-0.45 B 0. 0.15-0.45 B 0. 0.45-0.90		
									Sample	es	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Туре	Depth	Vane Test (KP	Hand Penetror (KPa)
- 0.0	TOPSO Soft dar SILT/CL Grey bro with a m angular granite. Obstruc: End of T	IL k brown to black sandy gravelly sligh AY with occasional rootlets own and dark brown clayey/silty sand redium cobble content. Sand is coars to subangular coarse. Cobbles are o to n - Possible granite rockhead Trial Pit at 0.90m	ttly organic dy GRAVEL se. Gravel is of weathered		 <u>○</u> <u>E</u> 0.15 0.45 0.90 	ш 19.70 19.40 18.95		05 22 AA39973 AA39974 AA39976 AA39975	а а а а а а а а а а а а а а а а а а а	0.15-0.45 0.15-0.45 0.15-0.45 0.45-0.90	Va	(Ki (Ki
4.0 - - - - - - - - - - - - -	undwater (bility lerate eral Rema ried out at at ring site by	Conditions rks original location of BH3/05. Hand du foot.	g pit carried ou	t due to la	ack of s	uitable ac	ccess fo	r track mad	chine. C).75hr acces	sing and	1



TRIAL PIT RECORD

REPORT NUMBER

18963

CONT	RACT	N6 Galway City Transport Project	ct - Phase 3					TRIAL PI	I NO.	TP3 Shee	/ 44 et 1 of 1	
.OGC	GED BY	A.Chryst	CO-ORDINAT	ES	533,74 728,00	40.76 E 60.11 N		DATE ST DATE CO	ARTED	19/04 2 D 19/04	1/2016 1/2016	
CLIEN	NT NEER	Galway County Council ARUP	GROUND LEV	/EL (m)	54.81			EXCAVA METHOD	TION)	Hitac	hi Zaxis	80
								Ş	Samples		a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	//44 ≥t 1 of 1 4/2016 2/10 Zaxis	Hand Penetrol (KPa)
0	GRAVE	L surface dressing - Possible Cl.8 ID)	04 (MADE		0.15	54.66						
.0	Angular occasion GROUN Firm ligh with a hi	to subangular COBBLES of crush nal fragments of concrete and red ID) nt brown slightly sandy slightly gra igh cobble content. Cobbles are o	velly SILT/CLAY		0.80	54.01		4 4 4 9 4 9 2	P	1.00		
-			n de slinbile		1.80	53.01		AA49493 AA49494 AA49495	в D	1.00 1.00 1.00		
.0	gravelly limestor	CLAY with a high cobble content.	Cobbles are of		2 50	52 31		AA49496 AA49497 AA49498	B B D	2.00 2.00 2.00		
	End of 1	Frial Pit at 2.50m			2.00	02.01						
3.0												
1.0												
Fou	ndwater (Conditions										
.,												
itabi Good	lity											
Sene Pit ter	ral Rema rminated	rks at 2.50m due to very slow progres	S									





<u>TP3/01 - 1 of 2</u>

TP3/01- 2 of 2



TP3/02 - 1 of 2

TP3/02 - 2 of 2





TP3/03 - 1 of 2

TP3/03 - 2 of 2



TP3/04 - 1 of 2

TP3/04 - 2 of 2



TP3/05 - 1 of 2

TP3/05 - 2 of 2



TP3/06 - 1 of 2



TP3/06 - 2 of 2











<u>TP3/08 - 2 of 2</u>





TP3/09 - 1 of 2

<u> TP3/09 - 2 of 2</u>



<u>TP3/10 - 1 of 2</u>



TP3/10 - 2 of 2



<u>TP3/11 - 1 of 2</u>



<u>TP3/11- 2 of 2</u>



<u>TP3/12 - 1 of 2</u>



<u>TP3/12 - 2 of 2</u>



<u>TP3/13 - 1 of 2</u>



TP3/13 - 2 of 2







<u>TP3/14 - 2 of 2</u>



<u>TP3/15 - 1 of 2</u>



<u>TP3/15 - 2 of 2</u>




<u>TP3/16 - 1 of 2</u>

<u>TP3/16 - 2 of 2</u>



<u>TP3/17 - 1 of 2</u>



<u>TP3/17 - 2 of 2</u>



<u>TP3/18 - 1 of 2</u>



<u>TP3/18 - 2 of 2</u>





<u>TP3/19 - 1 of 2</u>

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<u>TP3/22 - 1 of 2</u>

<u>TP3/22 - 2 of 2</u>





<u>TP3/23 - 1 of 2</u>

TP3/23 - 2 of 2





<u>TP3/24 - 1 of 2</u>

<u>TP3/24 - 2 of 2</u>





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TP3/28 - 1 of 2

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TP3/29 - 2 of 2







TP3/30 - 2 of 2







<u>TP3/31- 2 of 2</u>



TP3/32 - 1 of 2



TP3/32 - 2 of 2







<u>TP3/33 - 2 of 2</u>





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<u>TP3/37 - 2 of 2</u>





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<u>TP3/40 - 1 of 2</u>

TP3/40 - 2 of 2





<u>TP3/41 - 1 of 2</u>

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TP3/42- 2 of 2





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<u> TP3/44 - 1 of 2</u>



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<u>TP3/45 - 1 of 2</u>



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Appendix 6

Hand-excavated pit record from Trial Pit TP3/43 (formerly BH3/05)

LIGST)	Hand Dug Trial Pit Log (Formerly Cable Percussive BH3/05) See TP Log also	
LICATION PROJECT	TP3/43 (formerly I GCTP Phase 3 Co	nown as BH3/05) ntract 1	
PROJECT REF. DATE	18963 25/02/2016		
	PHOTOS		
Hand Dug	Pit at TP3/43	A CONTRACT OF THE A	
Spoil Hea	p at TP3/43	<image/>	
	LOG		
	0.0	0 0.15 TOPSOIL 0.45 Soft dark brown to black sandy gravelly slightly organic SILT/CLAY with	
	0.4	occasional rootlets 5 0.90 Grey brown and dark brown clayey/silty sandy GRAVEL with a medium cobble content. Sand is coarse. Gravel is angular to subangular coarse. Cobbles are of	
	0.9	weathered granite. OBSTRUCTION - Possible Weathered Granite Rockhead / Boulder	
	SAMPLES	D 0.15 to 0.45 AA39973 D 0.15 to 0.45 AA39974 B 0.15 to 0.45 AA39976 B 0.45 to 0.90 AA39975	
	GROUNDWATER	Water strike at 0.70m	
·			

Appendix 7

Soakaway Test Records

SW3/01 SW3/02

N.	TRIAL PIT RECORD						18963					
CONTRACT N6 Gal		N6 Galway City Transport Project -	alway City Transport Project - Phase 3 TRIAL PIT NO.						SW3/01			
LOGGED BY		A.Chryst	CO-ORDINATES 529,698.76 E 728,401.42 N		SHEET DATE STAR			Sheet 1 of 1 20/04/2016				
CLIENT Galway County Council		GROUND LEVEL (m)		13.33		EXCAVATION METHOD		Hitad	Hitachi Zaxis 80			
								Samples		;	a)	neter
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KP	Hand Penetror (KPa)
0.0	TOPSO	L k brown slightly sandy slightly grave	IIv CLAY with	<u>17</u> <u>17</u> 1 <u>7</u> <u>17</u> 1 <u>7</u> <u>17</u>	0.20	13.13						
-	rootlets Firm ligh occasior	t brown silty slightly sandy gravelly (CLAY with		0.50	12.83						
- - - - -	occasional coddles and occasional boulders.				1 50	14.02						
-	Obstruct End of T	ion - Possible limestone rockhead rial Pit at 1.50m			1.50	11.83						
2.0												
- - -												
3.0												
- - 4.0												
-												
Grou Dry	Indwater (Conditions										
Stability Good												
Gene Pit te	General Remarks Pit terminated on possible shallow rockhead											

IGSL TP LOG 18963.GPJ IGSL.GDT 16/8/16

1	And									REPORT N	UMBER	
C.	TRIAL PIT RECORD								18963			
CONTRACT N6 Galway City Transport Project -		- Phase 3						IT NO.	SW3/02			
LOGGED BY CLIENT ENGINEER		A.Chryst	CO-ORDINATES GROUND LEVEL (m)		532,683.26 E 728,117.63 N 21.03		DATE STARTED		26/04/2016 TED 27/04/2016			
		Galway County Council ARUP					EXCAVA METHO	ATION D	Hitad	achi Zaxis 80		
							Samples		s	'a)	neter	
		Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Sample Ref	Type	Depth	Vane Test (KF	Hand Penetrol (KPa)
0.0	TOPSO Soft to fi rootlets	IL rm brown sandy slightly gravelly SIL	T/CLAY with		0.20	20.83				0.50		
- - - 1.0	Soft ligh many co	t brown slightly sandy gravelly SILT/ bbles and occasional boulders	CLAY with	× -	0.85	20.18		AA46069 AA46070	В	1.00		
	End of 1	rial Pit at 1.44m			1.44	19.59						
2.0												
3.0												
4.0												
Groι Dry	Indwater (Conditions		<u> </u>	<u> </u>	I		<u> </u>				
Stab Good	ility d											
Gene	eral Rema	rks										

IGSL TP LOG 18963.GPJ IGSL.GDT 16/8/16

Soak	away	Design	f -value f	rom fi	eld tests	IGSL				
Contract:	GCTP Ph	ase 3			Contract No.	18963				
Test No.	SW 3/01	test 1								
Client	Galway C	o Co								
Date:	20.04.16									
Summary	of ground	conditions								
from	to	Desc	ription			Ground water				
0.00	0.20	TOPSOIL								
0.20	0.50	Dark brown sligtly	sandy slightly grav	elly CLAY	with rootlets	DRY				
0.50	1.50	Light brown silty s	lightly sandy slightl	y gravelly C	JLAY					
Notes:	Notes:									
Field Data	<u>a</u>		Field Test							
Depth to	Flapsed		Depth of Pit	(D)	1.50	m				
Water	Time		Width of Pit	(B)	1.15	m				
(m)	(min)		Length of Pi	(_) it (L)	1.50	m				
			-							
0.85	0.00		Initial depth	to Water =	0.85	m				
0.85	0.50		Final depth	to water =	1.40	m				
0.85	1.00		Elapsed tim	e (mins)=	1200.00					
0.85	1.50		Ten of norm	aabla aail	I					
0.00	2.00		Base of peri	meable soil		m				
0.86	3.00		Dase of per							
0.86	3.50									
0.86	4.00									
0.86	4.50									
0.86	5.00		Base area=		1.725	m2				
0.86	6.00	*Av. side area of p	permeable stratum	over test pe	2.00075	m2				
0.87	7.00		Total Expos	ed area =	3.72575	m2				
0.87	8.00									
0.87	9.00	Infiltration rate (f)	= Volume of w	/ater.used/i	unit exposed are	a / unit time				
0.88	30.00									
0.91	90.00	f= 0.0	0021 m/min	or	3.569E-06	m/sec				
1.40	1200.00			•						
		Depth of v	vater vs Elapsed 1	Γime (mins)					
	1400 0	0				_				
	1400.0	°								
	<u>م</u> 1200.0	0			•	-				
	1000.0	0				-				
F	800.0	0				-				
	b 600.0	0				_				
u o	950 400.0	0				_				
	200.0	0				_				
	0.0	0	1	•						
		0.00	0.50	1.00	1	.50				
	Depth to Water (m)									

Soak	away	Design	f -value fr	om fi	eld tests	IGSL				
Contract:	GCTP Ph	ase 3			Contract No.	18963				
Test No.	SW 3/01	test 2								
Client	Galwav C	o Co								
Date:	21.04.16									
Summarv	of around	conditions								
from	to	Desc	ription			Ground water				
0.00	0.20	TOPSOIL								
0.20	0.50	Dark brown sligtly	sandy slightly grave	elly CLAY v	with rootlets	551				
0.50	1.50	Light brown silty sl	ightly sandy slightly	gravelly C	LAY	DRY				
			<u> </u>	0 ,						
Notes:	Notes:									
Field Data	<u>1</u>		Field Test							
Depth to	Flansed		Depth of Pit	(D) [1 50	m				
Water	Time		Width of Pit	() (B)	1.15	 m				
(m)	(min)		Length of Pit	, (L)	1.50	m				
()	()		Longarorri	(-)	1.00					
0.82	0.00		Initial depth	o Water =	0.82	m				
0.82	0.50		Final depth t	o water =	1.28	m				
0.82	1.00		Elapsed time	(mins)=	1365.00					
0.82	1.50			()						
0.82	2.00		Top of perme	eable soil		m				
0.82	2.50		Base of pern	neable soil		m				
0.82	3.00			•						
0.82	3.50									
0.82	4.00									
0.82	4.50									
0.82	5.00		Base area=		1.725	m2				
0.82	6.00	*Av. side area of p	ermeable stratum c	ver test pe	2.385	m2				
0.82	7.00		Total Expose	ed area =	4.11	m2				
0.82	8.00									
0.82	9.00									
0.82	10.00	Infiltration rate (f) =	 Volume of w 	ater used/u	unit exposed are	ea / unit time				
0.84	30.00									
0.86	90.00	f= 0.0	0014 m/min	or	2.357E-06	m/sec				
1.28	1365.00									
	1600.0	Depth of w	vater vs Elapsed T	ime (mins))	1				
	1400.0	0			♦					
	1200.0	0				-				
		0								
	800.0	0				1				
a 🖁	600.0	0				-				
	₩ 400.0					1				
	200.0	0				-1				
	0.0	0		•						
	0.0	0.00	0.50	1.00	1	.50				
			B 41 4 111							
			Depth to Wate	er (m)						

Soak	away	Design	f -value	from fi	eld tests	IGSL				
Contract:	GCTP Ph	ase 3			Contract No.	18963				
Test No.	SW 3/01	test 3								
Client	Galwav C	o Co								
Date:	22.04.16									
Summarv	of around	conditions								
from	to	Desc	ription			Ground water				
0.00	0.20	TOPSOIL								
0.20	0.50	Dark brown sligtly	sandy slightly gr	avelly CLAY	with rootlets					
0.50	1.50	Light brown silty s	ightly sandy slig	htly gravelly (CLAY	DRY				
		<u> </u>	<u> </u>							
Notes:	Notes:									
<u>Field Data</u>	<u>a</u>		Field Test							
Depth to	Elapsed		Depth of I	Pit (D)	1.50	m				
Water	Time		Width of F	Pit (B)	1.15	m				
(m)	(min)		Length of	Pit (L)	1.50	m				
			Ŭ							
0.79	0.00		Initial dep	th to Water =	0.79	m				
0.79	0.50		Final dept	h to water =	0.84	m				
0.79	1.00		Elapsed ti	me (mins)=	90.00					
0.79	1.50									
0.79	2.00		Top of pe	rmeable soil		m				
0.79	2.50		Base of p	ermeable soi		m				
0.79	3.00									
0.79	3.50									
0.79	4.00									
0.79	4.50									
0.79	5.00		Base area	a=	1.725	m2				
0.79	6.00	*Av. side area of p	ermeable stratur	n over test p	3.6358	m2				
0.79	7.00		Total Exp	osed area =	5.3608	m2				
0.79	8.00									
0.79	9.00									
0.79	10.00	Infiltration rate (f) =	Volume or	f water used/	unit exposed are	ea / unit time				
0.81	30.00									
0.82	45.00	f= 0.0	0017 m/min	or	2.86E-06	m/sec				
0.84	90.00									
	Depth of water vs Elapsed Time (mins)									
	90.00	-			•	_				
	80.00				-					
	E 70.00									
_	9 60.00					_				
	50.00	1		•		-1				
a	40.00	-		•		-1				
	3 0.00	-	•			-1				
	20.00									
-	10 00					_				
	0.00									
	0.00		80 0.81	0.82 0.9	33 0.84 0) 85				
	,	0.10 0.19 (0.01	0.02 0.0	0.04 (
	Depth to Water (m)									
Soaka	away <mark>C</mark>	Design	f -val	ue fro	m field t	tests	IGSL			
-------------------	---------------------	-------------------	--------------	-------------	----------------	-------------------	---------------			
Contract:	GCTP Phas	se 3				Contract No.	18963			
Test No.	SW 3/02	test 1								
Client	Galway Co	Со								
Date:	26.04.16									
Summary	of ground of	conditions								
from	to	[Description				Ground water			
0.00	0.20	TOPSOIL								
0.20	0.85	Brown sandy s	lighlty grav	elly SILT/C	LAY with root	ets	עמס			
0.85	1.44	Light brown sli	ghtly sandy	gravelly s	ilty SILT/CLAY	with many	DRT			
		cobbles and oc	casional bo	oulders						
Notes:							-			
<u>Field Data</u>				Field Test						
Depth to	Elapsed]		Depth of	Pit (D)	1.44	lm			
Water	Time			Width of I	Pit (B)	1.10	m			
(m)	(min)			Length of	Pit (L)	1.30	m			
				Ŭ			_			
0.85	0.00	1		Initial dep	th to Water =	0.85	m			
0.85	0.50			Final dept	h to water =	1.16	m			
0.85	1.00			Elapsed ti	me (mins)=	348.00				
0.85	1.50						-			
0.85	2.00			Top of pe	rmeable soil		m			
0.85	2.50			Base of p	ermeable soil		m			
0.85	3.00					L	J			
0.85	3.50									
0.85	4.00									
0.85	4.50									
0.85	5.00			Base area	=	1.43	m2			
0.85	6.00	*Av. side area	of permeab	le stratum	over test peri	2.088	m2			
0.86	7.00			Total Exp	osed area =	3.518	m2			
0.86	8.00						J			
0.86	9.00									
0.87	10.00	Infiltration rate	e (f) =	Volume o	f water used/u	init exposed area	a / unit time			
0.90	30.00									
1 00	90.00	f_	0 0004	m/min	ór	6 03E-06	m/sec			
1.00	348.00	•—	0.0001		01	0.002 00	117 500			
1.10	340.00									
		Dept	h of water	vs Élapsec	Time (mins)					
	400.00 -									
	350.00 -					+	_			
	300.00 -									
	230.00 -									
E F	200.00 -									
	150.00 -									
	100.00									
<u> </u>	100.00				*					
	50.00 -				•		\neg			
	0.00 -				· · ·					
	0.	00	0.50		1.00		1.50			
			De	epth to Wa	nter (m)					

Soaka	way D	esign f-v	value from	field tes	sts	IGSL
Contract:	GCTP Phase	e 3			Contract No.	18963
Test No.	SW 3/02	test 2				
Client	Galway Co	Со				
Date:	27.04.16					
Summary c	of ground co	onditions				
from	to	Desc	ription			Ground water
0.00	0.20	TOPSOIL				
0.20	0.85	Brown sandy slighlt	y gravelly SILT/CLA	AY with rootlet	S	DRY
0.85	1.44	Light brown slightly	sandy gravelly silt	y SILT/CLAY w	vith many cobbles	Ditt
N		and occasional boul	ders			
Notes:						
<u>Field Data</u>			<u>Field Test</u>			
Depth to	Elapsed		Depth of P	it (D)	1.44	m
Water	Time		Width of P	it (B)	1.10	m
(m)	(min)		Length of	Pit (Ĺ)	1.30	m
			-		P	1
0.83	0.00		Initial dept	h to Water =	0.83	m
0.83	0.50		Final depth	to water =	1.44	m
0.83	1.00		Elapsed tin	ne (mins)=	1403.00	
0.83	1.50					
0.83	2.00		Top of per	meable soil		m
0.83	2.50		Base of pe	rmeable soil		m
0.83	3.00					
0.83	3.50					
0.83	4.00					
0.85	4.50					
0.83	5.00		Base area=	-	1.43	m2
0.83	6.00	*Av. side area of pe	ermeable stratum o	ver test period	1.464	m2
0.84	7.00		Total Expo	sed area =	2.894	m2
0.84	8.00					
0.84	9.00	lufilturtion water (f)	Values of			(
0.85	10.00	Inflitration rate (T)	= volume of	water used/ur	nit exposed area /	unit time
0.69	50.00	6 0 0	0001 (
0.98	90.00	t = 0.0	0021 m/min	or	3.581E-06	m/sec
1.44	1403.00					
	1600.00	Depth of	water vs Elapsed T	ime (mins)		
_	1400.00				•	
(su	1200.00					
j	1200.00					1
	2 1000.00					
E F	800.00					
	600.00					
	1					
"	400.00	1				
	200.00	+				_
	0.00		• • •			
	0	0.00 0.5	50 1.0	0	1.50	2.00
			Donth to Wa	tor (m)		

Soaka	way D	Design f	-value fror	n field to	ests	IGSL
Contract:	GCTP Phas	se 3			Contract No.	18963
Test No.	SW 3/02	test 3				
Client	Galway Co	Со				
Date:	28.04.16					
Summary of	of ground c	onditions				
from	to	Des	cription			Ground water
0.00	0.20	TOPSOIL				
0.20	0.85	Brown sandy sligh	lty gravelly SILT/CI	AY with rootle	ets	DRY
0.85	1.44	Light brown slight	ly sandy gravelly si	Ity SILT/CLAY	with many	BIT
		cobbles and occas	ional boulders			
Notes:						
<u>Field Data</u>			Field Test			
Depth to	Elapsed		Depth of	Pit (D)	1.44	m
Water	Time		Width of I	Pit (B)	1.10	m
(m)	(min)		Length of	Pit (L)	1.30	m
			U			
0.81	0.00]	Initial dep	th to Water =	0.81	m
0.82	0.50]	Final dept	h to water =	0.97	m
0.82	1.00		Elapsed ti	me (mins)=	90.00	
0.82	1.50					
0.82	2.00		Top of pe	rmeable soil		m
0.82	2.50		Base of p	ermeable soil		m
0.82	3.00					
0.82	3.50					
0.82	4.00					
0.82	4.50		_			
0.83	5.00		Base area	=	1.43	m2
0.83	6.00	*Av. side area of p	permeable stratum	over test perio	2.64	m2
0.83	7.00		Total Exp	osed area =	4.07	m∠
0.83	8.00					
0.83	10.00	Infiltration rate (f)		water used /u	nit avaacad araa	/ unit time
0.04	30.00	(I)	= volume o	water useu/u	nit exposed area	
0.07	15.00		0000	÷	1 0415 05	
0.90	45.00	T= 0	.0006 m/min	or	1.041E-05	m/sec
0.97	90.00					
	100.00 -	Depth o	f water vs Ělapsed	Time (mins)		_
	90.00 -				•	
() ()	80.00				•	
	70.00					
1,0						
3	60.00 -					
	50.00 -		•			
	4 0.00 -					
	30.00 -		•			1
	20.00					-
	10.00 -					-
	0.00 -					
	0.	80 0.8	0.9) (0.95	1.00
			Depth to Wa	ter (m)		

Falling Head Permeability Test Records

BH3/35R BH3/46R BH3/47R BH3/48R MW3

Varia	ble Head	d Permea	ability Tes	t Report Sheet		IGSL(F4B)
Contract:	GCTP Phase	3		TEST RESPONSE ZONE	DETAIL	S:
Number	18963					
Client:	Galway Co C	0	Top (mbgl):			12.00
Engineer	ARUP		Bottom (mbgl):			18.00
Location	BH3/35	(Elev.=17.521	Length (m):			6.00
Hole No.	BH3/35		*** Diameter (m	:		0.1013
Test No.	1		Initial Standing	Water Level		9.04
Date	27/04/2016		(m below top of	casing / standpipe):		
Elapsed	Depth	Ht/Ho	Height of casing	g or standpipe :		0.35
Time	to Water*		above ground l	evel (m)		
(mins)	(m)		Falling or Risin	g Head Test?		Falling
0.00	0.94	1.00				
0.25	1.69	0.91	1 00 🗖			
0.50	2.13	0.85	1.00 L			
0.75	2.62	0.79	ļ Č			
1.00	2.82	0.77	🔂			
1.50	3.40	0.70	┃			
2.00	3.88	0.64				
2.50	4.30	0.59	10			
3.00	4.72	0.53	•			
4.00	5.33	0.46				
5.00	5.81	0.40	7			
6.00	6.14	0.36				
7.00	6.45	0.32	0			
8.00	6.70	0.29	H.			
9.00	6.98	0.25				
10.00	7.22	0.22		$\overline{\Gamma}$		
11.00	7.26	0.22		7		
12.00	7.38	0.20		Ŕ <u></u>		
13.00	7.53	0.19	4			
14.00	7.71	0.16				
15.00	7.77	0.16				
16.00	7.84	0.15		┣		
17.00	7.94	0.14				
18.00	7.95	0.13				
19.00	7.98	0.13				
20.00	8.06	0.12	0.10			
25.00	8.32	0.09	0.00	50.00		100.00
30.00	8.50	0.07		Time /min	`	
40.00	8.63	0.05		i ime (min)	
50.00	8.75	0.04				
60.00	8.84	0.02	**Diameter of sta	indpipe/borehole (m)		0.1013
70.00	8 87	0.02	** X-sectional an	ea of BH/Standnine	A=	0 00806
80.00	8.90	0.02	Shape Factor		F=	9 02338
00.00	0.00	0.00	Time to reach H	/Ho = 0.37 (sec)	T=	342
		0.00	Extranolated Ver	/No	1-	No
		0.00	Coefficient of Pe	rmeability (A/FT) (m/s)	K=	2 61F-06
		0.00			1.	2.012-00
	I	0.00				

Varia	ble Head	l Permea	ability	Test Rep	ort Shee	et	IGSL(F4B)
Contract:	GCTP Phase	3		TEST RES	PONSE ZONE		S:
Number	18963						
Client:	Galway Co Co	0	Top (mbg	ı l):			12.0
Engineer	ARUP	<i>.</i>	Bottom (n	nbgl):			18.0
Location	BH3/35	(Elev.=17.521	Length (n	n):			6.0
Hole No.	BH3/35		*** Diame	ter (m):			0.101
Test No.	2		Initial Sta	nding Water Le	vel		9.0
Date	27/04/2016		(m below	top of casing /	standpipe):		
Elapsed	Depth	Ht/Ho	Height of	casing or stand	dpipe :		0.3
Time	to Water*		above gro	ound level (m)			
(mins)	(m)		Falling or	Rising Head Te	est?		Falling
0.00	0.00	1.00					
0.25	1.00	0.89	1.0)0 📮		·	
0.50	1.44	0.84					
0.75	1.76	0.81		<u> </u>			
1.00	2.14	0.76					
1.50	2.95	0.67		₿	+ + +		
2.00	3.29	0.64		<u>P</u>			
2.50	3.82	0.58		2			
3.00	4.20	0.54					
4.00	4.92	0.46					
5.00	5.42	0.40		II			
6.00	5.88	0.35					
7.00	6.23	0.31	<u> </u>	Ģ			
8.00	6.57	0.27	14				
9.00	6.82	0.25					
10.00	6.94	0.23		<u>T</u>			
11.00	7.08	0.22					
12.00	7.22	0.20					
13.00	7.36	0.19		1 1			
14.00	7.49	0.17					
15.00	7.61	0.16					
16.00	7.72	0.15					
17.00	7.82	0.13					
18.00	7.90	0.13		l Ğ			
19.00	7.95	0.12	-				
20.00	7.98	0.12	0.1			<u> </u>	
25.00	8.29	0.08		0.00	50.00		100.00
30.00	8.46	0.06			Time (mi	n)	
40.00	8.69	0.04			,	-	
50.00	8.74	0.03					
60.00	8.83	0.02	**Diamete	r of standpipe/bc	prehole (m)		0.101
70.00	8.85	0.02	** X-sectio	onal area of BH/S	Standpipe	A=	0.0080
80.00	8.87	0.02	Shape Fa	ctor		F=	9.0233
		0.00	Time to re	ach Ht/Ho = 0.37	7 (sec)	T=	33
		0.00	Extrapolat	ed Yes/No			N
		0.00	Coefficien	t of Permeability	(A/FT) (m/s)	K=	2.67E-0
		0.00					

Variat	ole Head	l Permea	ability Te	est Report Sheet	IGSL(F4B
Contract:	GCTP Phase	3		TEST RESPONSE ZONE DI	ETAILS:
Number	18963				
Client:	Galway Co Co	C	Top (mbgl):		13.
Engineer	ARUP		Bottom (mbg	gl):	16.
Location	BH3/46	(Elev.=29.882	Length (m):		3.
Hole No.	BH3/46		*** Diameter	(m):	0.10
Test No.	1		Initial Standi	ng Water Level	12.
Date	08/04/2016		(m below top	o of casing / standpipe):	
Elapsed	Depth	Ht/Ho	Height of cas	sing or standpipe :	0.
Time	to Water*		above groun	d level (m)	
(mins)	(m)		Falling or Ris	sing Head Test?	Falling
0.00	12.32	1.00			
0.50	12.39	0.88	1 00 1		
1.00	12.42	0.83	1.00		
1.50	12.45	0.78			
2.00	12.47	0.74	l .		
2.50	12.48	0.72	l .		
3.00	12.49	0.71			
3.50	12.50	0.69	· ·		
4.00	12.51	0.67			
4.50	12.52	0.66	ľ		
5.00	12.52	0.66			
6.00	12.53	0.64	- ·		
7.00	12.54	0.62	0		
8.00	12.55	0.60	H H		
9.00	12.57	0.57	Ľ Ť		
10.00	12.59	0.53			
11.00	12.60	0.52			
12.00	12.61	0.50			
13.00	12.62	0.48	l ·		
14.00	12.64	0.45			
15.00	12.65	0.43			
16.00	12.66	0.41			
17.00	12.68	0.38			
18.00	12.69	0.36			
19.00	12.70	0.34			
20.00	12.71	0.33	0.10		
25.00	12.77	0.22	0.	00 20.00 40	.00 60.00
30.00	12.80	0.17		Time (min)	
35.00	12.84	0.10		Time (min)	
40.00	12.87	0.05			
45.00	12.89	0.02	**Diameter of	standpipe/borehole (m)	0.10
50.00	12.90	0.00	** X-sectional	area of BH/Standpipe	A= 0.008
		0.00	Shape Factor		F= 5.264
		0.00	Time to reach	n Ht/Ho = 0.37 (sec)	T= 10
		0.00	Extrapolated	Yes/No	1
		0.00	Coefficient of	Permeability (A/FT) (m/s)	K= 1.46E-
		0.00			

Variat	ole Head	Permea	bility Test Repo	ort Sheet	IGSL(F4B)
Contract:	GCTP Phase	3	TEST RES	PONSE ZONE DETAIL	.S:
Number	18963				
Client:	Galway Co Co	0	Top (mbgl):		9.00
Engineer	ARUP		Bottom (mbgl):		12.00
Location	BH3/47	(Elev.=37.737	Length (m):		3.00
Hole No.	BH3/47		*** Diameter (m):		0.1013
Test No.	1		Initial Standing Water Lev	/el	10.45
Date	06/04/2016		(m below top of casing / s	standpipe):	
Elapsed	Depth	Ht/Ho	Height of casing or stand	pipe :	0.30
Time	to Water*		above ground level (m)		
(mins)	(m)		Falling or Rising Head Te	st?	Falling
0.00	7.68	1.00			
0.50	7.94	0.91	1 00		
1.00	7.99	0.89			
1.50	8.02	0.88			
2.00	8.05	0.87			
2.50	8.08	0.86			
3.00	8.11	0.84			
3.50	8.13	0.84			
4.00	8.15	0.83			
4.50	8.17	0.82			
5.00	8.19	0.82			
6.00	8.21	0.81		λ	
7.00	8.23	0.80	0		
8.00	8.25	0.79	H, I I I I I		
9.00	8.27	0.79	± +++++		
10.00	8.30	0.78			
11.00	8.32	0.77			
12.00	8.35	0.76			
13.00	8.37	0.75			
14.00	8.39	0.74			
15.00	8.41	0.74			
16.00	8.43	0.73			
17.00	8.46	0.72			
18.00	8.48	0.71			
19.00	8.50	0.70			
20.00	8.52	0.70	0.10		
25.00	8.61	0.66	0.00 50.00	0 100.00 150.0	00 200.00
30.00	8.70	0.63		Timo (min)	
35.00	8.79	0.60		rine (iiiii)	
40.00	8.89	0.56			
45.00	8.98	0.53	**Diameter of standpipe/bo	rehole (m)	0.1013
50.00	9.07	0.50	** X-sectional area of BH/S	tandpipe A=	0.00806
55.00	9,16	0.47	Shape Factor	F=	5.26442
60.00	9.25	0.43	Time to reach $Ht/Ho = 0.37$	(sec) T=	4141
90.00	9.74	0.26	Extrapolated Yes/No	()	No
120.00	10.16	0.10	Coefficient of Permeability	(A/FT) (m/s) K=	3 70F-07
150.00	10.45	0.00			

Vari	able Hea	d Permea	bility Te	st Repor	t Shee	t		IGSL(F4B)
Contract: Number	GCTP Phase 3 18963			TEST RE	Sponse Żo	one deta	ILS:		
Client:	Galwav Co Co	l	Top (mbgl);					11	.00
Engineer	ARUP	l	Bottom (mbgl):				20	.00
Location	BH3/48	(Elev.=40.717)	Lenath (m):	/-				9	.00
Hole No.	BH3/48	()	*** Diameter	(m):				0.10)13
Test No.	1	l	Initial Standing	Water Level				1	.76
Date	19/01/2016		(m below top	of casing / sta	ndpipe):				
Elapsed	Depth	Ht/Ho	Height of casi	ng or standpipe	э:			0	.36
Time	to Water*		above ground	level (m)					
(mins)	(m)		Falling or Risin	g Head Test?			Fa	lling	
0.00	0.03	1.00							
0.25	0.74	0.59	1.00 🗗						
0.50	1.47	0.17	4 °						
0.75	1.68	0.05	ľ						
1.00	1.74	0.01							
1.50	1.76	0.00	┃	+ $+$ $+$ $+$ $+$ $+$					
2.00	1.76	0.00							
		0.00		\					
		0.00	┃ ↓						
		0.00							
		0.00							
		0.00							
		0.00	오						
		0.00	≩						
		0.00							
		0.00							
		0.00							
		0.00	┃						
		0.00							
		0.00							
		0.00							
		0.00							
		0.00							
		0.00							
		0.00	0.10 🗕						
		0.00	0.00	0.50	1.00	1.50	2.0	0 2.50	
		0.00			Time	(
		0.00			TIME	(min)			
		0.00							
		0.00	**Diameter of	standpipe/bore	hole (m)			0.10)13
		0.00	** X-sectional	area of BH/Sta	ndpipe		A=	0.008	306
		0.00	Shape Factor				F=	12.490)20
		0.00	Time to reach	Ht/Ho = 0.37 ((sec)		T=		21
		0.00	Extrapolated Y	es/No					No
		0.00	Coefficient of	Permeability (A	/FT) (m/s)	K=	3.14E	-05
		0.00							
NL I									

* Depth of water below top of casing/standpipe

** 'A' is calculated from the standpipe or piezometer tube, or the borehole casing diameter if the test is carried out during the course of boring operations. *** This is normally the diameter of the borehole since the response zone includes the gravel surround

Time lag is taken as the elapsed time corresponding to a value of H/Ho = 0.37. If H/Ho does not reach 0.37, it will be necessary to extrapolate the graph and assess the time.

Vari	iable Hea	d Permea	bility Test R	eport	Shee	t		IGSL(F4B)
Contract: Number	GCTP Phase 3 18963			TEST RES	sponse Żo	one deta	LS:	
Client:	Galway Co Co		Top (mbal);					11.00
Engineer	ARUP		Bottom (mbgl);					20.00
Location	BH3/48	(Elev.=40.717)	Lenath (m):					9.00
Hole No.	BH3/48		*** Diameter (m):					0.1013
Test No.	2		Initial Standing Wate	r Level				1.76
Date	19/01/2016		(m below top of cas	ing / stan	dpipe):			
Elapsed	Depth	Ht/Ho	Height of casing or s	standpipe	:			0.36
Time	to Water*		above ground level (m)				
(mins)	(m)		Falling or Rising Hea	d Test?			Fal	ling
0.00	0.03	1.00						
0.25	1.27	0.28	1.00 📮					
0.50	1.59	0.10						
0.75	1.71	0.03]]]					
1.00	1.74	0.01						
1.25	1.75	0.01	•					
1.50	1.76	0.00						
2.00	1.76	0.00						
		0.00						
		0.00						
		0.00						
		0.00						
		0.00	운 \					
		0.00	≥ ↓ ↓					
		0.00	┷ ♥					
		0.00						
		0.00						
		0.00						
		0.00						
		0.00						
		0.00						
		0.00		Λ				
		0.00						
		0.00						
		0.00	0.10					
		0.00	0.00	0.50	1.00	1.50	2.00	2.50
		0.00			Time	(
		0.00			line	(min)		
		0.00						
		0.00	**Diameter of standp	oipe/boreł	nole (m)			0.1013
		0.00	** X-sectional area o	f BH/Stan	dpipe		A=	0.00806
		0.00	Shape Factor				F=	12.49020
		0.00	Time to reach Ht/Ho	= 0.37 (s	ec)		T=	12
		0.00	Extrapolated Yes/No					No
		0.00	Coefficient of Perme	ability (A/	FT) (m/s))	K=	5.46E-05
		0.00						
NL I	-	-						-

* Depth of water below top of casing/standpipe

** 'A' is calculated from the standpipe or piezometer tube, or the borehole casing diameter if the test is carried out during the course of boring operations. *** This is normally the diameter of the borehole since the response zone includes the gravel surround

Time lag is taken as the elapsed time corresponding to a value of H/Ho = 0.37. If H/Ho does not reach 0.37, it will be necessary to extrapolate the graph and assess the time.

Vari	able Hea	d Permea	bility Test	Report S	Sheet	1	GSL(F4B)
Contract: Number	GCTP Phase 3			TEST RESPO	onse zone detai	LS:	
Client:	Galway Co Co		Top (mbal):				11.00
Engineer			Rottom (mbal):				20.00
Location	RH3/48	(Flev =40 717)	Length (m):				9.00
Hole No	BH3/48	(Elev.= 10.1117)	*** Diameter (m)				0 1013
Test No.	3		Initial Standing W	ater i evel			1 76
Date	19/01/2016		(m below top of	casing / stando	ipe):		
Elapsed	Depth	Ht/Ho	Height of casing	or standpipe :		0000000	0.36
Time	to Water*		above ground lev	el (m)			
(mins)	(m)		Falling or Rising F	lead Test?		Falli	na
0.00	0.03	1.00	i annig er menig i				
0.00	1 16	0.35	1.00				
0.23	1.10	0.09	1.00				
0.30	1.00	0.03					
1.00	1.72	0.02	I • • •				
1.00	1.75	0.01					
1.20	1.76	0.00					
		0.00	· · · · · · · · · · · · · · · · · · ·				
		0.00					
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		0.00					
		0.00	0.10				
		0.00	0.00	0.50	1.00	1.50	2.00
		0.00			Time (min)		
		0.00					
		0.00					
		0.00	**Diameter of sta	ndpipe/borehol	e (m)		0.1013
		0.00	** X-sectional are	a of BH/Standp	ipe	A=	0.00806
		0.00	Shape Factor			F=	12.49020
		0.00	Time to reach Ht/	Ho = 0.37 (sec	.)	T=	14
		0.00	Extrapolated Yes/	No			No
		0.00	Coefficient of Per	meability (A/FT) (m/s)	K=	4.58E-05
		0.00					

* Depth of water below top of casing/standpipe

** 'A' is calculated from the standpipe or piezometer tube, or the borehole casing diameter if the test is carried out during the course of boring operations. *** This is normally the diameter of the borehole since the response zone includes the gravel surround

Time lag is taken as the elapsed time corresponding to a value of H/Ho = 0.37. If H/Ho does not reach 0.37, it will be necessary to extrapolate the graph and assess the time.

Varia	ble Head	Permea	ability Test Report Sheet	IGSL(F4B)
Contract:	GCTP Phase	3	TEST RESPONSE ZONE DETAIL	S:
Number	18963			
Client:	Galway Co C	0	Top (mbgl):	0.68
Engineer	ARUP		Bottom (mbgl):	7.50
Location	MW3	(Elev.=15.000	Length (m):	6.82
Hole No.	MW3		*** Diameter (m):	0.1500
Test No.	1		Initial Standing Water Level	5.40
Date	28/04/2016		(m below top of casing / standpipe):	
Elapsed	Depth	Ht/Ho	Height of casing or standpipe :	0.30
Time	to Water*		above ground level (m)	
(mins)	(m)		Falling or Rising Head Test?	Falling
0.00	0.98	1.00		
0.25	1.06	0.98	1 00 🗖	
0.50	1.13	0.97		
0.75	1.20	0.95		
1.00	1.24	0.94		
1.50	1.25	0.94		
2.00	1.27	0.93		
2.50	1.27	0.93		
3.00	1.27	0.93		
3.50	1.28	0.93		
4.00	1.28	0.93		
4.50	1.29	0.93		
5.00	1.29	0.93		
6.00	1.30	0.93	Ě IIIIIIIIIIIIIIIIIIIIIIIIIIIII	
7.00	1.31	0.93	Σ ·····	
8.00	1.32	0.92		
9.00	1.33	0.92		
10.00	1.33	0.92		
11.00	1.34	0.92		
12 00	1.34	0.92		
13.00	1.34	0.92		
14 00	1.34	0.92		
15.00	1.34	0.92		
16.00	1.34	0.92		
17.00	1 35	0.02		
18.00	1 35	0.02	0.10	
10.00	1 35	0.92	0.00 500.00 1000.001500.002000.002	500.003000.00
20.00	1 35	0.92		
25.00	1.35	0.02	Time (min)	
30.00	1.30	0.91		
35.00	1.07	0.01	**Diameter of standning/barabala (m)	0 1012
30.00	1.00	0.91	** X postional grad of DLU(Standaire	0.1013
40.00	1.39	0.91	A-sectional area of BH/Standpipe A=	0.00806
45.00	1.40	0.90		10.84844
60.00	1.43	0.90	Ime to reach Ht/H0 = 0.37 (sec) =	149896
120.00	1.51	0.88		Yes
2500.0	3.75	0.37	Coefficient of Permeability (A/FT) (m/s) K=	4.96E-09

Final elapsed time visually extrapolated from last measured point on graph

Depth of water below top of casing/standpipe

** 'A' is calculated from the standpipe or piezometer tube, or the borehole casing diameter if the test is carried out during the course of boring operations.
 *** This is normally the diameter of the borehole since the response zone includes the gravel surround

*** This is normally the diameter of the borehole since the response zone includes the gravel surround Time lag is taken as the elapsed time corresponding to a value of H/Ho = 0.37. If H/Ho does not reach 0.37, it will be necessary to extrapolate the graph and assess the time.

