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SUMMARY REPORT ON

GROUND INVESTIGATIONS AT WALSHESTOWN PIT CO. KILDARE

Submitted to:

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EXECUTIVE SUMMARY

Cemex (ROI) Ltd (Cemex) has retained Golder Associates Ireland (Golder) to assess the possible risks posed to the groundwater and surface water environment by a proposed facility for disposal/recovery of inert materials at a worked-out sand and gravel site, at Walshestown, Co Kildare.

There are three large ponds on the Site, two along the western boundary (Ponds A1/A2 and A3) and one in the southern part of the Site (Pond B). The worked-out pit area has been restored to agricultural land-use (grazing) in the southern and eastern parts of the Site. The northern part of the Site is, for the most part exposed silts, with glacial till along part of the western boundary. The central area of the Site, almost as far south as Pond B, comprises made ground.

The field investigation comprised eight rotary boreholes, one shell & auger borehole, nine window sample probes and one line of geophysics. A programme of laboratory testing was undertaken, which included classification testing of materials encountered. A piezometer was installed in each of the eight rotary boreholes to collect information on groundwater both upgradient and down-gradient of the proposed development.

From interpretation of the site investigation data a number of observations can be made about the on-Site sub-surface:

- (a) Recorded soil thickness ranges from ca.15 m to ca.38 m, and is typically greater than ca.22 m;
- (b) The mineral soils generally consisted of sandy gravelly silts (sometimes clays);
- (c) A zone of 'heavily weathered' 'bedrock', ranging from between 