Plate Bearing Tests

TP3/23 TP3/37 TP3/39 TP3/40

















Window Sample Records

WS3/01 WS3/02 WS3/03 WS3/04

15	And								REPORT N	UMBER	
00	13L N	INDOW	V SA	MPLE	RECO	ORD			18	963	
CON	TRACT N6 Galway City Transport Project - Ph	nase 3					PROBE	NO.	WS3/	01	
CO-0	DRDINATES 522,765.73 E 724,237.89 N 48.00						DATE DI DATE LO	RILLED	08/04/2 08/04/2	016 016	
	NT Galway County Council NEER ARUP						SAMPLI	ED BY D BY	CK JL		
Depth (m)	Geotechnical Description		Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	Firm dark brown clayey spongy PEAT with frequ decaying organic roots		<u>+- \/ \</u>								
- 1.0	Firm grey brown sandy slightly gravelly organic 0 with occasional decaying organic remnants. San medium to coarse. Gravel is subangular to subro fine to medium of limestone. Final Depth 0.50m	CLAY Id is		0.35 0.50	47.65 47.50		0.00-0.50	100			
2.0											
3.0											
4.0											
5.0											
Gene	eral Remarks				<u> </u>			<u> </u>		<u> </u>	<u> </u>
Insta	illations										

1								REPORT N	UMBER	
WINDOW SAMPLE RECORD							18	18963		
TRACT N6 Galway City Transport Project - P	hase 3					PROBE	NO.	WS3/	02	
DRDINATES 531,268.78 E 728,473.95 N NUND LEVEL (mOD) 9.55						DATE DI DATE DI DATE LO	RILLED	08/04/2 08/04/2	0f 1 2016 2016	
INT Galway County Council INEER ARUP						SAMPLI	ED BY D BY	CK JL		
Geotechnical Description		IJ		uo	Strike	of Sample (r	ery (%)	ount	Fest (KPa)	Denetrometer
		Legen	Depth (m)	Elevati	Water	Depth Run (n	Recov	Blowco	Vane 7	Hand F (KPa)
TOPSOIL: Soft brown sandy organic CLAY with frequent rootlets	1 	<u>111</u> , <u>117</u> , <u>1, 11</u> , <u>117</u> ,	0.20	9.35						
Soft to firm light yellow brown sandy gravely CI Sand is fine to medium. Gravel is subangular to subrounded fine to medium of limestone. Firm dark brown spongy PEAT	_AY. /		0.37	9.18 8.95						
Soft to firm light grey and light grey brown silty	CLAY		0.95	8.60		0.00-1.00	95			
CLAY. Sand is fine to medium.	y only									
		; × ×	1 90	7 65		1 00 2 00	00			
Firm occasional firm to stiff light grey sandy gra silty CLAY. Sand is fine to coarse. Gravel is sub to suborunded fine to coarse of limestone.	ivelly bangular					1.00-2.00	90			
Final Depth 2.80m		X	2.80	6.75		2.00-2.80	100			
General Remarks Installations										
	TRACT N6 Galway City Transport Project - P ORDINATES 531,268.78 E T28,473.95 N UND LEVEL (mOD) UND LEVEL (mOD) 9.55 NT Galway County Council NEER ARUP Geotechnical Description TOPSOL: Soft to firm light yellow brown sandy gravelly Cl Sand is fine to medium. Gravel is subangular to subrounded fine to medium of limestone. Firm dark brown spongy PEAT Soft to firm light grey and light grey brown silty Soft to firm light grey and light grey brown silty Soft to firm light grey and light grey sandy grasilty CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone. Firm occasional firm to stiff light grey sandy grasilty CLAY. Sand is fine to coarse. Gravel is subto suborunded fine to coarse of limestone. Final Depth 2.80m Prail Remarks	WINDO	TRACT N6 Galway City Transport Project - Phase 3 PRDINATES 531,268.78 E 728,473.95 N UND LEVEL (mOD) 9.55 NT Galway County Council NEER ARUP Geotechnical Description TOPSOIL: Soft borown sandy organic CLAY with frequent rootlets Soft to firm light yellow brown sandy gravelly CLAY. Sad is fine to medium. Gravel is subangular to subrounded fine to medium of limestone. Firm dark brown spongy PEAT Soft to firm light grey and light grey sandy gravelly silty CLAY. Sand is fine to coarse of limestone. Firm occasional firm to stiff light grey sandy gravelly silty CLAY. Sand is fine to coarse of limestone. Final Depth 2.80m	TRACT N6 Galway City Transport Project - Phase 3 TRACT N6 Galway City Transport Project - Phase 3 TROINATES 531,268.78 E T28,473.95 N UND LEVEL (mOD) UND LEVEL (mOD) 9.55 NT Galway Council NEER ARUP Geotechnical Description 0.20 TorPSOLL: Soft brown sandy organic CLAY with Trequent rootlets 0.20 Soft to firm light grey and light grey low on sinty CLAY 0.60 Soft to firm light grey and light grey brown silty CLAY 0.60 Soft to firm light grey and light grey brown silty CLAY 0.95 Firm dark brown spongy PEAT 0.95 Soft to firm light grey and light grey sandy gravelly cLAY. Sand is fine to coarse of limestone. 1.90 Firm occasional firm to stiff light grey sandy gravelly suborunded fine to coarse of limestone. 2.80 Final Depth 2.80m 2.80	TRACT N6 Galway City Transport Project - Phase 3 PRDINATES \$31,268,78 E 722,473,95 N UND LEVEL (mOD) 9.55 NT Galway County Council NEER ARUP Geotechnical Description Geotechnical Description 0.20 Soft to firm light yellow brown sandy organic CLAY with requent rootlets 0.20 Soft to firm light grey and light grey torwn silty CLAY. 0.60 Soft to firm light grey and light grey torwn silty CLAY. 0.60 Soft to firm light grey and light grey sandy silty 0.95 Firm occasional firm to stiff light grey sandy gravelly to subrounded fine to coarse of limestone. 1.90 7.65 Final Depth 2.80m 2.80 6.75	TRAC NG Galway City Transport Project - Phase 3 TRAC NG Galway City Transport Project - Phase 3 TRAC Tage 73.85 R. T28.473.85 R. T28.473.8	WINDOW SAMPLE RECORD TRACT NE Galway Chy Transport Project - Phase 3 PROMETER 728,473.95 N DATE DI DATE D	WINDOW SAMPLE RECORD TRACT NO Galway City Transport Project - Phase 3 PRODE NO. PRIMATE S1 208.78 E TORINATE S1 208.78 E DATE MELLOGED MUDLEVEL (mOD) 9.55 NET Calway County Council DATE MELLOGED SM MUDLEVEL (mOD) SUMPLED BY Calcotter for the council of the counce of the council of the council of the council of the	REPORT NI TABLE PROOF NO NINDOW SAMPLE RECORD 188 TRACT NS Galway City Transport Project - Phase 3 PROBE NO. WS3/J NINDOW SAMPLE RECORD Arrange Mail Colspan="2">Site of the Site of the S	NUNDOW SAMPLE RECORD REPORT NUMBER 1896.33 TRACT NG Galway Cay Transport Project -Phase 3 PROBE NO. WS3/02 SHEET 72(47):387.6 E 72(47):387.6 E NOINATES S12,837.6 E 72(47):387.6 E DATE DRILLED GOOD 0.9.5 I SMPLED BY OK NERE ARUP Genetchnical Description Up define and provide

Cher.	WINDO	W SA	MPLE	RECO	ORD			REPORT N	umber 963	
CON	TRACT N6 Galway City Transport Project - Phase 3					PROBE	NO.	WS3/	03	
:0-0 GRO	DRDINATES 528,959.08 E 728,090.10 N UND LEVEL (mOD) 7.63					DATE DI DATE DI DATE LO	RILLED DGGED	Sheet 1 08/04/2 08/04/2	of 1 2016 2016	
LIE	NT Galway County Council NEER ARUP					SAMPLI	ED BY D BY	CK JL		
Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Vane Test (KPa)	Hand Penetrometer
.0	Soft brown sandy slightly gravelly CLAY with occasional rootlets. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of limestone.		0.25	7.38						
	medium. Gravel is subangular to subrounded fine to coarse of limestone. Angular COBBLE and BOULDER-sized fragments of strong grey fine grained limestone		0.65	6.98 6.63		0.00-1.00	80			
	Final Deput 1.00m									
.0										
8.0										
4.0										
5.0										
Sene	eral Remarks									
ista	Ilations									

WINDOW SAMPLE RECORD CONTRACT N6 Galway City Transport Project - Phase 3 PROBE NO. SHEET	18963							
CONTRACT N6 Galway City Transport Project - Phase 3 PROBE NO. SHEET SHEET	11100/04							
SHEET	WS3/04							
CO-ORDINATES 531,290.25 E DATE DRILLED 728,447.79 N DATE LOGGED DATE LOGGED	Sheet 1 of 1 0 08/04/2016 0 08/04/2016							
GROUND LEVEL (mOD) 9.90 CLIENT Galway County Council SAMPLED BY LOCOSED BY	CK							
		eter						
Depth (m) Depth (m) Cegend Depth of Sample Recovery (%) Recovery (%)	Blowcount Vane Test (KPa	Hand Penetrom (KPa)						
^{0.0} TOPSOIL: Soft dark brown very sandy organic CLAY with frequent roots and rootlets. Sand is fine to coarse 0.15 9.75								
Soft brown sandy gravelly organic CLAY. Sand is fine to medium. Gravel is subangular fine to coarse of limestone. 0.40 9.50								
Firm dark brown spongy to fibrous PEAT								
$\frac{1.0}{1.0}$								
Soft to firm grey to grey blue sandy gravelly organic								
Soft light grey to light grey brown sandy silty CLAY								
Sand is fine to medium.								
(Medium dense) Grey silty fine to medium SAND 1.80 8.10 1.90 8.00 1.00-2.00 67								
Sand is fine to medium.								
Firm light grey sandy gravelly CLAY. Sand is fine to 2.80 7.10 2.00-3.00 15								
^{3.0} medium of limestone.								
4.0 Final Depth 4.00m 4.00 5.90								
5.0								
General Remarks								
Installations								
Installations								

Report No: 18963 N6 Galway City Transport Project – Phase 3

<u>WS3/01</u>



Report No: 18963 N6 Galway City Transport Project – Phase 3



<u>WS3/02</u>

Report No: 18963 N6 Galway City Transport Project – Phase 3









Geophysical Survey Report

MGX File Ref: 6031f-005.doc

N6 Galway City Transport Plan County Galway

Geophysical Survey

Report Status: Final MGX Project Number:6031 MGX File Ref: 6031f-005.doc 3rd July 2016

Confidential Report To:

IGSL Unit FM7 Business Park M7 Business Park Naas Co. Kildare

Report submitted by : Minerex Geophysics Limited

Issued by:

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

Ruth Jackson (Senior Geophysicist)

Hartmut Krahn (Senior Geophysicist)



Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

- 1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of 2D-Resistivity and seismic refraction (p-wave) for the ground investigation for the Galway N6 GCTP.
- 2. The main objectives of the survey were to determine ground conditions, estimate the depth to rock and overburden thickness and to check for karst and other possible features that may create a concern during construction.
- 3. The survey was carried out at certain areas within the scheme that were given by the consulting engineers.
- 4. The geophysical surveys carried out show that the subsurface bedrock geology consists of Granite and Limestone.
- 5. The results of direct ground investigations which were on-going at the time of the geophysics survey, are drawn on the plans and show a good fit overall with the geophysics.
- 6. High resistivities and seismic velocities within the Granite section indicate the presence of bedrock close to the surface.
- 7. This Granite would require breaking or blasting and trial breaking of rock is recommended in proposed deep cut areas.
- 8. High resistivities within the Limestone area indicate a clean Limestone, often occurring quite close to the surface. This type of limestone is liable to karstification.
- 9. Zones of lower resistivity within the clean Limestone point towards a weathered or karstified Limestone. Rotary core holes could be drilled at these locations to test for the degree of weathering/karstification.
- 10. Recommendations for targeted trial pits with test breaking and coreholes have been made, based on the geophysics models. These locations may be investigated at a later ground investigation phase.

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Title	Pages	Document
		Reference
Table 1: Geophysical Survey Locations and Acquisition Parameters	2 x A4	6031f-Tab1.xls
Table 2: Structure Locations and Geological Background	3 x A4	6031f-Tab2.xls
Table 3: Interpretation Areas	In text	In text
Table 4: Summary of Results and Interpretation in Granite Area	In text	In text
Table 5: Summary of Results and Interpretation in Limestone Area	In text	In text
(Resistivity only)		
Table 6: Summary of Results and Interpretation in Limestone Area	In text	In text
(Resistivity and Seismic Refraction)		
Table 7: Locations of recommended Rotary Core holes	In text	In text
Plan 1a: Survey Locations and Models for GP3/01	1 x A1	6031f_Plans.dwg
Plan 1b: Survey Locations and Models for GP3/02 & GP3/04	1 x A1	6031f_Plans.dwg
Plan 1c: Survey Locations and Models for GP3/03	1 x A1	6031f_Plans.dwg
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Plan 1g: Survey Locations and Models for GP3/08	1 x A1	6031f_Plans.dwg
Plan 1h: Survey Locations and Models for GP3/09 & GP3/10	1 x A1	6031f_Plans.dwg
Plan 1i: Survey Locations and Models for GP3/12,GP3/18,GP3/13	1 x A1	6031f_Plans.dwg
Plan 1j: Survey Locations and Models for GP3/14	1 x A1	6031f_Plans.dwg
Plan 1k: Survey Locations and Models for GP3/15,GP16,GP3/17	1 x A1	6031f_Plans.dwg
Plan 1I: Survey Locations and Models for GP3/17	1 x A1	6031f_Plans.dwg
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Plan 2a: Survey Locations and Interpretation for GP3/01	1 x A1	6031f_Plans.dwg
Plan 2b: Survey Locations and Interpretation for GP3/02 & GP3/04	1 x A1	6031f_Plans.dwg
Plan 2c: Survey Locations and Interpretation for GP3/03	1 x A1	6031f_Plans.dwg
Plan 2d: Survey Locations and Interpretation for GP3/05	1 x A1	6031f_Plans.dwg
Plan 2e: Survey Locations and Interpretation for GP3/06	1 x A1	6031f_Plans.dwg
Plan 2f: Survey Locations and Interpretation for GP3/07	1 x A1	6031f_Plans.dwg
Plan 2g: Survey Locations and Interpretation for GP3/08	1 x A1	6031f_Plans.dwg

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Plan 2h: Survey Locations and Interpretation for GP3/09 & GP3/10	1 x A1	6031f_Plans.dwg
Plan 2i: Survey Locations and Interpretation for GP3/12,GP3/18,GP3/13	1 x A1	6031f_Plans.dwg
Plan 2j: Survey Locations and Interpretation for GP3/14	1 x A1	6031f_Plans.dwg
Plan 2k: Survey Locations and Interpretation for GP3/15,GP16,GP3/17	1 x A1	6031f_Plans.dwg
Plan 2I: Survey Locations and Interpretation for GP3/17	1 x A1	6031f_Plans.dwg
Plan 2m: Survey Locations and Interpretation for GP3/23,GP3/24,GP3/25	1 x A1	6031f_Plans.dwg
Plan 2n: Survey Locations and Interpretation for GP3/19	1 x A1	6031f_Plans.dwg
Plan 2o Survey Locations and Interpretation for GP3/20	1 x A1	6031f_Plans.dwg
Plan 2p: Survey Locations and Interpretation for GP3/21	1 x A1	6031f_Plans.dwg
1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the N6 Galway City Transport Plan. The survey consisted of 2D-Resistivity and seismic refraction (p-wave) measurements.

The survey employed various geophysical methods that complement each other and improve the interpretation. The role of geophysics as a non-destructive fast method is to allow later targeted direct investigations. Those results can be used to improve the initial results and interpretation.

The survey was done at locations selected by the consulting engineers. This report was reviewed after the results from direct ground investigation results were available. Recommendations for targeted direct ground investigation are made in this report. These may be carried out at a future ground investigation stage.

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 detect possible karstified zones and fracture zones within the rock

1.3 Site Description

The site is located around Galway city, from Bearna in the west to Coolagh, Briarhill in the east.

The geophysical profiles were located at specific chainage locations along the proposed road alignment and the survey was carried out as close as possible to the proposed centre line.

The survey locations are tabulated in Table 1 and shown on maps in the upper frames of the plans. The route crosses mainly over private farmland with one survey area on paved ground.

A weekly programme of works was used to ensure access was arranged in advance of MGX carrying out the geophysical survey. A number of locations within the survey area were overgrown and it was not possible to carry out the geophysics at the time. These locations were returned to at a later date when clearance had been carried out by the client. At some locations the survey lines were meandered through the vegetation after agreeing the path on site with the engineers.

1.4 Geology

The Geological Survey of Ireland bedrock geological map (<u>www.gsi.ie</u>) indicates that the survey area is underlain by both Carboniferous Limestones (Visean Limestone) and Caledonian Granitic rocks (mainly the Errisbeg Townland Granite).

The overburden is predominantly Made Ground and Till derived from either the Limestone or Granite.

Table 2 contains a summary of the geology and survey locations of the individual survey areas.

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 client provided maps of the site and the digital version was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections.

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 consisted of using 2D-Resistivity and Seismic Refraction as outlined in the tender documents.

The survey locations are indicated in the top frames of Plans 1a - 1p. The profiles, locations, chainage and parameters are tabulated in Tab. 1.

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

The 2D-Resistivity profiles were as continuous as possible along the chainage and 3m or 5m electrode spacing was used. The standard spacing of 5m was used to achieve the maximum depth along the majority of profiles. The exception to this was GP 3/1 and GP3/4 where the maximum cuts were 3.8 and 2.9m respectively and therefore 3m spaced electrodes allowed for more detail in the shallow subsurface.

In concrete and hard standing areas small holes (12mm) were drilled to place the electrodes in them and saline water was added to make a good electrical connection.

The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes, laptop and ImagerPro acquisition software.

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.

While the achieved depth may be viewed as greater than required for the proposed project it does not result in a loss of detail or accuracy in the shallow subsurface. It may however provide additional useful information such as detecting areas of possible karstification which may have implications for subsidence or other construction issues.

The penetration depth of a resistivity profile increases towards the centre where it reaches an approx. value of 1/6th of the layout length.

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 Plans 1a – 1p.

Each of the profiles consisted of 24 geophones with 3 m spacing, resulting in lengths of 69m per profile. Profiles were acquired continuously along chainage to allow for concatenation during the processing stage. 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. At least 7 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 (e.g. below solid ground surface) or where layers dip with more than 20 degrees angle the accuracy becomes much less.

The seismic refraction profiles with 69 m individual length have a reasonable penetration depth of around 10m. An internationally accepted maximum depth estimate for a seismic refraction layout is 1/6 of the layout length. The depth penetration varies according to the velocity structure of the subsurface.

2.4 Site Work

The data acquisition was carried out between the 26th of January and 15th of April 2016, which included a period of time away from the site, to allow for overgrown areas to be cleared and access possible for geophysical surveying. The weather conditions were variable throughout the acquisition period. Health and safety standards were adhered to at all times. While working on roadways the area was clearly highlighted by the use of warning signs and cones and a traffic management system was in place.

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.

The interpretation is based on the methods available and the type of bedrock in each area. In some areas only 2D-Resistivity was carried out, so the interpretation is made solely by resistivity. In other areas seismic refraction was done at the same location as the 2D-Resistivity and the interpretation is based on both methods. Table 3 shows the areas along the survey area and the method of interpretation used.

The bedrock geological map of Ireland (www.gsi.ie) shows the granite/limestone boundary occurring at approx. CH8890. This chainage agrees with the survey (Plan 2d) where a sudden change in elevation is present in Area GP 3/5. The interpretation at the start of this area is made for the granite area and the interpretation for the rest of the area follows the limestone area.

Interpretation Areas	Chainage (CH)
Granite Bedrock with 2D-Resistivity and Seismic Refraction Survey	5315 – 8325
	Side Road 0 - 600
Limestone bedrock with 2D- Resistivity Survey only	8750 – 10060
	10550 – 11110
	12220 - 12575
Limestone Bedrock with 2D-Resistivity and Seismic Refraction Survey	All other areas
	Interpretation Areas Granite Bedrock with 2D-Resistivity and Seismic Refraction Survey Limestone bedrock with 2D- Resistivity Survey only Limestone Bedrock with 2D-Resistivity and Seismic Refraction Survey

Table 3: Interpretation Areas

Ground investigation results were available after the survey and the abbreviated borehole logs are indicated on the sections. The rock was generally divided into Limestone/Granite and Weathered Limestone/Granite based on the driller description. Where no description was made in the logs, it was based on the RQD value of more or less than 50%. This can be done only to a certain extent as the rock is very variable and RQD values and fracture index often changes rapidly with depth.

In general, there is a good fit between the boreholes and the geophysical data. In some boreholes a difference in rock level with the geophysical interpretation is evident, those are discussed further below.

3.1 2D-Resistivity Models

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 < 3.0%. The resulting models were colour contoured with the same resistivity scale for all profiles and they are displayed as cross sections (Plans 1a – 1p).

Resistivities are characteristic for certain overburden material types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than as if there is a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand/gravel content the lower the resistivity. The water content in the overburden also influences the resistivities but generally the clay content has a larger effect.

The resistivities cover a range typical for materials from clay rich overburden (low resistivities) to fresh strong unweathered bedrock (high resistivities). The ranges have been taken into the consideration for the interpretation.

Within bedrock types like clean limestone and granite high resistivities indicate a fresh strong unweathered rock. As the weathering in the rock increases the resistivity gets lower because of weathering products, remineralisation of rock and infill of cracks, faults and voids with clay and water. Weathering within rock is typically indicated by lower resistivity values in the cross sections.

In limestone areas karstified rock is defined in this report as a formerly intact clean limestone rock, liable to karstification, that has been partially dissolved by water over long geological time scales and where the cavities and voids have either remained empty (filled by air) or became filled by overburden sediment (clay, silt, sand), weathering product of the broken rock itself or water. This process would lead to a reduction of the resistivity of the overall rock and therefore karstified rock has a lower resistivity than intact clean limestone rock.

3.2 Seismic Refraction Models

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 2 layers were used for the granite area and 3-4 layers were used for the limestone area. 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, traveltime computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.9 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 (Plans 1a - 1p). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

The p-wave seismic velocity is closely linked to the density of subsurface materials and to parameters like compaction, stiffness, strength and rock quality. The higher the density of the subsurface materials the higher the seismic velocity. Similarly for the other parameters it is generally valid that a more compacted, stiffer and stronger material will have a higher seismic velocity. For rock the seismic velocity is higher when the rock is stronger, less weathered and has a higher quality. If the rock is more weathered broken fractured or fissured then the seismic velocity will be reduced compared to that of intact fresh rock.

Because of the above relation the seismic refraction method and seismic velocities are suitable to investigate ground where the layers get denser, more compacted and stronger with depth. A disadvantage is that some different materials have the same or similar seismic velocity: A very stiff or very dense highly consolidated overburden and a weathered rock can have the same seismic velocity range.

3.3 Interpretation of Granite Area with 2D-Resistivity and Seismic Refraction

Table 4 summarises the interpretation for this area. The stiffness/compaction and the rock strength/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.

Interpreted cross sections are shown in Plans 2a – 2c (lower sections). 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 different types of rock. 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 (m/sec)	General Resistivity Range (Ohmm)	Compaction/ Strength/ Rock Quality	Interpretation	Estimated Excavation Method
G1 G2a	200 - 400 4100 - 7500	All < 640	Soft/Loose Fair to Good Rock	Topsoil/Overburden Strong Granite with some Weathered Zones	Diggable Breaking & Blasting
G2b	4100 - 7500	> 640	Fair to Good Rock	Strong Granite	Breaking & Blasting

Table 4: Summary of Results and Interpretation in Granite Area

Layer G1 is generally thin (1m) and comprises topsoil, made ground and overburden. The seismic velocity range of 200 - 400 m/s indicates that the geological material in this layer would be mainly soft or loose in terms of stiffness and compaction.

The depth to top of rock (Layer G2a and G2b) with a seismic velocity range of 4100 - 7500 m/s varies between 1 and 3m bgl. under the survey profiles. This layer requires breaking/blasting for removal. Layer G2a with high velocities (4100 - 7500 m/s) but lower resistivities (<640 Ohmm) occurs at a small number of locations. The lower resistivities would indicate that the granite rock is partially weathered.

3.4 Interpretation of Limestone Area with 2D-Resistivity Method only

Table 5 summarises the interpretation for the resistivities in the limestone area. Interpreted cross sections are shown in Plans 2d, 2e, 2g & 2h (lower sections).

Resistivities are used to indicate the bedrock type and how clean the limestone is. Resistivity values < 120 Ohmm, where present near the surface indicate a clay or silt overburden and where they occur at depth a clay filled karstified limestone (Layer A). Layer B with a medium resistivity range (120 - 640 Ohmm) has been interpreted as a more gravel rich overburden or an infilled (silt, sand, weathering products and moisture) or karstified limestone.

Resistivity values greater than 640 Ohmm (Layer C) have been interpreted as either a sand/gravel overburden or a clean limestone that is hardly weathered or broken.

2D-Resistivity data allows for interpretation of different types of overburden and rock types and features within the rock, but it is not possible to distinguish between overburden and rock where they have similar velocities. This distinction is done from the seismic refraction which was not carried out in this area.

Layer	General Resistivity Range (Ohmm)	Interpretation
A	< 120	Clay or Silt Overburden, or Clay Filled Limestone
В	120 - 640	Gravelly Clay Overburden, or Infilled Limestone
с	> 640	Sand or Gravel Overburden, or Fresh Limestone

Table 5: Summary	v of Results and I	nterpretation in Limestone	e Area (Resistivity only)
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3.5 Interpretation of Limestone Area with 2D-Resistivity and Seismic Refraction

Table 6 summarises the interpretation for this area. The stiffness/compaction and the rock strength/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.

Interpreted cross sections are shown in Plans 2f, 2j & 2i - 2p (lower sections). 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 different types of overburden and rock. Resistivity data is better suited to show overburden and 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 (m/sec)	General Resistivity Range (Ohmm)	Stiffness/ Compaction or Rock Strength/ Quality	Interpretation	Estimated Excavation Method
1	200 - 360	Any	Soft or Loose	Topsoil/Fill/Made Ground	Diggable
2a	900 - 1200	< 120	Firm to Stiff or Medium Dense	Clay or Silt Overburden	Diggable
2b	900 - 1200	120 - 640	Firm to Stiff or Medium Dense	Gravelly Clay Overburden	Diggable
2c	900 – 1200	> 640	Firm to Stiff or Medium Dense	Sand or Gravel Overburden	Diggable
3a	2000 – 2400	< 120	Poor to fair rock or Very stiff to hard or Very dense	Clay Filled Weathered Limestone or Clay or Silt Overburden	Diggable/rippable to marginal rippable
3b	2000 – 2400	120 - 640	Poor to fair rock or Very stiff to hard or Very dense	Infilled Weathered Limestone or Gravelly Clay Overburden	Diggable/rippable to marginal rippable
3с	2000 - 2400	> 640	Poor to fair rock or Very stiff to hard or Very dense	Weathered Limestone or Sand or Gravel Overburden	Diggable/rippable to marginal rippable
4a	4000 - 5000	< 120	Good to very good rock	Clay Filled Strong Limestone	Breaking & Blasting
4b	4000 - 5000	120 – 640	Good to very good rock	Infilled Strong Limestone	Breaking & Blasting
4c	4000 - 5000	> 640	Good to very good rock	Fresh Strong Limestone	Breaking & Blasting

Table 6: Summary of Results and Interpretation in Limestone Area (Resistivity and Seismic Refraction)

Seismic layer 1, a relatively thin layer with seismic velocities of 200 - 340 m/s, has been interpreted as a layer of overburden, mainly comprised of made ground, topsoil and soil with a soft/loose stiffness/compaction.

Seismic layer 2 was modelled with a velocity range of 900 – 1200 m/s, which indicates overburden material with firm to stiff or medium dense strength/compaction. The resistivity ranges indicate varying amounts of clay, sand or gravel within the overburden. This layer may also include some highly weathered limestone at the base of the layer.

Seismic layer 3, with velocities of 2000 – 2400 m/s indicates predominantly Limestone bedrock with varying degrees of weathering or a very stiff to hard/very dense overburden. Within this layer, where the lower resistivity ranges occur at depth, the interpretation points towards that of a weathered/karstified Limestone. Occurring closer to the surface, the layer is more likely overburden with varying degrees of clay, silt, sand and gravel.

Strong Limestone is indicated by seismic velocities between 4000 – 5000 m/s of Layer 4. Again the varying resistivity ranges within this Limestone layer indicate varying degrees of weathering/karstification.

A division of seismic layers 2 - 4 into the subdivisions by resistivity (A - C) is made, and the interpretation by resistivity is the same as for chapter 3.4.

4. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made:

- The geophysical surveys carried out show that the subsurface geology consists of various overburden material overlying granite and limestone bedrock. Recommendations for targeted ground investigation locations were made during the geophysical survey. These are included in this report for a future phase of ground investigation.
- Direct ground investigation comprising of cable percussive boreholes, rotary boreholes and trial pits was carried out by IGSL Ltd. The locations are shown on the maps, in the upper frames of plans. The abbreviated logs of the cable percussive and rotary core holes have been drawn on the sections (lower frames). There is generally a good fit between the boreholes and the geophysical data.
- It is possible to divide the survey area along the length of the chainage based on this subsurface geology. The Caledonian Granitic rocks are located from CH0 to approx. CH8890. East from here the geology consists of Carboniferous Limestones.

<u>Granite</u>

- Within the Granite section (Plans a-c), high resistivities and high seismic velocities indicate granite bedrock close to the surface. The overburden has an average thickness of 1 m.
- Small zones of lower resistivities in the rock indicate that the Granite is slightly weathered at these locations. On the side road at CH 250 (Plans c), this zone of weathered rock extends to a depth of approx. 18m bgl and might also indicate a fault. A targeted rotary core hole is recommended at this location (CH250).
- High seismic velocities in the granite rock indicate that the rock requires breaking or blasting for removal.
- The direct ground investigation results generally indicate that the granite is shallow and unweathered. Some boreholes near the survey line (BH3/17, BH3/18 and BH3/20) indicate the strong unweathered granite deeper than the seismic data. This could indicate irregular weathering of granite (spheroidal or woolsack weathering), where the overall rock unit is good quality rock though at a small scale weathered granite and unweathered granite occur close together. Other boreholes in the granite area show a good fit of the rock head with the seismic interpretation.
- Trial breaking of granite rock is recommended in the proposed deep cut areas CH7700 8200 and sideroad CH50 – 350. Trial breaking of rock in trial pits with a large surface area will give the best indication of the excavatability.

Limestone

- Within the Limestone section high resistivities indicate a clean Limestone, which occurs shallowest under the topographical rises along the scheme. This good to very good Limestone would require breaking and blasting during construction of cuts.
- The bedrock resistivities in the limestone section are generally high which indicates a clean limestone that is liable to karstification (but does not have to be karstified).
- Lower resistivity values within the clean high resistivity limestone point towards a weathered or karstified Limestone. The existence of karstified rock could lead to subsidence and therefore its location is of particular relevance in areas of proposed cut and fill in the construction plan.
- The limestone area starts at approx. CH8890, from here on to the eastern end of the scheme there is a risk of the occurrence of karst.
- The first karst feature appears inside the rock at CH8930 and has a width of approx. 40m and a depth of 20m. This feature could be drilled by a targeted corehole if there is an impact of the future design, e.g. if foundations for a bridge are proposed at this chainage.
- At area GP 3/5 the resistivities indicate overburden or infilled limestone. Borehole BH 3/53R places the depth to rock at approx. 5m bgl. In this area no seismic refraction was done, and the depth to rock cannot be determined from the resistivity data alone.
- The largest zone of weathered and karstified limestone occurs CH13650 14150. It is located in a topographical depression likely caused by erosion of the lesser quality rock.
- A zone of thick overburden and deep rock occurs at CH13050 13140 where the resistivity profile did not reach good quality limestone to at least 15m depth. A longer 2D-Resistivity profile is recommended at this location.
- The survey at the abandoned Coolagh quarry was done to check for weathered and karstified rock in relation to the hydrogeological conditions between the quarry and the proposed road.
- In some areas there are possible contradictions between the resistivity and seismic data (e.g. CH11900 11950 in area GP 3/9). The resistivities are quite high (> 1000 Ohmm) and the seismic velocities medium (2300 m/s). Resistivities can indicate a limestone rock while seismic velocities indicate poor to fair weathered rock or very dense sand and gravel overburden. The models were reviewed and it is not possible to seismically model a strong limestone at shallow depth as might be proposed by the resistivity data. Targeted boreholes can resolve these locations more, especially such locations like at CH11970 where the construction changes from proposed cut to fill or bridge.

• In order to test for weathered and karstified limestone targeted rotary core holes could be drilled and have been recommended at the following locations shown in Table 7.

Chainage	Plan
8930	Plan 2d
10760	Plan 2g
12020	Plan 2h
12370	Plan 2h
13775	Plan 2i
200m along GP3/19	Plan 2n
480m along GP3/19	Plan 2n
320m along GP3/20	Plan 2o
200m along GP3/21	Plan 2p

Table 7: Locations of recommended Rotary Core Holes

5. **REFERENCES**

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2D-Resistivity Survey								
Site	Profile	Length (m)	Combined Length (m)	Electrode Spacing	Start Chainage			
GP3/1	R4	189		3	5309			
GP3/1		96		3				
GP3/1		42	327	3				
GP3/2	R1	200	200	5	7565			
GP3/2	R3	315		5	7750			
GP3/2		75	390	5				
GP3/3	R2	315		5	16			
GP3/3		160		5				
GP3/3		120	595	5				
GP3/4	R5	153	153	3	8203			
GP3/5	R13	315		5	8759			
GP3/5		160		5				
GP3/5		60	535	5				
GP3/6	R6	315		5	9491			
GP3/6		55	370	5				
GP3/6	R22	295	295	5	9790			
GP3/7	R21	285	285	5	10160			
GP3/7								
GP3/8	R7	315		5	10550			
GP3/8		160		5				
GP3/8		115	590	5				
GP3/9	R25	265	265	5	11855			
GP3/10	R16	315		5	12222			
GP3/10		45	360	5				
GP3/12	R8	85	85	5	13052			
GP3/13	R10	315		5	13457			
GP3/13		150	465	5				
GP3/14	R11	315		5	13957			
GP3/14		55	370	5				
GP3/15	R14	205	205	5	15499			
GP3/16	R15	105	105	5	15724			
GP3/17	R12	315		5	15874			
GP3/17		160		5				
GP3/17		160		5				
GP3/17		65	700	5				
GP3/18	R9	120	120	5	13198			
GP3/19	R23	315		5	OFF Mainline			

Table 1: Geophysical Survey Locations and Acquisition Parameters

GP3/19		160		5	
GP3/19		50	525	5	
GP3/20	R24	315		5	OFF Mainline
GP3/20		95	410	5	
GP3/21	R17	315		5	Across Mainline
GP3/21		80	395	5	
GP3/23	R20	115	115	5	Across Mainline
GP3/24	R19	170	170	5	10958
GP3/25	R18	290	290	5	10897
	SUM	8320			
		Seismic Refr	action Survey		
Site	Profile Name	Length (m)	Spacing (m)	No. Geophones	Start Chainage
GP3/1	S5	321	3	108	5309
GP3/2	S1	171	3	58	7565
GP3/2	S3	213	3	72	7750
GP3/2	S4	174	3	58	7948
GP3/3	S2	591	3	198	16
GP3/4	S6	141	3	48	8206
GP3/7	S21	285	3	96	10154
GP3/9	S31	258	3	87	11854
GP3/12	S7	84	3	29	13052
GP3/13	S9	285	3	96	13457
GP3/13	S10	177	3	59	13742
GP3/14	S11	357	3	120	13957
GP3/15	S15	213	3	72	15499
GP3/16	S16	105	3	36	15724
GP3/17	S12	285	3	96	15874
GP3/17	S13	216	3	72	16162
GP3/17	S14	195	3	65	16361
GP3/18	S8	120	3	41	13198
GP3/19	S30	501	3	168	OFF Mainline
GP3/20	\$32	411	3	138	OFF Mainline
GP3/21	S17	402	3	135	Across Mainline
GP3/23	S33	69	3	24	Across Mainline
GP3/24	S19	162	3	55	10960
GP3/25	S18	285	3	96	10898
	SUM	6021			
Chainage is based on the Ali	gnment received 12/02/2016				

Table 2: Structure Locations and Geological Background

Geophysical Survey Area	Geophysical Method	Proposed Cut Depth/Design Feature	Soil	Subsoils	Soft Ground	Bedrock	Outcrop (Rock < 2m bgl)	Fractures/Faults	Karst Features
G.P 3/1	2D-Resistivity 3m & Seismic Refraction 3m	Maximum cut depth 3.8m	Shallow soils derived from non- calcareous rock or gravels	Bedrock outcrop and subcrop	No	Errisbeg Townland Granite - Megacrystic pink/grey monzogranite	Yes	No	No
G.P 3/2	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 14.6m at approx. Ch. 7900	Shallow soils derived frommainly non-calcareous parent materials	Bedrock outcrop and subcrop	No	Errisbeg Townland Granite - Megacrystic pink/grey monzogranite	Yes	No	No
G.P 3/3	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 12m at approx. Ch. 145	Shallow soils derived from mainly non-calcareous parent materials	Till derived chiefly from grainite	No	Errisbeg Townland Granite - Megacrystic pink/grey monzogranite	Yes	No	No
G.P 3/4	2D-Resistivity 3m & Seismic Refraction 3m	Maximum cut depth of 2.9m at approx. Ch. 8+270	Shallow soils derived from mainly non-calcareous parent materials	Till derived chiefly from grainite	No	Errisbeg Townland Granite - Megacrystic pink/grey monzogranite & Murvey Granite - non-porphyritic syenogranite; pink	No	No	No
G.P 3/5	2D-Resistivity 5m	Bridge structure, 30m depth required due to bedrock formation change (granite to limestone)	Made Ground, Soils derived from mainly calcareous and non calcareous parent materials	Made ground, Till derived from granites and karstified bedrock outcrop and subcrop	No	Partially Murvey Granite - non-porphyritic syenogranite; pink and moves into Visean Limestones- Undifferentiated limestome	No	No	No
G.P 3/6	2D-Resistivity 5m	Bridge structure, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrock outcrop or subcrop	Soft Compressible Ground	Visean Limestones- Undifferentiated limestome	Yes	No	No

Table 2: Structure Locations and Geological Background

Geophysical Survey Area	Geophysical Method	Proposed Cut Depth/Design Feature	Soil	Subsoils	Soft Ground	Bedrock	Outcrop (Rock < 2m bgl)	Fractures/Faults	Karst Features
G.P 3/7	2D-Resistivity 5m & Seismic Refraction 3m	Viaduct structure, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/8	2D-Resistivity 5m	Lackagh Tunnel (21m below surface) 30m depth required	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/9	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 13.4m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/10	2D-Resistivity 5m	Embankment, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	Cut Peat	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/12	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 7.7m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	No	No	No
G.P 3/13	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 7.3m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	Yes	No	No

Table 2: Structure Locations and Geological Background

Geophysical Survey Area	Geophysical Method	Proposed Cut Depth/Design Feature	Soil	Subsoils	Soft Ground	Bedrock	Outcrop (Rock < 2m bgl)	Fractures/Faults	Karst Features
G.P 3/14	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 12.3m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/15	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 7.0m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/16	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 7.0m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/17	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 7.0m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones	No	Visean Limestones- Undifferentiated limestome	Yes	No	No
G.P 3/18	2D-Resistivity 5m & Seismic Refraction 3m	Maximum cut depth 12.1m, 30m depth required due to limestone bedrock and karst potential	Soils derived from mainly calcareous parent materials	Till derived from limestones and Karstified bedrok outcrop or subcrop	No	Visean Limestones- Undifferentiated limestome	No	No	No
































































Appendix 12

Groundwater Measurements

Water Readings Project Name GCTP Phase 3 $\mathbf{G} \mathbf{S}$ Project No. 18963 Engineer ARUP Date Borehole No. 16/03/2016 21/03/2016 14-15/04/2016 25/05/2016 13-14/06/2016 18-19/07/2016 18-19/08/2016 29/09/2016 11/03/2016 09/11/2016 m bgl / m OD Borehole No. BH3/04R 0.46 0.52 0.47 0.59 0.58 0.48 0.54 0.50 0.12 BH3/06R 0.87 0.95 1.14 1.22 1.10 1.14 1.08 0.96 BH3/08R 1.52 0.66 2.02 2.19 1.8 2.2 2.2 1.69 BH3/10R 3.14 2.43 2.63 2.35 2.59 2.44 1.85 BH3/11R 0.97 1.28 1.11 1.40 1.41 1.15 1.38 1.3 1.14 BH3/13R 1.71 5.38 5.80 1.99 4.66 1.53 BH3/16R 3.92 3.94 4.02 3.94 3.99 3.78 3.21 BH3/17R 2.47 2.83 2.61 2.79 2.87 2.65 2.85 2.84 BH3/18R 2.61 1.53 no access 2.55 2.3 2.58 2.48 2.3 BH3/20R 3.02 3.50 3.8 3.16 3.65 3.55 3.15 BH3/21 [CP] 1.27 1.32 1.55 dry dry dry 1.35 BH3/23R 3.47 4.31 4.55 4.61 4 4.52 4.3 4.10 BH3/24R 2.52 2.39 3.40 3.24 3.25 4.19 4.1 3.06 BH3/27R 2.69 2.97 3.2 2.9 2.71 BH3/29R 4.50 6.19 no access dry dry dry dry BH3/31R 1.53 no access 1.63 1.3 no access no access no access BH3/32R dry (14,0) dry (14.0) dry dry 14.19 dry dry BH3/34R 7.52 12.88 7.70 7.78 8.04 6.66 8.50 BH3/35R 8.91 9.10 9.61 9.14 9.49 9.20 8.37 BH3/36R 18.98 18.52 18.07 17.96 17.90 17.93 17.90 17.78 BH3/38R 2.26 2.35 2.58 2.66 2.69 2.28 2.72 2.60 1.44 BH3/40R 2.66 2.95 2.96 no access 3.04 2.65 3.00 3.05 2.46 BH3/41R 3.16 3.67 3.78 no access 4.01 3.43 no access no access 3.20 BH3/42R 2.72 2.97 2.72 3.15 2.53 2.85 2.80 2.66 BH3/46R 12.78 13.01 12.49 12.71 12.75 13.00 12.74 13.00 BH3/47R 10.05 10.16 10.19 10.00 dry dry 10.02 BH3/48R 1.41 1.45 1.55 no access 1.46 1.40 1.48 1.50 1.40 NOTES

Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 1

IGSL Ltd Materials	Laboratory						Tes	st Repor	rt					ISO 17025			
Unit J5, N	17 Business F	Park			Determi	nation of	Moisture	Content	, Liquid &	& Plastic	Limits						
Co Kildar	vaas e							_	•					TESTING			
045 8461	76				Tested in ac	cordance v	vith BS137	7:Part 2:19	90, clause	s 3.2*, 4.3,	4.4 & 5.3			SCOPE REG NO. 1331			
	Report No.	R70242		Contract	No.	18963		Contract Name:		GCTP Pha	ase 3-Cont	ract 1					
	Customer	GCC															
	Samples Re	eceived:	01-02-16	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			
TP3/01	AA37828	0.0	A16/0310	В	645								Dark brown/black sandy gr	avelly very fibrous PEAT			
TP3/01	AA37829	1.0	A16/0311	В	12								Grey/brown claye	ey/silty, very sandy, GRAVEL			
TP3/03	AA44474	0.5	A16/0312	D	54								Dark brown/black	silty, very sandy, GRAVEL			
TP3/03	AA44479	0.5	A16/0313	D	42	63	NP	NP	28	WS	4.4		Dark brown/black silty, very sandy, GRAVEL				
TP3/03	AA44480	0.5	A16/0314	В	25								Dark brown/black silty, very sandy, GRAVEL				
TP3/03	AA44481	1	A16/0315	D	80								Dark brown/black sandy gravelly SILT/CLAY				
TP3/03	AA44482	1.6	A16/0316	D	26								Dark brown silty, very sand	y, GRAVEL with occasional cobbles			
TP3/03	AA44483	1.6	A16/0317	D	23	59	NP	NP	17	WS	4.4		Dark brown silty, very sand	y, GRAVEL with occasional cobbles			
TP3/03	AA44484	1.6	A16/0318	В	18								Dark brown silty, very sand	y, GRAVEL with occasional cobbles			
TP3/05	AA44473	0.5	A16/0319	D	892								Dark brown fib	rous PEAT			
TP3/05	AA44474	0.5	A16/0320	D	970								Dark brown/bla	ack fibrous PEAT			
TP3/05	AA44475	0.5	A16/0321	В	912								Dark brown/bla	ack very fibrous PEAT			
TP3/05	AA44476	1	A16/0322	D	30								Dark brown/grey clayey/silt	y, very sandy, GRAVEL			
TP3/05	AA44477	1	A16/0323	В	30								Dark brown/grey clayey/silt	y, very sandy, GRAVEL			
TP3/06	AA35350	0.5	A16/0324	D	855								Dark brown/bla	ack fibrous PEAT			
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:		•							
		AR - As recei	ived			U - Undisturb	ed										
		NP - Non pla	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of I	SO17892-1:2014			
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	4			Opinions and	d interpretation	ons are outsid	e the scope o	e of accreditation.					
	Ciause:		Persons autho	rized to appro	ve reports	The results h	eiate to the s	Approved	bv	aming mater	Date	Page					
IG	IGSL Ltd Materials Laboratory						10 100010				45.00.40	4.54					
				5		H Byrne	(Quality Ma	Manager)				15-02-16	1 OT 1				

IGSL Ltd Materials	Laboratory						ISO 17025										
Unit J5, M	7 Business F	Park			Determi	nation of	Moisture	e Content	Liquid 8	& Plastic	l imits			IVNAB			
Newhall, N	laas				Dotonin			oontont	,					TESTING			
Co. Kildar	e 76				Tested in ac	cordance w	ith BS137	7:Part 2:19	90, clause	s 3.2*, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 133T			
043 040 1	0																
	Report No.	R70244		Contract	ontract No. 18963				Contract Name:		ase 3-Cont	ract 1					
	Customer	Galway Co	o.Co.														
	Samples Re	eceived:	01-02-16	Date Tes	sted:	: Various											
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n			
		/		Туре	Content %	Limit %	Limit %	Index	<425µm		Clause	(BS5930)					
TP3/06	AA37803	0.5	A16/0324	В	787								Dark brown/black PEAT				
TP3/06	AA37804	1.1	A16/0325	D	22								Dark brown/black clayey/sil	ty, sandy, GRAVEL with some cobbles			
TP3/06	AA37805	1.1	A16/0326	В	21								Dark brown/black clayey/sil	ty, sandy, GRAVEL with some cobbles			
TP3/07	AA37806	0.2	A16/0327	D	31	42	NP	NP	40	WS	4.4		3rown silty, very gravelly, SAND with some cobbles				
TP3/07	AA37807	0.2	A16/0328	В	27								Brown silty, very gravelly, SAND with some cobbles				
TP3/08	AA37818	0.5	A16/0329	29 D 19 Dark brown clayey/silty, ve							y sandy, GRAVEL with some cobbles						
TP3/08	AA37819	0.5	A16/0330	В	12								Dark brown clayey/silty, ver	y sandy, GRAVEL with some cobbles			
TP3/08	AA37820	1.2	A16/0331	D	13								Light brown/grey clayey/silt	y, very sandy, GRAVEL			
TP3/08	AA37821	1.2	A16/0332	В	12								Light brown/grey clayey/silt	y, very sandy, GRAVEL			
TP3/11	AA37814	0.25	A16/0333	В	26								Dark brown clayey/silty, ver	y sandy, GRAVEL with many cobbles			
TP3/12	AA44457	0.1	A16/0334	В	90								Dark brown/black sandy gr	avelly organic SILT/CLAY			
TP3/13	AA44458	0.1	A16/0335	D	246								Dark brown/black	fibrous PEAT			
TP3/13	AA44459	0.1	A16/0336	В	39								Dark brown/black slightly s	andy, gravelly, SILT/CLAY with many cobbles			
TP3/13	AA44460	0.5	A16/0337	D	25	27	NP	NP	59	WS	4.4		Light brown/grey	sandy, slightly gravelly, SILT			
TP3/13	AA44461	0.5	A16/0338	В	23								Light brown/grey sandy, sli	ghtly gravelly, SILT			
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:									
		AR - As recei	ived			U - Undisturb	ed										
		NP - Non plas	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of I	SO17892-1:2014			
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	l			Opinions and	d interpretatio	ons are outsid	e the scope c	f accreditatio	n.				
	Clause:	4.4 Cone Per	netrometer one	point method	Domona avita	rized to an array	vo ronanta	The results relate to the specimens tested. Any remaining materi				ial will be reta	ined for one month.				
IG	IGSL I to Materials Laboratory					nzed to appro	ve reports	Approved by			Date	гаус					
				' y		H Byrne	(Quality Ma	lanager)			Al Byrene 15			1 of 1			

IGSL Ltd Materials	Laboratory						Tes	st Repor	t					ISO 17025			
Unit J5, M	17 Business F	Park			Determi	nation of	Moisture	e Content	. Liauid 8	& Plastic	Limits			IVNAB			
Newhall, N	Vaas							•••••	,					TESTING			
045 84617	e 76				Tested in ac	cordance w	ith BS137/	7:Part 2:19	90, clause	s 3.2*, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 133T			
040 040 11	0																
	Report No.	R70245		Contract	No.	18963		Contract Name:		GCTP Pha	ase 3-Cont	ract 1					
	Customer	Galway Co	o. Co.														
	Samples Re	eceived:	01-02-16	Date Tes	sted:	Various											
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n			
				Туре	Content %	% Limit % Limit % Index $<425\mu m$ Clause $(BS5930)$							-				
TP3/15	AA44485	0.1	A16/0340	D	210	247	NP	NP	46	WS	4.4		Dark brown/bla	ack PEAT			
TP3/15	AA44486	0.1	A16/0341	В	140								Dark brown/bla	ack slightly gravelly PEAT			
TP3/16	AA37816	0.2	A16/0342	D	44								Dark brown sligh	tly clayey/silty, sandy, GRAVEL			
TP3/16	AA37817	0.2	A16/0496	В	15								Dark brown slightly clayey/silty, sandy, GRAVEL				
TP3/17	AA44487	0.5	A16/0509	D	17								Orange/brown clayey/silty, sandy, GRAVEL with some cobbles				
TP3/17	AA44488	0.5	A16/0343 B 14 Orangebrown clayey/silty, sa								sandy, GRAVEL with some cobbles						
TP3/17	AA44489	0.5	A16/0344	В	18								Orange/brown clayey/silty,	sandy, GRAVEL with some cobbles			
TP3/18	AA37825	0.15	A16/0345	В	36								Dark brown/blac	sandy gravelly SILT/CLAY			
TP3/18	AA37826	1	A16/0346	В	10								Brown clayey/s	silty, sandy, GRAVEL			
TP3/18	AA37827	2	A16/0347	В	6.2								Light brown slightly clayey	silty, sandy, GRAVEL with some cobbles			
TP3/19	AA44490	0.5	A16/0348	D	11								Dark brown/black clayey/s	Ity, very sandy, GRAVEL with some cobbles			
TP3/19	AA44491	0.5	A16/0349	В	15								Dark brown/black clayey/s	Ity, very sandy, GRAVEL with some cobbles			
TP3/19	AA44492	0.5	A16/0350	В	14								Dark brown/black clayey/s	Ity, very sandy, GRAVEL with some cobbles			
TP3/20	AA37822	0.15	A16/0351	В	169								Dark brown/bla	ack very fibrous PEAT			
TP3/20	AA37823	1	A16/0352	В	170								Dark brown/bla	ack very fibrous PEAT			
Notes:	Preparation:	WS - Wet sie	eved	1	Sample Type:	B - bulk distu	rbed	Remarks:		1							
		AR - As recei	ived			U - Undisturb	ed										
		NP - Non plas	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of	SO17892-1:2014			
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	l			Opinions and	d interpretatio	ons are outsid	e the scope o	f accreditatio	n.				
	Clause:	4.4 Cone Per	netrometer one p	point method	Doroono outha	rized to enner	uo ronorto	The results relate to the specimens tested. Any remaining mate				aining mater	al will be reta	ned for one month.			
IG	ICSI I to Materials Laboratory					nzeu to appro	ve reports	Approved by			Dale	r aye					
				' Y		H Byrne (Quality Ma	anager)		A Byen 15-			15-02-16	1 of 1			

IGSL Ltd Materials	Laboratory						ISO 17025										
Unit J5, N	17 Business F	Park			Determi	nation of	Moisture	e Content	. Liauid &	& Plastic	Limits			IVNAB			
Newhall, I	Naas								, 1					TESTING			
045 8461	e 76				Tested in ac	cordance w	vith BS137	7:Part 2:19	90, clause	s 3.2*, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 1337			
	Report No.	R70246		Contract	No.	18963		Contract Name:		GCTP Pha	ase 3-Cont	ract 1					
	Customer	GCC															
	Samples Re	eceived:	01-02-16	Date Tes	sted: 10-02-16												
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n			
		/		Туре	Content %	Limit %	Limit %	Index	<425µm		Clause	(BS5930)					
TP3/20	AA37824	1.0	A16/0353	В	11								Dark brown/gre	ey very sandy GRAVEL			
TP3/20	AA37824	1.0	A16/0354	E	11								Dark brown/grey very sandy GRAVEL				
TP3/21	AA44493	0.2	A16/0355	D	15								Dark brown/black clayey/si	ty, sandy, GRAVEL with some cobbles			
TP3/21	AA44494	0.15	A16/0356	В	17								Dark brown/black clayey/silty, sandy, GRAVEL with some cobbles				
TP3/21	AA44495	0.15	A16/0357	В	19								Dark brown/black clayey/silty, sandy, GRAVEL with some cobbles				
TP3/22	AA39946	0.15	A16/0358	D	25	34	NP	NP	75	WS	4.4		Brown sandy, slightly gravelly, SILT				
TP3/22	AA33947	0.15	A16/0359	В	24								Brown sandy, s	slightly gravelly, SILT			
TP3/23	AA39940	0.5	A16/0360	D	17	29	NP	NP	77	WS	4.4		Light brown slightly sandy,	slightly gravelly, SILT			
TP3/23	AA33941	0.5	A16/0361	В	17								Light brown slightly sandy,	slightly gravelly, SILT			
TP3/23	AA33942	1.1	A16/0362	D	12	21	NP	NP	65	WS	4.4		Light brown slightly sandy,	gravelly, SILT with some cobbles			
TP3/23	AA33943	1.1	A16/0363	В	11								Light brown slightly sandy,	gravelly, SILT with some cobbles			
TP3/23	AA33944	2	A16/0364	D	6.6	19	NP	NP	54	WS	4.4		Light brown slightly sandy,	gravelly, SILT with some cobbles			
TP3/23	AA33945	2	A16/0365	В	7.9								Light brown slightly sandy,	gravelly, SILT with some cobbles			
TP3/25	AA33934	0.15	A16/0366	D	34	59	NP	NP	34	WS	4.4		Brown silty, ve	y sandy, GRAVEL			
TP3/25	AA33935	0.15	A16/0367	В	16								Brown silty, ve	y sandy, GRAVEL			
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:									
		AR - As rece	ived			U - Undisturb	ed										
		NP - Non pla	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of I	SO17892-1:2014			
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	ł			Opinions and	l interpretatio	ons are outsid	e the scope o	f accreditatio	n.				
	Clause:	4.4 Cone Per	netrometer one	point method	Doroona auto	rized to an array	vo ron-t-	The results relate to the specimens tested. Any remaining mate				aining mater	ial will be reta	ined for one month.			
	IGSL I td Materials Laboratory					iized to appro	ve reports	Approved by			Date	гауе					
				чy		H Byrne	(Quality Ma	anager)		A Byon 15-0.			15-02-16	1 of 1			

IGSL Ltd Materials	Laboratory						Tes	st Repoi	rt					ISO 17025		
Unit J5, N	17 Business F	Park			Determi	nation of	Moisture	e Content	, Liquid &	& Plastic	Limits					
Co Kildar	vaas o													TESTING		
045 8461 [°]	76				Tested in ac	DETAILED IN SCOPE REG NO. 1337										
	Report No.	R70247		Contract	ntract No. 18963				lame:	GCTP Ph	ase 3-Cont	ract 1				
	Customer	Galway Co	o.Co.													
	Samples Re	eceived:	01-02-16	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		
TP3/25	AA33936	1.0	A16/0368	D	7.7	24	NP	NP	38	WS	4.4		Light brown/grey	very sandy very gravelly SILT		
TP3/25	AA33937	1.0	A16/0369	В	8.1								_ight brown/grey very sandy very gravelly SILT			
TP3/25	AA33938	2.0	A16/0370	D	7.9								Light brown/grey slightly sa	ndy, gravelly, SILT/CLAY with some cobbles		
TP3/25	AA33939	2.0	A16/0371	В	7.7								Light brown/grey slightly sandy, gravelly, SILT/CLAY with some cobbles			
TP3/27	AA44451	0.5	A16/0372	D	15	34	NP	NP	64	WS	4.4		Brown slightly	sandy, gravelly, SILT		
TP3/27	AA44452	0.5	A16/0373	В	17								Brown slightly sandy, gravelly, SILT			
TP3/27	AA44453	1.0	A16/0374	D	6.7	18	NP	NP	66	WS	4.4		Grey/brown slightly sandy, slightly gravelly, SILT			
TP3/27	AA44454	1.0	A16/0375	В	9.2								Grey/brown sligh	tly sandy, slightly gravelly, SILT		
TP3/27	AA44455	2.0	A16/0376	D	6.4	18	NP	NP	73	WS	4.4		Light brown sligh	tly sandy, slightly gravelly, SILT		
TP3/27	AA44456	2.0	A16/0377	В	9.3								Light brown sligh	tly sandy, slightly gravelly, SILT		
TP3/28	AA37830	0.5	A16/0378	D	14	22	NP	NP	51	WS	4.4		Light brown slightly sandy,	gravelly, SILT with some cobbles		
TP3/28	AA37831	0.5	A16/0379	В	11								Light brown slightly sandy,	gravelly, SILT with some cobbles		
TP3/28	AA37832	1.0	A16/0380	D	13	22	NP	NP	64	WS	4.4		Light brown sligh	tly sandy, slightly gravelly, SILT		
TP3/28	AA37833	1.0	A16/0381	В	12								Light brown sligh	tly sandy, slightly gravelly, SILT		
TP3/28	AA37834	2.0	A16/0382	D	10	21	NP	NP	69	WS	4.4		Light brown sligh	tly sandy, slightly gravelly, SILT		
Notes:	Preparation:	WS - Wet sie	eved	•	Sample Type:	B - bulk distu	rbed	Remarks:		•			•			
		AR - As rece	ived			U - Undisturb	ed									
		NP - Non pla	stic					NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of						SO17892-1:2014		
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	1			Opinions and interpretations are outside the scope of accredita					on.	ined for one marth		
	Clause:	4.4 Cone Per	ietrometer one		J Persons autho	rized to appro	ve renorts	I he results relate to the specimens tested. Any remaining				aining mater	Date	Page		
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				- ,		H Byrne	(Quality Ma	anager)		A Byone 15			15-02-16	1 of 1		

IGSL Ltd Materials	Laboratory				Test Report												
Unit J5, N	17 Business F	Park			Determi	nation of	Moisture	e Content	, Liquid &	& Plastic	Limits						
Co Kildar	vaas e								-					TESTING			
045 8461	76				Tested in ac	cordance v	vith BS137	7:Part 2:19	90, clause	s 3.2*, 4.3	, 4.4 & 5.3			DETAILED IN SCOPE REG NO. 1331			
	Report No.	R70248		Contract	No.	18963		Contract N	lame:	GCTP Ph	ase 3-Cont	ract 1					
	Customer	GCC															
Samples Received: 01-02-16 Date T					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			
TP3/28	AA37835	2.0	A16/0383	В	9.5								Light brown sligh	tly sandy, gravelly, SILT/CLAY			
TP3/28	AA37836	3.0	A16/0384	D	9.4	20	NP	NP	63	WS	4.4		Light brown slightly sandy, gravelly, SILT				
TP3/28	AA37837	3.0	A16/0385	В	8.5								Light brown slightly sandy, gravelly, SILT				
TP3/29	AA37808	0.5	A16/0386	D	316								Dark brown/bla	Dark brown/black fibrous PEAT			
TP3/29	AA37809	0.5	A16/0387	В	199								Dark brown/bla	Dark brown/black fibrous PEAT			
TP3/29	AA37810	1	A16/0388	D	45	38	23	15	49	WS	4.4	CI	Brown clayey/silty, sandy, GRAVEL with many cobbles				
TP3/29	AA37811	1	A16/0389	В	27								Brown clayey/silty, sandy,	GRAVEL with many cobbles			
TP3/29	AA37812	1.6	A16/0390	D	29	55	NP	NP	46	WS	4.4		Dark brown/grey clayey/silt	y, very sandy, GRAVEL with some cobbles			
TP3/29	AA37813	1.6	A16/0391	В	27								Dark brown/grey clayey/silt	y, very sandy, GRAVEL with some cobbles			
TP3/33	AA35349	0	A16/0392	В	72								Black gravelly	sandy organic SILT/CLAY			
TP3/34	AA44464	0.5	A16/0393	D	653								Dark brown/bla	ack PEAT			
TP3/34	AA44465	0.5	A16/0394	D	531								Dark brown/bla	ack PEAT			
TP3/34	AA44466	0.5	A16/0395	В	493								Dark brown/bla	ack PEAT			
TP3/34	AA44467	1	A16/0396	D	25	35	NP	NP	78	WS	4.4		Grey/brown slightly	sandy, slightly gravelly, SILT			
TP3/34	AA44468	1	A16/0397	В	23								Grey/brown slightly	andy, slightly gravelly, SILT			
Notes:	Preparation:	WS - Wet sie	eved	•	Sample Type:	B - bulk distu	rbed	Remarks:		•			•				
		AR - As rece	ived			U - Undisturb	ed										
		NP - Non pla	stic					NOTE: *Clau	ise 3.2 of BS	oublication of l	SO17892-1:2014						
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	1			Opinions and	d interpretatio	ons are outsid	le the scope c	of accreditatio	on.	in a d fan an a manth			
	Ciause:	4.4 Cone Per	ieuometer one		Persons author	rized to appro	ve reports	I he results relate to the specimens tested. Any remaining mate					Date	Page			
IG	IGSL Ltd Materials Laboratory						10 100010				45.00.40	4.54					
				. ,		H Byrne	(Quality Ma	Manager)				15-02-16	1 of 1				

IGSL Ltd Materials Unit J5, N Newhall, I Co. Kildar 045 8461	Laboratory 17 Business F Naas re 76 Report No. Customer	Park R70249 GCC		Contract	Determi Tested in ac No.	nation of cordance v 18963	Tes Moisture vith BS137	st Report Content 7:Part 2:19 Contract N	rt , Liquid & 90, clause Name:	& Plastic s 3.2*, 4.3, GCTP Ph	Limits , 4.4 & 5.3 ase 3-Cont		ISO 17025 ACCREDIPED ACCREDIPED TESTING DETAILED IN SCOPE REG NO. 1337			
	Samples Re	eceived:	01-02-16	Date Tes	sted:	:d: 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		
TP3/34	AA44469	2.0	A16/0398	D	15	33	NP	NP	24	WS	4.4		Grey clayey/sil	ty, sandy, GRAVEL		
TP3/34	AA44470	2.0	A16/0399	В	11								Grey clayey/sil	ty, sandy, GRAVEL		
TP3/34	AA44471	1.0	A16/0400	CBR	25								Dark brown very sandy ver	y gravelly SILT/CLAY with root hairs		
TP3/34	AA44472	1.0	A16/0401	CBR	25								Dark brown very sandy very gravelly SILT/CLAY with root hairs			
TP3/35	AA44462	0.5	A16/0402	D	612								Dark brown/black PEAT			
TP3/35	AA44463	0.5	A16/0403	В	643								Drk brown/black fibrous PEAT			
0	0	0	0	0	0								0			
TP3/14	AA37815	0.2	A16/0339	В	22								Dark brown/black clayey/si	Ity, sandy, GRAVEL with many cobbles		
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:								
		AR - As recei	ived			U - Undisturb	ed	NOTE to		4077				0047000 4 0044		
	Liquid Limit	NP - Non plas	SIIC potromotor dofin	itivo mothod	1			NOTE: "Clau	ise 3.2 of BS	13// is a "Wit	Indrawn" stan	dard due to p	ublication of I	SO17892-1:2014		
	Clause:	4.3 Cone Per 4.4 Cone Per	netrometer one	point method	l d			The results r	elate to the s	pecimens tes	sted. Anv rem	e or accreation. remaining material will be retained for one month				
						rized to appro	ve reports			Approved by				Page		
IG	IGSL Ltd Materials Laboratory					H Byrne	(Quality Ma	anager)		AByene 1			15-02-16	1 of 1		
















































TEST REPORT Determination of Particle Size Distribution Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5 (note: Sedimentation stage not accredited)										a
particle	%		Contract	No: 18	963	Report N	No. R70381			
size	passing		Contract:	G	CTP Phas	e 3 - Coi	ntact 1			
75	100		TP:	TF	' 03/25					
63	94	CODDLLO	Sample N	lo. AA	\33939	Lab. Sar	mple No.	A16/0371		
50	94		Sample T	ype: B						
37.5	89		Depth (m) 2.0	00	Custome	er: Galway Co.(Co.		
28	82		Date Rec	eived 01	-02-16	Date Te	sting started	05-02-16		
20	76		Descriptio	on: Lig	jht brown/	/grey sligł	ntly sandy, gravel	ly, SILT/CLAY \	with some cobbles	
14	71									
10	68	GRAVEL	Remarks							
6.3	61						Q 3	0 D	Q	2
5	58						0.1	0.3 0.42 0.6 1.1	2 4 0 3 3 3 3 3 3 5 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0	230 - 1 200 - 1 200 - 1
3.35	50		100							
2	41		90							
1.18	35		80							
0.6	28		° 70 + − − +		+					
0.425	26	SAND	00							
0.3	25		d FO							
0.15	23									
0.063	20								1	
			<u>5</u> 30 – – – – – – – – – – – – – – – – – –							
			20							
			10							
		SILT/CLAY	0							
			0.0001	0.001		0.01	0.1	1	10	100
				CLAY		SILT	Sieve size (mm)	SAND	GRAVEL	
Approved by:								:	Date:	Page no:
IGSL Ltd Materials Laboratory									1 of 1	































IGSL Ltd									
	Materials Laboratory			ISO 17025					
	Unit J5,M7 Business F Naas	Park	Dry D						
	Co. Kildare		Teste	TESTING DETAILED IN SCOPE REG NO. 1331					
	Report No.	-							
	Contract Name:	Contract Name: GCTP Ph		ract 1 GI					
	Lab Contract No.	18963	Location: TP03/18						
	Sample No.	AA37826	Depth (m)	1	Material T	ype	В		
	Lab sample no.	A16/0346	Customer: Galway Co.Co.						
	Date Received:	01-02-16	Test Method: 2.5 KG Rammer						
	Date Tested:	19-02-16							
	Dry Density (Mg/m ³)	1.96	1.97	2.04	2.03	1.87			
	Moisture Content (%)	13	6.2	7.1	9.3	4.7			
	2 06	10%		5%	、	0%			
	2.04					\mathbf{X}			
	2.04								
	2.02		`\.		·. \				
	2.00 <u><u><u></u></u></u>				<u>``</u>	\mathbf{h}			
	5 1.98 E	-/					\bigtriangledown		
	1.96			` <u>`</u>	`````````````````````````````````	<u>`</u>		\mathbf{X}	
	ق 1.94			<u>``</u>				\rightarrow	
	1 .92	/				<u>```</u>			
	1.90	' 		``	\	<u>`</u>			
	1.88				``\		Ì.		
	1.00				\`.\		Ì,		
	1.86 + / + 4 5	6	 7 8		10		 2 13	1 14	
			I	Moisture Conte	ent (%)				
Maximum Dry Density (Mg/m³): 2.04 Optimum Moisture Content (%): 7 Description: Brown clayey/silty, sandy, GRAVEL									
									Sample Preparation: Material passing 20mm Single / Separate samples used
	Particle Density (Mg/m	n ³):	Particle Density: Assumed						
% retained on 20/37.5mm sieve: 37				,					
			•			Persons auth	porised to app	prove reports	
	-				J Barrett (De	J Barrett (Dep. Quality Manager)			
	Opinions and interpretation	ecimen tested. Is are outside the sc	ope of accredit	ation			н вyrne (Qu	anty Manager)	
				Approved by	V		Date	Page	
IGSL Materials Laboratory				4 Bire		15-03-16	1 of 1		

























































































 IGSL Ltd
 Test Report

 Materials Laboratory
 Determination of Moisture Condition Value at Natural Moisture

 Unit J5,M7 Business Park
 Determination of Moisture Condition Value at Natural Moisture

 Naas
 Co. Kildare

 045 899324
 Tested in accordance with BS1377:Part 4:1990, clause 5.4

 Report No.
 R70281

	1(70201
Contract No.	18963
Contract Name:	N6 Galway
Customer:	Galway Co. Co.
BH/TP	TP3/07
Sample No.	AA37807
Depth (m)	0.50
Sample Type:	В
Lab Sample No.	A16/0328
Source (if applicable)	unknown
Material Type (if applicable):	В
Sample Received:	01-02-16
Date Tested:	08-02-16
Sample Cert:	N/A
Moisture Content (%):	32
% Particles > 20mm (By dry mass):	5.6
MCV:	<1
Interpretation of Plot:	Steepest Straight Line
Description of Soil:	Brown silty, very gravelly, SAND with some cobbles

The result relates to the specimen tested.		Persons authorised to approve reports			
Any remaining material will be retained for one month.		J Barrett (Dep. Quality Manager)			
Sampling and opinions and interpretations are outside the scope of	of accreditation.	H Byrne (Quality Manager)			
	Approved by	•	Date	Page	
IGSL Ltd Materials Laboratory	# Byone		09-02-16	1 of 1	

Co. Kildare

045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content



Report No.	R70761		
Contract No.	18963		
Contract Name:	GCTP Phase 3 - Contract 1 SI		
Customer:	Galway Co.Co		
BH/TP	TP03/13		
Sample No.	AA44461		
Depth (m)	0.50		
Sample Type:	В		
Lab Sample No.	A16/0338		
Source (if applicable)	unknown		
Material Type (if applicable):	В		
Sample Received:	01-02-16		
Date Tested:	18-02-16		
Sample Cert:	N/A		
Moisture Content (%):	23		
% Particles > 20mm (By dry mass):	0		
MCV:	<1		
Interpretation of Plot:	Steepest Straight Line		
Description of Soil:	Light brown/grey sandy, slightly g	ıravelly, S	ILT
The result relates to the specimen tested. Any remaining material will be retained for one month. Sampling and opinions and interpretations are outside the scope of	Persons au of accreditation.	thorised to a J Barrett (Dep H Byrne (0	approve reports o. Quality Manager) Quality Manager)
	Approved by	Date	Page
IGSL Ltd Materials Laboratory	Al Byene	03-03-16	1 of 1

Co. Kildare

045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content



Report No.	R70762			
Contract No.	18963			
Contract Name:	GCTP Phase 3 - Contract 1 SI			
Customer:	Galway Co.Co			
BH/TP	TP03/25			
Sample No.	AA33935			
Depth (m)	0.15			
Sample Type:	В			
Lab Sample No.	A16/0367			
Source (if applicable)	unknown			
Material Type (if applicable):	В			
Sample Received:	01-02-16			
Date Tested:	18-02-16			
Sample Cert:	N/A			
Moisture Content (%):	22			
% Particles > 20mm (By dry mass):	50			
MCV:	5			
Interpretation of Plot:	Steepest Straight Line			
Description of Soil:	Brown silty, very sandy, GRAVEL			
The result relates to the specimen tested.	Persons aut	horised to a	pprove reports	
Any remaining material will be retained for one month. Sampling and opinions and interpretations are outside the scope of	of accreditation.	J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)		
	Approved by	Date	Page	
IGSL Ltd Materials Laboratory	A Byone	03-03-16	1 of 1	

Co. Kildare

045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content



Report No.	R70765		
Contract No.	18963		
Contract Name:	GCTP Phase 3 - Contract 1 SI		
Customer:	Galway Co.Co		
BH/TP	TP03/27		
Sample No.	AA44452		
Depth (m)	0.50		
Sample Type:	В		
Lab Sample No.	A16/0373		
Source (if applicable)	unknown		
Material Type (if applicable):	В		
Sample Received:	01-02-16		
Date Tested:	16-02-16		
Sample Cert:	N/A		
Moisture Content (%):	19		
% Particles > 20mm (By dry mass):	12		
MCV:	6		
Interpretation of Plot:	Steepest Straight Line		
Description of Soil:	Brown slightly sandy, gravelly, SIL	.т	
The result relates to the specimen tested.	Persons aut	norised to a	approve reports
Sampling and opinions and interpretations are outside the scope of	of accreditation.	H Byrne (C	Quality Manager)
	Approved by	Date	Page
IGSL Ltd Materials Laboratory	11 Byon	03-03-16	1 of 1

Co. Kildare

045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content



Report No.	R70764			
Contract No.	18963			
Contract Name:	GCTP Phase 3 - Contra	act 1 SI		
Customer:	Galway Co.Co			
BH/TP	TP03/29			
Sample No.	AA37812			
Depth (m)	1.00			
Sample Type:	В			
Lab Sample No.	A16/0389			
Source (if applicable)	unknown			
Material Type (if applicable):	В			
Sample Received:	01-02-16			
Date Tested:	16-02-16			
Sample Cert:	N/A			
Moisture Content (%):	29			
% Particles > 20mm (By dry mass):	6.9			
MCV:	<1			
Interpretation of Plot:	Steepest Straight Line			
Description of Soil:	Brown clayey/silty, sand cobbles	ly, GRAVE	L with m	any
The result relates to the specimen tested.	Γ	Persons auth	orised to a	pprove reports
Sampling and opinions and interpretations are outside the scope	of accreditation.		и Barrett (Dep H Byrne (C	. Quality Manager) Quality Manager)
	Approved by		Date	Page
IGSL Ltd Materials Laboratory	A Byon		03-03-16	1 of 1

Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 2

IGSL Ltd Materials	Laboratory			Test Report									ISO 17025	
Unit J5, M	7 Business F	Park			Determi	nation of	Moisture			2. Plastic	Limits			IVNAB
Newhall, N	Vaas				Determi		moisture	, content	, Liquiu c		LIIIIII			
Co. Kildar	e			Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3									DETAILED IN SCOPE REG NO. 133T	
045 84617	76									, ,				
	Report No.	R70322		Contract	No.	18963		Contract N	lame:	GCTP Pha	ase 3-Cont	ract 1		
	Customer	Galway Co	o.Co.											
	Samples Re	eceived:	12/02/16	Date Tes	sted:	Various								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n
				Туре	Content %	Limit %	Limit %	Index	<425µm		Clause	(BS5930)	-	
TP3/02	AA44496	0.5	A16/0560	D	17								Brown clayey/s	silty, very sandy, GRAVEL
TP3/02	AA44497	0.5	A15/0561	В	12								Brown clayey/s	ilty, very sandy, GRAVEL
TP3/04	AA44498	0.5	A16/0562	D	218								Dark brown/bla	ack PEAT
TP3/04	AA44499	0.5	A15/0563	A15/0563 D 208 Dark brown							Dark brown/bla	ack PEAT		
TP3/04	AA44500	0.5	A16/0564	В	175								Dark brown /bl	ack PEAT
TP3/04	AA49501	0.8	A15/0565 D 30							Grey/brown claye	ey/silty, very gravelly, SAND			
TP3/04	AA49502	0.8	A16/0566	В	26								Grey/brown claye	ey/silty, very gravelly, SAND
TP3/09	AA49503	0.5	A15/0567	D	136								Dark brown sli	ghtly gravelly PEAT
TP3/09	AA49504	0.5	A16/0568	D	140								Dark brown sligh	tly sandy slightly gravelly CLAY
TP3/09	AA49505	0.5	A15/0569	В	190								Dark brown/bla	ack PEAT
TP3/24	AA49456	0.5	A16/0570	D	9.7								Brown clayey/s	silty, sandy, GRAVEL
TP3/24	AA49457	0.5	A15/0571	В	11								Brown clayey/s	silty, sandy, GRAVEL
TP3/31	AA49458	0.5	A16/0572	D	11	23	NP	NP	66	WS	4.4		Light brown sligh	tly sandy, slightly gravelly, SILT
TP3/31	AA49459	0.5	A15/0573	В	10								Light brown sligh	tly sandy, slightly gravelly, SILT
TP3/31	AA49460	1.5	A16/0574	D	9.5	20	NP	NP	46	WS	4.4		Light brown sa	ndy very gravelly SILT
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:						
		AR - As recei	ived			U - Undisturb	ed							
		NP - Non plas	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of I	SO17892-1:2014
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	l			Opinions and	interpretatio	ons are outsid	e the scope c	f accreditatio	n.	
	Clause:	4.4 Cone Per	netrometer one	point metho	k			The results r	elate to the s	pecimens tes	ted. Any rem	aining mater	ial will be reta	ined for one month.
		atoriala	Laborata	r\/	Persons autho	rized to appro	ve reports			Approved	ру		Date	Page
IG		alcials	Laborato	ıy		H Byrne	(Quality Ma	anager)		AB	ene-		18/02/16	1 of 1

IGSL Ltd Materials Laboratory Unit J5, M7 Business Park Newhall, Naas Co. Kildare 045 846176					Determi Tested in ac	Test Report Determination of Moisture Content, Liquid & Plastic Limits ested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3							ISO 17025 ACCREDIED ACCREDIED TESTING DETAILED IN SCOPE REG NO. 1337	
	Report No. Customer Samples Re	R70323 Galway Co eceived:	o.Co. 12/02/16	Contract Date Tes	No. sted:	18963 Various		Contract N	lame:	GCTP Pha	ase 3-Cont	ract 1		
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
TP3/31	AA49461	1.5	A16/0575	В	7.6								Light brown sa	ndy very gravelly SILT
TP3/31	AA49462	2.5	A16/0576	D	9.1	21	NP	NP	61	WS	4.4		Light brown sli	ghtly sandy, gravelly, SILT
TP3/31	AA49463	2.5	A16/0577	В	8.5								Light brown sli	ghtly sandy, gravelly, SILT
TP3/31	AA49464	3.5	A16/0578	D	11	22	NP	NP	52	WS	4.4		Light brown sli	ghtly sandy, gravelly, SILT
TP3/31	AA49465	3.5	A16/0579	В	8.3								Light brown sli	ghtly sandy, gravelly, SILT
TP3/32	AA49466	0.4	A16/0580	D	23	39	NP	NP	70	WS	4.4		Brown sandy s	ightly gravelly SILT
TP3/32	AA49467	0.4	A16/0581	D	27	38	NP	NP	81	WS	4.4		Brown sandy s	ightly gravelly SILT
TP3/32	AA49468	0.4	A16/0582	В	28	32	NP	NP	70	WS	4.4		Brown sandy s	ightly gravelly SILT
Notes:	Preparation: Liquid Limit Clause:	WS - Wet sie AR - As recei NP - Non pla: 4.3 Cone Per 4.4 Cone Per	eved ived stic netrometer defin netrometer one	itive method	Sample Type:	B - bulk distu U - Undisturb	rbed ed	Remarks: NOTE: *Clau Opinions and The results r	use 3.2 of BS I interpretation elate to the s	1377 is a "wit ons are outsid pecimens tes	hdrawn" stan e the scope c ted. Any rem	dard due to p of accreditatio naining mater	ublication of I n. ial will be reta	SO17892-1:2014 ined for one month.
IG	SL Ltd M	aterials	Laborato	ry	Persons autho	rized to appro	ve reports	apagar)		Approved	by		Date 19/02/16	Page 1 of 1

















IGSL Ltd Materials Laboratory M7 Business Park		Dry De	Test Report Dry Density/Moisture Content Relationship						
Naas Co. Kildare		Teste	ed in accordar	ice with BS1	1377:Part 4:	1990	DETAILED IN SCOPE REG NO. 1331		
Report No.	R71144	•	Contract No.	18963					
Contract Name:	GCTP Pha	ise 3 - Contr	act 1 GI						
Lab Contract No.	18963		Location:	TP03/02					
Sample No.	AA44497	Depth (m)	0.5	Material T	уре	В			
Lab sample no.	A16/0561	Customer:	Galway Co.Co.						
Date Received: 1	2/02/2016		Test Method:	:	2.5 KG Rar	nmer			
Date Tested: 0	9/03/2016		BS1377:Part	4:1990	3.3				
Dry Density (Mg/m ³)	1.60	1.71	1.74	1.78	1.80	1.75			
Moisture Content (%)	22	6.9	8.9	11	13	15			
1.82			5%		J‰ T∕_T	<u> </u>			
1.80					$\left \right\rangle$				
1.78		•			\vdash				
1.76				\mathbf{h}		\mathbb{N}			
ê ^{1.74}				+ + + + + + + + + + + + + + + + + + +					
¹ อีญ 1.72			· · · ·		$\left\{ \begin{array}{c} \cdot \\ \cdot \end{array} \right\}$				
1.70				Ň.	1		+		
ة 1.68 ك									
1.62					<u>``</u>		``.		
1.60									
1.58									
6 7	8 9 10	11 12	13 14 Moisture Conten	15 16 t (%)	17 18	19 20	21 22		
Maximum Dry Density (Mg/m ³):	1.80		Optimum M	loisture Cor	itent (%):	13		
Description:	Brown clay	/ey/silty, very	/ sandy, GRA	VEL					
Sample Preparation:	Material pa	assing 20mm	ı	Single / Se	parate sam	oles used			
Particle Density (Mg/m ³	³):	2.65		Particle De	nsity:	Assumed			
% retained on 20/37.5n	nm sieve:	9							
The result relates to the speci Opinions and interpretations a	imen tested. are outside the scop	be of accreditation	on		Persons autho	orised to appr J Barrett (Dep H Byrne (Qua	rove reports o. Quality Manager) ality Manager)		
IGSL Materia	ls Laborato	ory	Approved by	AR		Date	Page		
		-	4	1) Depen		23/03/10	1011		





Contract Number: 30014

Client's Reference: 18963 PO: 8215

Laboratory Report

Report Date: 08-03-2016

Client Irish Geotechnical Services Limited M7 Business Park Naas Co. Kildare Ireland

Contract Title: **GCTP Phase 3** For the attention of: **Hugh Byrne**

Date Received: 22-02-2016 Date Commenced: 22-02-2016 Date Completed: 08-03-2016

Test Description

Immediate Shear Strength - set of 3 60 x 60 mm Shear Box Specimens by Direct Shearing (note suitable for free draining material only) Non Accredited Test - @ Non Accredited Test

Disposal of Samples on Project

Notes: Observations and Interpretations are outside the UKAS Accreditation

- * denotes test included in laboratory scope of accreditation
- # denotes test carried out by approved contractor
- @ denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager) Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director) Qty

3

Test Report: Quick Shearbox Test BS1377:Part 7:4.5 :1990.

Boreh Samp	nole: Ile Number :	BH3/09 A16/0586	Depth (m) from: Depth (m) to:	1.00 1.30)
Samp	le Type:	D			
Partic	le Density - Mg/m3:	2	2.65 (Assumed)		
Speci	men Tested:	Submerged, Remo	ulded material above 2.00m	n removed	
Samp	le Description:				
Light	t brown grey sandy (fine-me F	dium) gravelly (fine-coarse/angul	lar-subangular) CLAY	2	3
Initia	al Conditions			2	
Heigh	nt - mm:		24.50	24.50	24.50
Lengt	n - mm: ure Content - %:		59.90	59.90	59.90
Bulk	Density - Mg/m3:		2.31	2.31	2.31
Dry D	Density - Mg/m3:		2.09	2.09	2.09
Voids	Ratio: al Pressure- kPa		0.2/05	0.2704	0.2701
Cons	solidation				
Conso	olidated Height - mm:		24.43	24.09	23.75
Bate	nr of Strain (mm/min)		1 250	1 25	0 1 250
Strain	at peak shear stress (mm)		10.45	10.03	9.60
Peak	shear Stress - kPa:		22	37	53
DEAL	(
Angle	e of Shearing Resistance:(0)				38.0
Effect	tive Cohesion - kPa:				6
0 Shear Stress - (kPa). 0 07 07					
	0	20 Normal	40 Stress -(kPa).	60	80
		• Peak shear Stress - kPa:		Best Fit Line	
				DP Gang Checked Page 1 by: DP Gang Approved Page 1 by:	08/03/16 Date 08/03/16 Date Contract No.: 30014
C	istl	GCTP	Phase 3		Client Ref Number: 18963
GEO S	ILE OF TESTING SERVICES LTD	1 Of	1		USU/U4 QSHEARBOX

Test Report: Quick Shearbox Test BS1377:Part 7:4.5 :1990.

Borehole: Sample Number :	TP A1	23/31 .6/0575	Depth (m) from: Depth (m) to:	1.	.50	
Sample Type:	D					
Particle Density - Mg/m3:	D	2.65	(Ass	umed)		
Specimen Tested:	Su	Ibmerged, Remoulde	ed material above 2	.00mm removed		
Sample Description:	r) <i>"</i>	, .		~		
Light brown grey sandy (fine-m	edium) gravelly (fine	e-coarse/angular-	subangular) CLA	Y 2	3	
Initial Conditions			1	Z	3	
Height - mm.				24 50 24	50	24 50
Length - mm:				59.90 59	.90	59.90
Moisture Content - %:				11	11	11
Bulk Density - Mg/m3:				2.31 2	.31	2.31
Dry Density - Mg/m3:				2.09 2	.09	2.09
Voids Ratio:			0	2699 0.26	572	0.265
Normal Pressure- kPa			-	50 1	100	150
Consolidation				24.00 22	10	22.01
				24.09 23	.40	22.07
Rate of Strain (mm/min)				1 250 1	250	1 25
Strain at peak shear stress (mm)			1	10.38 9	.92	9.46
Peak shear Stress - kPa:				43	71	101
			·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	
PEAK						
Angle of Shearing Resistance:(0)						30.0
Effective Cohesion - kPa:						14
60 - 40 - 20 - 0 - 20	40 60	80	100	120 140	160	18
	Peak s	bear Stress - kPa:	ess -(kPa).			
				2PRimo		
				ON MARY	08/03/16	
				Checked Page 1 by:	: Date	
					08/02/11	
				DF Wars	00/05/16	
				Approved Page 1 by	y: Date	
					Contract No.: 30014	
OCTI		GCTP P	hase 3			
					Client Ref Nu 18963	mber:

Test Report: Quick Shearbox Test BS1377:Part 7:4.5 :1990.

Borehole: Sample Number :	TP3/31 A16/057	7	Depth (m) from: Depth (m) to:	2.50	0	
Comple Type						
Particle Density - Mg/m3		2.65	(Assume	d)		
Specimen Tested:	Submer	ed, Remoulded	material above 2.00	nm removed		
Light brown grey sandy (fine-med	dium) gravelly (fine-coa	rse/angular-su	ıbangular) CLAY			
STAGE			1	2	3	
Initial Conditions			24 5	0 24.50	n	24 50
length - mm.			59.0	0 24.3	5 D	59.90
Moisture Content - %:			1	0 10	0	1(
Bulk Density - Mg/m3:			2.2	9 2.3	0	2.3
Dry Density - Mg/m3:			2.0	8 2.08	3	2.0
Voids Ratio:			0.275	0 0.274	5 0	.273
Normal Pressure- kPa			5	0 10	0	150
Consolidation			24.1	0 22.60	2	<u>, , , , , , , , , , , , , , , , , , , </u>
Shear			24.1	23.0	9	23.2
Rate of Strain (mm/min)			1 2	50 1 25	50	1.25
Strain at peak shear stress (mm)			10.4	3 10.4	5	10.4
Peak shear Stress - kPa:			4	0 7	1	10
Angle of Shearing Resistance:(0)						33.0
Effective Cohesion - kPa:						7
	FAIL	URE CONDIT	IONS			
120						
100 -						
80 -						
00						
60 -						
40 -						
20 -						
0						
0 20	40 60	80	100 1	20 140	160	18
		Normal Stres	ss -(kPa).			
	 Peak shear S 	tress - kPa:		– Best Fit Line		
				9PC-0		
				er - Warz	08/03/16	
				Checked Page 1 by:	Date	
				9PC-0	08/03/16	
				a branz		
				Approved Page 1 by:	Date	
					Contract No.:	
					Contract No.: 30014	
		GCTP Ph	ase 3		Contract No.: 30014 Client Ref Numbe	er:
		GCTP Ph	ase 3		Contract No.: 30014 Client Ref Numbe 18963	er:
CCTI		GCTP Ph	ase 3		Contract No.: 30014 Client Ref Numbe 18963	er:
GSTL		GCTP Ph	ase 3		Contract No.: 30014 Client Ref Numbe 18963	er:

Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 3

NOTE:

For BH3/09 Shearbox see GSTL Report 30014 featured in Appendix 13, Schedule 2

IGSL Ltd Materials Unit J5, M Newhall, N Co. Kildar 045 8461	Laboratory I7 Business F Vaas 'e 76	Park	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										ISO 17025 ACCOUNT OF THE ACCOUNT OF THE DETAILED IN NOUTHER FROM 1535	
	Report No.	R70324		Contract	et No. 18963			Contract Name:		GCTP Pha	ase 3-Cont	ract 1		
	Customer	GCC												
	Samples Re	12/02/16	2/02/16 Date Tested:			3/16								
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)	Description	
BH3/06	AA43886	0.5	A16/0583	В	15	35	NP	NP	25	WS	4.4		Brown silty, very sandy, GRAVEL	
BH3/08	AA38885	0.5	A16/0584	В	28								Dark brown clayey/silty, very sandy, GRAVEL with some cobbles	
BH3/09	AA43887	0.5	A16/0585	D	28	51	NP	NP	13	WS	4.4		Mottled grey/brown slightly peatyy very sandy gravelly SILT	
BH3/09	AA43888	1.0	A16/0586	В	15								Mottled greylbrown clayey/silty, very sandy, GRAVEL	
BH3/09	AA43889	1.3	A16/0587	D	11	32	NP	NP	40	WS	4.4		Light brown sandy gravelly SILT	
BH3/11	AA43876	1.0	A16/0588	В	519								Dark brown/black slightly gravelly PEAT	
BH3/11	AA43877	1.0	A16/0589	D	98								Dark brown/black slightly gravelly PEAT	
BH3/11	AA43878	2.0	A16/0590	D	7.0								Dark brown slightly clayey/silty, sandy, GRAVEL with some cobbles	
BH3/11	AA43879	2.0	A16/0591	В	6.8								Dark brown slightly clayey/silty, sandy, GRAVEL with some cobbles	
BH3/12	AA43880	0.5	A16/0592	D	93	130	NP	NP	43	WS	4.4		Black slightly gravelly organic SILT	
BH3/12	AA43881	0.5	A16/0593	В	23								Dark brown/black slightly silty, sandy, GRAVEL with many cobbles	
BH3/12	AA43882	1.5	A16/0594	D	15	37	NP	NP	30	WS	4.4		Dark brown/grey silty, sandy, GRAVEL	
BH3/12	AA43883	1.5	A16/0595	В	15								Dark brown/grey silty, sandy, GRAVEL	
BH3/25	AA43893	0.5	A16/0596	В	15	32	NP	NP	41	WS	4.4		Mottled brown silty, very sandy, GRAVEL with some cobbles	
BH3/25	AA43894	1.0	A16/0597	В	12	31	NP	NP	41	WS	4.4		Mottled brown silty, sandy, GRAVEL with some cobbles	
Notes:	Preparation:	WS - Wet sie	ved	1	Sample Type: B - bulk disturbed Remarks:									
		AR - As recei	ved			U - Undisturbe	ed							
		NP - Non plas	stic			se 3.2 of BS	1377 is a "withdrawn" standard due to publication of ISO17892-1:2014							
	Liquid Limit	4.3 Cone Per	netrometer defini	tive method				Opinions and	Dpinions and interpretations are outside the scope of accreditation.					
Clause: 4.4 Cone Penetrometer one point method					Domono outh-	rized to energy	o ronarta	The results re	The results relate to the specimens tested. Any remaining materia					d for one month.
IGSL Ltd Materials Laboratory				rv	Fersons author	Approved by				Date	r aye			
					H Byrne (Quality Manager)					A Byone			18/02/16	1 of 1

IGSL Ltd Materials Laboratory Unit J5, M7 Business Park Newhall, Naas Co. Kildare 045 846176 Report No. R70325 Customer GCC			Test Report Determination of Moisture Content, Liquid & F Tested in accordance with BS1377:Part 2:1990, clauses 3 Contract No. 18963 Contract No.							& Plastic s 3.2*, 4.3, GCTP Pha	Limits 4.4 & 5.3 ase 3-Cont	ISO 17025 ACCREDIES ACCREDIES TESTING DETAILED IN SCOPE REG NO. 1337		
	Samples Re	eceived:	12/02/16	Date Tes	sted: 00/01/00									
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
BH3/25	AA43895	2.0	A16/0598	В	9.5	15	NP	NP	62	WS	4.4		Light brown sligh	tly sandy, gravelly, SILT
BH3/25	AA43896	3.0	A16/0599	В	7.7	18	NP	NP	47	WS	4.4		Light brown/grey slightly sa	andy, gravelly, SILT with many cobbles
BH3/29	AA43890	1.0	A16/0600	В	12.1	37	NP	NP	64	WS	4.4		Brown silty, sandy, GRAVEL with many cobbles	
BH3/29	AA43891	1.5	A16/0601	В	9.4	23	NP	NP	37	WS	4.4		Light brown silty,	sandy, GRAVEL with many cobbles
BH3/29	AA43892	2.5	A16/0602	В	23.1	35	19	16	82	WS	4.4	CL	Light brown slightly sandy, slightly gravelly, CLAY with many cobbles	
Notes:	Notes: Preparation: WS - Wet sieved AR - As received					B - bulk distu U - Undisturb	rbed ped	Remarks:						
	Liquid Limit	NP - Non plas 4.3 Cone Per	i			NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of Opinions and interpretations are outside the scope of accreditation.						SO17892-1:2014		
Ciause: 4.4 Cone Penetrometer one point metho					J Persons autho	rized to appro	ve reports	I ne results relate to the specimens tested. Any remaining materia					Date	Page
IGSL Ltd Materials Laboratory						H Byrne	(Quality Ma	nager)				05/01/16	1 of 1	



TEST REPORT Determination of Particle Size Distribution Tested in accordance with: BS1377:Part2:1990 . clause 9.2 & 9.5 (note: Sedimentation stage not accredited) DETAILED IN SCOPE REG NO. 13 Report No. particle % Contract No: 18963 R70499 passing Contract: GCTP Phase 3 - Contact 1 size 100 75 BH: BH3/08 COBBLES 63 88 Sample No. AA43885 Lab. Sample No. A16/0330 50 76 Sample Type: В 37.5 74 Depth (m) 0.50 Galway Co.Co. Customer: 28 65 02-02-16 Date Testing started 05-02-16 Date Received Dark brown clayey/silty, very sandy, GRAVEL with some cobbles 20 58 Description: 50 14 GRAVEL Remarks 10 45 Sample size did not meet the requirements of BS1377 6.3 38 0.063 0.3 0.425 0.6 0.15 1.18 10 14 20 53 53 53 53 3.35 5.35 5 35 \sim 100 3.35 32 90 2 26 80 1.18 22 Percentage passing (%) 17 0.6 70 SAND 0.425 15 60 0.3 13 50 0.15 10 40 0.063 6 30 20 10 SILT/CLAY 0 0.0001 0.1 0.001 0.01 1 10 100 Sieve size (mm) CLAY SILT SAND **GRAVEL** Approved by: Page no: Date: **IGSL Ltd Materials Laboratory** A Byone 18-02-16 1 of 1 Persons authorised to approve report: J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)


























Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 4

IGSL Ltd Materials Laboratory			Test Report											ISO 17025		
Unit J5, M7 Business Park			Determination of Moisture Content. Liquid & Plastic Limits													
Newnall, Naas																
045 846176					Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3									DETAILED IN SCOPE REG NO. 1337		
	Report No.	t No. R70973 Contract			xt No. 18963			Contract Name:		GCTP Pha	ase 3 Cont	ract 1 GI				
Customer Galway Co.Co.																
Samples Received: 12-02-16 Date Tested: 14-03-16																
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)	Description			
BH3/23	AA32640	1.0	A16/0952	В	17	51	NP	NP	11	WS	4.4		Dark brown silty, very sandy, GRAVEL			
BH3/23	AA32641	2.0	A16/0953	В	12	34	NP	NP	24	WS	4.4		Brown silty, very sandy, GRAVEL with some cobbles			
BH3/23	AA32643	3.0	A16/0954	В	12								Brown clayey/silty, very sandy, GRAVEL			
BH3/32	AA48851	0.5	A16/0955	В	12	21	NP	NP	60	WS	4.4		Light brown slightly sandy, gravelly, SILT			
BH3/32	AA48852	1.0	A16/0956	В	8.9	20	NP	NP	55	WS	4.4		Mottled light brown slightly sandy, gravelly, SILT with some cobbles			
BH3/32	AA48853	2.0	A16/0957	В	9.3	15	NP	NP	56	WS	4.4		Light brown slightly sandy, gravelly, SILT			
BH3/32	AA48854	3.0	A16/0958	В	6.7	16	NP	NP	45	WS	4.4		Light brown slightly sandy, gravelly, SILT			
BH3/32	AA48855	4.0	A16/0959	В	12	22	NP	NP	67	WS	4.4		Mottled grey/brown slightly sandy, slightly gravelly, SILT			
BH3/32	AA48856	4.5	A16/0960	D	23								Grey/brown sandy gravelly SILT/CLAY			
BH3/32	AA48857	5.0	A16/0961	В	25	34	21	13	95	WS	4.4	CL	Grey/brown slightly sandy, slightly gravelly, CLAY			
BH3/32	AA48858	6.0	A16/0962	В	24	35	NP	NP	89	WS	4.4		Dark brown/grey slightly sandy, slightly gravelly, SILT			
BH3/32	AA48859	7.0	A16/0963	В	24	40	NP	NP	95	WS	4.4		Dark brown/grey slightly sandy, slightly gravelly, SILT			
BH3/32	AA48860	8.0	A16/0964	В	29	45	NP	NP	94	WS	4.4		Dark brown/grey slightly sandy, slightly gravelly, SILT			
BH3/32	AA48861	9.0	A16/0965	В	29	45	22	23	89	WS	4.4	CI	Mottled light brown/grey slightly sandy, slightly gravelly, CLAY			
BH3/32	AA48862	10.0	A16/0966	В	30	53	NP	NP	97	WS	4.4		Dark brown/grey slightly sandy, slightly gravelly, SILT			
Notes:	Preparation:	WS - Wet sie	ieved Sample Type: B - bulk disturbed Remarks:													
	AR - As received					U - Undisturb	ed									
	NP - Non plastic					NOTE: *Clause 3.2 c					3S1377 is a "withdrawn" standard due to publication of ISO17892-1:2014					
Liquid Limit 4.3 Cone Penetrometer definitive method					4			Opinions and	binions and interpretations are outside the scope of accreditation					inad for one menth		
Clause. 4.4 Cone Penetrometer one point metho					Persons autho	rized to appro	ve reports	Approved by				aming mater	Date	Page		
IGSL Ltd Materials Laboratory					H Byrne (Quality Manager)					H Byene			05-04-16	1 of 1		

IGSL Ltd Materials Unit J5, M Newhall, N Co. Kildar 045 84617	Laboratory I7 Business F Naas 'e 76	Park	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										ISO 17025 ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED ACCREDIED	
	Report No. Customer Samples Re	R70974 Galway Co ceived:	o.Co. 12/2/166	Contract	No. sted:	18963 14-03-16		Contract N	lame:	GCTP Ph	ase 3 Cont	ract 1 GI		
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
BH3/33	AA48863	0.5	A16/0967	B	8.9	21	NP	NP	45	WS	4.4		Light brown/grey	slightly sandy, gravelly, SILT
BH3/33	AA48864	1.0	A16/0968	В	6.4	23	NP	NP	41	WS	4.4		Light brown/grey	silty, very sandy, GRAVEL
BH3/33	AA48865	2.0	A16/0969	В	5.6	18	NP	NP	39	WS	4.4		Light brown silty, sandy, GRAVEL with some cobbles	
BH3/34	AA48866	0.5	A16/0970	В	13	23	NP	NP	55	WS	4.4		Light brown slightly sandy, gravelly, SILT	
BH3/34	AA48867	1	A16/0971	В	10	19	NP	NP	59	WS	4.4		Light brown slightly sandy, gravelly, SILT	
BH3/34	AA48868	2	A16/0972	В	8.6	19	NP	NP	49	WS	4.4		Light brown slightly sandy, gravelly, SILT	
Notos	Preparation:	WS - Wat air	wed		Sample Type:	B - bulk distu	rbed	Remarke						
NOLES.		AR - As recei	ived U - Undisturbed											
		NP - Non pla	astic					NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of						SO17892-1:2014
	Liquid Limit	4.3 Cone Per	netrometer definitive method					Opinions and interpretations are outside the scope of accreditation.						
Clause: 4.4 Cone Penetrometer one point meth					d			The results r	elate to the s	pecimens tested. Any remaining mater			ial will be reta	ined for one month.
ICSI I to Matariala Laboratany				Persons autho		Approved by D				Page				
IGSL LIU MALEMAIS LADOFALORY				H Byrne (Quality Manager)					# Byone			05-04-16	1 of 1	


























































(in the second		(
			BS1	377:Part 5:1	990			
R	Report No.	R71371						
c	Contract:	GCTP Phase 3				Contract nu	mber:	18963
В	iH:	3/32 Sample nu	nber:	AA48857		Depth (m):	5.0	
D	escription	Grey sandy SILT						
s	pecimen H	leight (mm)	20.0)	Specimen c	liameter (m	m)	75.0
A	ssumed Pa	Moisture co Bulk densit Dry density Void ratio article density Mg/m ³	ontent % y Mg/m ³ Mg/m ³ 2.65	Initial 24 2.13 1.72 0.541	Final 20 2.21 1.84 0.454			
		Applied Pressure (kPa)	m _v (n	n²/MN)	c _v (m ² /	/year)	Voids	Ratio
		0 - 20 20 - 40	1.	695 404	9.752		0.48	832 631
		40 - 60	0.	277	20.275		0.46	814
		60 - 80	0.	252	11.145		0.46	075
		120 - 40	0.	166 025	13.674 U 32.892 0			397
		0.49 0.485 0.48 0.475 0.47 0.475 0.47 0.465 0.465 0.465 0.465 0.455 0.45 1		Applied Pres	100 sure kPa		1000	
			A	Applied Pres	sure kPa			





Contract Number: 30319

Client's Reference: 18963 PO 8443

Laboratory Report

Report Date: 03-04-2016

Client Irish Geotechnical Services Limited M7 Business Park Naas Co. Kildare Ireland

Contract Title: **G.C.T.P** For the attention of: **Hugh Byrne**

Date Received: 18-03-2016 Date Commenced: 18-03-2016 Date Completed: 03-04-2016

Test Description

Immediate Shear Strength - set of 3 60 x 60 mm Shear Box Specimens by Direct Shearing (note suitable for free draining material only) Non Accredited Test - @ Non Accredited Test

Disposal of Samples on Project

Notes: Observations and Interpretations are outside the UKAS Accreditation

- * denotes test included in laboratory scope of accreditation
- # denotes test carried out by approved contractor
- @ denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager) Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director) Qty

4

GEO SITE & TESTING SERVICES LTD

	A16/0986	Depth (m) from: Depth (m) to:	0.3 0.0	80 00	
Sample Type:	D				
Particle Density - Mg/m3:		2.65 (Assum	ned)		
Specimen Tested:	Submerged, Ren	noulded material above 2.0	0mm removed		
Sample Description:					
Brown silty clayey sandy (fine-coarse) GRAV	EL (fine-coarse/ang	ular-subangular) 1	2	3	
Initial Conditions			£		
Height - mm:		24	50 24 5	50	24 50
length - mm:		59	.90 59.0	0	59.90
Moisture Content - %:			13 1	3	13
Bulk Density - Ma/m3:		1	.95 1.9	95	1.95
Dry Density - Ma/m3:		1	.73 1.7	73	1.73
Voids Ratio:		0.53	346 0.534	14	0.5340
Normal Pressure- kPa			50 10	00	150
Consolidation					
Consolidated Height - mm:		23	.95 23.5	58	23.21
Shear					
Rate of Strain (mm/min)		1.	250 1.2	50	1.250
Strain at peak shear stress (mm)		10	.11 9.8	35	9.58
Peak shear Stress - kPa:			59 0	95	134
		I		-	201
PEAK				•	
Angle of Shearing Resistance:(0)					37.0
Effective Cohesion - kPa:					19
140 -					
120 - 100 -					
120 - 100 - 80 -		•		•	
120 - 100 - 80 - 60 -					
120 - 100 - 80 - 60 -		•			
120 - 100 - 80 - 60 - 40 -					
120 - 100 - 80 - 60 - 40 - 20 -					
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	(0 90	100	120 140	100	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	60 80		120 140	160	180
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	60 80 Norm	100 al Stress -(kPa).	120 140	160	180
120 100 80 60 40 20 0 0 20 40	60 80 Norm	100 al Stress -(kPa).	120 140	160	180
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	60 80 Norm 9 Peak shear Stress - kf	100 al Stress -(kPa). Pa:	120 140 — Best Fit Line	160	180
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	60 80 Norm 9 Peak shear Stress - kf	100 al Stress -(kPa). Pa:	- Best Fit Line	160	180
120 - 100 - 80 - 60 - 40 - 20 - 40 - 40 - 100	60 80 Norm 9 Peak shear Stress - kh	100 al Stress -(kPa). Pa: —	120 140 — Best Fit Line	160	180
120 100 80 60 40 20 0 0 20 40	60 80 Norm Peak shear Stress - ki	100 al Stress -(kPa). Pa:	120 140 — Best Fit Line	160	180
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	60 80 Norm 9 Peak shear Stress - kf	100 al Stress -(kPa).	120 140 —Best Fit Line DPGars	160	180
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	60 80 Norm 9 Peak shear Stress - kf	100 al Stress -(kPa). Pa:	120 140 — Best Fit Line DPGas Checked Page 1 by:	160 01/04/16 Date	180

Approved Page 1 by: Date

Contract No.: 30319



1 of 1

Borehole:	BH3/23	Depth (m) from:	3 50	
Sample Number :	A16/0954	Depth (m) to:	0.00	
	, (20, 000)		0.00	
Sample Type:	D			
Particle Density - Mg/m3:		2.65 (Assumed)		
Specimen Tested:	Submerged, Re	moulded material above 2.00mm ren	noved	
Consula Deceminticas				
Sample Description:	ilty CRAVEL (fine-coorce/cul	hangular-cubroundod)		
STAGE	ity GRAVEL (Time-coarse/ su		2	3
Initial Conditions				5
Height - mm:		24.50	24.50	24.50
Length - mm:		59.90	59.90	59.90
Moisture Content - %:		14	14	14
Bulk Density - Mg/m3:		2.20	2.20	2.20
Dry Density - Mg/m3:		1.94	1.93	1.93
Voids Ratio:		0.3694	0.3709	0.3726
Normal Pressure- kPa		50	100	150
Consolidation				
Consolidated Height - mm:		24.11	23.86	23.60
Shear		1 250	1 050	1.05
Rate of Strain (mm/min)		1.250	1.250	1.25
Strain at peak shear stress (mm)	10.06	9.92		
Peak shear Stress - KPa:		48	91	134
PEAK				
Angle of Shearing Resistance:(0)				39.0
Effective Cohesion - kPa:				9
	FATI LIRE (
160	TALEORE	conditions		
100				
140				
110			•	_
120 -				
p 100 -				
2				
, 80 -				
<u> </u>				
8 40 -				
7 20				
20				
0		1		
0 20 40	60 80	100 120	140 1	60 180
	Norm	nal Stress -(kPa)		
	NOTI	iai Juess - (red).		

• Peak shear Stress - kPa: ------ Best Fit Line



01/04/16 Checked Page 1 by:

Date 01/04/16

DP Gianz Approved Page 1 by:

Date

Contract No.: 30319

Client Ref Number: 8443 030704 QSHEARBOX



Borehole: Sample Number :	BH3/32 A16/0957	Depth (m) from: Depth (m) to:	2.00 0.00		
Sample Type:	D				
Particle Density - Mg/m3:		2.65 (Assumed))		
Specimen Tested:	Submerged, Rem	noulded material above 2.00m	m removed		
Sample Description:	grouelly (fine coorse (sub	angular subrounded) siltu	CLAX		
STAGE	graveny (inte-coarse/sub		2	3	
Initial Conditions					
Height - mm:		24.50	24.50		24.50
Length - mm:		59.90	59.90		59.90
Moisture Content - %:		12	12		12
Bulk Density - Mg/m3:		2.22	2.22		2.22
Dry Density - Mg/m3:		1.97	1.97		1.98
Voids Ratio:		0.3432	0.3425		0.3407
Normal Pressure- kPa		20	40		60
Consolidation		24.40	24.24		24.02
		24.46	24.24	+	24.03
Bate of Strain (mm/min)		1 250	1 75/		1 250
Strain at neak chear stress (mm)		1.230	10.40		10 10
Peak shear Stress - kPa		10.07	10.49	+	10.10
I Cur Silcai Sucss - rra.		19	57	1	22
PEAK					
Angle of Shearing Resistance:(0)					41.0
Effective Cohesion - kPa:					2
			•		
0 20)	40	60		80
	Norma	al Stress -(kPa).			
	 Peak shear Stress - kP 	'a: — [Best Fit Line		
			DPGas Checked Page 1 by: DPGas Approved Page 1 by:	01/04/16 Date 01/04/16 Date	
				Contract No.:	



Single Type: D 2.6 (Assumed) Specime Tested: Submerged, Remoulded material above 2.00mm removed Single Descriptor: Submerged, Remoulded material above 2.00mm removed Single Descriptor: Initial conditions 1 2 3 Tinde Conditions 1 2 3 3 Initial conditions 1 2 3 3 Under Conditions 1 1 1 1 3 Solute Context - %1 10 13 2 23 23 24 24 20 23 24 24 20 23 24 24 20 24	Borehole: Sample Number :	BH3/35 A16/0991	Depth (m) from: Depth (m) to:	1.00 0.00		
Particle Density - Mg/m2: 2.65 (Assumed) (Assumed) Sections Tests: Submerged, Remoulded meteral above 2.00mm removed Single Density (fine-coarse/angular-subrounded) sity CLAY TAGE 1 2 3 Table Toom are gravely (fine-coarse/angular-subrounded) sity CLAY 1 1 1 1 Table Toom are gravely (fine-coarse/angular-subrounded) sity CLAY 1	Sample Type:	D				
Sample Description: Light brown gray gravely (fine-coarse/angular-subrounded) sity CLAY State 1 2 3 Jack Description: 1 2 3 Jack Description: 1 2 3 Jack Description: 1 1 1 9 Jack Description: 1 1 1 9 9 Joint State 1 1 1 9 9 9 9 9 9 9 9 9 2 0 2 <td< td=""><td>Particle Density - Mg/m3: Specimen Tested:</td><td>2 Submerged, Remor</td><td>2.65 (Assumed) ulded material above 2.00mm</td><td>n removed</td><td></td><td></td></td<>	Particle Density - Mg/m3: Specimen Tested:	2 Submerged, Remor	2.65 (Assumed) ulded material above 2.00mm	n removed		
Light brown grey gravelly (fine-coarse/angular-subrounded) sitty CLV 2 3 Trikel 1 2 3 Initial Conditions 24.50 24.50 24.50 Langth - Initial Conditions 1 2 3 Hight - Initial Conditions 1 24.50 24.50 24.50 Langth - Initial Conditions 1 24.50 24.50 24.50 Langth - Initial Conditions 1 24.50 24.50 24.50 Longth - Initial Conditions 1 24.50 24.50 24.50 Longth - Initial Conditions 1 22.20	Sample Description:					
Bit Name Image	Light brown grey gravelly (fine-coars	e/angular-subrounded) silty (CLAY	2		
Height mm: 2450 2450 2450 Length - mm: 11 11 11 11 Molsture Content - %: 11 11 11 11 Dry Density - Mg/m3: 2.22 2.22 2.22 2.22 Dry Density - Mg/m3: 0.228 0.3276 0.3226 Consolidation 200 2.00 2.00 2.00 Consolidation Meght - mm: 24.20 0.328 0.3276 0.3226 Normal Pressure- kPa 50 100 15 0.350 1.35 1.35 Consolidation Meght - mm: 24.20 23.82 23.4 3.4 3.55 1.3 Stear 10.326 9.35 1.3 1.350 1.35 1.3 Rate of Stean (mm/min) 10.38 9.35 1.3 3.2 1.6	Initial Conditions		1	2	3	
Icengen 59.80 <	Height - mm:		24.50	24.50	2	24.50
Moisture Content - %: 11 </td <td>Length - mm:</td> <td></td> <td>59.90</td> <td>59.90</td> <td>5</td> <td>59.90</td>	Length - mm:		59.90	59.90	5	59.90
Data Disky - Phylling: 1 2 3 2 3 2 3 2 3	Moisture Content - %:		11	11		11
Vide 0.3299 0.3276 <td>Dry Density - Mg/m3:</td> <td></td> <td>1 99</td> <td>2.22</td> <td>+</td> <td>2.22</td>	Dry Density - Mg/m3:		1 99	2.22	+	2.22
Normal Pressure: kPa 50 100 115 Consolidation -	Voids Ratio:		0.3289	0.3276	0.3	3264
Consolidation 24.20 23.82 23.41 Shear 1.250 1.250 1.2 Stain (mm/min) 10.38 9.95 9.5 Stain geak shear stress (mm) 10.38 9.95 9.5 Peak shear stress (her) 41 72 10 Peak shear stress (her) 32 10.38 9.95 9.5 Peak shear stress (her) 10.38 9.95 9.5 9.5 Peak shear stress (her) 10.38 9.95 9.5 9.5 Peak shear stress (her) 32 10 10 10 10 10 100 0 0 0 100 120 140 160 10 100 0 0 0 100 120 140 160 10 100 0 0 100 120 140 160 10 100 10 10 120 140 160 10 1010 10 10 <t< td=""><td>Normal Pressure- kPa</td><td></td><td>50</td><td>100</td><td></td><td>150</td></t<>	Normal Pressure- kPa		50	100		150
Consolidated Height - mm: 24.20 23.82 23.42 Rate of Strain (mm/min) 1.250 1.250 1.250 1.250 Peak shear Stress - KPa: 41 72 10 Peak shear Stress - KPa: 41 72 10	Consolidation					
Singer 1.250 <t< td=""><td>Consolidated Height - mm:</td><td></td><td>24.20</td><td>23.82</td><td>2</td><td>23.44</td></t<>	Consolidated Height - mm:		24.20	23.82	2	23.44
Construction Interest (mm) Interest	Snear Bate of Strain (mm/min)		1 250	1 250	1	1 250
Peak shear Stress - kPa: 1 72 10 PEAK Angle of Shearing Resistance:(#) 32. 32. 33. Effective Cohesion - kPa: FAILURE CONDITIONS 32. 100	Strain at peak shear stress (mm)		1.250	9.95		9.51
PEAK Angle of Shearing Resistance:(#) 32. Effective Cohesion - kPa: FAILURE CONDITIONS 120 100 100 100 100 100 100 100 100 100	Peak shear Stress - kPa:		41	72		103
PEAK 32. Effective Cohesion - kPa: FAILURE CONDITIONS 100 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 80 100 120 120 140 120 160 120 100 120 100 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140 120 140	· · · · · · · · · · · · · · · · · · ·				<u>.</u>	
Figure 20 shading Vestative (4) 52 Effective Cohesion - KP2: FAILURE CONDITIONS 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 120 100 100 100 120 100 120 100 120 100 120 100 120 100 120 100 120 100 120 100 120 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100	PEAK					22.0
FAILURE CONDITIONS FAILURE CONDITIONS FOR THE CONDITIONS FAILURE CONDITIONS FAILUR	Effective Cohesion - kPa:					<u>52.0</u> 9
FILURE CONDITIONS						
Image: Normal Stress - (kPa). Image: Peak shear Stress - kPa:	- 80 - - 80 - - 60 - - 60 - - 40 -					
GSTL G.C.T.P Define		60 80	100 120	140	160	180
SPROS 01/04/16 Checked Page 1 by: 01/04/16 SPROS 01/04/16 Approved Page 1 by: 01/04/16 Date Date Contract No.: 30319 Client Ref Number: 8443		60 80 Normal	100 120 Stress -(kPa).	140 est Fit Line	160	180
SPROS 01/04/16 Approved Page 1 by: Date GSSTL G.C.T.P Client Ref Number: 8443 August 1 and		60 80 Normal • Peak shear Stress - kPa:	100 120 Stress -(kPa). —— B	140 est Fit Line	160	180
Approved Page 1 by: Date Contract No.: 30319 Client Ref Number: 8443 Contract Ocurate Contract No.: 30319 Client Ref Number: 8443 Contract Ocurate Contract No.: 30319 Client Ref Number: 8443 Contract Ocurate Contract Ocurate Contract Ocurate Contract No.: 30319 Client Ref Number: 8443 Contract Ocurate Contract Ocurate Contract Ocurate Contract Ocurate Contract No.: 30319 Client Ref Number: 8443 Contract Ocurate		60 80 Normal • Peak shear Stress - kPa:	100 120 Stress -(kPa). —— В	140 est Fit Line DPQage Checked Page 1 by:	160 01/04/16 Date	180
Contract No.: 30319G.C.T.PClient Ref Number: 84431 of 1000704 OCULTADDOX		60 80 Normal • Peak shear Stress - kPa:	100 120 Stress -(kPa). ——B	140 est Fit Line D P Grang Checked Page 1 by: D P Grang	160 01/04/16 Date 01/04/16	180
Client Ref Number: 8443		60 80 Normal • Peak shear Stress - kPa:	100 120 Stress -(kPa). —— B	140 est Fit Line P P Grange Checked Page 1 by: P P Grange Approved Page 1 by:	160 01/04/16 Date 01/04/16 Date	180
		60 80 Normal • Peak shear Stress - kPa:	100 120 Stress -(kPa). ——B	140 est Fit Line DP Gans Checked Page 1 by: DP Gans Approved Page 1 by:	160 01/04/16 Date 01/04/16 Date Contract No.: 30319	180

Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 5

IGSL Ltd Materials	Laboratory				Test Report							ISO 17025				
Unit J5, M	7 Business F	Park			Determi	nation of	Moisture	Content	. Liauid 8	& Plastic	Limits			IVNAB		
Newhall, N	Naas								,					TESTING		
045 84617	e 76				Tested in ac	cordance w	ith BS137/	7:Part 2:19	90, clause	s 3.2*, 4.3,	4.4 & 5.3			DETAILED IN SCOPE REG NO. 133T		
043 040 17	0															
	Report No. R70975 Contrac				No.	18963		Contract N	Contract Name: GCTP Phase 3 Contra			ract 1 GI				
Customer Galway Co.Co.																
	Samples Re	eceived:	22-02-16	Date Tes	sted:	14-03-16										
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n		
		,		Туре	Content %	Limit %	Limit %	Index	<425µm		Clause	(BS5930)				
BH3/03	AA49473	0.5	A16/0973	D	472								Dark brown ve	y fibrous PEAT		
BH3/03	AA49474	0.5	A16/0974	D	476								Dark brown ve	y fibrous PEAT		
BH3/03	AA49475	0.5	A16/0975	В	270								Dark brown very fibrous PEAT			
BH3/07	AA49476	0.1	A16/0976	D	261								Dark brown/blackvery fibrous PEAT			
BH3/07	AA49477	0.1	A16/0977	D	214								Dark brown/blackvery fibrous PEAT			
BH3/07	AA49478	0.1	A16/0978	В	246								Dark brown/blackvery fibrous PEAT			
BH3/14	AA39959	0.1	A16/0979	В	18								Dark brown claye	y/silty, very sandy, GRAVEL		
BH3/15	AA39960	0.2	A16/0980	В	13								Dark brown clayey/silty, sa	ndy, GRAVEL with many cobbles		
BH3/15	AA39961	0.4	A16/0981	В	13								Brown silty/clay	ey sandy GRAVEL		
BH3/15	AA39962	0.8	A16/0982	В	8.5								Dark brown slightly clayey/	silty, very sandy, GRAVEL		
BH3/21	N/A	0.5	A16/0983	В	458	523	NP	NP	N/A	AR	4.4		Dark brown sa	ndy, very gravelly PEAT		
BH3/21	N/A	1.0	A16/0984	В	33	62	NP	NP	28	WS	4.4		Light brown silty,	sandy, GRAVEL with many cobbles		
BH3/21	N/A	1.7	A16/0985	В	14	24	NP	NP	15	WS	4.4		Reddish/brown s	ightly silty, very sandy, GRAVEL		
BH3/22	AA49472	0.5	A16/0986	В	11								Brown slightly clayey/silty,	sandy, GRAVEL with many cobbles		
BH3/27	AA48872	0.5	A16/0987	В	19	34	18	16	65	WS	4.4	CL	Brown slightly sa	ndy, slightly gravelly, CLAY		
Notes:	Preparation:	WS - Wet sie	eved	11	Sample Type:	B - bulk distu	rbed	Remarks:			I					
		AR - As recei	ived			U - Undisturb	ed									
		NP - Non pla	stic					NOTE: *Clau	ise 3.2 of BS	of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014				SO17892-1:2014		
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	l			Opinions and	l interpretatio	ons are outsid	e the scope o	f accreditatio	n.			
	Clause:	4.4 Cone Per	netrometer one	point method	k			The results r	The results relate to the specimens tested. Any remaining material will be				ial will be reta	ined for one month.		
		atoriala	Laborata	nv	Persons autho	rized to appro	ve reports			Approved	ру		Date	Page		
IGSL LIG Materials Laboratory				H Byrne (Quality Manager)					1 Degan 20-04-16			1 of 1				

IGSL Ltd Materials Unit J5, M Newhall, N Co. Kildar 045 84617	Laboratory 17 Business F Vaas e 76 Report No. Customer	Determi Tested in ac No.	Test Report Determination of Moisture Content, Liquid & Plastic Limits ested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3 o. 18963 Contract Name: GCTP Phase 3 Contract 1 GI						ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO. 1331						
	Samples Re	eceived:	22-02-16	Date Tes	sted:	14-03-16									
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	
BH3/27	AA48873	1.0	A16/0988	В	12	34	18	16	53	WS	4.4	CL	Brown slightly	sandy, gravelly, CLAY	
BH3/28	AA39957	0.2	A16/0989	В	19	34	NP	NP	51	WS	4.4		Brown slightly	sandy, gravelly, SILT	
BH3/35	AA39963	0.5	A16/0990	В	13	20	NP	NP	66	WS	4.4		Mottled brown sli	ghtly sandy, slightly gravelly, SILT	
BH3/35	AA39964	1.0	A16/0991	В	11	23	15	8	62	WS	4.4	CL	Mottled brown sli	ghtly sandy, gravelly, CLAY	
BH3/36	AA49479	0.1	A16/0992	В	31	48	NP	NP	64	WS	4.4		Brown sandy, slightly grave	ally, SILT with some cobbles	
BH3/40	AA49469	0.2	A16/0993	В	12	29	16	13	62	WS	4.4	CL	Brown slightly sandy, gravelly, CLAY		
BH3/40	AA49470	0.5	A16/0994	В	25	42	NP	NP	46	WS	4.4		Brown slightly sandy, grave	sly, SILT with some cobbles	
BH3/48	AA49471	0.1	A16/0995	В	29	40	26	14	73	WS	4.4	ΜΙ	Light brown sligh	tly sandy, slightly gravelly, SILT	
Notes:	Preparation: Liquid Limit	WS - Wet sie AR - As recei NP - Non plas 4.3 Cone Per 4.4 Cone Per	eved ived stic netrometer defin	itive method	Sample Type:	B - bulk distu U - Undisturb	rbed ed	Remarks: NOTE: *Clau Opinions and The results r	use 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	publication of l	SO17892-1:2014	
	Clause:	4.4 Cone Per	ietrometer one		a Persons autho	rized to appro	ve reports	i ne results r	eiale lo the s	specimens tested. Any remaining material will be ref			Date	Page	
IGSL Ltd Materials Laboratory				Persons authorized to approve reports H Byrne (Quality Manager)					20-04-16			1 of 1			
















































IGSL Ltd Materials Laboratory Unit J5,M7 Business Park Naas

Co. Kildare

045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content



Tested in accordance with BS1377:Part 4:1990, clause 5.4

Report No.	R71423	
Contract No.	18963	
Contract Name:	GCTP Phase 3 - Contract 1	
Customer:	Galway Co.Co.	
BH/TP	BH3/40	
Sample No.	AA49470	
Depth (m)	0.50	
Sample Type:	В	
Lab Sample No.	A16/0994	
Source (if applicable)	unknown	
Material Type (if applicable):	В	
Sample Received:	12-02-16	
Date Tested:	08-04-16	
Sample Cert:	N/A	
Moisture Content (%):	28	
% Particles > 20mm (By dry mass):	22	
MCV:	5.1	
Interpretation of Plot:	Steepest Straight Line	
Description of Soil:	Dark brown sandy gravelly SILT v	vith roothairs
The result relates to the specimen tested. Any remaining material will be retained for one month. Sampling and opinions and interpretations are outside the scope of	Persons aution	norised to approve reports J Barrett (Dep. Quality Manager) H Byrne (Quality Manager)
	Approved by	Date Page
IGSL Ltd Materials Laboratory	# Sym	12-04-16 1 of 1





Contract Number: 30537

Client's Reference: 18963 PO: 8576

Laboratory Report

Report Date: 26-04-2016

Client Irish Geotechnical Services Limited M7 Business Park Naas Co. Kildare Ireland

Contract Title: **G.C.T.P** For the attention of: **Hugh Byrne**

Date Received: 07-04-2016 Date Commenced: 07-04-2016 Date Completed: 26-04-2016

Test Description	Qty
CUD 100mm Consolidated undrained triaxial compression test on a Single Specimen with Multistage Loading with the measurement of pore water pressure including saturation and consolidation, test duration FOUR days. BS1377 : Part 8 : Clause 7 : 1990 - @ Non Accredited Test	2
Remoulding Specimen - @ Non Accredited Test	2
Extra over items for test duration in excess of four days.	17
Disposal of Samples on Project	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

- * denotes test included in laboratory scope of accreditation
- # denotes test carried out by approved contractor
- @ denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager) Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50
Date		26/04/2016
Disturbed / Undisturbed		2.5kg Recompacted

Description of Specimen

Light greyish brown sl fine sub-angular gravelly sl fine sandy silty soft CLAY

Initial Specimen Conditions

Height	mm	205.00
Diameter	mm	102.00
Area	mm ²	8171.28
Volume	cm ³	1675.11
Mass	g	4162.90
Dry Mass	g	3564.60
Density	Mg/m ³	2.49
Dry Density	Mg/m ³	2.13
Moisture Content	%	17
Specific Gravity	kN/m ³	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	9
Density	Mg/m ³	2.51
Dry Density	Mg/m³	2.31

DP Gronz

Сћескеа апа Арргоуеа Ву

26/04/16

Date

Client Ref 18963 Contract No



G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50

Test Setup

Date started	14/04/2016
Date Finished	25/04/2016
Top Drain Used	У
Base Drain Used	У
Side Drains Used	У
Pressure System Number	P2
Cell Number	C2

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	95.00
Differential Pressure	kPa	5.00
Final Cell Pressure	kPa	400.00
Final Pore Pressure	kPa	399.00
Final B Value		1.04

Consolidation

Effective Pressure	kPa	50.00	100.00	150.00
Cell Pressure	kPa	400.00	400.00	400.00
Back Pressure	kPa	350.00	300.00	250.00
Excess Pore Pressure	kPa	49.00	80.00	105.00
Pore Pressure at End	kPa	350.00	300.00	250.00
Consolidated Volume	cm ³	1584.21	1562.01	1544.41
Consolidated Height	mm	201.29	194.57	186.46
Consolidated Area	mm ²	7875.67	8028.51	8282.87
Vol. Compressibility	m²/MN	0.15504	0.04671	0.04507
Consolidation Coef.	m²/yr.	0.11726	0.12759	0.18629

G.C.T.P



26/04/16 Date

Client Ref

18963

Contract No



BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50

Consolidation Stage





G.C.T.P

 $\mathcal{D} \mathcal{P}$ \mathcal{G} $\mathcal{O} \mathcal{S}$ Checked and Approved By

26/04/16 Date

Client Ref 18963 Contract No



BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing

Shearing				
Initial Cell Pressure	kPa	400	400	400
Initial Pore Pressure	kPa	350	300	250
Rate of Strain	mm/min	0.0024	0.0025	0.0035
Max Deviator Stress				
Axial Strain		4.203	9.036	12.078
Axial Stress	kPa	149.978	356.74	633.61
Cor. Deviator stress	kPa	147.008	352.28	629.07
Effective Major Stress	kPa	177.008	435.28	823.07
Effective Minor Stress	kPa	31.000	83.00	194.00
Effective Stress Ratio		5.710	5.244	4.24
s'	kPa	104.004	259.14	508.53
ť'	kPa	73.004	176.14	314.53
Max Effective Priciple	Stress F	Ratio		
Axial Strain		4.054	8.887	9.702
Axial Stress	kPa	147.897	355.625	590.393
Cor. Deviator stress	kPa	143.938	351.181	585.990
Effective Major Stress	kPa	173.938	433.181	726.990
Effective Minor Stress	kPa	30.000	82.000	141.000
Effective Stress Ratio		5.798	5.283	5.156
S'	kPa	101.969	257.590	433.995
ť'	kPa	71.969	175.590	292.995
Shear Resistance Angle	degs			41.6
Cohesion c'	kPa			7

DP Gronz

Checked and Approved By

26/04/16 Date

> Client Ref 18963 Contract No



G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing Stage







26/04/16 Date

Client Ref 18963 Contract No 30537



G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing Stage





DP Grong

Checked and Approved By

26/04/16 Date

Client Ref 18963 Contract No

30537



G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details

-		
Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing Stage



DP Gronz Снескеа апа Арргоуеа Ву

26/04/16 Date

Client Ref

18963

Contract No

GSTL GEO SITE & TESTING SERVICES LTD G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details		
Borehole		BH3/27
Sample No.		A16/0987
Depth	from(m)	0.5
Depth	to(m)	0.50



G.C.T.P

DP Grang

Checked and Approved By

26/04/16 Date

Client Ref 18963 Contract No

GSTL GEO SITE & TESTING SERVICES LTD

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50
Date		26/04/2016
Disturbed / Undisturbed		2.5kg Recompacted

Description of Specimen

Light greyish brown sl fine sub-angular gravelly sl fine sandy silty soft CLAY

Initial Specimen Conditions

-		
Height	mm	215.00
Diameter	mm	98.00
Area	mm ²	7542.96
Volume	cm ³	1621.74
Mass	g	3967.60
Dry Mass	g	3386.20
Density	Mg/m ³	2.45
Dry Density	Mg/m ³	2.09
Moisture Content	%	17
Specific Gravity	kN/m ³	2.65
(assumed/r	measured)	assumed

Final Specimen Conditions

Moisture Content	%	10
Density	Mg/m ³	2.43
Dry Density	Mg/m ³	2.22

DP Gronz

Сћескеа апа Арргоуеа Ву

26/04/16

Date

Client Ref 18963 Contract No



G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50

Test Setup

Date started	14/04/2016
Date Finished	25/04/2016
Top Drain Used	у
Base Drain Used	у
Side Drains Used	у
Pressure System Number	P3
Cell Number	C3

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	95.00
Differential Pressure	kPa	5.00
Final Cell Pressure	kPa	400.00
Final Pore Pressure	kPa	394.00
Final B Value		0.99

Consolidation

Effective Pressure	kPa	50.00	100.00	150.00
Cell Pressure	kPa	400.00	400.00	400.00
Back Pressure	kPa	350.00	300.00	250.00
Excess Pore Pressure	kPa	44.00	81.00	98.00
Pore Pressure at End	kPa	350.00	300.00	350.00
Consolidated Volume	cm ³	1555.14	1538.74	1524.24
Consolidated Height	mm	212.06	205.95	199.19
Consolidated Area	mm ²	7336.45	7471.47	7652.49
Vol. Compressibility	m²/MN	0.11733	0.03515	0.02692
Consolidation Coef.	m²/yr.	0.15669	0.18841	0.27855

G.C.T.P



26/04/16 Date

Client Ref

18963

Contract No

GSTL GEO SITE & TESTING SERVICES LID

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50

Consolidation Stage





G.C.T.P

DP Gronz **Checked and Approved By**

26/04/16 Date

Client Ref 18963 Contract No

GSTL GEO SITE & TESTING SERVICES LTD

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing

Shearing								
Initial Cell Pressure	kPa	400	400	400				
Initial Pore Pressure	kPa	350	300	350				
Rate of Strain	mm/min	0.0036	0.0061					
Max Deviator Stress								
Axial Strain		4.395	7.502	11.915				
Axial Stress	kPa	209.025	467.30	854.26				
Cor. Deviator stress	kPa	206.020	462.97	849.68				
Effective Major Stress	kPa	233.020	586.97	1188.68				
Effective Minor Stress	kPa	28.000	124.00	339.00				
Effective Stress Ratio		8.322	3.51					
s'	kPa	130.510	763.84					
ť'	kPa	102.510	102.510 231.49 424.8 ⁴					
Max Effective Priciple	Stress R	latio						
Axial Strain		2.084	5.069	8.737				
Axial Stress	kPa	153.885	353.926	762.379				
Cor. Deviator stress	kPa	150.063	349.866	757.999				
Effective Major Stress	kPa	158.063	427.866	1020.999				
Effective Minor Stress	kPa	8.000	78.000	263.000				
Effective Stress Ratio		19.758	5.485	3.882				
s'	kPa	83.032	252.933	642.000				
ť'	kPa	75.032	174.933	379.000				
Shear Resistance Angle	degs		<u>B</u>	32.8				
Cohesion c'	kPa			38				

G.C.T.P

DP Gronz

Checked and Approved By

26/04/16 Date

> Client Ref 18963 Contract No



BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing Stage





DP Granz

Checked and Approved By

26/04/16 Date

Client Ref 18963 Contract No 30537



G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details

Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing Stage





G.C.T.P

DP Grong

Checked and Approved By

26/04/16 Date

Client Ref 18963 Contract No



BS 1377 : Part 8 : 1990

Specimen Details

-		
Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50

Shearing Stage



DP Gronz Снескеа апа Арргоуеа Ву

26/04/16 Date

Client Ref

18963

Contract No

GSTL GEO SITE & TESTING SERVICES LTD G.C.T.P

BS 1377 : Part 8 : 1990

Specimen Details		
Borehole		BH3/35
Sample No.		A16/0990
Depth	from(m)	0.5
Depth	to(m)	0.50



DP Granz

Checked and Approved By

26/04/16 Date

G.C.T.P

Client Ref 18963 Contract No

GSTL GEO SITE & TESTING SERVICES LTD

Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 6

IGSL Ltd Materials Unit J5, M Newhall, N Co. Kildar 045 84617	Laboratory I7 Business F Naas re 76 Report No. Customer	Park R70977 Galway Co	Tested in accordance with BS137 7 Contract No. 18963 Co.Co.						st Report Content, Liquid & Plastic Limits 7:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3 Contract Name: GCTP Phase 3 Contract 1 GI				ISO 17025 ACGREDIED TESTING DETAILED IN SCOPE REG NO. 1337		
	Samples Re	eceived:	26-02-16	Date Tes	sted:	30-03-16									
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	
BH3/18	AA39965	0.5	A16/0998	B	15				·				Dark brown cla	ayey/silty, sandy, GRAVEL	
BH3/30	AA39968	0.2	A16/0999	В	18								Dark brown clayey/silty, ve	ry sandy, GRAVEL(Red Brick and Plastic)	
BH3/31	AA39971	0.3	A16/1002	В	59	46	NP	NP	84	WS	4.4		Dark brown slightly sandy, slightly gravelly, SILT		
BH3/31	AA39972	0.6	A16/1003	В	19	32	NP	NP	43	WS	4.4		Mottled brown slightly sandy, gravelly, SILT with some cobbles		
BH3/43	AA39966	0.2	A16/1004	В	16	30	NP	NP	52	WS	4.4		Brown slightly sandy, gravelly, SILT with some cobbles		
BH3/43	AA39967	0.3	A16/1005	В	22	31	NP	NP	69	WS	4.4		Dark brown slightly sandy, slightly gravelly, SILT		
TP3/43	AA39973	0.2	A16/1006	В	64								Dark brown sandy gravelly SILT/CLAY rootlets		
TP3/43	AA39974	0.2	A16/1007	В	94								Dark brown sandy gravelly SILT/CLAY with organics		
TP3/43	AA39976	0.2	A16/1008	В	61								Dark brown sand	y gravelly SILT/CLAY with rootlets	
TP3/43	AA39975	0.5	A16/1009	В	18								Dark brown cla	ayey/silty, sandy, GRAVEL	
Notes: Preparation: WS - Wet sieved Sample Type: B AR - As received U NP - Non plastic				B - bulk distu U - Undisturb	B - bulk disturbed J - Undisturbed NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication			publication of	ISO17892-1:2014						
Clause: 4.4 Cone Penetrometer one point method				The results relate to the			elate to the s	specimens tested. Any remaining material will be re				ined for one month.			
				Persons authorized to approve reports			Approved by			Date	Page				
IGSL Ltd Materials Laboratory			H Byrne (Laboratory Manager)			A Byone 05-01.			05-01-16	1 of 1					































Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 7
IGSL Ltd Materials Laboratory			Test Report											ISO 17025	
Unit J5, M7 Business Park				Determination of Moisture Content, Liguid & Plastic Limits											
Co Kildar	vaas ≏														
045 84617	76		Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3											DETAILED IN SCOPE REG NO. 1337	
	Report No.	R71366 Contract			ct No. 18963			Contract Name:		GCTP Phase 3 - Contract 1					
	Customer	Galway Co	o.Co.												
	Samples Received: 29-03-16 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)	Description		
TP3/30	AA49484	0.1	A16/1314	B	14	40	NP	NP	46	WS	4.4		Brown slightly sandy, gravelly, SILT		
BH3/15	AA48883	0.5	A16/1315	В	2.3								Brown slightly clayey/silty, slightly sandy, GRAVEL with many cobbles		
BH3/17	AA48880	0.5	A16/1316	В	11	54	NP	NP	17	WS	4.4		Dark brown silty, sandy, GRAVEL with some cobbles		
BH3/17	AA48881	1.0	A16/1317	В	9.6	39	NP	NP	30	WS	4.4		Brown silty, sandy, GRAVEL with some cobbles		
BH3/17	AA48882	2.0	A16/1318	В	4.3	26	NP	NP	19	WS	4.4		Brown silty, sandy, GRAVEL with many cobbles		
BH3/19	AA39978	0.3	A16/1319	В	18								Dark brown clayey/silty, very sandy, GRAVEL		
BH3/19	AA39979	0.5	A16/1320	В	13	47	NP	NP	65	WS	4.4		Dark brown silty, sandy, GRAVEL with some cobbles		
BH3/20	AA49485	0.1	A16/1321	В	21								Dark brown clayey/silty, very sandy, GRAVEL		
BH3/20	AA49486	0.5	A16/1322	В	8.5								Orange/Brown slightly clayey/silty, sandy, GRAVEL with many cobbles		
BH3/20	AA49487	0.8	A16/1323	В	5.3								Brown slightly clayey/slity, very sandy, GRAVEL with some cobbles		
BH3/31CR	AA48875	0.5	A16/1324	В	14	19	NP	NP	62	WS	4.4		Light brown/grey sandy, slightly gravelly, SILT		
BH3/31CR	AA48876	1.0	A16/1325	В	11	30	15	15	51	WS	4.4	CL	Light brown/grey slightly sandy, gravelly, CLAY with some cobbles		
BH3/31CR	AA48877	2.0	A16/1326	В	13	25	NP	NP	55	WS	4.4		Light brown slightly sandy,	gravely, SILT with some cobbles	
Notes:	Preparation:	WS - Wet sie	eved	Sample Type:	B - bulk distu	rbed	Remarks:								
AR - As received						U - Undisturb	ea		SO17802-1·2014						
Liquid Limit 4.3 Cone Penetrometer definitive methor					4			Opinions and	d interpretatio	on	3017092-1.2014				
Clause: 4.4 Cone Penetrometer one point metho					d	The results relate to the specimens tested. Any rem			aining mater	ial will be reta	ined for one month.				
IGSL Ltd Materials Laboratory					Persons autho	rized to appro	ve reports	•		Approved	by		Date	Page	
					H Byrne (Laboratory Manager)					A Byone 14-06-				1 of 1	

IGSL Ltd Materials Laboratory			Test Report											ISO 17025
Unit J5, M Newhall, N Co_Kildar	7 Business F laas e		Determination of Moisture Content, Liquid & Plastic Limits											
045 84617	76			Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3										
	Report No.	No. R71367 Contract			act No. 18963			Contract Name:		GCTP Ph	ase 3 - Cor	ntract 1		
Customer Galway Co.Co. Samples Received: 29-03-16 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)	Description	
BH3/31 CF	AA48878	3.0	A16/1327	В	14.1	21	NP	NP	54	WS	4.4		Mottled light brown slightly	sandy, slightly gravelly, SILT
BH3/31 CF	AA48879	4.0	A16/1328	В	13.6	19	12	7	64	WS	4.4	CL	Light brown/grey slightly sandy, slightly gravelly, CLAY	
BH3/47	AA48890	0.5	A16/1629	В	12.2	24	NP	NP	60	WS	4.4		Mottled brown slightly sandy, slightly gravelly, SILT with some cobbles	
BH3/47	AA48891	1.0	A16/1630	В	9.1	20	NP	NP	69	WS	4.4		Light brown slightly sandy, slightly gravelly, SILT	
BH3/47	AA48892	2.0	A16/1631	В	9.9	23	13	10	23	WS	4.4	CL	Mottled brown slightly sandy, slightly gravelly, CLAY	
BH3/47	AA48893	3.0	A16/1632	В	10.4	24	13	11	75	WS	4.4	CL	Light brown/grey slightly sandy, slightly gravelly, CLAY	
BH3/52	AA48884	0.5	A16/1633	В	5.6	19	11	8	36	WS	4.4	CL	Light brown/grey slightly sandy, gravelly, CLAY with some cobbles	
BH3/52	AA48885	1.0	A16/1634	В	13.6	24	14	10	58	WS	4.4	CL	Light brown sandy gravelly CLAY	
BH3/52	AA48886	2.0	A16/1635	В	9.3	21	NP	NP	69	WS	4.4		Light brown/grey slightly sandy, slightly gravelly, SILT	
BH3/52	AA48887	3.0	A16/1636	В	10.8	20	11	9	70	WS	4.4	CL	Light brown/grey slightly sandy, slightly gravelly, CLAY	
BH3/53	AA48888	0.5	A16/1637	В	5.7	19	NP	NP	22	WS	4.4		Light brown/grey silty, sandy, GRAVEL	
BH3/53	AA48889	1.0	A16/1638	В	4.6	20	NP	NP	32	WS	4.4		Light brown/grey silty, sand	y, GRAVEL with some cobbles
Notes: Preparation: WS - Wet sieved AR - As received					Sample Type:	B - bulk distu U - Undisturb	rbed ed	Remarks:	SO17802-1-2014					
	Liquid Limit Clause:	4.3 Cone Per 4.4 Cone Per	netrometer defin netrometer one	itive methoo point methoo	d Opini d The r				Divide the second second second standard due to publication of the second secon					ined for one month.
					Persons autho	rized to appro	ve reports		Approved by Date					Page
					H Byrne (Laboratory Manager)					A Byone			14-06-16	1 of 1






































































(The second sec	C	One dimensional Co	onsolidation					
		BS1377:Part 5:	1990					
Report No.	R72309							
Contract:	GCTP Phase 3 Contract number: 1							
BH:	3/31 Sample number: AA48877 Depth (m): 2.0							
Description	Greyish brown sandy g	ravelly SILT/CLAY (rer	noulded includes some	fine gravel)				
Specimen ⊢	leight (mm)	18.7	Specimen diameter (m	im) 75.9				
Assumed Pa	Moisture co Bulk density Dry density Void ratio article density Mg/m ³	Initial ntent % 11 / Mg/m ³ 2.33 Mg/m ³ 2.10 0.264 2.65	Final 11 2.47 2.21 0.163					
	Applied Pressure (kPa)	m _v (m ² /MN)	c, (m²/year)	Voids Ratio				
	0 - 50	1.153	2.288	0.19101				
	50 - 100	0.279	1.838	0.17439				
	150 - 200	0.132	0.920	0.16057				
	200 - 100	0.009	1.020	0.16195				
	100 - 50	0.021	4.858	0.16317				
	0.2 0.195 0.19 0.185 0.18 0.185 0.18 0.18 0.175 0.175 0.165 0.16 0.155 0.15 1							
		Applied Pres	ssure kPa					
	L]				

(The second sec	C	one dimensional Co	onsolidation	
		BS1377:Part 5:	1990	
Report No.	R72310			
Contract:	GCTP Phase 3	umber: 18963		
BH:	3/52 Sample nun	2.0		
Description	Greyish brown sandy g	ravelly SILT/CLAY (rei	moulded includes some	fine gravel)
Specimen H	eight (mm)	18.5	Specimen diameter (m	nm) 76.2
Assumed Pa	Moisture co Bulk density Dry density Void ratio article density Mg/m ³	ntent % 10 / Mg/m ³ 2.40 Mg/m ³ 2.18 0.217 2.65	Final 9 2.49 2.28 0.161	
	Applied Pressure (kPa)	m. (m ² /MN)	c. (m²/year)	Voids Ratio
	0 - 50	0.618	3.596	0.17942
	50 - 100	0.147	1.129	0.17074
	150 - 200	0.110	0.176	0.16429
	200 - 100	0.006	2.382	0.15850
	100 - 50	0.035	2.983	0.16054
	0.19 0.185 0.18 0.175 0.17 0.175 0.165 0.165 0.165 0.155 0.15 1	10 Applied Pre-	100 ssure kPa	



BS1377:Part 8:1990 and K H Head Manual of Soil Laboratory Testing vol 3

Report N	0.	R72733			Lab Sample no.		A16/1534	1
Contract	No.	18963	Contract N	ame	GCTP Phase 3			
Location	BH3/52	Sample No.	AA48885	Depth (m)	1.00	Sample T	уре	В
Method c	of Preparatio	n	Remoulded	d 2.5kg ram	mer 5 layer	er 5 layers 25 blows / layer		
Descripti	on	Light greyis	h brown san	dy gravelly	silty CLAY	Test Type	Multi-sta	ge
Initial Din	nensions an	d condition						
Height (n	nm)	202.0	Diameter (ı	mm)	102.0	Side drain	s fitted	Yes
			Initial		Final			
Moisture Bulk Den Dry Dens	Content (% sity (Mg/m ³) sity (Mg/m ³))	9.7 2.33 2.13		7.9 2.38 2.21			
Saturatio	n Stage							
Saturatio	n by increm	ents of Cell &	Back Press	ure				
Initial B	/alue	0.82	Final <i>B</i> Va	lue	0.98	Increment	s of Pressu	ure 50
0.9								
0.8								
0.7								
0.6								
alue 0.5								
> 四 0.4								
0.3								
0.2								
0.1								
0								
	0 50	J 100	150 Cell F	200 Pressure (kPa	250	300 35	bU 40	U
L]

Number of days saturating



BS1377:Part 8:1990 and K H Head Manual of Soil Laboratory Testing vol 3

Report No.		R72733			Lab Sample no. A16/1534			
Contract No	0.	18963	Contract N	Name	GCTP Ph	ase 3		
Location	BH3/52	Sample No.		Depth (m)	1.00	Sample Ty	ре	В
Consolidati	ion Stage							
Stage Num Cell Pressu Back Press Effective Pr Final Pore Volume Ch % Pore Pre	iber ure (kPa) sure (kPa) ressure (kl Pressure (ange (ml) essure Dis	Pa) kPa) sipation	1 350 300 50 297 30.56 100	2 400 300 100 290 19.23 100	3 450 300 150 301 11.09 99			



Number of days consolidating

3

Compression Stage

Failure criteria	Maximum E	ffective Prin	cipal Stress	Ratio
Stage		1	2	3
Effective Stress (kPa)	50	100	150
Rate of Strain (mm/m	nin)	0.005	0.0041	0.004
Pore Pressure at sta	rt (kPa)	299	291	301
Axial strain at failure	(%)	3.37	5.25	7.55
Deviator Stress at fai	lure (kPa)	79.3	201	369.3
Pore Pressure at fail	ure (kPa)	325.8	340.1	349.2
Major Principal stres	s at failure	103.5	261.0	470.1
Minor Principal stres	s at failure	24.2	59.9	100.8
Number of days in co	ompression	3		
Total Number of days	s on test	11		









Stage 3









GEO Site & Testing Services Ltd

Contract Number: 30805

Client's Reference: 18963 - PO: 8741

Laboratory Report

Report Date: 19-05-2016

Client Irish Geotechnical Services Limited M7 Business Park Naas Co. Kildare Ireland

Contract Title: **G.C.T.P** For the attention of: **Hugh Byrne**

Date Received: 29-04-2016 Date Commenced: 29-04-2016 Date Completed: 19-05-2016

Test Description

Immediate Shear Strength - set of 3 60 x 60 mm Shear Box Specimens by Direct Shearing (note suitable for free draining material only) Non Accredited Test - @ Non Accredited Test

Disposal of Samples on Project

Notes: Observations and Interpretations are outside the UKAS Accreditation

- * denotes test included in laboratory scope of accreditation
- # denotes test carried out by approved contractor
- @ denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager) Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director) Qty

1

Test Report: Quick Shearbox Test BS1377:Part 7:4.5 :1990.

Borehole: Sample Number :	BH3/17 A16/1318	Depth (m) from: Depth (m) to:	2.00 0.00			
Sample Type:	D	2.65 (4	D			
Particle Density - Mg/m3: Specimen Tested:	2.65 (Assumed) Submerged, Remoulded material above 2.00mm removed					
Specificit rested.	Submergeu, Kem					
Sample Description:						
light brown slightly clayey slightly sill	ty sandy (fine-medium) GRA	VEL (fine-coarse/subang	ular-subrounded)	2		
Initial Conditions		1	2	3		
Height - mm:		24.5	24.50	24.50		
Length - mm:		59.9	59.90	59.90		
Moisture Content - %:		1	1 11	11		
Bulk Density - Mg/m3:		2.2	4 2.24	2.24		
Dry Density - Mg/m3: Voids Patio:		2.0	2.01	2.01		
Normal Pressure- kPa		0.519	0.5202	6		
Consolidation						
Consolidated Height - mm:		24.5	24.34	24.18		
Shear						
Rate of Strain (mm/min)		1.25	1.25	0 1.25		
Strain at peak shear stress (mm)		10.3	9.84	9.33		
Peak snear Stress - кРа:		3	56 J	83		
PEAK						
Angle of Shearing Resistance:(0)				51.0		
Effective Cohesion - kPa:				8		
	20	40	60			
	Norma	l Stress -(kPa).	00			
	Peak shear Stress - kPa	a:	-Best Fit Line			
			DP Gaas Checked Page 1 by:	19/05/16 Date		
			21 F Wang	19/05/16		
			Approved Page 1 by:	Date		
GSTI	G	G.C.T.P		Contract No.: 30805 Client Ref Number:		
	4 -	\f 1	0	8741		
GEO SITE & TESTING SERVICES LTD	1 (וונ	0	30704 QSHEARBOX		

Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 8

IGSL Ltd Materials	Laboratory		Test Report								ISO 17025			
Unit J5, M Newhall, N	7 Business F Jaas	Park			Determi	nation of	Moisture	e Content	, Liquid &	& Plastic	Limits			
Co. Kildar 045 84617	e 76		Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3								TESTING DETAILED IN SCOPE REG NO. 1331			
	Report No.	R71368		Contract	No.	18963		Contract N	lame:	GCTP Ph	ase 3 - Cor	ntract 1		
	Customer	Galway Co	o.Co.											
	Samples Re	eceived:	29-03-16	Date Tes	sted:	26-04-16								
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
BH3/35 CF	AA001	0.5	A16/1329	В	5.9	21	12	9	67	WS	4.4	CL	Brown slightly	sandy, gravelly, CLAY
BH3/35 CF	AA002	1.0	A16/1330	В	8.3	18	NP	NP	60	WS	4.4		Light brown/grey slightly sa	andy, slightly gravelly, SILT
BH3/35 CF	AA003	2.0	A16/1331	В	6	21	NP	NP	61	WS	4.4		Light brown/grey	slightly sandy gravelly SILT
BH3/35 CF	AA004	3.0	A16/1332	В	9.7	22	NP	NP	71	WS	4.4		Light brown/grey slightly sa	andy, gravelly, SILT with some cobbles
BH3/35 CF	AA005	4.0	A16/1333	В	11	22	NP	NP	69	WS	4.4		Mottled brown sl	ghtly sandy, gravelly, SILT
BH3/35 CF	AA006	5.0	A16/1334	В	8.9	23	NP	NP	53	WS	4.4		Mottled light brown slightly	sandy, slightly gravelly, SILT with many cobbles
BH3/35 CF	AA007	6.5	A16/1323	В	5.3		NP	NP					Mottled grey/brown slightly	sandy, slightly gravelly, SILT
BH3/35 CF	AA008	8.0	A16/1336	В	13	24	NP	NP	68	WS	4.4		Mottled grey/brown slightly	sandy, slightly gravelly, SILT
BH3/54	AA009	0.5	A16/1337	В	2.3		NP	NP					COBBLES with dark brow	n/grey slightly silty, slightly sandy, gravel
BH3/54	AA010	1.0	A16/1338	В	5.1	21	NP	NP	39	WS	4.4		Grey brown sil	ty sandy GRAVEL
BH3/54	AA011	2.0	A16/1339	В	2.7	23	NP	NP	33	WS	4.4		Light brown/grey slightly si	Ity, sandy, GRAVEL with many cobbles
BH3/54	AA012	3.0	A16/1340	В	5.2	19	NP	NP	39	WS	4.4		Mottled light brown/grey si	ty, sandy, GRAVEL with some cobbles
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:						
		AR - As rece	ived			U - Undisturb	ed							
		NP - Non pla	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wi	thdrawn" stan	dard due to p	oublication of	SO17892-1:2014
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	4			Opinions and	d interpretation	ons are outsic	le the scope o	of accreditatio	on.	ined for one menth
	Giause:	4.4 Cone Per	ieuometer one	point method	Persons autho	rized to appro	ve reports	The results r		Approved	bv	laining mater	Date	Page
IG	SL Ltd M	aterials	Laborato	rv			10 100010			IAD	~ j			
				- ,		H Byrne (L	aboratory	Manager)		ATA	ique -		28-04-16	1 of 1



















TEST REPORT Determination of Particle Size Distribution Tested in accordance with: BS1377:Part2:1990 . clause 9.2 & 9.5 (note: Sedimentation stage not accredited) DETAILED IN SCOPE REG NO. 13 Report No. particle % Contract No: 18963 R72736 passing Contract: GCTP Phase 3 - Contact 1 size 100 75 BH: BH3/54 COBBLES 63 100 Sample No. AA10 Lab. Sample No. A16/1338 50 100 Sample Type: В 37.5 85 Depth (m) 1.00 Galway Co.Co. Customer: 28 82 05-04-16 Date Testing started 09-06-16 Date Received Mottled light brown/grey silty, very sandy, GRAVEL 75 20 Description: 70 14 GRAVEL Remarks 10 65 Sample size did not meet the requirements of BS1377 6.3 61 0.063 0.3 0.425 0.6 0.15 1.18 10 14 20 53 53 53 53 3.35 5.35 5 58 \sim 100 3.35 51 90 2 46 80 1.18 41 Percentage passing (%) 0.6 35 70 SAND 0.425 31 60 0.3 27 50 0.15 19 40 0.063 11 30 20 10 SILT/CLAY 0 0.0001 0.1 0.001 0.01 1 10 100 Sieve size (mm) CLAY SILT SAND **GRAVEL** Approved by: Page no: Date: **IGSL Ltd Materials Laboratory** A Byone 17-06-16 1 of 1 Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)









E		(One dimensional	Consolidation						
	S L		BS1377:Part	5:1990						
F	Report No.	R72448								
0	Contract:	GCTP Phase 3 Contract number: 18963								
E	3H:	3/35 Sample nur	2.0							
C	Description	Greyish brown sandy g	ravelly silty CLAY (F	Remoulded specimen inclu	ded some gravel)					
5	Specimen H	eight (mm)	20.1	Specimen diameter (m	nm) 75.1					
ļ	Assumed Pa	Moisture co Bulk density Dry density Void ratio article density Mg/m ³	Initia ontent % 8.8 y Mg/m³ 2.42 Mg/m³ 2.23 0.190 2.65	I Final 8.4 2.53 2.34 0.122						
		Applied Pressure (kPa)	m _v (m²/MN)	c _v (m²/year)	Voids Ratio					
		0 - 50	0.736	5.927	0.14638					
		100 - 200	0.170	3.940	0.12162					
		200 - 300	0.048	12.234	0.11629					
		300 - 100	0.013	3.422	0.11926					
		100 00	0.012	000.001	0.12102					
		0.15								
		0.145								
		0.14								
		0.135								
		0.13 de la companya d								
		° _{0.125}								
		0.12								
		0.115								
		0.11 + 1	10	100	1000					
			Applied P	ressure kPa						



BS1377:Part 8:1990 and K H Head Manual of Soil Laboratory Testing vol 3

Report No.	R72456			Lab Sample no.		A16/1329		
Contract No.	18963	Contract I	Name	GCTP Ph	ase 3			
Location BH3/35	5CF Sample No	D. AA1	Depth (m)	0.50	Sample 1	Гуре	В	
Method of Prepara	ation	Remoulde	ed 2.5kg ram	mer 5 laye	ers 25 blows	s / layer		
Description	Greyish br	own sandy g	ravelly CLA	Y	Test Type	e Multi-sta	ge	
Initial Dimensions	and condition							
Height (mm)	200.0	Diameter	(mm)	102.0	Side drai	ns fitted	Yes	
		Initial		Final				
Moisture Content Bulk Density (Mg/i Dry Density (Mg/n	(%) m ³) n ³)	9.9 2.34 2.13		8.2 2.37 2.19				
Saturation Stage								
Saturation by incre	ements of Cell	& Back Pres	sure					
Saturation by incre Initial <i>B</i> Value	ements of Cell	& Back Pres Final <i>B</i> V	sure alue	0.98	Incremen	nts of Press	ure 50	
Saturation by incre	ements of Cell	& Back Pres	sure alue	0.98	Incremen	its of Press	ure 50	
Saturation by incre Initial <i>B</i> Value	ements of Cell	& Back Pres	sure alue	0.98	Incremen	ts of Press	ure 50	
Saturation by incre Initial <i>B</i> Value	ements of Cell	& Back Pres	sure	0.98	Incremer	ts of Press	ure 50	
Saturation by increases of the second	ements of Cell	& Back Pres	sure	0.98		◆	ure 50	
Saturation by increases initial <i>B</i> Value	ements of Cell	& Back Pres	sure	0.98		◆	ure 50	
Saturation by increases initial <i>B</i> Value	ements of Cell	& Back Pres	sure	0.98		f Press	ure 50	
Saturation by increases of the second secon	ements of Cell	& Back Pres	sure alue	0.98			ure 50	
Saturation by increases initial <i>B</i> Value $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	ements of Cell	& Back Pres	sure alue	0.98		of Press	ure 50	
Saturation by increases initial <i>B</i> Value $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	ements of Cell	& Back Pres	sure alue	0.98		the of Press	ure 50	
Saturation by increases initial <i>B</i> Value $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	ements of Cell	& Back Pres	sure alue	0.98			ure 50	
Saturation by increases initial <i>B</i> Value $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	ements of Cell	& Back Pres	sure alue	0.98			ure 50	

Number of days saturating



BS1377:Part 8:1990 and K H Head Manual of Soil Laboratory Testing vol 3

Report No.	R72456			Lab Samp	ole no.	A16/1329
Contract No.	18963	Contract N	Name	GCTP Ph	ase 3	
Location BH3/35CF	Sample No.		Depth (m)	0.50	Sample Ty	be B
Consolidation Stage						
Stage Number Cell Pressure (kPa) Back Pressure (kPa) Effective Pressure (k Final Pore Pressure (Volume Change (ml) % Pore Pressure Dis	Pa) (kPa) sipation	1 350 300 50 301 18.13 98	2 400 300 100 305 27.21 95	3 450 300 150 300 13.83 99		



Number of days consolidating

3

Compression Stage

Failure criteria Maximu	m Effective Prir	ncipal Stress	Ratio
Stage	1	2	3
Effective Stress (kPa)	50	100	150
Rate of Strain (mm/min)	0.007	0.00598	0.00517
Pore Pressure at start (kPa)	301	305	302
Axial strain at failure (%)	2.54	5.22	7.79
Deviator Stress at failure (kPa)	75	213.4	455.5
Pore Pressure at failure (kPa)	331.3	339.6	321.5
Major Principal stress at failure	93.7	273.8	584.0
Minor Principal stress at failure	18.7	60.4	128.5
Number of days in compression	n 3		
Total Number of days on test	9		










Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 9

IGSL Ltd Materials Unit J5, M Newhall, N Co. Kildar 045 84617	Laboratory I7 Business F Naas e 76 Report No.	Park R73993		Contract	Determi Tested in ac No.	Test Report Determination of Moisture Content, Liquid & Plastic Limits ested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3 lo. 18963 Contract Name: GCTP Phase 3,Contract 1							ISO 17025 ACCREDITED ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331				
	Samples Re	ceived:	29-04-16	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			
WS3/01	N/A	0.4	A16/1650	WS	89								Brown sandy	organic CLAY			
WS3/02	N/A	0.6	A16/1651	WS	177								Brown PEAT	with occasional clay			
WS3/02	N/A	1.3	A16/1652	WS	9.1								Brown slightly s	sandy slightly gravelly CLAY			
WS3/02	N/A	2.4	A16/1653	WS	7.2								Grey sandy g	gravelly SILT/CLAY			
WS3/03	N/A	0.7	A16/1654	WS	23								Brown slightly sandy slightly gravelly CLAY with root hairs				
WS3/04	N/A	0.1	A16/1655	WS	265								Brown PEAT				
WS3/04	N/A	1.0	A16/1656	WS	12								Grey gravelly	v silty/clayey SAND			
WS3/04	N/A	2	A16/1657	WS	11								Grey sandy gra	velly SILT/CLAY			
Notes:	Preparation:	WS - Wet sie	eved		Sample Type:	B - bulk distu	rbed	Remarks:					-				
		AR - As recei	ived			U - Undisturb	ed										
	Liquid Lippit	NP - Non plas	stiC actromator dofin	itivo mothod				NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	thdrawn" stan	dard due to p	ublication of I	SO17892-1:2014			
	Clause [.]	4.3 Cone Per	netrometer one	point method	' d			The results r	elate to the s	preside outsid	sted. Anv rem	naining mater	ial will be reta	ined for one month			
					Persons authorized to approve reports					Approved by Date				Page			
IG	SL Ltd M	aterials	Laborato	ry		H Byrne (L	aboratory	Manager)		AB	pue-		20-07-16	1 of 1			

	0				
		BS1377:F	art 5:1990		
Report No.	R72732				
Contract:	GCTP Phase 3			Contract number:	18963
BH:	WS3/04 Sample num	ıber: -		Depth (m): 3	3
Description	Grey slightly sandy sligh				
Specimen H	leight (mm)	20.0	Specimen d	diameter (mm)	50.0
Assumed Pa	Moisture cor Bulk density Dry density Void ratio article density Mg/m ³	ntent % Mg/m ³ Mg/m ³ 2.65	itial Final 10 15 .17 2.27 .97 1.98 346 0.287		
	Applied Pressure (kPa)	m _v (m²/MN) c _v (m ² /	/year) Void	ds Ratio
	0 - 50	0.586	10.7	777 O.	30642
	100 - 150	0.183	3.5	<u>45</u> 0.	29579
	150 - 200	0.092	2.5	38 0.	28422
	200 - 100	0.005	8.3	57 0.	28489
	100 - 50	0.027	5.9	95 0.	28664
	0.31 0.305 0.3 0.3 0.295 0.295 0.295 0.285 0.285 1	10 Applie	100 d Pressure kPa		
	0.28	10 Applie	100 d Pressure kPa	1000	

(set)	C	One dimensional C	onsolidation	
		:1990		
Report No.	R72752			
Contract:	GCTP Phase 3		Contract n	umber: 18963
BH:	WS3/02 Sample nur	nber: -	Depth (m):	0.6
Description	Dark brown fibrous PE	AT with occasional ligh	nt greyish brown clay	
Specimen H	leight (mm)	20.0	Specimen diameter (m	nm) 49.9
Assumed Pa	Moisture co Bulk density Dry density Void ratio article density Mg/m ³	ntent % / Mg/m ³ Mg/m ³ 1.11 0.40 2.749	Final 161 1.29 0.49 1.973	
	Applied Pressure (kPa)	m _v (m²/MN)	c _v (m²/year)	Voids Ratio
	0 - 6.25	5.024	0.133	2.63099
	12.5 - 25	3.399	0.241	2.35565
	25 - 50	1.603	0.454	2.26812
	50 - 100	2.189	0.209	1.91049
	100 - 50	0.152	0.223	1.93261
	00-20	0.002	0.400	2.2000
	2.7 2.6 2.5 2.4 2.3 2.2 2.1 2.1 2.1 2 1.9 1			
		Applieu Pre	σσαις κι α	

(ED)	C			
		BS1377:Part 5:	1990	
Report No.	R72753			
Contract:	GCTP Phase 3		Contract n	umber: 18963
BH:	WS3/02 Sample num	nber: -	Depth (m):	1.3
Description	Light grey slightly sandy	/ slightly gravelly CLAY	1	
Specimen F	leight (mm)	20.0	Specimen diameter (m	ım) 50.0
Assumed Pa	Moisture con Bulk density Dry density Void ratio article density Mg/m ³	Initial ntent % 9.1 Mg/m ³ 2.38 Mg/m ³ 2.18 0.214 2.65	Final 8.8 2.44 2.24 0.174	
	Applied Pressure (kPa)	m _v (m²/MN)	c _v (m²/year)	Voids Ratio
	0 - 50	1.739	0.18861	
	100 - 150	0.088	1.166	0.17817
	150 - 200	0.095	0.289	0.17258
	200 - 100	0.008	165.729	0.17355
	100 - 50	0.012	10.373	0.17428
	0.19 0.188 0.186 0.186 0.184 0.182 0.182 0.182 0.182 0.182 0.182 0.182 0.18 0.178 0.176 0.174 0.172 0.17 1	10 Applied Pres	100 ssure kPa	



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Report No.	R73541		Lab Sam	Lab Sample no						
Contract No.	18963	Contract Name	GCTP PI	hase 3						
Location WS3/03	Sample No	Depth	(m) 0.50	Sample Type	U					
Method of Preparati	on	Remoulded								
Description	Brown sligh	ntly sandy slightly g	ravelly CLAY	Test Type Multi-stage	е					
Initial Dimensions a	nd condition	oliels								
Height (mm)	76.0	Diameter (mm)	38.0	Side drains fitted	No					
		Initial	Final							
Moisture Content (% Bulk Density (Mg/m Dry Density (Mg/m ³	6) ³)	23 1.74 1.42	29 2.00 1.55							
Saturation Stage										
Saturation by increr	nents of Cell &	& Back Pressure								
Initial <i>B</i> Value	0.17	Final <i>B</i> Value	0.95	Increments of Pressu	re 50					
0.8										
0.7										
0.6										
en 10.0										
0.4										
0.3	/									
0.2										
0.1										
0		450 000								
U	ou 100	Cell Pressure	250 e (kPa)	300 350 400						

Number of days saturating



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Report No.	R73541								
Contract No.	18963	Contract I	Name	GCTP Ph	GCTP Phase 3				
Location WS3/03	Sample No.		Depth (m)	0.50	Sample Type	U			
Consolidation Stage									
Stage Number Cell Pressure (kPa) Back Pressure (kPa) Effective Pressure (k Final Pore Pressure (Volume Change (ml) % Pore Pressure Dis	Pa) (kPa) sipation	1 350 300 50 300 2.69 100	2 400 300 100 299 2.92 100	3 450 300 150 302 2.02 99					



Number of days consolidating

3

Compression Stage

Failure criteria	Maximum E	Effective Principal Stress Ratio					
Stage		1	2	3			
Effective Stress (kPa	a)	50	100	150			
Rate of Strain (mm/r	nin)	0.0063	0.0007	0.0023			
Pore Pressure at sta	ırt (kPa)	300	300	302			
Axial strain at failure	(%)	5.07	8.41	14.8			
Deviator Stress at fa	ilure (kPa)	54.9	115.8	188.5			
Pore Pressure at fai	ure (kPa)	327.9	355.1	382.9			
Major Principal stres	s at failure	77.0	160.7	255.6			
Minor Principal stres	s at failure	22.1	44.9	67.1			
Number of days in c	ompression	3					
Total Number of day	s on test	10					









Stage 3







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Report No.	R72964		Lab Sam	ple no	
Contract No.	18963	Contract Name	GCTP PI	hase 3	
Location WS3/04	4 Sample No	o Depth (r	m) 2.00	Sample Type	В
Method of Preparat	ion	Remoulded			
Description	Grey slight	ly gravelly silty/clayey	SAND	Test Type Multi-stage	
Initial Dimensions a	nd condition				
Height (mm)	76.0	Diameter (mm)	38.0	Side drains fitted	No
		Initial	Final		
Moisture Content (% Bulk Density (Mg/m Dry Density (Mg/m ³	%) ³))	10 2.30 2.08	10 2.41 2.19		
Saturation Stage					
Saturation by increm	ments of Cell	& Back Pressure			
Initial B Value	0.30	Final <i>B</i> Value	1.00	Increments of Pressure	ə 50
0.9					
0.8					
0.7					
0.0					
е. 0.5 Х В					
0.4					
0.3					
0.2					
0.1					
0	50 100	150 200	250	300 350 400	
		Cell Pressure (k	Pa)		
Number of days sat	urating	4			



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Report No.	R72964			Lab Sample no					
Contract No.	18963	Contract I	Name	GCTP Ph	ase 3				
Location WS3/04	Sample No.		Depth (m)	2.00	Sample Type	В			
Consolidation Stage									
Stage Number Cell Pressure (kPa) Back Pressure (kPa) Effective Pressure (k Final Pore Pressure Volume Change (ml) % Pore Pressure Dis	Pa) (kPa) sipation	1 350 300 50 300 2.30 100	2 400 300 100 305 0.90 100	3 450 300 150 300 0.71 100					



3

Number of days consolidating

Compression Stage

Failure criteria	Maximum B	Effective Prin	cipal Stress	s Ratio
Stage		1	2	3
Effective Stress (kPa)		50	100	150
Rate of Strain (mm/mir	ı)	0.0024	0.0035	0.00517
Pore Pressure at start	(kPa)	300	300	300
Axial strain at failure (%	6)	2.16	4.42	6.08
Deviator Stress at failu	re (kPa)	289.5	504.4	795.5
Pore Pressure at failure	e (kPa)	302.5	290.7	283.3
Major Principal stress a	at failure	337.0	613.7	962.2
Minor Principal stress a	at failure	47.5	109.3	166.7
Number of days in com	pression	3		
Total Number of days of	on test	10		











Appendix 13

Geotechnical Laboratory Testing

Lab Schedule 10

IGSL Ltd Materials	Laboratory						Tes	st Repoi	t					ISO 17025
Unit J5, M	17 Business F	Park			Determi	nation of	Moisture		l iquid &	2 Plastic	Limits			IVNAB
Newhall, N	Vaas				Determi		moisture	, content	, Liquiu d		Lining			
Co. Kildar	е				ested in accordance with BS1377:Part 2:1990. clauses 3.2*, 4.3, 4.4 & 5.3									DETAILED IN SCOPE REG NO. 133T
045 84617	76									,,				
	Report No.	R72102		Contract	xt No. 18963			Contract Name:		GCTP Pha	ase 3,Cont	ract 1		
Customer Galway Co.Co														
	Samples Re	eceived:	12-05-16	Date Tes	sted:	27-05-16								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n
				Туре	Content %	Limit %	Limit %	Index	<425µm		Clause	(BS5930)	-	
SW3/02	AA46069	0.5	A16/1921	В	23								Brown sandy, s	slightly gravelly, SILT/CLAY
SW3/02	AA46070	1.0	A16/1922	В	10								Light brown sligh	tly sandy, gravelly, SILT/CLAY
TP3/36	AA43065	0.4	A16/1923	В	25								Brown slightly sa	ndy, slightly gravelly, SILT/CLAY
TP3/36	AA43066	0.4	A16/1924	A16/1924 B 27 Brown slightly sandy,								ndy, slightly gravelly, SILT/CLAY		
TP3/36	AA43067	0.8	A16/1925	A16/1925 B 11 Brown slightly sandy, gravelly								ndy, gravelly, SILT/CLAY		
TP3/36	AA43068	0.8	A16/1926	В	10								Brown slightly sa	ndy, gravelly, SILT/CLAY
TP3/37	AA49488	0.5	A16/1927	В	15								Dark brown claye	y/silty, very sandy, GRAVEL
TP3/37	AA49489	1.0	A16/1928	В	14								Brown very sar	ndy very gravelly CLAY
TP3/39	AA49491	0.5	A16/1929	В	9.9								Dark brown slight	tly clayey/silty, sandy, GRAVEL
TP3/39	AA49492	1.1	A16/1930	В	54								Brown very sar	ndy GRAVEL
TP3/40	AA49490	0.3	A16/1931	В	16								Dark brown claye	y/silty, very sandy, GRAVEL
TP3/41	AA43057	0.5	A16/1932	В	19								Orange/Brown sa	ndy, slightly gravelly, CLAY
TP3/41	AA43058	0.5	A16/1933	В	21	38	17	21	56	WS	4.4	CI	Orange/Brown sa	ndy, slightly gravelly, CLAY
TP3/42	AA43059	0.4	A16/1934	В	17							-	Dark brown sa	ndy gravelly SILT/CLAY
TP3/42	AA43060	0.8	A16/1935	В	12	19	11	8	75	WS	4.4	CL	Light brown sligh	tly sandy, slightly gravelly, CLAY
Notes:	Preparation:	WS - Wet sie	ved		Sample Type:	B - bulk distur	rbed	Remarks:						
		AR - As recei	ved			U - Undisturb	ed							
		NP - Non plas	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of I	SO17892-1:2014
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	l			Opinions and	l interpretatio	ons are outsid	e the scope c	f accreditatio	n.	
	Clause:	4.4 Cone Per	netrometer one	point method	t –			The results relate to the specimens tested. Any remaining material will I				ial will be reta	ined for one month.	
		atoriala	Laborata	n	Persons autho	rized to approv	ve reports	Approved by D			Date	rage		
IG		atenals	Laborato	ı y		H Byrne (La	aboratory l	Manager)		AB	pue-		17-06-16	1 of 1

IGSL Ltd Materials	Laboratory			Test Report									ISO 17025	
Unit J5, M	17 Business F	Park			Determi	nation of	Moisture	e Content	Liquid 8	& Plastic	Limits			IVNAB
Newhall, N	Naas													
Co. Kildar	e 76				Tested in accordance with BS1377:Part 2:1990, clauses 3.2*, 4.3, 4.4 & 5.3									DETAILED IN SCOPE REG NO. 133T
040 040 1	10													
	Report No.	R72103		Contract	.t No. 18963			Contract Name:		GCTP Pha	ase 3,Cont	ract 1		
	Customer	Galway Co	o.Co											
	Samples Re	ceived:	12-05-16	Date Tes	sted:	27-05-16								
BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample	Moisture	Liquid	Plastic	Plasticity	%	Preparation	Liquid Limit	Classification	Descriptio	n
				Туре	Content %	Limit %	Limit %	Index	<425µm		Clause	(BS5930)		
TP3/42	AA43061	0.8	A16/1936	D	11								Light brown sligh	tly sandy, slightly gravelly, CLAY
TP3/42	AA43062	1.5	A16/1937	В	8.3								Brown clayey/s	ilty, gravelly, SAND
TP3/42	AA43063	2.5	A16/1938	В	8.6								Brown slightly	clayey gravelly SAND
TP3/42	AA43064	3.5	A16/1939	В	8.5								Brown clayey/s	ilty, very sandy, GRAVEL
TP3/44	AA49493	1.0	A16/1940	В	9.8								Brown slightly sa	ndy, slightly gravelly, SILT/CLAY
TP3/44	AA49494	1.0	A16/1941	В	12								Brown slightly sa	ndy, slightly gravelly, SILT/CLAY
TP3/44	AA49495	1.0	A16/1942	D	15	20	NP	NP	67	WS	4.4		Brown slightly	sandy gravelly SILT
TP3/44	AA49496	2.0	A16/1943	В	9.5								Light brown/grey slightly sa	ndy, slightly gravelly, CLAY
TP3/44	AA49497	2.0	A16/1944	В	8.4								Light brown/grey slightly sa	ndy, slightly gravelly, CLAY
TP3/44	AA49498	2.0	A16/1945	D	7.9	20	10	10	72	WS	4.4	CL	Light brown/grey slightly sa	ndy, slightly gravelly, CLAY
TP3/45	AA43051	1.5	A16/1946	В	11								Brown slightly sa	ndy, slightly gravelly, SILT/CLAY
TP3/45	AA43052	1.5	A16/1947	В	9.8								Brown slightly sa	ndy, slightly gravelly, SILT/CLAY
TP3/45	AA43053	1.5	A16/1948	D	14	21	NP	NP	66	WS	4.4		Brown slightly sa	ndy, slightly gravelly, SILT
TP3/45	AA43054	2.5	A16/1949	В	8.3								Light brown/grey slightly sa	ndy, slightly gravelly, SILT/CLAY
TP3/45	AA43055	2.5	A16/1950	В	9.1								Light brown/grey slightly sa	ndy, slightly gravelly, SILT/CLAY
Notes:	Preparation:	WS - Wet sie	ved		Sample Type:	B - bulk distur	rbed	Remarks:					1	
	·	AR - As recei	ved			U - Undisturb	ed							
		NP - Non plas	stic					NOTE: *Clau	ise 3.2 of BS	1377 is a "wit	hdrawn" stan	dard due to p	ublication of I	SO17892-1:2014
	Liquid Limit	4.3 Cone Per	netrometer defin	itive method	1			Opinions and	Opinions and interpretations are outside the scope of accreditation.				n.	
	Clause:	4.4 Cone Per	netrometer one	point method	d Demons		· · · ·	The results relate to the specimens tested. Any remaining material w				ial will be reta	ined for one month.	
	M ht I 12	atoriale	Lahorato	rv	Persons autho	rized to approv	ve reports	Approved by Dat			Date	raye		
		alti 1813		ı y		H Byrne (La	aboratory l	Manager)		AB	que		17-06-16	1 of 1

IGSL Ltd Materials Laboratory Unit J5, M7 Business Park Newhall, Naas Co. Kildare 045 846176			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											ISO 17025 ACREDIED TESTING DETAILED IN SCOPE REG NO. 1331
	Report No. R72104			Contract	No.	18963		Contract Name:		GCTP Ph	ase 3,Cont	ract 1		
	Customer	Galway Co	o.Co											
	Samples Re	eceived:	12-05-16	5-16 Date Tested: 27-05-16										
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
TP3/45	AA43056	2.5	A16/1951	В	12	20	10	10	62	WS	4.4	CL	Light brown/grey slightly sa	andy, slightly gravelly, CLAY
Notes:	Preparation: WS - Wet sieved				Sample Type: B - bulk disturbed			Remarks:						
	NP - Non plastic					0 - Ondistand	cu	NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of					SO17892-1:2014	
	Liquid Limit 4.3 Cone Penetrometer definitive metho				Ł			Opinions and interpretations are outside the scope of accreditation.					-	
	Clause:	4.4 Cone Per	netrometer one point method					The results relate to the specimens tested. Any remaining material will				rial will be reta	ined for one month.	
IGSL Ltd Materials Laboratory				m (Persons authorized to approve reports					Approved by Date			Page	
		atenals	Laborato	тy		H Byrne (L	aboratory	Manager)		A Byene			17-06-16	1 of 1






























IGSL Ltd Materials Laboratory Unit J5,M7 Business Park Naas

Co. Kildare

045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content



Tested in accordance with BS1377:Part 4:1990, clause 5.4

Report No.	R72383							
Contract No.	18963							
Contract Name:	N6 Galway							
Customer:	Galway Co.Co.							
BH/TP	TP3/42							
Sample No.	AA43059							
Depth (m)	0.40							
Sample Type:	В							
Lab Sample No.	A16/1934							
Source (if applicable)	unknown							
Material Type (if applicable):	В							
Sample Received:	12-05-16							
Date Tested:	30-05-16							
Sample Cert:	N/A							
Moisture Content (%):	22							
% Particles > 20mm (By dry mass):	1.2							
MCV:	7.4							
Interpretation of Plot:	Steepest Straight Line							
Description of Soil:	Dark brown sandy gravelly SILT/CLAY							
The result relates to the specimen tested. Any remaining material will be retained for one month. Sampling and opinions and interpretations are outside the scope of	Pe	rsons auth J Ba H Byrr	norized to a rrett (Quali ne (Laborat	approve reports ty Manager) ory Manager)				
	Approved by		Date	Page				
IGSL Ltd Materials Laboratory	A Byone		02-06-16	1 of 1				















Contract Number: 31135

Client's Reference: 18963 PO: 8952

Laboratory Report

Report Date: 06-06-2016

Client Irish Geotechnical Services Limited M7 Business Park Naas Co. Kildare Ireland

Contract Title: **G.C.T.P** For the attention of: **Hugh Byrne**

Date Received: 01-06-2016 Date Commenced: 01-06-2016 Date Completed: 06-06-2016

Test Description

Immediate Shear Strength - set of 3 60 x 60 mm Shear Box Specimens by Direct Shearing (note suitable for free draining material only) Non Accredited Test - @ Non Accredited Test

Disposal of Samples on Project

Notes: Observations and Interpretations are outside the UKAS Accreditation

- * denotes test included in laboratory scope of accreditation
- # denotes test carried out by approved contractor
- @ denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager) Jon Tatam (Administrative/Quality Assistant) - Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director) Qty

1

Test Report: Quick Shearbox Test BS1377:Part 7:4.5 :1990.

pre i futtibel i		TP3/42 A16/1938	Depth (m) from: Depth (m) to:		2.50 2.50		
Sample Type:	-	D					
Particle Density - Mg/m3 Specimen Tested	3:	Submerged Rem	2.65 (Assur	ned))0mm remove	'nd		
opeennen resteur		Submerged, Ren					
Sample Description:							
Grey brown slightly s	lity slightly clayey GRA	VEL (fine-coarse/ang	jular-subangular) 1		2		3
Initial Conditions					-		5
Height - mm:			24	1.50	24.50		24.50
Length - mm:			59	9.90	59.90		59.90
Moisture Content - %: Bulk Density - Ma/m3:				9 2.21	2 21		2 21
Drv Density - Mg/m3:				2.21	2.02		2.21
Voids Ratio:			0.3	136	0.3123		0.3098
Normal Pressure- kPa				20	40		60
Consolidation							
Consolidated Height - m	m:		24	1.49	24.42		24.35
Bate of Strain (mm/min)		1	250	1 250		1 250
Strain at peak shear stre	ess (mm)		1().57	10.26	1	9.94
Peak shear Stress - kPa:	()			22	41		59
PEAK	(0)						
Angle of Shearing Resist	tance:(0)						43.0
						•	
60 - 40 - 20 -	•				•		
	20	Norma	40 al Stress -(kPa).	Best Fit Lir	60 ee		80



1 of 1

Contract No.: **31135**

Appendix 14

Soil Chemical Test Records

Lab Test Schedule No.	Jones Report Reference
1*	16/4934
2	16/5504
5**	16/9137
7	16/8318
9	16/10473
10	16/9709

*Sample result from TP3/20 contained in Jones Report 16/12147 featured in Appendix 15

**Sample result from BH3/03 contained in Jones Report 16/12147 featured in Appendix 15



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	25th February, 2016
Your reference :	18963
Our reference :	Test Report 16/4934 Batch 1
Location :	GCTP Phane 3 Contract 1 GI
Date samples received :	15th February, 2016
Status :	Final report
Issue :	1

Thirty four samples were received for analysis on 15th February, 2016 of which thirty four were scheduled for analysis. 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 lun

Bruce Leslie Project Co-ordinator

Client Name:					
Reference:					
Location:					
Contact:					
JE Job No.:					

18963 GCTP Phane 3 Contract 1 GI Darren Keogh 16/4934

IGSL

Report : Solid

											-		
J E Sample No.	1	2	3	4-5	6	7	8	9	10	11			
Sample ID	TP3/01	TP3/03	TP3/03	TP3/03	TP3/05	TP3/05	TP3/06	TP3/06	TP3/07	TP3/08			
Depth	GL-0.40	0.50	1.00	1.60	0.50	1.00	0.50	1.10	0.20-0.50	0.50	Please se	e attached n	otes for all
COC No / misc											abbrevi	ations and ad	cronyms
Containers	J	J	J	J	J	J	J	J	J	J			
Sample Date	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016			
Sample Type	Soil												
Batch Number	1	1	1	1	1	1	1	1	1	1			Method
Date of Receipt	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	LOD/LOR	Units	No.
Chloride #	-	-	47	-	-	-	-	-	-	42	<2	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) [#]	-	0.0357	-	0.0341	-	0.0154	-	0.0362	0.0127	0.0072	<0.0015	g/l	TM38/PM20
Organic Matter	17.9	-	8.4	1.8	60.9	-	72.7	-	3.4	1.1	<0.2	%	TM21/PM24
Loss on Ignition #	37.3	-	15.4	4.9	74.5	-	83.4	-	-	-	<1.0	%	TM22/PM0
pH [#]	6.55	6.18	-	6.64	-	6.72	6.23	6.40	5.28	7.54	<0.01	pH units	TM73/PM11

Client Name:					
Reference:					
Location:					
Contact:					
JE Job No.:					

GCTP Phane 3 Contract 1 GI Darren Keogh 16/4934

IGSL

18963

Report : Solid

	10	10		15	10	47	10	10					
J E Sample No.	12	13	14	15	16	17	18	19	20	21			
Sample ID	TP3/08	TP3/12	TP3/13	TP3/14	TP3/15	TP3/16	TP3/18	TP3/19	TP3/20	TP3/20			
Depth	1.20	0.60-0.80	0.50	0.20-0.40	0.10-0.40	0.20-0.50	0.15-0.50	0.50	0.15-0.40	1.00-1.30	Please se abbrevi	e attached n ations and a	otes for all cronyms
COC NO / IIISC													
Containers	J	J	J	J	J	J	J	J	J	J			
Sample Date	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016			
Sample Type	Soil												
Batch Number	1	1	1	1	1	1	1	1	1	1			Method
Date of Receipt	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	LOD/LOR	Units	No.
Chloride [#]	-	-	-	-	-	51	-	-	-	52	<2	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)#	0.0437	<0.0015	0.0103	<0.0015	0.0181	<0.0015	-	<0.0015	-	0.4069	<0.0015	g/l	TM38/PM20
Organic Matter	1.1	22.2	1.2	4.6	24.2	1.6	9.8	-	42.7	1.0	<0.2	%	TM21/PM24
Loss on Ignition #	-	26.6	-	-	-	-	20.6	-	78.0	-	<1.0	%	TM22/PM0
pH ⁻	7.76	5.56	7.46	4.70	5.96	5.67	7.23	6.35	6.56	7.07	<0.01	pH units	TM73/PM11

Client Name:					
Reference:					
Location:					
Contact:					
JE Job No.:					

GCTP Phane 3 Contract 1 GI Darren Keogh 16/4934

IGSL

18963

Report : Solid

J E Sample No.	22	23	24	25	26	27	28	29	30	31			
Sample ID	TP3/21	TP3/23	TP3/23	TP3/23	TP3/25	TP3/25	TP3/27	TP3/27	TP3/28	TP3/29			
Depth	0.15-0.40	0.50	1.10	2.00	0.15-0.40	2.00	0.50	2.00	0.50	0.50	Please se abbrevi	e attached n	otes for all
COC No / misc													,
Containers	J	J	J	J	J	J	J	J	J	J			
Sample Date	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016	11/02/2016			
Sample Type	Soil												
Batch Number	1	1	1	1	1	1	1	1	1	1		Unite	Method
Date of Receipt	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	15/02/2016	LOD/LOIX	Onits	No.
Chloride [#]	30	-	-	-	-	38	29	35	25	-	<2	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) [#]	<0.0015	<0.0015	0.0051	0.0056	<0.0015	0.0037	0.0057	0.0047	0.0061	-	<0.0015	g/l	TM38/PM20
Organic Matter	-	0.3	<0.2	0.2	2.6	0.3	1.4	0.2	0.3	67.1	<0.2	%	TM21/PM24
Loss on Ignition #	-	-	-	-	-	-	-	-	-	70.9	<1.0	%	TM22/PM0
рН *	6.38	7.30	8.73	8.70	8.09	8.75	8.39	8.78	8.63	5.99	<0.01	pH units	TM73/PM11

J E Sampio No. 22 23 34 35 1 1 1 1 1 Bangio D THU THU <th>Client Name: Reference: Location: Contact: JE Job No.:</th> <th>IGSL 18963 GCTP Ph Darren Ke 16/4934</th> <th>ane 3 Con eogh</th> <th>tract 1 GI</th> <th></th> <th></th> <th>Report : Solids: V=</th> <th>Solid 60g VOC ja</th> <th>r, J=250g gl</th> <th>lass jar, T=p</th> <th colspan="6">=plastic tub</th>	Client Name: Reference: Location: Contact: JE Job No.:	IGSL 18963 GCTP Ph Darren Ke 16/4934	ane 3 Con eogh	tract 1 GI			Report : Solids: V=	Solid 60g VOC ja	r, J=250g gl	lass jar, T=p	=plastic tub					
Sample D Total	J E Sample No.	32	33	34	35						1					
Image: sector of the sector	Sample ID	TP3/29	TP3/34	TP3/35	TP3/17											
COC No finite Container J <thj< th=""> J J J</thj<>	Depth	1.60-1.80	0.50	0.50	0.50						Plaasa sa	o attached n	otos for all			
Containe J <thj< th=""> J J J <t< th=""><th>COC No / misc</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>abbrevi</th><th>ations and a</th><th>cronyms</th></t<></thj<>	COC No / misc										abbrevi	ations and a	cronyms			
Same base 1100201 1100201 1100201 1100201 100201 100201 100201 100201 100201 100201 100000 100000 100000 100000 1000000 1000000 1000000 1000000 1000000 1000000 1000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 10000000 100000000 100000000 100000000 100000000 1000000000000 1000000000000000000000000000000000000	Containers	L	J	L	L											
Assemble Type Bath Number 1 <	Sample Date	11/02/2016	11/02/2016	11/02/2016	11/02/2016											
Data of the origination of the ori	Sample Type	Soil	Soil	Soil	Soil											
balan mode balan m	Batah Numbar	1	1	1	1											
Choose 0.3 0.3 0.4 0.0174 <t< th=""><th>Date of Receipt</th><th>15/02/2016</th><th>15/02/2016</th><th>15/02/2016</th><th>15/02/2016</th><th></th><th></th><th></th><th></th><th></th><th>LOD/LOR</th><th>Units</th><th>Method No.</th></t<>	Date of Receipt	15/02/2016	15/02/2016	15/02/2016	15/02/2016						LOD/LOR	Units	Method No.			
Supplie on SO-42:1E-01* 0.0197 0.1	Chloride [#]	53	-	-	-						<2	mg/kg	TM38/PM20			
Organe Matter 2.3 7.15 8.73 1.18 1 <	Sulphate as SO4 (2:1 Ext) [#]	0.0197	-	-	0.0174						<0.0015	g/l	TM38/PM20			
Loas on lynkov ⁴ . 71.0 04.1 . <	Organic Matter	2.3	71.5	87.3	1.8						<0.2	%	TM21/PM24			
ph* 7.80 6.05 5.79 5.15 NOI PH unit TM/3PMU1 I	Loss on Ignition #	-	71.1	84.1	-						<1.0	%	TM22/PM0			
Image: Market in the sector of the sector	рН#	7.60	6.05	5.79	5.15						<0.01	pH units	TM73/PM11			
Image: Sector of the sector																
Image: sector of the sector																
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Client Name:IGSLReference:18963Location:GCTP Phane 3 Contract 1 GIContact:Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason							
	No deviating sample report results for job 16/4934												

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/4934

SOILS

Please note we are only MCERTS accredited (UK soils only) 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 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 $35^{\circ}C \pm 5^{\circ}C$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}C \pm 5^{\circ}C$.

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

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/4934

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	Yes		AD	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AD	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Method Code Appendix



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	8th March, 2016
Your reference :	N6 Galway
Our reference :	Test Report 16/5504 Batch 1
Location :	
Date samples received :	26th February, 2016
Status :	Final report
Issue :	1

Three samples were received for analysis on 26th February, 2016 of which three were scheduled for analysis. 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:

Phil Sommerton BSc Project Manager

Client Name: Reference:	IGSL N6 Galwa	у			Report :	Solid					
Location: Contact: JE Job No.:	Darren Ke 16/5504	eogh			Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
J E Sample No.	1-2	3-4	5-6								
Sample ID	TP3/04	TP3/09	TP3/32								
Depth	0.50	0.50	0.40						Please se	e attached n	otes for all
COC No / misc									abbrevi	ations and ad	cronyms
Containers	J	J	J								
Sample Date	25/02/2016	25/02/2016	25/02/2016								
Sample Type	Soil	Soil	Soil								
Batch Number	1	1	1								Method
Date of Receipt	26/02/2016	26/02/2016	26/02/2016						LOD/LOR	Units	No.
Organic Matter	70.8	30.6	4.9						<0.2	%	TM21/PM24
Loss on Ignition [#]	79.1	45.2	5.2						<1.0	%	TM22/PM0
рн	5.50	5.04	0.10						<0.01	pri units	1101/3/P10111

Client Name: IGSL

Reference: N6 Galway

Location:

Contact: Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
			•	•	No deviating sample report results for job 16/5504	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

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NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/5504

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

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Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

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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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

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ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/5504

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	Yes		AD	Yes
ТМ73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Method Code Appendix



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	20th July, 2016
Your reference :	18963
Our reference :	Test Report 16/9137
Location :	GCTP Phase 3
Date samples received :	19th May, 2016
Status :	Final report
Issue :	2

Two samples were received for analysis on 19th May, 2016 of which two were scheduled for analysis. 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:

h lun

Bruce Leslie Project Co-ordinator

Client Name:
Reference:
Location:
Contact:
JE Job No.:

18963 GCTP Phase 3 Darren Keogh 16/9137

IGSL

Report : Solid

J E Sample No.	1	2							
Sample ID	BH321	BH321							
Depth	0.5	17							
COC No / misc							Please se abbrevi	e attached n ations and a	otes for all cronyms
Containers	J	J							
Sample Date	16/05/2016	16/05/2016							
Sample Date	5 cil	5 cil							
Sample Type	301	301							
Batch Number	1	1					LOD/LOR	Units	Method No.
Date of Receipt	19/05/2016	19/05/2016					-0.0	97	TM04/DM04
	<0.2	0.5					<0.2	70	110121/1210124
рН#	8.78	8.56					<0.01	pH units	TM73/PM11

Client Name:IGSLReference:18963Location:GCTP Phase 3Contact:Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
					No deviating sample report results for job 16/9137	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

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NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/9137

SOILS

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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.

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

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

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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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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

#	ISO17025 (UKAS) accredited - UK
B	Indicates analyte found in associated method blank
DR	Dilution required
M	MCERTS accredited
NA	Not applicable
	No Ashestos Detected
	None Detected (usually refers to VOC and/SVOC TICs)
	No Determination Rescible
	Calibrated against a single substance
50	Surrogate recovery outside performance citteria. This may be due to a matrix effect.
VV	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.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/9137

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
ТМ73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Method Code Appendix



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	10th May, 2016
Your reference :	18963
Our reference :	Test Report 16/8318 Batch 1
Location :	GCTP
Date samples received :	29th April, 2016
Status :	Final report
Issue :	1

Two samples were received for analysis on 29th April, 2016 of which two were scheduled for analysis. 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:

Phil Sommerton BSc Project Manager

IGSL

18963 GCTP

Darren Keogh

Client Name:
Reference:
Location:
Contact:
JE Job No.:

Report : Solid

JE Job No.:	16/8318						_		
J E Sample No.	1	2							
Sample ID	BH3131	BH3152							
Depth	0.50	0.50					Please se	e attached n	otes for all
COC No / misc							abbrevia	ations and ac	ronyms
Containers	J	J					1		
Sample Date	26/04/2016	26/04/2016					1		
Sample Type	Soil	Soil					1		
Batch Number	1	1							Mothod
Date of Receipt	29/04/2016	29/04/2016					LOD/LOR	Units	No.
Organic Matter	0.7	<0.2					<0.2	%	TM21/PM24
рН [#]	7.97	8.49					<0.01	pH units	TM73/PM11
									!

Client Name:IGSLReference:18963

Location: GCTP

Contact: Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason				
	No deviating sample report results for job 16/8318									

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

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NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/8318

SOILS

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A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/8318

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Method Code Appendix



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Darren Keogh
30th June, 2016
18963
Test Report 16/10473 Batch 1
20th June, 2016
Final report
1

Seven samples were received for analysis on 20th June, 2016 of which seven were scheduled for analysis. 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

Client Name: Reference:	IGSL 18963						Report :	Solid					
Location: Contact: JE Job No.:	Darren Ke 16/10473	eogh					Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
	1	2	2	4	5	C	7						
J E Sample No. Sample ID	1 WS3/01	2 WS3/02	3 WS3/02	4 WS3/02	5 WS3/03	б WS3/04	7 WS3/04						
Depth	0.40	0.80	1.20	2.30	0.60	0.40	1.00				Please se	e attached n	otes for all
COC No / misc											abbrevi	ations and ad	cronyms
Containers	т	т	т	т	т	т	т						
Sample Date	<>	<>	<>	<>	<>	<>	<>						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						N (a the a st
Date of Receipt	20/06/2016	20/06/2016	20/06/2016	20/06/2016	20/06/2016	20/06/2016	20/06/2016				LOD/LOR	Units	No.
Organic Matter	0.8	34.0	0.8	0.3	35.1	40.2	11.5				<0.2	%	TM21/PM24
оЧ.#	_	7 28	8.54	_	_	_	_				<0.01	nH unite	TM73/PM11
рп	-	1.20	0.04	-	-	-	-				<0.01	pri units	1107 3/1 1011

Client Name: IGSL

Reference: 18963

Location:

Contact: Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
16/10473	1	WS3/02	0.80	2	All analyses	No sampling date given
16/10473	1	WS3/02	1.20	3	All analyses	No sampling date given

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

Matrix : Solid

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/10473

SOILS

Please note we are only MCERTS accredited (UK soils only) 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 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 $35^{\circ}C \pm 5^{\circ}C$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}C \pm 5^{\circ}C$.

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

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/10473

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Method Code Appendix



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	14th June, 2016
Your reference :	18963
Our reference :	Test Report 16/9709 Batch 1
Location :	GCTP Phase 3
Date samples received :	1st June, 2016
Status :	Final report
Issue :	1

Two samples were received for analysis on 1st June, 2016 of which two were scheduled for analysis. 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:

Phil Sommerton BSc Project Manager

Client Name:	IGSL
Reference:	18963
Location:	GCTP Phase 3
Contact:	Darren Keogh
JE Job No.:	16/9709

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2							
Sample ID	A16/1940/TP2/ 44	A16/1946/TP3/ 45							
Depth	1.0	1.5					Please se	e attached n	otes for all
COC No / misc							abbrevi	ations and ad	pronyms
Containers	J	J							
Sample Date	27/05/2016	27/05/2016							
Sample Type	Soil	Soil							
Batch Number	1	1						Units	Method
Date of Receipt	01/06/2016	01/06/2016					LOBILON	onito	No.
Organic Matter	0.3	0.3					<0.2	%	TM21/PM24
[#] На	8.72	8.35					<0.01	pH units	TM73/PM11
F	-								i

Client Name:IGSLReference:18963Location:GCTP Phase 3Contact:Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
					No deviating sample report results for job 16/9709	
						,

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/9709

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NOTE

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ND	None Detected (usually refers to VOC and/SVOC TICs).
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SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
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СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/9709

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No

Method Code Appendix

Appendix 15

Soil Environmental Test Records

Lab Test Schedule No.	Jones Report Reference
1	16/12147
6	16/6459



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	4th August, 2016
Your reference :	
Our reference :	Test Report 16/12147 Batch 7
Location :	
Date samples received :	26th July, 2016
Status :	Final report
Issue :	2

Two samples were received for analysis on 26th July, 2016 of which two were scheduled for analysis. 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 lun

Bruce Leslie Project Co-ordinator

Client Name: Reference:	IGSL	
Location: Contact: JE Job No.:	Darren Ke 16/12147	eogh
J E Sample No.	1-2	3

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3											
Sample ID	TP3/20	BH3/03											
Depth	1.0	0.5									Please se	e attached n	otes for all
COC No / misc											abbrevi	ations and a	cronyms
Containers	VJ	J									1		
Sample Date	25/07/2016	25/07/2016											
Oample Date	23/07/2010	23/07/2010											
Sample Type	501	Soli									 		
Batch Number	1	1									LOD/LOR	Units	Method
Date of Receipt	26/07/2016	26/07/2016											140.
Antimony	<1	-									<1	mg/kg	TM30/PM15
Arsenic"	3.1	-									<0.5	mg/kg	TM30/PM15
Barium"	59	-									<1	mg/kg	TM30/PM15
Cadmium	24.1	-									<0.1	mg/kg	TM20/PM15
Copper [#]	11	-									<1	mg/kg	TM30/PM15
Lead#	33	-									<5	mg/kg	TM30/PM15
Mercurv [#]	<0.1	-									<0.1	ma/ka	TM30/PM15
Molvbdenum [#]	1.2	-									<0.1	mg/kg	TM30/PM15
Nickel [#]	20.7	-									<0.7	mg/kg	TM30/PM15
Selenium [#]	1	-									<1	mg/kg	TM30/PM15
Zinc [#]	67	-									<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene [#]	0.07	-									<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-									<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	-									<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04	-									<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.09	-									<0.03	mg/kg	TM4/PM8
Anthracene [#]	0.04	-									<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	0.12	-									<0.03	mg/kg	TM4/PM8
Pyrene*	0.11	-									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene *	0.12	-									< 0.06	mg/kg	TM4/PM8
Chrysene "	0.10	-									<0.02	mg/kg	
Benzo(bk)fluoranthene	0.18	-									< 0.07	mg/kg	
Benzo(a)pyrene	0.09	-									<0.04	mg/kg	
Dibenzo(ab)anthracene #	<0.03	-									<0.04	mg/kg	TM4/PM8
Benzo(ahi)pervlene [#]	0.07	-									<0.04	mg/kg	TM4/PM8
Coronene	< 0.04	-									< 0.04	ma/ka	TM4/PM8
PAH 17 Total	1.08	-									<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.13	-									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.05	-									<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	115	-									<0	%	TM4/PM8
EPH (C8-C40) [#]	222	-									<30	mg/kg	TM5/PM8
C8-C40 Mineral Oil (Calculation)	39	-									<30	mg/kg	TM5/PM8
GRO (>C4-C8)#	<100	-									<100	ug/kg	TM36/PM12
GRO (>C8-C12)#	<100	-									<100	ug/kg	TM36/PM12
GRO (>C4-12)*	<100	-									<100	ug/kg	FM36/PM12
MTBE"	<5	-									<5	ug/kg	1M31/PM12
Benzene"	<5	-									<5	ug/kg	TM31/PM12
roluene	<2	1 -	i i	1	1	1	1	i i	i i	1	<0	ug/Kg	111/131/11/12

Client Name:	IGSL				Report :	Solid					
Location: Contact:	Darren Ke	eogh			Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
JE Job No.:	16/12147										
J E Sample No.	1-2	3									
Sample ID	TP3/20	BH3/03									
Depth	1.0	0.5							Disses		-4 611
COC No / misc									abbrevi	ations and a	cronyms
Containan											
Containers	V J	J									
Sample Date	25/07/2016	25/07/2016									
Sample Type	Soil	Soil									
Batch Number	1	1								Units	Method
Date of Receipt	26/07/2016	26/07/2016							LOBILOI	onito	No.
Ethylbenzene [#]	<5	-							<5	ug/kg	TM31/PM12
m/p-Xylene [#]	<5	-							<5	ug/kg	TM31/PM12
o-Xylene [#]	<5	-							<5	ug/kg	TM31/PM12
										-	
PCB 28 *	<5	-							<5	ug/kg	TM17/PM8
PCB 52*	<5	-							<5	ug/kg	TM17/PM8
PCB 101"	<5	-							<5	ug/kg	
PCB 138 [#]	<5	-							<5	ug/kg	TM17/PM8
PCB 153 [#]	<5	-							<5	ug/kg	TM17/PM8
PCB 180 [#]	<5	-							<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	-							<35	ug/kg	TM17/PM8
Natural Moisture Content	10.2	412.7							<0.1	%	PM4/PM0
% Dry Matter 105°C	77.8	-							<0.1	%	NONE/PM4
Sulphate as SO4 (2:1 Ext)	-	0.2302							<0.0015	g/l	TM38/PM60
Total Organic Carbon #	0.64	-							<0.02	%	TM21/PM24
Organic Matter	-	79.8							<0.2	%	TM21/PM24
Loss on Ignition #	2.1	92.7							<1.0	%	TM22/PM0
pH [#]	-	4.53							<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1156	-								kg	NONE/PM17
Mass of dried test portion	0.09	-								kg	NONE/PM17

Client Name:
Reference:
Location:
Contact:

Darren Keogh

IGSL

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

JE Job No.:	16/12147								
J E Sample No.	1-2								
							i		
Sample ID	TP3/20								
Depth	1.0						Please se	e attached n	otes for all
COC No / misc							abbrevi		Jonyma
Containers	νJ								
Sample Date	25/07/2016								
Sample Type	Soil								
Batch Number	1								
Data of Boosint	20/07/2040						LOD/LOR	Units	Method No.
Date of Receipt	20/07/2010	1	1						Th 400 /Dh 44 7
Dissolved Antimony (A10)"	<0.02						<0.02	mg/kg	TM30/PM17
Dissolved Arsenic (A10)*	<0.025						<0.025	mg/kg	TM30/PM17
Dissolved Barium (A10)"	0.22						< 0.03	mg/kg	TM30/PM17
Dissolved Cadmium (A10)*	<0.005						<0.005	mg/kg	TM30/PM17
Dissolved Chromium (A10)*	0.021						<0.015	mg/kg	TM30/PM17
Dissolved Copper (A10) #	<0.07						<0.07	mg/kg	TM30/PM17
Dissolved Lead (A10) [#]	<0.05						<0.05	mg/kg	TM30/PM17
Dissolved Mercury (A10) [#]	<0.01						<0.01	mg/kg	TM30/PM17
Dissolved Molybdenum (A10) [#]	0.08						<0.02	mg/kg	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02						<0.02	mg/kg	TM30/PM17
Dissolved Selenium (A10) [#]	<0.03						<0.03	mg/kg	TM30/PM17
Dissolved Zinc (A10) [#]	0.05						<0.03	mg/kg	TM30/PM17
Resorcinol	<0.1						<0.1	mg/kg	TM26/PM0
Catechol	<0.1						<0.1	mg/kg	TM26/PM0
Phenol	<0.1						<0.1	mg/kg	TM26/PM0
m/p-cresol	<0.2						<0.2	mg/kg	TM26/PM0
o-cresol	<0.1						<0.1	mg/kg	TM26/PM0
Total cresols	<0.3						<0.3	mg/kg	TM26/PM0
Xylenols	<0.6						<0.6	mg/kg	TM26/PM0
1-naphthol	<0.1						<0.1	mg/kg	TM26/PM0
2,3,5-trimethyl phenol	<0.1						<0.1	mg/kg	TM26/PM0
2-isopropylphenol	<0.1						<0.1	mg/kg	TM26/PM0
Total Speciated Phenols HPLC	<1						<1	mg/kg	TM26/PM0
Fluoride	<3						<3	mg/kg	TM27/PM0
Sulphate #	2394.3						<0.5	mg/kg	TM38/PM0
Chloride [#]	9						<3	mg/kg	TM38/PM0
Mass of raw test portion	0.1156							kg	NONE/PM17
Leachant Volume	0.874							I.	NONE/PM17
Eluate Volume	0.8							I.	NONE/PM17
Dissolved Organic Carbon	60						<20	mg/kg	TM60/PM0
Total Dissolved Solids #	4458						<350	mg/kg	TM20/PM0

EPH	Interr	oretatio	on R	eport
		/ otatic		oport

Matrix : Solid

Client Name:	IGSL
--------------	------

Reference:

Location:

r

Contact:

Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	EPH Interpretation
16/12147	1	TP3/20	1.0	1-2	Possible tarmac/bitumen & Possible naturally occurring compounds

Client Name: IGSL

Reference:

Location:

Contact: Darren Keogh

Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
1	TP3/20	1.0	1-2	GRO	Solid Samples were received at a temperature above 9°C.
	Batch	Batch Sample ID I TP3/20 I TP3/20 I TP3/20 I TP3/20 I TP3/20	Batch Sample ID Depth 1 TP3/20 1.0 1 TP3	BatchSample IDDepthJ E Sample No.1TP3/201.01-21TP3/201.01-211 <td< td=""><td>Batch Sample ID Depth JE Sample No. Analysis 1 TP3/20 1.0 1-2 GRO 1 TP3/20 1.0 1-2 International State Sta</td></td<>	Batch Sample ID Depth JE Sample No. Analysis 1 TP3/20 1.0 1-2 GRO 1 TP3/20 1.0 1-2 International State Sta

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

Matrix : Solid

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/12147

SOILS

Please note we are only MCERTS accredited (UK soils only) 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 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 $35^{\circ}C \pm 5^{\circ}C$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}C \pm 5^{\circ}C$.

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

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range

Method Code Appendix

JE Job No: 16/12147

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Gravimetric determination of Total Dissolved Solids/Total Solids based on BS 1377- 3:1990 and BSEN 15126	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

Method Code Appendix

JE Job No: 16/12147

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM27	Modified US EPA method 9056.Determination of water soluble anions using Dionex (Ion- Chromatography).	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7 and 6010B	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7 and 6010B	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7 and 6010B	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM0	No preparation is required.	Yes		AR	Yes

JE Job No: 16/12147

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	PM0	No preparation is required.			AR	Yes
ТМ73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	



IGSL Unit F

Naas Co Kildare Ireland

M7 Business Park

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. U

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

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



Attention :	Darren Keogh
Date :	4th April, 2016
Your reference :	N6 Galway
Our reference :	Test Report 16/6459 Batch 1
Location :	
Date samples received :	17th March, 2016
Status :	Final report
Issue :	1

Two samples were received for analysis on 17th March, 2016 of which two were scheduled for analysis. 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.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Phil Sommerton BSc Project Manager

Client Name:			
Reference:			
Location:			
Contact:			
JE Job No.:			

Darren Keogh

16/6459

IGSL

N6 Galway

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1							
Sample ID	BH 3/30							
Depth	0.50					Please se	e attached n	otes for all
COC No / misc						abbrevi	ations and a	cronyms
Containore	т							
Containers	1							
Sample Date	01/03/2016							
Sample Type	Soil							
Batch Number	1							
Defendencies	47/00/0040					LOD/LOR	Units	Nethod No.
Date of Receipt	17/03/2016			 				
Antimony	<1					<1	mg/kg	TM30/PM15
Arsenic [#]	2.8					<0.5	mg/kg	TM30/PM15
Barium"	87					<1	mg/kg	TM30/PM15
Cadmium *	0.5					<0.1	mg/kg	TM30/PM15
Chromium *	31.1		 			 <0.5	mg/kg	TM30/PM15
Copper*	22		 			 <1	mg/kg	TM30/PM15
Lead *	42					<5	mg/kg	TM30/PM15
Mercury*	<0.1					<0.1	mg/kg	TM30/PM15
Molybdenum [#]	1.6					<0.1	mg/kg	TM30/PM15
Nickel [#]	13.2					<0.7	mg/kg	TM30/PM15
Selenium [#]	1					<1	mg/kg	TM30/PM15
Zinc [#]	94		 			<5	mg/kg	TM30/PM15
PAH MS								
Naphthalene [#]	<0.04					<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03					<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	 	 			 <0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	 	 			 <0.04	mg/kg	TM4/PM8
Phenanthrene [#]	<0.03		 			 <0.03	mg/kg	TM4/PM8
Anthracene [#]	<0.04		 			<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	0.04		 			<0.03	mg/kg	TM4/PM8
Pyrene#	0.04		 			<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	<0.06		 			 <0.06	mg/kg	TM4/PM8
Chrysene [#]	0.04					<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene *	<0.07		 			<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04		 			 <0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene#	<0.04		 			 <0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	<0.04					<0.04	mg/kg	TM4/PM8
Coronene	<0.04					<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64					<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05					<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02					<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	110		 			 <0	%	TM4/PM8
EPH (C8-C40) [#]	293					<30	mg/kg	TM5/PM8
C8-C40 Mineral Oil (Calculation)	59					<30	mg/kg	TM5/PM8
GRO (>C4-C8) [#]	<100					<100	ug/kg	TM36/PM12
GRO (>C8-C12) [#]	<100					<100	ug/kg	TM36/PM12
GRO (>C4-12)#	<100					<100	ug/kg	TM36/PM12
MTBE [#]	<5					<5	ug/kg	TM31/PM12
Benzene [#]	<5					<5	ug/kg	TM31/PM12
Toluene [#]	<5					<5	ug/kg	TM31/PM12

Client Name:	IGSL N6 Galway	,			Report :	Solid					
Location: Contact: JE Job No.:	Darren Kec 16/6459	ogh			Solids: V=	60g VOC ja	r, J=250g gl	ass jar, T=p	lastic tub		
I E Sample No	1										
J E Sample No.	1										
Sample ID	BH 3/30										
Denth	0.50										
Depti	0.50								Please se abbrevia	e attached no ations and ac	otes for all cronyms
COC No / misc											2
Containers	Т										
Sample Date	01/03/2016										
Sample Type	Soil										
Batch Number	1										
Batch Number	1								LOD/LOR	Units	Method No.
Date of Receipt	17/03/2016										
Ethylbenzene [#]	<5								<5	ug/kg	TM31/PM12
m/p-Xylene [#]	<5								<5	ug/kg	TM31/PM12
o-Xylene *	<5								<5	ug/kg	TM31/PM12
	-										
PCB 28"	<5								<5	ug/kg	TM17/PM8
PCB 52"	<5								<5	ug/kg	TM17/PM8
PCB 101"	<5								<5	ug/kg	
PCB 118	<5								<5	ug/kg	
PCB 153#	<5								<5	ug/kg	TM17/PM8
PCB 180 [#]	<5								<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35								<35	ua/ka	TM17/PM8
										5.5	
Natural Moisture Content	20.4								<0.1	%	PM4/PM0
% Dry Matter 105°C	83.4								<0.1	%	NONE/PM4
Chloride [#]	63								<2	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)#	1.3045								<0.0015	g/l	TM38/PM20
Total Organic Carbon [#]	1.04								<0.02	%	TM21/PM24
Loss on Ignition #	4.2								<1.0	%	TM22/PM0
рН [#]	7.99								<0.01	pH units	TM73/PM1
Mass of raw test portion	0.1077									kg	NONE/PM1
Mass of dried test portion	0.09									kg	NONE/PM1
	1					1					

Client Name:				
Reference:				
Location:				
Contact:				
JE Job No.:				

Darren Keogh

IGSL

N6 Galway

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

JE Job No.:	16/6459							
J E Sample No.	1					Í		
Sample ID	BH 3/30							
Depth	0.50					Please se	e attached n	otes for all
COC No / misc						abbrevi	ations and a	cronyms
Containers	т					1		
Sample Date	01/03/2016					1		
Sample Ture	Roil					1		
Sample Type	301					ļ,		1
Batch Number	1					LOD/LOR	Units	Method
Date of Receipt	17/03/2016							110.
Dissolved Antimony (A10) #	<0.02					<0.02	mg/kg	TM30/PM17
Dissolved Arsenic (A10)*	< 0.025					<0.025	mg/kg	TM30/PM17
Dissolved Barium (A10)*	0.12					<0.03	mg/kg	TM30/PM17
Dissolved Carmium (A10)	0.016					<0.005	ma/ka	TM30/PM17
Dissolved Copper (A10) #	< 0.07					<0.07	mg/kg	TM30/PM17
Dissolved Lead (A10) [#]	<0.05					<0.05	mg/kg	TM30/PM17
Dissolved Mercury (A10) [#]	<0.01					<0.01	mg/kg	TM30/PM17
Dissolved Molybdenum (A10) [#]	0.10					<0.02	mg/kg	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02					<0.02	mg/kg	TM30/PM17
Dissolved Selenium (A10) [#]	<0.03					<0.03	mg/kg	TM30/PM17
Dissolved Zinc (A10) [#]	0.06					<0.03	mg/kg	TM30/PM17
Pagarainal	-0.1					<0.1	malka	TM26/DM0
Catechol	<0.1					<0.1	ma/ka	TM26/PM0
Phenol	<0.1					<0.1	mg/kg	TM26/PM0
m/p-cresol	<0.2					<0.2	mg/kg	TM26/PM0
o-cresol	<0.1					<0.1	mg/kg	TM26/PM0
Total cresols	<0.3					<0.3	mg/kg	TM26/PM0
Xylenols	<0.6					<0.6	mg/kg	TM26/PM0
1-naphthol	<0.1					<0.1	mg/kg	TM26/PM0
2,3,5-trimethyl phenol	<0.1					<0.1	mg/kg	TM26/PM0
2-isopropyipnenoi	<0.1					<0.1	mg/kg	TM26/PM0
Total Specialed Filenois TIFEC							ilig/kg	
Fluoride	<3					<3	mg/kg	TM27/PM0
Sulphate [#]	1034.9					<0.5	mg/kg	TM38/PM0
Chloride *	8					<3	mg/kg	TM38/PM0
Mass of row tost portion	0 1077						ka	NONE/PM17
Leachant Volume	0.882						ky I	NONE/PM17
Eluate Volume	0.85						I.	NONE/PM17
Dissolved Organic Carbon	30					<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	2920					<100	mg/kg	TM20/PM0
								-
								-
								1
								1

Mass of sample taken (kg) 0.1077 Dry Matter Content Ratio (%) = 83.4 0.882 Mass of dry sample (kg) = Leachant Volume (I) 0.09 Particle Size <4mm = >95% Eluate Volume (I) 0.85 JEFL Job No 16/6459 Landfill Waste Acceptance **Criteria Limits** Sample No 1 BH 3/30 **Client Sample No** 0.50 Depth/Other Stable Sample Date 01/03/2016 Inert Hazardous Non-reactive Batch No 1 Solid Waste Analysis Total Organic Carbon (%) 1.04 5 6 3 Sum of BTEX (mg/kg) <0.025 6 --Sum of 7 PCBs (mg/kg) <0.035 1 --Mineral Oil (mg/kg) 59 500 --PAH Sum of 6 (mg/kg) _ _ --PAH Sum of 17 (mg/kg) < 0.64 100 --10:1 Limit values for compliance concn leaching test using leached Eluate Analysis BS EN 12457-2 at L/S 10 l/kg A10 mg/kg mg/kg <0.025 Arsenic 0.5 2 25 Barium 0.12 20 100 300 Cadmium <0.005 0.04 1 5 Chromium 0.016 0.5 10 70 Copper < 0.07 2 50 100 <0.01 0.01 0.2 2 Mercury 30 Molybdenum 0.10 0.5 10 Nickel < 0.02 0.4 10 40 50 < 0.05 10 Lead 0.5 < 0.02 0.06 0.7 5 Antimony Selenium < 0.03 0.1 0.5 7 Zinc 0.06 4 50 200 800 15000 25000 Chloride _ Fluoride 10 150 500 <3 Sulphate as SO4 1000 20000 50000 _ 100000 Total Dissolved Solids 2920 4000 60000 Phenol < 0.1 1 --

Jones Environmental Laboratory

QF-PM 3.1.18 v1

Dissolved Organic Carbon

30

500

800

1000

10:1 Result Report

Client Name:	IGSL
Reference:	N6 Galway
Location:	
Contact:	Darren Keogh

Matrix : Solid

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	EPH Interpretation
16/6459	1	BH 3/30	0.50	1	Possible tarmac/bitumen

Client Name:	IGSL
Reference:	N6 Galway
Location:	
Contact:	Darren Keogh

Note:

Analysis was carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Samples are retained for not less than 6 months from the date of analysis unless specifically requested. Opinions lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:

1 **[**[1]]

Ryan Butterworth Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
16/6459	1	BH 3/30	0.50	1	21/03/2016	General Description (Bulk Analysis)	soil-stones
					21/03/2016	Asbestos Fibres	NAD
					21/03/2016	Asbestos Fibres (2)	NAD
					21/03/2016	Asbestos ACM	NAD
					21/03/2016	Asbestos ACM (2)	NAD
					21/03/2016	Asbestos Type	NAD
					21/03/2016	Asbestos Type (2)	NAD
					21/03/2016	Asbestos Level Screen	NAD
16/6459	1	BH 3/30	1.00	2	21/03/2016	General Description (Bulk Analysis)	soil-stones
					21/03/2016	Asbestos Fibres	NAD
					21/03/2016	Asbestos Fibres (2)	NAD
					21/03/2016	Asbestos ACM	NAD
					21/03/2016	Asbestos ACM (2)	NAD
					21/03/2016	Asbestos Type	NAD
					21/03/2016	Asbestos Type (2)	NAD
					21/03/2016	Asbestos Level Screen	NAD

Client Name: IGSL

Reference: N6 Galway

Location:

Contact: Darren Keogh

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
16/6459	1	BH 3/30	0.50	1	Chloride, LOI, Sulphate, TOC	Sample holding time exceeded
16/6459	1	BH 3/30	0.50	1	EPH	Sample received in inappropriate container
16/6459	1	BH 3/30	0.50	1	EPH, GRO, PAH, PCB	Sample holding time exceeded prior to receipt
16/6459	1	BH 3/30	0.50	1	GRO	Solid Samples were received at a temperature above 9°C.

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

Matrix : Solid

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/6459

SOILS

Please note we are only MCERTS accredited (UK soils only) 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 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 $35^{\circ}C \pm 5^{\circ}C$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}C \pm 5^{\circ}C$.

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

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
OC	Outside Calibration Range
Jones Environmental Laboratory

JE Job No: 16/6459

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified USEPA 8163. Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes

Jones Environmental Laboratory

Method Code Appendix

JE Job No: 16/6459

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM27	Modified US EPA method 9056.Determination of water soluble anions using Dionex (Ion- Chromatography).	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AD	Yes
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	PM0	No preparation is required.			AR	Yes

Jones Environmental Laboratory

Method Code Appendix

JE Job No: 16/6459

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.			AR	
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

Appendix 16

Rock Test Records

POINT LOAD STRENGTH INDEX TEST DATA									ata
Contract: 189	963 - N6 Ga Project 6/5/16	lway City Transport	Sample Type: Core Contract no. 1896	3					IGSL
RC No.	Depth	D (Diameter)	P (failure load)	F	ls (index strength)	Is(50) (index strength)	*UCS	Turne	Orionation
DU2/02D	2.2	79	KIN 14.0	1 2 2 2	мра 2.20	Mpa	MPa	туре	Unenation
BH3/USK	2.3	70	7.0	1.222	2.30	2.01	20	d	
	4.2	70	16.0	1.222	2.27	2.80	20	d	
BH3/04K	1.5	70	30.0	1.103	5.27	7.12	1/2	d	
	4.0	70	28.0	1.103	5 71	6.65	142	d	
	1.0	70	20.0	1.105	0.22	0.03	133	d	
DH3/UUK	1.5	70	2.0	1.222	0.33	1.20	24	d	
	5.5	70	33.0	1.222	0.33 5 42	6.63	122	d	
DH3/0/K	4.4	70	30.0	1.222	J.42 4 92	6.02	133	d	
	3.7	70	25.0	1.222	4.55 5 10	5.02	110	d	
DH3/UOK	5.0	70	23.0	1.103	2.10	3.94	Q1	d	
	0.5	70	30.0	1.105	1 93	6.02	120	d	
DH3/TUK	1.5	70	30.0	1.222	7.55	0.02	120	d	
	3.9	70	40.0	1.222	1.30	1.61	22	d	
	4.5	70	41.0	1.222	6.74	9.22	165	d	
	115	70	21.0	1.222	2 4 5	0.23	84	d	
	125	70	21.0	1.222	3.43 2.47	4.22	04 60	u d	
	15.5	70	15.0	1.222	2.47	5.01	00 11C	u d	
DI 12 /11D	10.9	70	29.0	1.222	4.77	5.02	104	u d	
DH3/11K	3.2	70	26.0	1.222	4.27	2.21	64	u d	
DU2/12D	1.5	70	10.0	1.222	2.03	3.21	04	d	
	1.5	70	12.0	1.105	1.07	4.31	30	u d	
DH3/10K	5.7	70	12.0	1.222	1.97	2.41 E 02	40	u d	
DU12 /1 7D	4.7	70	25.0	1.222	4.11	5.02	100	u al	
DH3/1/K	0.0	70	20.0	1.222	5.29	4.02	00	u al	
	7.4	/ 0	7.0	1.222	1.15	I.41	20	CI AL	//
Number of Co	tatistical Sul	nmary Data	IS(50)	0051	^ULS NO	ormal Distribution Curve		AI :	breviations
Number of Sa	amples l'este	a	25	25	0.25				irregular
Minimum			0.40	0	0.2	\rightarrow		a	axiai
Average			4.40	88	0.2			a	DIOCK
Maximum			9.24	185	0.15			a	diametrai
Standard Dev	/. 		2.32	40					
Upper 95% C	onfidence Li	mit	8.94	1/8./3	0.1			approx	x. orientation to
Lower 95% C	onfidence Li	mit	-0.14	-2.79	0.05				planes of
					0.03			weak	kness/bedding
<u>comments:</u>				20	0 +	$+$ \rightarrow		U	unknown
TOUS taken as	sкх Point L	.oad IS(50): k=		20	0	100 200	300	Р //	perpendicular

			POINT LOAD S	FRENGTH I	NDEX TEST DATA				(sta)
Contract: 18 Date of test:	963 - N6 Ga Project : 6/5/16	lway City Transport	Sample Type: Core Contract no. 1896	; ;3					IGSL
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	ls (index strength) Mpa	ls(50) (index strength) Mpa	*UCS MPa	Type	Orienation
BH3/18R	5.7 7.5 10.4	78 78 78 78	14.0 31.0 32.0	1.222 1.222 1.222	2.30 5.10 5.26	2.81 6.22 6.42	56 124 128	d d d	// // //
	12.4 15.1 17.8 19.8	78 78 78 78	34.0 31.0 29.0 32.0	1.222 1.222 1.222 1.222	5.59 5.10 4.77 5.26	6.83 6.22 5.82 6.42	137 124 116 128	d d d	// // //
BH3/19R	21.6 2.7 4.9 10.5 12.0	78 78 78 70 70	30.0 44.0 37.0 22.0 13.0	1.222 1.222 1.222 1.163 1.163	4.93 7.23 6.08 4.49 2.65	6.02 8.83 7.43 5.22 3.09	120 177 149 104 62	d d d d	// // // //
BH3/20R	14.0 6.6 7.5 10.9 12.0	70 78 78 78 78 78	26.0 11.0 41.0 18.0 44.0	1.163 1.222 1.222 1.222 1.222	5.31 1.81 6.74 2.96 7.23	6.17 2.21 8.23 3.61 8.83	123 44 165 72 177	d d d d	
BH3/22R	14.7 3.2 6.5 10.2	78 78 78 78 78	31.0 29.0 30.0 6.0	1.222 1.222 1.222 1.222 1.222	5.10 4.77 4.93 0.99	6.22 5.82 6.02 1.20	124 116 120 24	d d d d	// // // //
BH3/23R	12.7 7.3 8.5	78 78 78	22.0 11.0 25.0	1.222 1.222 1.222	3.62 1.81 4.11	4.42 2.21 5.02	88 44 100	d d d	// // //
Number of S Minimum Average Maximum Standard Dev	<u>Statistical Sur</u> amples Teste	mmary Data ad	ls(50) 24 1.20 5.47 8.83 2.06	UCS* 24 24 109 177 41	*UCS No 0.25 0.2 0.15	ormal Distribution Curve		At i a b d	obreviations irregular axial block diametral
Standard Dev. 2.06 41 0.13 Upper 95% Confidence Limit 9.52 190.31 0.1 Lower 95% Confidence Limit 1.43 28.59 0.05 <u>Comments:</u> *UCS taken as k x Point Load Is(50): k= 20 0 100 200				300	approx weak U P //	c. orientation to planes of <u>ness/bedding</u> unknown perpendicular parallel			

			POINT LOAD S	TRENGTH I	NDEX TEST DATA				A
Contract: 18 Date of test:	963 - N6 Ga Project 6/5/16	lway City Transport	Sample Type: Core Contract no. 1896	9 63					IGSL
RC No.	Depth	D (Diameter)	P (failure load)	F	ls (index strength)	ls(50) (index strength)	*UCS	Turne	Orionation
DU2 (24D	111		KIN 1.0.0	1 2 2 2	мра	Mpa	MPa 70	туре	Urienation
BH3/24R	2.0	78	18.0	1.222	2.96	3.61	12	a	11
	6.5	70	31.0	1.163	6.33	7.36	147	a	11
BH3/25R	4.6	78	13.0	1.222	2.14	2.61	52	a	11
	5.6	78	29.0	1.222	4.//	5.82	116	d	11
DU 2 (2 CD	7.8	78	33.0	1.222	5.42	6.63	133	d	11
BH3/26R	2.3	78	31.0	1.222	5.10	6.22	124	d	//
BU 0 (0 7 B	6.0	78	19.0	1.222	3.12	3.81	76	d	//
BH3/27R	1.8	78	25.0	1.222	4.11	5.02	100	d	//
	5.6	78	28.0	1.222	4.60	5.62	112	d	//
	7.8	78	25.0	1.222	4.11	5.02	100	d	//
BH3/28R	4.2	78	19.0	1.222	3.12	3.81	76	d	//
	7.4	78	25.0	1.222	4.11	5.02	100	d	//
	8.4	78	19.0	1.222	3.12	3.81	76	d	//
BH3/30R	4.0	78	10.0	1.222	1.64	2.01	40	d	//
	7.0	78	20.0	1.222	3.29	4.02	80	d	//
BH3/32R	24.9	78	22.0	1.222	3.62	4.42	88	d	//
BH3/33R	7.1	78	18.0	1.222	2.96	3.61	72	d	//
	10.3	78	24.0	1.222	3.94	4.82	96	d	//
	12.7	78	28.0	1.222	4.60	5.62	112	d	//
BH3/34R	4.4	78	10.0	1.222	1.64	2.01	40	d	//
	6.1	78	15.0	1.222	2.47	3.01	60	d	//
	9.6	78	21.0	1.222	3.45	4.22	84	d	//
	11.5	78	22.0	1.222	3.62	4.42	88	d	//
	14.0	78	20.0	1.222	3.29	4.02	80	d	//
	15.2	78	19.0	1.222	3.12	3.81	76	d	//
	17.2	78	24.0	1.222	3.94	4.82	96	d	//
	Statistical Su	mmary Data	ls(50)	UCS*	*UCS N	ormal Distribution Curve		A	bbreviations
Number of S	amples Teste	ed	26	26	0.45			i	irregular
Minimum			2.01	40	0.4 +	\sim		а	axial
Average			4.43	89	0.35	- <u>\</u>		b	block
Maximum			7.36	147	0.3 +/-			d	diametral
Standard De	v.		1.31	26	0.25				
Upper 95% (Confidence Li	mit	7.00	140.04	0.2 + /			appro	x. orientation to
Lower 95% Confidence Limit 1.86 37.1		37.16	0.15				planes of		
				0.1 + /			wea	kness/bedding	
Comments:	Comments:				0.05			U	unknown
*UCS taken a	as k x Point L	.oad ls(50): k=		20	0 +			Р	perpendicular
		· · /			0	100 200	300		parallel

			POINT LOAD S	TRENGTH I	NDEX TEST DATA				A
Contract: 18 Date of test:	963 - N6 Galv Project 6/5/16	way City Transport	Sample Type: Core Contract no. 1896	3					IGSL
RC No.	Depth	D (Diameter)	P (failure load)	F	ls (index strength)	ls(50) (index strength)	*UCS		
	m	mm	kN		Мра	Мра	MPa	Туре	Orienation
BH3/35R	21.7	78	22.0	1.222	3.62	4.42	88	d	//
BH3/36R	2.5	78	18.0	1.222	2.96	3.61	72	d	//
	4.9	78	22.0	1.222	3.62	4.42	88	d	//
	7.4	78	21.0	1.222	3.45	4.22	84	d	11
	10.4	78	31.0	1.222	5.10	6.22	124	d	11
	14.1	78	24.0	1.222	3.94	4.82	96	d	11
	16.4	78	19.0	1.222	3.12	3.81	76	d	11
	16.7	78	27.0	1.222	4.44	5.42	108	d	11
	19.8	78	22.0	1 222	3 62	4 42	88	d	11
BH3/38R	4 1	78	18.0	1 222	2.96	3.61	72	d	11
D1137 3010	7.0	78	29.0	1 222	4 77	5.82	116	d	11
	8.8	78	24.0	1 222	3.94	4.82	96	d	11
BH3/30D	3.7	70	23.0	1 222	3.78	4.62	92	d	11
DI137 3 3K	7.0	70	16.0	1 222	2.63	3 21	52	d	11
	7.0	70	10.0	1.222	2.03	3.21	04	d	11
DU2 /40D	3.0	70	23.0	1.222	3.70	4.02	92	u d	11
DH3/40K	2.0	70	22.0	1.222	3.02	4.42	00	u d	11
	7.0	70	20.0	1.222	5.29	4.02	00	a	11
DU2 (41D	10.0	78	16.0	1.222	2.63	3.21	64 11C	a	11
BH3/41R	3.7	78	29.0	1.222	4.77	5.82	116	a	//
	4.6	78	28.0	1.222	4.60	5.62	112	d	11
	7.0	78	22.0	1.222	3.62	4.42	88	d	//
BH3/42R	3.0	78	23.0	1.222	3.78	4.62	92	d	//
	4.5	78	23.0	1.222	3.78	4.62	92	d	//
	6.5	78	23.0	1.222	3.78	4.62	92	d	//
	9.5	78	20.0	1.222	3.29	4.02	80	d	//
BH3/43R	5.2	78	15.0	1.222	2.47	3.01	60	d	//
	7.2	78	20.0	1.222	3.29	4.02	80	d	//
	9.3	78	23.0	1.222	3.78	4.62	92	d	//
	Statistical Sur	nmary Data	ls(50)	UCS*	*UCS N	ormal Distribution Curve		A	bbreviations
Number of Sa	amples Teste	d	28	28	0.8			i	irregular
Minimum			3.01	60	0.7	~		а	axial
Average			4.47	89	0.6	- \		b	block
Maximum			6.22	124	0.5	Α		d	diametral
Standard Dev	/.		0.80	16	0.4				
Upper 95% C	Confidence Lin	nit	6.03	120.65	03			appro	x. orientation to
Lower 95% (Confidence Lir	nit	2.90	58.04	0.0				
					0.2		7	planes of	weakness/bedding
Comments:								U	unknown
*UCS taken a	as k x Point Lo	oad ls(50): k=		20	0+			Р	perpendicular
		. ,			0	100 200	300		parallel

			POINT LOAD S	TRENGTH 1	NDEX TEST DATA				ato
Contract: 18 Date of test:	963 - N6 Gal Project 6/5/16	way City Transport	Sample Type: Core Contract no. 1896	3					IGSL
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	ls (index strength) Mpa	ls(50) (index strength) Mpa	*UCS MPa	Type	Orienation
BH3/46R BH3/47R BH3/48R BH3/52R BH3/53R BH3/54R	2.6 5.6 7.5 10.7 6.2 1.6 10.0 9.5 12.5 8.0 10.5 7.1 9.0	78 78 78 78 78 78 78 78 78 78 78 78 78 7	9.0 19.0 22.0 24.0 22.0 26.0 10.0 18.0 25.0 21.0 26.0 28.0 14.0	1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222 1.222	1.48 3.12 3.62 3.94 3.62 4.27 1.64 2.96 4.11 3.45 4.27 4.60 2.30	1.81 3.81 3.81 4.42 4.82 4.42 5.22 2.01 3.61 5.02 4.22 5.22 5.62 2.81	36 76 76 88 96 88 104 40 72 100 84 104 112 56	d d d d d d d d d d d d d d d d d	// // // // // //
	Statistical Su	mmary Data	ls(50)	UCS*	*UCS N	ormal Distribution Curve		A	obreviations
Number of Sa Minimum Average Maximum Standard Dev Upper 95% (Lower 95% (amples Teste v. Confidence Lii Confidence Li	d mit mit	14 1.81 4.06 5.62 1.18 6.37 1.75	14 36 81 112 24 127.39 34.95	0.25 0.2 0.15 0.1 0.05			i a b d appro	irregular axial block diametral x. orientation to weakness/bedding
<u>Comments:</u> *UCS taken a	as k x Point L	oad ls(50): k=		20	0	100 200	300	U P //	unknown perpendicular parallel

Uniaxial Co	ompression T	est Report Shee	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/03 3.3-3.6m	sport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange mottl ned	ed	
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolouratio Considerable weakening Considerable we	Unchanged from original sta on, slight weakening g, penetrative discolouratior eakening, penetrative discolo	ate n puration, breaks in ha	nd
Sample Measurements			<u>Sketch of Fail</u>	ire Surfaces
Length Diameter (Ø) <u>Testing</u>	211 78	mm		
Load Rate Load at Failure (P)	3.3 294	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strength	=	<u> </u>	0 4	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	61.53	(Mpa)	
Bulk Density	=	2.64	(Mg/m ³)	
Moisture Content	=	0.09	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/04 1.9-2.2m	nsport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange mott ined	led	
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	nd
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ire Surfaces
Length Diameter (Ø)	201 78.1	mm		
Load Rate Load at Failure (P)	3.3 400	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	. =	40000 4788.19	0 385	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	83.50	(Mpa)	
Bulk Density	=	2.61	(Mg/m ³)	
Moisture Content	=	0.11	(%)	
<u>Notes:</u>				

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
<u>Sample Identification</u>				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/04 5.1-5.3m	sport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange mot ned	tled	
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratio eakening, penetrative disco	tate n Iouration, breaks in ha	nd
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces
Length Diameter (Ø) Testing	176 70	mm		
Load Rate Load at Failure (P)	3.3 287	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	. =	<u>28700</u> 3846	.5	
	=	1000 x P ∏ x (Ø/2)^2		
	=	74.58	(Mpa)	
Bulk Density	=	2.61	(Mg/m ³)	
Moisture Content	=	0.14	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>
Sample Identification			
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/06 4.5-4.7m	nsport Project	
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 discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouration eakening, penetrative discol	ate n ouration, breaks in hand
<u>Sample Measurements</u>			Sketch of Failure Surfaces
Length Diameter (Ø)	196 78	mm	
<u>Testing</u> Load Rate Load at Failure (P)	3.3 344	kN/min kN	
Strength Calculations			
Uniaxial Compressive Strength	1 =	<u> </u>	0 94
	=	1000 x P ∏ x (Ø/2)^2	_
	=	71.99	(Mpa)
Bulk Density	=	2.60	(Mg/m ³)
Moisture Content	=	0.17	(%)
Notes:			

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>						
Sample Identification						
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/07 5.0-5.4m	sport Project				
Sample Description						
Colour: Grain size: Weathering Grade: Rock Type:	Pink/brown/green n Fine to medium grai Fresh GRANITE	nottled ned				
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratic eakening, penetrative disco	tate on louration, breaks in ha	and		
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ure Surfaces		
Length Diameter (Ø)	204 78]]mm				
Load Rate Load at Failure (P)	3.3 254	kN/min kN				
Strength Calculations						
Uniaxial Compressive Strength	. =	<u> </u>	00 94	-		
	=	1000 x P ∏ x (Ø/2)^2				
	=	53.16	(Mpa)			
Bulk Density	=	2.61	(Mg/m ³)			
Moisture Content	=	0.22	(%)			
Notes:						

Uniaxial Compression Test Report Sheet I.G.S.L.					
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/08 5.1-5.3m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Pink/brown/green n Fine to medium grai Fresh GRANITE	nottled ined			
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	nd	
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces	
Length Diameter (Ø)	170 61	mm			
Testing Load Rate Load at Failure (P)	3.3 108	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	10800 2920.9	0 85		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	36.96	(Mpa)		
Bulk Density	=	2.60	(Mg/m ³)		
Moisture Content	=	0.15	(%)		
<u>Notes:</u>					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/10 2.4-2.6m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange mott ined	led		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	nd	
Sample Measurements			<u>Sketch of Fail</u>	ire Surfaces	
Length Diameter (Ø) <u>Testing</u>	212 78.1	mm			
Load Rate Load at Failure (P)	3.3 364	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	=	<u> </u>	0 385		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	75.98	(Mpa)		
Bulk Density	=	2.61	(Mg/m ³)		
Moisture Content	=	0.08	(%)		
Notes:					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/10 5.2-5.6m	isport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange mott ned	led		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratior eakening, penetrative discolo	ate 1 ouration, breaks in ha	ind	
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces	
Length Diameter (Ø)	198 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 313	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	1 =	<u> </u>	0 04		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	65.50	(Mpa)		
Bulk Density	=	2.61	(Mg/m ³)		
Moisture Content	=	0.17	(%)		
Notes:					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
<u>Sample Identification</u>					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/10 9.2-9.5m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange mottl ined	ed		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original sta on, slight weakening g, penetrative discolouration eakening, penetrative discolo	ute ouration, breaks in ha	nd	
Sample Measurements			<u>Sketch of Failu</u>	ire Surfaces	
Length Diameter (Ø)	208 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 112	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	1 =	<u> </u>) 4		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	23.44	(Mpa)		
Bulk Density	=	2.61	(Mg/m ³)		
Moisture Content	=	0.09	(%)		
Notes:					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
<u>Sample Identification</u>					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/10 14.7-14.9m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange mottl ined	ed		
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original sta on, slight weakening g, penetrative discolouratior eakening, penetrative discolo	ate 1 puration, breaks in ha	nd	
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces	
Length Diameter (Ø)	206 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 196	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength) =	<u> </u>	0 4		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	41.02	(Mpa)		
Bulk Density	=	2.60	(Mg/m ³)		
Moisture Content	=	0.16	(%)		
Notes:					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/11 5.8-6.0m	isport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Pink/brown/green n Fine to medium grai Fresh GRANITE	nottled			
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratic eakening, penetrative disco	tate on louration, breaks in ha	ind	
Sample Measurements			<u>Sketch of Fail</u>	ure Surfaces	
Length Diameter (Ø) Testing	152 61	mm			
Load Rate Load at Failure (P)	3.3 258	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	1 =	2580 2920.9	00 985		
	=	1000 x P ∏ x (Ø/2)^2			
	=	88.28	(Mpa)		
Bulk Density	=	2.61	(Mg/m ³)		
Moisture Content	=	0.11	(%)		
<u>Notes:</u>					

Uniaxial Co	Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
Sample Identification						
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/13 1.1-1.3m	sport Project				
Sample Description						
Colour: Grain size: Weathering Grade: Rock Type:	Purple/brown mottl Fine to medium grai Fresh GRANITE	ed ned				
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouration eakening, penetrative discol	ate n ouration, breaks in ha	nd		
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces		
Length Diameter (Ø) Testing	170 61]]mm				
Load Rate Load at Failure (P)	3.3 231	kN/min kN				
Strength Calculations						
Uniaxial Compressive Strength	=	<u>23100</u> 2920.9	0 85			
	=	1000 x P ∏ x (Ø/2)^2	_			
	=	79.04	(Mpa)			
Bulk Density	=	2.60	(Mg/m ³)			
Moisture Content	=	0.08	(%)			
<u>Notes:</u>						

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/16 6.2-6.4m	isport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Purple/brown/grey Fine to medium grai Fresh GRANITE	mottled ined		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratic eakening, penetrative disco	tate on louration, breaks in ha	and
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ure Surfaces
Length Diameter (Ø)	211 78	mm		
Load Rate Load at Failure (P)	3.3 262	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	1 =	<u>26200</u> 4775.	00 94	-
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	54.83	(Mpa)	
Bulk Density	=	2.62	(Mg/m ³)	
Moisture Content	=	0.14	(%)	
<u>Notes:</u>				

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>						
Sample Identification						
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/17 8.4-8.6m	isport Project				
Sample Description						
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange mott ned	led			
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	ınd		
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ire Surfaces		
Length Diameter (Ø)	202 78	mm				
Load Rate Load at Failure (P)	3.3 202	kN/min kN				
Strength Calculations						
Uniaxial Compressive Strength	1 =	<u>20200</u> 4775.9	0 94			
	=	1000 x P ∏ x (Ø/2)^2	_			
	=	42.27	(Mpa)			
Bulk Density	=	2.60	(Mg/m ³)			
Moisture Content	=	0.11	(%)			
<u>Notes:</u>						

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
<u>Sample Identification</u>					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/18 5.2-5.6m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange moti ined	iled		
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable w	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	ınd	
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	<u>ire Surfaces</u>	
Length Diameter (Ø) Testing	174 70	mm			
Load Rate Load at Failure (P)	3.3 296	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	1 =	29600 3846	00 5		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	76.91	(Mpa)		
Bulk Density	=	2.62	(Mg/m ³)		
Moisture Content	=	0.13	(%)		
<u>Notes:</u>					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
<u>Sample Identification</u>					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/18 13.7-14.2m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange mott ined	led		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable w	Unchanged from original st on, slight weakening ıg, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	nd	
Sample Measurements			<u>Sketch of Failu</u>	ire Surfaces	
Length Diameter (Ø)	172 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 157	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	ו =	15700 4775.9	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	32.86	(Mpa)		
Bulk Density	=	2.58	(Mg/m ³)		
Moisture Content	=	0.18	(%)		
Notes:					

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
<u>Sample Identification</u>				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/18 23.0-23.2m	isport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange mott ned	led	
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in hai	nd
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	re Surfaces
Length Diameter (Ø)	202 61	mm		
<u>Testing</u> Load Rate Load at Failure (P)	3.3 374	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strength	1 =	<u> </u>	00 85	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	127.97	(Mpa)	
Bulk Density	=	2.59	(Mg/m ³)	
Moisture Content	=	0.14	(%)	
Notes:				

Uniaxial C	ompression T	est Report Shee	et	I.G.S.L.
<u>Sample Identification</u>				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/19 2.2-2.6m	nsport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	vn/grey/white/orange mottl ined	ed	
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original sta on, slight weakening g, penetrative discolouration eakening, penetrative discolo	ate buration, breaks in ha	nd
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces
Length Diameter (Ø)	198 78	mm		
<u>Testing</u> Load Rate Load at Failure (P)	3.3 215	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strength	1 =	215000 4775.9	0 4	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	44.99	(Mpa)	
Bulk Density	=	2.60	(Mg/m ³)	
Moisture Content	=	0.18	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
<u>Sample Identification</u>				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/19 10.1-10.3m	nsport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Green/pink/brown i Fine to medium grai Fresh GRANITE	mottled ined		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n louration, breaks in ha	and
Sample Measurements			<u>Sketch of Fail</u>	ure Surfaces
Length Diameter (Ø) <u>Testing</u>	171 61	mm		
Load Rate Load at Failure (P)	3.3 102	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strength) =	<u> </u>	00 185	-
	=	1000 x P ∏ x (Ø/2)^2		
	=	34.90	(Mpa)	
Bulk Density	=	2.59	(Mg/m ³)	
Moisture Content	=	0.19	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/20 8.8-9.1m	isport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Very dark green Fine to medium grai Fresh BASALT	ined		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratic eakening, penetrative disco	tate on louration, breaks in ha	and
Sample Measurements			<u>Sketch of Fail</u>	ure Surfaces
Length Diameter (Ø)	191 78	mm		
<u>Testing</u> Load Rate Load at Failure (P)	3.3 272	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	1 =	<u> </u>	00 94	-
	=	1000 x P ∏ x (Ø/2)^2		
	=	56.92	(Mpa)	
Bulk Density	=	2.62	(Mg/m ³)	
Moisture Content	=	0.10	(%)	
Notes:				

Uniaxial Co	ompression T	est Report She	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/20 13.5-13.7m	sport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Very dark green Fine to medium grai Fresh BASALT	ned		
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratio eakening, penetrative disco	tate m louration, breaks in ha	Ind
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ure Surfaces
Length Diameter (Ø) Testing	208 78.1]]mm		
Load Rate Load at Failure (P)	3.3 162	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	=	<u> </u>	00 9385	-
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	33.82	(Mpa)	
Bulk Density	=	2.61	(Mg/m ³)	
Moisture Content	=	0.08	(%)	
Notes:				

Uniaxial C	ompression T	est Report Shee	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/22 6.2-6.5m	isport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange mott ned	led	
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouration eakening, penetrative discolo	ate 1 ouration, breaks in ha	ind
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ire Surfaces
Length Diameter (Ø)	198 78]]mm		
Load Rate Load at Failure (P)	3.3 176	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	. =	<u> </u>	004	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	36.83	(Mpa)	
Bulk Density	=	2.62	(Mg/m ³)	
Moisture Content	=	0.13	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/22 11.7-11.9m	isport Project		
Sample Description				
Colour: Grain size: Weathering Grade: Rock Type:	Light pink/red/brow Fine to medium grai Fresh GRANITE	n/grey/white/orange moti ned	led	
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in ha	ınd
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces
Length Diameter (Ø)	209 78	mm		
Load Rate Load at Failure (P)	3.3 172	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strength	1 =	17200 4775.9	94	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	36.00	(Mpa)	
Bulk Density	=	2.61	(Mg/m ³)	
Moisture Content	=	0.11	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>
Sample Identification			
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/24 5.2-5.4m	isport Project	
Sample Description			
Colour: Grain size: Weathering Grade: Rock Type:	Dark and light green Fine to medium-grai Fresh GRANITE	ined	
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratic eakening, penetrative disco	tate n louration, breaks in hand
<u>Sample Measurements</u>			Sketch of Failure Surfaces
Length Diameter (Ø)	172 61	mm	
Load Rate Load at Failure (P)	3.3 252	kN/min kN	
Strength Calculations			
Uniaxial Compressive Strength	1 =	25200 2920.9	00 985
	=	1000 x P ∏ x (Ø/2)^2	
	=	86.23	(Mpa)
Bulk Density	=	2.63	(Mg/m ³)
Moisture Content	=	0.18	(%)
Notes:			

Uniaxial C	ompression T	est Report Shee	et <i>I.G.S.L.</i>		
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/25 4.7-4.9m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine grained Fresh LIMESTONE				
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			Sketch of Failure Surfaces		
Length Diameter (Ø)	202 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 349	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	<u> </u>	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	73.04	(Mpa)		
Bulk Density	=	2.67	(Mg/m ³)		
Moisture Content	=	0.20	(%)		
Notes:					

Uniaxial C	ompression 7	est Report She	et <i>I.G.S.L.</i>		
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/26 4.7-5.0m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE				
Weathering Grade Criteria Unchanged from original state I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			Sketch of Failure Surfaces		
Length Diameter (Ø)	201 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 262	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	26200 4775.9	0 04		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	54.83	(Mpa)		
Bulk Density	=	2.67	(Mg/m ³)		
Moisture Content	=	0.15	(%)		
<u>Notes:</u>					

Uniaxial C	ompression T	est Report She	et	I.G.S.L.	
Sample Identification					
Contract Name:	N6 Galway City Trar	nsport Project			
	20205 70/2010				
Dopth (m):	$B\Pi 3/27$				
	5.8-4.011				
Sample Description					
Colour:	Grey				
Grain size:	Fine-grained				
Weathering Grade:	Fresh				
Rock Type:	LIMESTONE				
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable w	Unchanged from original s ion, slight weakening ig, penetrative discolourati eakening, penetrative disco	state on olouration, breaks in ha	ınd	
Sample Measurements			<u>Sketch of Fail</u>	ure Surfaces	
Length	201				
Diameter (Ø) <u>Testing</u> Load Rate Load at Failure (P)	78 3.3 472	mm kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strengtl	1 =	4720 4775	.94		
	=	1000 × P ∏ × (Ø/2)^2			
	=	98.78	(Mpa)		
Bulk Density	=	2.66	(Mg/m ³)		
Moisture Content	=	0.19	(%)		
Notes:					
Uniaxial C	ompression T	est Report She	et	I.G.S.L.	
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Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/28 6.2-6.6m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE				
Weathering Grade Criteria I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ure Surfaces	
Length Diameter (Ø)	204 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 223	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	22300 4775.9	0 94		
	=	1000 x P ∏ x (Ø/2)^2			
	=	46.67	(Mpa)		
Bulk Density	=	2.67	(Mg/m ³)		
Moisture Content	=	0.20	(%)		
Notes:					

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>		
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/32 24.6-24.8m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE				
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			Sketch of Failure Surfaces		
Length Diameter (Ø)	204 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 168	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	16800 4775.9	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	35.16	(Mpa)		
Bulk Density	=	2.67	(Mg/m ³)		
Moisture Content	=	0.23	(%)		
Notes:					

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>		
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/33 9.3-9.6m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine grained Fresh LIMESTONE				
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand					
Sample Measurements			Sketch of Failure Surfaces		
Length Diameter (Ø)	204 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 210	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength) =	<u>21000</u> 4775.9	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	43.95	(Mpa)		
Bulk Density	=	2.65	(Mg/m ³)		
Moisture Content	=	0.22	(%)		
Notes:					

Uniaxial Compression Test Report Sheet I.G.S.L.						
<u>Sample Identification</u>						
Contract Name:	N6 Galway City Trar	nsport Project				
Job Number:	18963					
Hole No:	BH3/33					
Depth (m):	16.2-16.6m					
Sample Description						
Colour:	Grey					
Grain size:	Fine-grained					
Weathering Grade:	Fresh					
Rock Type:	LIMESTONE					
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand						
<u>Sample Measurements</u>		-	Sketch of Failure Surfaces			
Length	194					
Diameter (Ø)	/8	mm				
Testing						
Load Rate	3.3	kN/min				
Load at Failure (P)	185	kN				
<u>Strength Calculations</u> Uniaxial Compressive Strength = 185000						
		4775.9	94			
	=	1000 x P ∏ x (Ø/2)^2	_			
	=	38.72	(Mpa)			
Bulk Density	=	2.66	(Mg/m ³)			
Moisture Content	=	0.27	(%)			
Notes:						

Uniaxial Compression Test Report Sheet I.G.S.L.					
Sample Identification					
Contract Name:	N6 Galway City Trar	nsport Project			
Job Number:	18963				
Hole No:	BH3/34				
Depth (m):	7.0-7.3m				
Sample Description					
Colour:	Grey				
Grain size:	Fine-grained				
Weathering Grade:	Fresh				
Rock Type:	LIMESTONE				
Weathering Grade Criteria I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>		_	<u>Sketch of Failure Surfaces</u>		
Length	207				
Diameter (Ø) <u>Testing</u> Load Rate Load at Failure (P)	3.3 231	_mm _kN/min _kN			
Strength Calculations					
Uniaxial Compressive Strengtl	ı =	23100 4775.	94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	48.34	(Mpa)		
Bulk Density	=	2.67	(Mg/m ³)		
Moisture Content	=	0.24	(%)		
Notes:					

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>		
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/34 13.1-13.3m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE				
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			Sketch of Failure Surfaces		
Length Diameter (Ø)	200 78	mm			
<u>Testing</u> Load Rate Load at Failure (P)	3.3 83	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	8300 4775.9	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	17.37	(Mpa)		
Bulk Density	=	2.65	(Mg/m ³)		
Moisture Content	=	0.27	(%)		
Notes:					

Uniaxial Compression Test Report Sheet I.G.S.L.					
Sample Identification					
Contract Name:	N6 Galway City Trar	nsport Project			
Job Number:	18963				
Hole No:	BH3/35				
Depth (m):	21.6-21.8m				
Sample Description					
Colour:	Grey				
Grain size:	Fine-grained				
Weathering Grade:	Fresh				
Rock Type:	LIMESTONE				
Weathering Grade Criteria Unchanged from original state I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>		-	Sketch of Failure Surfaces		
Length	204	_			
Diameter (Ø) <u>Testing</u> Load Rate Load at Failure (P)	78 3.3 243	mm kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	24300 4775.9	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	50.85	(Mpa)		
Bulk Density	=	2.66	(Mg/m ³)		
Moisture Content	=	0.19	(%)		
Notes:					

Uniaxial Compression Test Report Sheet <i>I.G.S.L.</i>					
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/36 7.1-7.4m	isport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine grained Fresh LIMESTONE				
Weathering Grade Criteria I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
Sample Measurements			Sketch of Failure Surfaces		
Length Diameter (Ø)	207 78.1	mm			
Load Rate Load at Failure (P)	3.3 170	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength		17000 4788.19	0 385		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	35.49	(Mpa)		
Bulk Density	=	2.67	(Mg/m ³)		
Moisture Content	=	0.25	(%)		
<u>Notes:</u>					

Uniaxial Compression Test Report Sheet I.G.S.L.					
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/36 11.9-12.3m	isport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine grained Fresh LIMESTONE				
Weathering Grade Criteria Unchanged from original state I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			Sketch of Failure Surfaces		
Length Diameter (Ø)	202 78.1	mm			
Load Rate Load at Failure (P)	3.3 432	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	=	43200 4788.19	0 385		
	=	1000 x P ∏ x (Ø/2)^2			
	=	90.18	(Mpa)		
Bulk Density	=	2.66	(Mg/m ³)		
Moisture Content	=	0.26	(%)		
Notes:					

Uniaxial C	ompression 7	est Report She	et	I.G.S.L.	
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/36 18.0-18.3m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE				
Weathering Grade Criteria Unchanged from original state I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			<u>Sketch of Fail</u>	ure Surfaces	
Length Diameter (Ø)	198 78	mm			
Load Rate Load at Failure (P)	3.3 211	kN/min kN			
<u>Strength Calculations</u>					
Uniaxial Compressive Strength	1 =	<u>2110</u> 4775	00 .94	-	
	=	1000 x P ∏ x (Ø/2)^2			
	=	44.16	(Mpa)		
Bulk Density	=	2.64	(Mg/m ³)		
Moisture Content	=	0.28	(%)		
Notes:					

Uniaxial C	ompression T	est Report Shee	et	I.G.S.L.	
<u>Sample Identification</u>					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/38 5.9-6.1m	nsport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine-grained Fresh LIMESTONE				
Weathering Grade Criteria I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
Sample Measurements			<u>Sketch of Failu</u>	re Surfaces	
Length Diameter (Ø) Testing	200 78	mm			
Load Rate Load at Failure (P)	3.3 339	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength	1 =	<u> </u>	0 94		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	70.94	(Mpa)		
Bulk Density	=	2.66	(Mg/m ³)		
Moisture Content	=	0.11	(%)		
Notes:					

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>		
Sample Identification					
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/39 5.3-5.5m	isport Project			
Sample Description					
Colour: Grain size: Weathering Grade: Rock Type:	Grey Fine grained Fresh LIMESTONE				
Weathering Grade Criteria Unchanged from original state I. Fresh: Unchanged from original state II. Slightly weathered: Slight discolouration, slight weakening III. Moderately weathered: Considerable weakening, penetrative discolouration IV. Highly weathered: Considerable weakening, penetrative discolouration, breaks in hand					
<u>Sample Measurements</u>			Sketch of Failure Surfaces		
Length Diameter (Ø)	202 78.1	mm			
Load Rate Load at Failure (P)	3.3 181	kN/min kN			
Strength Calculations					
Uniaxial Compressive Strength		<u>18100</u> 4788.19	00 9385		
	=	1000 x P ∏ x (Ø/2)^2	_		
	=	37.78	(Mpa)		
Bulk Density	=	2.66	(Mg/m ³)		
Moisture Content	=	0.15	(%)		
Notes:					

Uniaxial C	Compression T	lest Report Sh	neet	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/40 8.0-8.2m	nsport Project		
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 discolourati Considerable weakenin Considerable w	Unchanged from origina ion, slight weakening ng, penetrative discoloura eakening, penetrative dis	al state ation scolouration, breaks in ha	and
Sample Measurements			<u>Sketch of Fail</u>	ure Surfaces
Length Diameter (Ø)	201 78	mm		
Load Rate Load at Failure (P)	3.3 134	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strengt	h =	<u> </u>	4000 75.94	-
	=	1000 x P ∏ x (Ø/2)^2		
	=	28.04	(Mpa)	
Bulk Density	=	2.67	(Mg/m ³)	
Moisture Content	=	0.17	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>	
Sample Identification				
Contract Name:	N6 Galway City Trar	nsport Project		
Hole No:	BH3//1			
Depth (m):	6.2-6.8m			
Sample Description				
Colour:	Grey			
Grain size:	Fine-grained			
Weathering Grade:	Fresh			
Rock Type:	LIMESTONE			
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand				
<u>Sample Measurements</u>		_	Sketch of Failure Surfaces	
Length Diameter (Ø)	204 78	mm		
Testing				
Load Rate	3.3	kN/min		
Load at Failure (P)	271	kN		
<u>Strength Calculations</u> Uniaxial Compressive Strength	1 =	27100	0	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	56.71	(Mpa)	
Bulk Density	=	2.65	(Mg/m ³)	
Moisture Content	=	0.23	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>
Sample Identification			
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/42 4.5-4.7m	isport Project	
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 discolourati Considerable weakenin Considerable we	Unchanged from original s on, slight weakening g, penetrative discolouratic eakening, penetrative disco	tate on louration, breaks in hand
<u>Sample Measurements</u>			Sketch of Failure Surfaces
Length Diameter (Ø) Testing	209 78.1	mm	
Load Rate Load at Failure (P)	3.3 291	kN/min kN	
Strength Calculations			
Uniaxial Compressive Strength	1 =	29100 4788.19	00 9385
	=	1000 x P ∏ x (Ø/2)^2	
	=	60.74	(Mpa)
Bulk Density	=	2.67	(Mg/m ³)
Moisture Content	=	0.18	(%)
Notes:			

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>
Sample Identification			
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Tran 18963 BH3/43 5.5-5.7m	isport Project	
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 discolourati Considerable weakenin Considerable we	Unchanged from original st on, slight weakening g, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in hand
<u>Sample Measurements</u>			Sketch of Failure Surfaces
Length Diameter (Ø)	199 78	mm	
Load Rate Load at Failure (P)	3.3 344	kN/min kN	
<u>Strength Calculations</u>			
Uniaxial Compressive Strength	1 =	<u> </u>	0 94
	=	1000 x P ∏ x (Ø/2)^2	_
	=	71.99	(Mpa)
Bulk Density	=	2.66	(Mg/m ³)
Moisture Content	=	0.26	(%)
Notes:			

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>
Sample Identification			
Contract Name:	N6 Galway City Trar	nsport Project	
Job Number:	18963		
Hole No:	BH3/47		
Depth (m):	6.0-6.1m		
Sample Description			
Colour:	Grey		
Grain size:	Fine-grained		
Weathering Grade:	Fresh		
Rock Type:	LIMESTONE		
Weathering Grade Criteria I. Fresh: II. Slightly weathered: III. Moderately weathered: IV. Highly weathered:	Slight discolourati Considerable weakenin Considerable w	Unchanged from original st ion, slight weakening ig, penetrative discolouratio eakening, penetrative discol	ate n ouration, breaks in hand
<u>Sample Measurements</u>		_	Sketch of Failure Surfaces
Length Diameter (Ø)	210	mm	
Load Rate Load at Failure (P)	3.3 122	kN/min kN	
Strength Calculations			
Uniaxial Compressive Strength	1 =	12200 4775.9	0 94
	=	1000 x P ∏ x (Ø/2)^2	_
	=	25.53	(Mpa)
Bulk Density	=	2.66	(Mg/m ³)
Moisture Content	=	0.21	(%)
Notes:			

Uniaxial C	ompression T	est Report She	et /	.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/48 8.0-8.2m	nsport Project		
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 discolourati Considerable weakenin Considerable w	Unchanged from original st ion, slight weakening ig, penetrative discolouration eakening, penetrative discol	ate n ouration, breaks in hand	
<u>Sample Measurements</u>			Sketch of Failure	<u>Surfaces</u>
Length Diameter (Ø)	199 78.1	mm		
<u>Testing</u> Load Rate Load at Failure (P)	3.3 248	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	1 =	24800 4788.19	0 385	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	51.77	(Mpa)	
Bulk Density	=	2.67	(Mg/m ³)	
Moisture Content	=	0.23	(%)	
Notes:				

Uniaxial C	Compression T	Fest Report She	et	I.G.S.L.
<u>Sample Identification</u>				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/52 8.6-8.9m	nsport Project		
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 discolourati Considerable weakenin Considerable w	Unchanged from original s ion, slight weakening ng, penetrative discolouratic eakening, penetrative disco	tate on louration, breaks in hanc	1
<u>Sample Measurements</u>			Sketch of Failure	e Surfaces
Length Diameter (Ø)	201 78	mm		
<u>Testing</u> Load Rate Load at Failure (P)	3.3 237	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strengt	h =	<u>23700</u> 4775.	00 94	
	=	1000 x P ∏ x (Ø/2)^2		
	=	49.60	(Mpa)	
Bulk Density	=	2.66	(Mg/m ³)	
Moisture Content	=	0.24	(%)	
Notes:				

Uniaxial C	ompression T	est Report Shee	et	I.G.S.L.
Sample Identification				
Contract Name: Job Number: Hole No: Depth (m):	N6 Galway City Trar 18963 BH3/53 6.4-6.6m	nsport Project		
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 discolourati Considerable weakenin Considerable we	Unchanged from original st ion, slight weakening ig, penetrative discolouratior eakening, penetrative discolo	ate n puration, breaks in ha	ınd
<u>Sample Measurements</u>			<u>Sketch of Failu</u>	ire Surfaces
Length Diameter (Ø)	212 78	mm		
Load Rate Load at Failure (P)	3.3 294	kN/min kN		
Strength Calculations				
Uniaxial Compressive Strength	1 =	29400 4775.9	0	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	61.53	(Mpa)	
Bulk Density	=	2.67	(Mg/m ³)	
Moisture Content	=	0.21	(%)	
Notes:				

Uniaxial C	ompression T	est Report She	et <i>I.G.S.L.</i>
Sample Identification			
Contract Name:	N6 Galway City Tran	sport Project	
Hole No:	18903 BH3/53		
Depth (m):	13.55-13.70m		
Sample Description			
Colour:	Grey		
Grain size:	Fine grained		
Weathering Grade:	Fresh		
Rock Type:	LIMESTONE		
<u>Weathering Grade Criteria</u> I. Fresh: II. Slightly weathered:	Slight discolourati	Unchanged from original st on, slight weakening	tate
IV. Highly weathered:	Considerable weakenin Considerable we	eakening, penetrative discolutation	louration, breaks in hand
<u>Sample Measurements</u> Length Diameter (Ø)	206 78.1]]mm	Sketch of Failure Surfaces
Testing			
Load Rate	33		
Load at Failure (P)	151	kN	
<u>Strength Calculations</u> Uniaxial Compressive Strength	=		00 9385
	=	1000 x P	
		∏ x (Ø/2)^2	
	=	31.52	(Mpa)
Bulk Density	=	2.66	(Mg/m ³)
Moisture Content	=	0.18	(%)
Notes:			

Uniaxial C	ompression 7	Fest Report She	et <i>I.G.S.L.</i>	
Sample Identification				
Contract Name:	N6 Galway City Trar	nsport Project		
Job Number:	18963			
Hole No:	BH3/54			
Depth (m):	7.6-7.8m			
Sample Description				
Colour:	Grey			
Grain size:	Fine-grained			
Weathering Grade:	Fresh			
Rock Type:	LIMESTONE			
Weathering Grade CriteriaI. Fresh:Unchanged from original stateII. Slightly weathered:Slight discolouration, slight weakeningIII. Moderately weathered:Considerable weakening, penetrative discolourationIV. Highly weathered:Considerable weakening, penetrative discolouration, breaks in hand				
Sample Measurements	202	7	Sketch of Failure Surfaces	
Diamotor (Ø)	202			
Load Rate Load at Failure (P)	3.3 282	kN/min kN		
<u>Strength Calculations</u>				
Uniaxial Compressive Strength	ı =	28200 4775.9	94	
	=	1000 x P ∏ x (Ø/2)^2	_	
	=	59.02	(Mpa)	
Bulk Density	=	2.66	(Mg/m ³)	
Moisture Content	=	0.20	(%)	
Notes:				

IGSL Ltd Unit J5, Materials Laboratory		Test Report		
M7 Business Park Naas	Resistanc	e to Fragmentation -	Los Angeles Test	IVNAB Accredited
Co. Kildare 045-899324	Teste	d in accordance with BS E	EN1097-2:2010	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.		R73037		
Client:		Arup, 50 Ringsend Rd, D	Publin 4	
Contract:		N6 Galway City Transpor	rt Proiect Phase 3	
Contract No:		18963	,	
Sample No.		A16/1996		
Client Ref:		3/34 5.8-8.8m		
Location:		N/A		
Source:		N/A		
Material Type:		Core		
Sample Received:		22-04-16		
Date tested:		11-05-16		
Sample Cert:		Attached /Provided		
Size of Material:	1	<14mm >12.5mm		
	2	<12.5mm >10mm		
Los Angeles Coefficient:		27		
The result relates to the specimen tested.			Persons authorised to	approve report
Any remaining material will be retained for one month. Sampling and opinions and interpretations are outside the sco		pe of accreditation. J Barrett (Quality I		ality Manager)
		Approved by		ooratory Manager)
IGSL Materials Laborat	ory			
	5	# Bypen	29-00-16	

IGSL Ltd Unit J5, Materials Laboratory		Test Report		
M7 Business Park Naas	Resistanc	e to Fragmentation -	Los Angeles Test	IVNAB Accredited
Co. Kildare 045-899324	Teste	d in accordance with BS E	EN1097-2:2010	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.		R73038		
Client:		Arup, 50 Ringsend Rd, D	Dublin 4	
Contract		N6 Galway City Transpo	rt Project Phase 3	
Contract No:		18963		
Sample No		A16/1999		
Client Ref		3/36 10 8-13 7m		
Location:		N/A		
Source:		N/A		
Material Type:		Core		
Sample Received:		22-04-16		
Date tested:		23-05-16		
Sample Cert:		Attached /Provided		
Size of Material	1	<14mm >12 5mm		
	2	<12.5mm >10mm		
Los Angeles Coefficient:		28		
The result relates to the specimen tested.			Persons authorised to	approve report
Any remaining material will be retained for one month. Sampling and opinions and interpretations are outside the sc		pe of accreditation		ality Manager)
			H Byrne (Lab	poratory Manager)
		Approved by	Date	Page
IGSL Materials Laborat	ory	A Byon	29-06-16	1 of 1

IGSL Ltd Unit J5, Materials Laboratory		Test Report		
M7 Business Park Naas	Resistanc	e to Fragmentation -	Los Angeles Test	I N A B ACCREDITED
Co. Kildare 045-899324	Teste	d in accordance with BS E	EN1097-2:2010	DETAILED IN SCOPE REG NO. 1337
Report No.		R73039		
Client:		Arup, 50 Ringsend Rd, D	Dublin 4	
Contract:		N6 Galway City Transpo	rt Project Phase 3	
Contract No:		18963		
Sample No.		A16/2000		
Client Ref:		3/38 7.4-10.2m		
Location:		N/A		
Source:		N/A		
Material Type:		Core		
Sample Received:		22-04-16		
Date tested:		23-05-16		
Sample Cert:		Attached /Provided		
Size of Material:	1 2	<14mm >12.5mm <12.5mm >10mm		
Los Angeles Coefficient:		28		
The result relates to the specimen tested. Any remaining material will be retained for one n	nonth.		Persons authorised to	approve report
Sampling and opinions and interpretations are o	utside the scope	of accreditation.	J Barrett (Qu H Byrne (Lal	uality Manager) poratory Manager)
		Approved by	Date	Page
IGSL Materials Laborate	ory	H Byon	29-06-16	1 of 1

IGSL Ltd Unit J5, Materials Laboratory		Test Report		
M7 Business Park Naas	Resistanc	e to Fragmentation - L	os Angeles Test	I NAB Accredited
Co. Kildare 045-899324	Teste	d in accordance with BS El	N1097-2:2010	TESTING DETAILED IN SCOPE REG NO. 1331
Report No.		R73990		
Client:		Arup, 50 Ringsend Rd, Du	ıblin 4	
Contract:		N6 Galway City Transport	Project Phase 3	
Contract No:		18963		
Sample No.		A16/2314		
Client Ref:		3/40 2.8-5.75m		
Location:		N/A		
Source:		N/A		
Material Type:		Core		
Sample Received:		02-06-16		
Date tested:		15-06-16		
Sample Cert:		Attached /Provided		
Size of Material:	1 2	<14mm >12.5mm <12.5mm >10mm		
Los Angeles Coefficient:		28		
The result relates to the specimen tested. Any remaining material will be retained for one n	nonth.	F	Persons authorised to	approve report
Sampling and opinions and interpretations are o	utside the scope	of accreditation.	J Barrett (Qu H Byrne (Lab	ality Manager) oratory Manager)
		Approved by	Date	Page
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IGSL Ltd Unit J5, Materials Laboratory		Test Report		
M7 Business Park Naas	Resistanc	e to Fragmentation -	Los Angeles Test	IVNAB Accredited
Co. Kildare 045-899324	Teste	d in accordance with BS E	EN1097-2:2010	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.		R73991		
Client:		Arup, 50 Ringsend Rd, D	Jublin 4	
Contract:		N6 Galway City Transpor	rt Proiect Phase 3	
Contract No:		18963	·····	
Sample No.		A16/2315		
Client Ref:		3/20 7.1-10m		
Location:		N/A		
Source:		N/A		
Material Type:		Core		
Sample Received:		02-06-16		
Date tested:		16-06-16		
Sample Cert:		Attached /Provided		
Size of Material:	1	<14mm >12.5mm		
	2	<12.5mm >10mm		
Los Angeles Coefficient:		26		
The result relates to the specimen tested.			Persons authorised to	approve report
Any remaining material will be retained for one n Sampling and opinions and interpretations are o	nonth. utside the scope	of accreditation.	J Barrett (Qu	ality Manager)
			H Byrne (Lab	ooratory Manager)
ICSI Matariala Laborat	051	Approved by	Date	Page
	ory	A Byen	29-06-16	1 of 1

IGSL Ltd Materials Laboratory	Test Report			
Unit J5, M7 Business Park Newhall, Naas	Slake Durabilit	у		I N ABB ACCREDITED
Co. Kildare 045 846176	Tested in accordance with ISR	VI Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.	R73033			
Contract No.	18963			
Contract Name:	N6 Galway City Transpor	t Project P	hase 3	
Client:	Arup, 50 Ringsend Rd, D	ublin 4		
Sample No.	A16/1992			
Client Ref	BH3/040 @ 0.8-5.60m			
Location	N/A			
Sample Certificate	Approved / Not Provided			
Date Received	22-04-2016			
Date Tested	04-05-16			
Slake Durability				
Cycle 1	99.4			
Cycle 2	99.2			
Description of the rock				
Pre Test: See Logs				
Post Test: See Logs				
The slaking fluid is tap water at 20°C	unless otherwise stated in this report	t.		
The results relate to the specimens tested.	F	Persons au	thorised to	approve report
Sampling and opinions and interpretations ar	e outside the scope of accreditation.	J B H Bw	arrett (Quality	/ Manager) ny Manager)
	Approved by		Date	Page
IGSL Materials Laborat	ory		29-06-16	1 of 1

IGSL Ltd Materials Laboratory		Test Repo	ort		
Unit J5, M7 Business Park Newhall, Naas		Slake Durabi	ility		I N ABB
Co. Kildare 045 846176	Teste	d in accordance with IS	RM Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.		R73034			
Contract No.		18963			
Contract Name:		N6 Galway City Transp	ort Project P	hase 3	
Client:		Arup, 50 Ringsend Rd,	Dublin 4		
Sample No.		A16/2001			
Client Ref		BH3/41 @ 4.2-7.2m			
Location		N/A			
Sample Certificate		Approved / Not Provide	ed		
Date Received		22/4/16			
Date Tested		04-05-16			
Slake Durability					
Cycle 1		99.6			
Cycle 2		99.5			
Description of the rock					
Pre Test: See Logs					
Post Test: See Logs					
The slaking fluid is tap water at 20°C	unless oth	erwise stated in this rep	ort.		
The results relate to the specimens tested. Any remaining material will be retained for or Sampling and opinions and interpretations ar	e month. e outside the s	scope of accreditation.	Persons au J B	Ithorised to arrett (Quality	approve report Manager)
		Approved by	Н Ву	rne (Laborato Date	ry Manager) Page
IGSL Materials Laborat	ory	A Byon		29-06-16	1 of 1

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IGSL Ltd Materials Laboratory	Test Report			
Unit J5, M7 Business Park Newhall, Naas	Slake Durability	/		I N ABB
Co. Kildare 045 846176	Tested in accordance with ISRM	1 Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.	R73035			
Contract No.	18963			
Contract Name:	N6 Galway City Transport	Project P	hase 3	
Client:	Arup, 50 Ringsend Rd, Du	ıblin 4		
Sample No.	A16/1998			
Client Ref	BH3/36 @ 7.85 10.8m			
Location	N/A			
Sample Certificate	Approved / Not Provided			
Date Received	22/4/16			
Date Tested	04-05-16			
Slake Durability				
Cycle 1	99.3			
Cycle 2	99.1			
Description of the rock				
Pre Test: See Logs				
Post Test: See Logs				
The slaking fluid is tap water at 20°C	c unless otherwise stated in this report.			
The results relate to the specimens tested.	Pe month	ersons au	thorised to	approve report
Sampling and opinions and interpretations and	e outside the scope of accreditation.	J Ba H Bvr	arrett (Quality	r Manager) rv Manager)
	Approved by		Date	Page
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IGSL Ltd Materials Laboratory		Test Repo	rt		
Unit J5, M7 Business Park Newhall, Naas		Slake Durabi	lity		ISO 17025 INAB ACCREDITED
Co. Kildare 045 846176	Teste	ed in accordance with ISI	RM Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO.1337
Report No.		R73036			
Contract No.		18963			
Contract Name:		N6 Galway City Transp	ort Project P	hase 3	
Client:		Arup, 50 Ringsend Rd,	Dublin 4		
Sample No		A16/1994			
Client Ref		BH3/33 @ 11 5 12 5m			
Location		N/A			
Sample Certificate		Approved / Not Provide	d		
Date Received		22/4/16			
Date Tested		04-05-16			
Slake Durability					
Cycle 1		99.6			
Cycle 2		99.4			
Description of the rock					
Pre Test: See Logs					
Post Test: See Logs					
The slaking fluid is tap water at 20°C	cunless oth	erwise stated in this repo	ort.		
The results relate to the specimens tested.	e month		Persons au	thorised to	approve report
Sampling and opinions and interpretations ar	e outside the s	scope of accreditation.	J B H Rv	arrett (Quality	r Manager) rv Manager)
		Approved by	, 11 Dy	Date	Page
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IGSL Ltd Materials Laboratory	Test Report			
Unit J5, M7 Business Park Newhall, Naas	Slake Durability			I N ABB ACCREDITED
Co. Kildare 045 846176	Tested in accordance with ISRM	Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.	R73986			
Contract No.	18963			
Contract Name:	N6 Galway City Transport F	Project P	hase 3	
Client:	Arup, 50 Ringsend Rd, Dub	olin 4		
Sample No.	A16/2310			
Client Ref	BH3/19 @ 3.2-4.2m			
Location	N/A			
Sample Certificate	Approved / Not Provided			
Date Received	02-06-16			
Date Tested	17-06-16			
Slake Durability				
Cycle 1	99.5			
Cycle 2	99.2			
Description of the rock				
Pre Test: See Logs				
Post Test: See Logs				
The slaking fluid is tap water at 20°C	C unless otherwise stated in this report.			
The results relate to the specimens tested. Any remaining material will be retained for or	ne month.	rsons au	thorised to	approve report
Sampling and opinions and interpretations ar	e outside the scope of accreditation.	J Ba H Byr	arrett (Quality rne (Laborato	/ Manager) ry Manager)_
ICSI Matariala Laborat	Approved by		Date	Page
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IGSL Ltd Materials Laboratory	Test Report			
Unit J5, M7 Business Park Newhall, Naas	Slake Durability			I N A B ACCREDITED
Co. Kildare 045 846176	Tested in accordance with ISRM	Part 2 (19	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.	R73987			
Contract No.	18963			
Contract Name:	N6 Galway City Transport I	Project Pł	nase 3	
Client:	Arup, 50 Ringsend Rd, Dub	blin 4		
Sample No.	A16/2311			
Client Ref	BH3/19 @ 12.5-13.5m			
Location	N/A			
Sample Certificate	Approved / Not Provided			
Date Received	02-06-16			
Date Tested	17-06-16			
Slake Durability				
Cycle 1	99.3			
Cycle 2	99.1			
Description of the rock				
Pre Test: See Logs				
Post Test: See Logs				
The slaking fluid is tap water at $20^\circ C$	unless otherwise stated in this report.			
The results relate to the specimens tested.	Pe	ersons aut	horised to	approve report
Any remaining material will be retained for on Sampling and opinions and interpretations are	e month. e outside the scope of accreditation.	J Ba H Rvn	nrett (Quality	/ Manager) rv Manager)
	Approved by		Date	Page
IGSL Materials Laborat	ory		29-06-16	1 of 1

IGSL Ltd Materials Laboratory	Test Report			
Unit J5, M7 Business Park Newhall, Naas	Slake Durability	1		I N A B ACCREDITED
Co. Kildare 045 846176	Tested in accordance with ISRM	l Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.	R73988			
Contract No.	18963			
Contract Name:	N6 Galway City Transport	Project P	hase 3	
Client:	Arup, 50 Ringsend Rd, Du	blin 4		
Sample No.	A16/2312			
Client Ref	BH3/22 @ 9.7-10.7m			
Location	N/A			
Sample Certificate	Approved / Not Provided			
Date Received	02-06-16			
Date Tested	16-06-16			
Slake Durability				
Cycle 1	99.5			
Cycle 2	99.3			
Description of the rock				
Pre Test: See Logs				
Post Test: See Logs				
The slaking fluid is tap water at 20°C	unless otherwise stated in this report.			
The results relate to the specimens tested. Any remaining material will be retained for one	e month.	ersons au	thorised to	approve report
Sampling and opinions and interpretations are	e outside the scope of accreditation.	J B H Bv	arrett (Quality	/ Manager) prv Manager)
	Approved by		Date	Page
IGSL Materials Laborate	ory IAR		29-06-16	1 of 1

IGSL Ltd Materials Laboratory	Test Report			
Unit J5, M7 Business Park Newhall, Naas	Slake Durabilit	у		I N ABB ACCREDITED
Co. Kildare 045 846176	Tested in accordance with ISRN	/I Part 2 (1	981)	TESTING DETAILED IN SCOPE REG NO. 1337
Report No.	R73989			
Contract No.	18963			
Contract Name:	N6 Galway City Transport	t Project P	hase 3	
Client:	Arup, 50 Ringsend Rd, Du	ublin 4		
Sample No.	A16/2316			
Client Ref	BH3/20 @ 6.1-7.1m			
Location	N/A			
Sample Certificate	Approved / Not Provided			
Date Received	02-06-16			
Date Tested	20-06-16			
Slake Durability				
Cycle 1	99.5			
Cycle 2	99.4			
Description of the rock				
Pre Test: See Logs				
Post Test: See Logs				
The slaking fluid is tap water at 20°C	unless otherwise stated in this report	t.		
The results relate to the specimens tested.	٩	ersons au	thorised to	approve report
Any remaining material will be retained for or Sampling and opinions and interpretations a	e month. e outside the scope of accreditation.	J Ba H Bvr	arrett (Quality	/ Manager) ry Manager)
	Approved by		Date	Page
IGSL Materials Laborat	ory		29-06-16	1 of 1

Materials Laboratory	Test Report		ISO 170
Unit J5, M7 Business Park Newhall, Naas	Ten per cent Fines	/alue	
Co. Kildare 045 846176	Tested in accordance with BS812	2:Part 111:1990	DETAILED IN SCOPE REG NO
Report No.	R73040		
Customer:	Arup, 50 Ringsend Rd, Dublin 4		
Contract No.	18963		
Contract Name:	N6 Galway City Transport Project Pha	ase 3	
Sample No.	A16/1995		
Customer Ref.	Bh 3/33 @ 8.0-10.6m		
Material Type:	Core		
Date Received:	22-04-16		
Date Tested:	23-05-16		
Location:	N/A		
Sample Certificate:	Not Provided		
Description:	14-10mm aggregate		
Condition of aggregate tested:	Soaked		
Ten per cent Fines Value (kN):	180		
The result relates to the specimens tested. Any remaining material will be retained for a Sampling and opinions and interpretations	one month. are outside the scope of accreditation.	proved signatories H Byrne (Lab	ooratory Manage
Materials Laboratory	Test Report		ISO 170
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Unit J5, M7 Business Park Newhall, Naas	Ten per cent Fines V	/alue	
Co. Kildare 045 846176	Tested in accordance with BS812	:Part 111:1990	DETAILED IN SCOPE REG NO
Report No.	R73041		
Customer:	Arup, 50 Ringsend Rd, Dublin 4		
	40000		
Contract No.	18963		
Contract Name:	N6 Galway City Transport Project Pha	se 3	
Sample No.	A16/1997		
Customer Ref.	Bh 3/36 @ 5.0-7.85m		
Material Type:	Core		
Date Received:	22-04-16		
Date Tested:	13-05-16		
Location:	N/A		
Sample Certificate:	Not Provided		
Description:	14-10mm aggregate		
Condition of aggregate tested:	Soaked		
Ten per cent Fines Value (kN):	170		
The result relates to the specimens tested.	Ap	proved signatories	
Any remaining material will be retained for Sampling and opinions and interpretations	one month. are outside the scope of accreditation.	H Byrne (Lab	ooratory Manage
	Approved by	Date	Page
IGSL Materials Labora	tory	29-06-16	1 of 1

Materials Laboratory	Test Report		ISO 170
Unit J5, M7 Business Park Newhall, Naas	Ten per cent Fines V	alue	
Co. Kildare 045 846176	Tested in accordance with BS812:	Part 111:1990	DETAILED IN SCOPE REG NO
Report No.	R73042		
Customer:	Arup, 50 Ringsend Rd, Dublin 4		
Contract No.	18963		
Contract Name:	N6 Galway City Transport Project Phas	se 3	
Sample No.	A16/1992		
Customer Ref.	Bh 3/04 @ 0.8-3.7m		
Material Type:	Core		
Date Received:	22-04-16		
Date Tested:	16-05-16		
Location:	N/A		
Sample Certificate:	Not Provided		
Description:	14-10mm aggregate		
Condition of aggregate tested:	Soaked		
Ten per cent Fines Value (kN):	140		
The result relates to the specimens tested. Any remaining material will be retained for Sampling and opinions and interpretations	one month. are outside the scope of accreditation.	proved signatories H Byrne (Lat	poratory Manage
	Approved by	Date	Page
IGSL Materials Labora	tory	29-06-16	1 of 1

Unit J5, M7 Business Park Newhall, Naas Co. Kildare 045 846176 Report No. Customer: Contract No. Contract Name: Sample No. Customer Ref. Material Type: Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregatitested: Ten per cent Fines Value (kN): The result relates to the specimens tested Any remaining material will be retained for Sampling and opinions and interpretation	Test Report		ISO 170
Co. Kildare 045 846176 Report No. Customer: Contract No. Contract Name: Sample No. Customer Ref. Material Type: Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregatitested: Ten per cent Fines Value (kN): The result relates to the specimens tested Any remaining material will be retained for Sampling and opinions and interpretation	Ten per cent Fines	Value	
Report No.Customer:Contract No.Contract Name:Sample No.Customer Ref.Material Type:Date Received:Date Tested:Location:Sample Certificate:Description:Condition of aggregationstested:Ten per cent Fines Value (kN):	Tested in accordance with BS812	2:Part 111:1990	DETAILED IN SCOPE REG NO
Customer: Contract No. Contract Name: Sample No. Customer Ref. Material Type: Date Received: Date Tested: Date Tested: Location: Sample Certificate: Description: Condition of aggregatitested: Ten per cent Fines Value (kN):	R73043		
Contract No. Contract Name: Sample No. Customer Ref. Material Type: Date Received: Date Tested: Date Tested: Location: Sample Certificate: Description: Condition of aggregat tested: Ten per cent Fines Value (kN):	Arup, 50 Ringsend Rd, Dublin 4		
Contract No. Contract Name: Sample No. Customer Ref. Material Type: Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregate tested: Ten per cent Fines Value (kN):			
Contract Name: Sample No. Customer Ref. Material Type: Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregat tested: Ten per cent Fines Value (kN):	18963		
Sample No.Customer Ref.Material Type:Date Received:Date Tested:Location:Sample Certificate:Description:Condition of aggregation tested:Ten per cent Fines Value (kN):The result relates to the specimens tested Any remaining material will be retained for Sampling and opinions and interpretation	N6 Galway City Transport Project Pha	ase 3	
Customer Ref. Material Type: Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregate tested: Ten per cent Fines Value (kN):	A16/1995		
Material Type: Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregate tested: Ten per cent Fines Value (kN):	Bh 3/18 @ 12.5-15.2m		
Date Received: Date Tested: Location: Sample Certificate: Description: Condition of aggregate tested: Ten per cent Fines Value (kN):	Core		
Date Tested: Location: Sample Certificate: Description: Condition of aggregate tested: Ten per cent Fines Value (kN):	22-04-16		
Location: Sample Certificate: Description: Condition of aggregat tested: Ten per cent Fines Value (kN): The result relates to the specimens teste Any remaining material will be retained for Sampling and opinions and interpretation	26-05-16		
Sample Certificate: Description: Condition of aggregatitested: Ten per cent Fines Value (kN): The result relates to the specimens tester Any remaining material will be retained for Sampling and opinions and interpretation	N/A		
Description: Condition of aggregate tested: Ten per cent Fines Value (kN): The result relates to the specimens teste Any remaining material will be retained for Sampling and opinions and interpretation	Not Provided		
Condition of aggregativested: Ten per cent Fines Value (kN): The result relates to the specimens tester Any remaining material will be retained for Sampling and opinions and interpretation	14-10mm aggregate		
Ten per cent Fines Value (kN): The result relates to the specimens teste Any remaining material will be retained for Sampling and opinions and interpretation	e Soaked		
The result relates to the specimens teste Any remaining material will be retained fo Sampling and opinions and interpretatior	210		
The result relates to the specimens teste Any remaining material will be retained fo Sampling and opinions and interpretatior			
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The result relates to the specimens teste Any remaining material will be retained for Sampling and opinions and interpretation			
The result relates to the specimens teste Any remaining material will be retained for Sampling and opinions and interpretation			
Sampling and opinions and interpretation	d. Ar	pproved signatories	
	s are outside the scope of accreditation.	H Byrne (Lab	ooratory Manage
	Approved by	Date	Page

Materials Laboratory	Test Report		ISO 17
Unit J5, M7 Business Park Newhall, Naas	Ten per cent Fines V	alue	
Co. Kildare 045 846176	Tested in accordance with BS812:	Part 111:1990	DETAILED IN SCOPE REG NO
Report No.	R73992		
Customer:	Arup, 50 Ringsend Rd, Dublin 4		
Contract No.	18963		
Contract Name:	N6 Galway City Transport Project Phas	e 3	
Sample No.	A16/313		
Customer Ref.	Bh 3/48 @ 4.3-7.3m		
Material Type:	Core		
Date Received:	02-06-16		
Date Tested:	23-06-16		
Location:	N/A		
Sample Certificate:	Not Provided		
Description:	14-10mm aggregate		
Condition of aggregate tested:	Soaked		
Ten per cent Fines Value (kN):	170		
The result relates to the specimens tested.	Apr	proved signatories	
Any remaining material will be retained for a Sampling and opinions and interpretations a	one month. are outside the scope of accreditation.	H Byrne (Lab	ooratory Manage
	Approved by	Date	Page

Appendix 17

Exploratory Hole Location Plan



	Date: 22/06/2017	22/06	Date:	Ē	Checked:
18963-000-001	Original Scale: 1:40,000 @A3	22/06	Date:	Ŗ	Drawn:
Drawing No:	File Name: 18963	22/06	Date:	Ř	Designed:
	Overview Plan				Title
ontract 1	und Investigation C	Grou		nt	Compone
oject - Phase 3	y City Transport Pro	Galway	N6		Project:



	Date: 22/06/2017	22/06	Date:	Ļ	Checked:
18963-000-101	Original Scale: 1:5000 @A3	22/06	Date:	Ŗ	Drawn:
Drawing No:	File Name: 18963	22/06	Date:	Ŕ	Designed:
9	Location Plan 1 of				Title
ontract 1	und Investigation Co	Grou		nt	Compone
ject - Phase 3	/ City Transport Pro	Galway	NO		Project:





Designed: CK Drawn: CK Checked: JL	Component: Title:	Project:	
Date: 22/06 Date: 22/06 Date: 22/06	Gro	N6 Galwa	
File Name: 18963 Original Scale: 1:5000 @A3 Date: 22/06/2017	Location Plan 3 of	ay City Transport Pro	
Drawing No: 18963-000-103	9	ject - Phase 3	



Checked: JL	Project: Component: Title: Designed: OK	
Date: 22/06 Date: 22/06	N6 Galwa Gro	Under const.
Original Scale: 1:5000 @A3 Date: 22/06/2017	ay City Transport Proj ound Investigation Co Location Plan 4 of	BH3
18963-000-104	lect - Phase 3 Intract 1 9	









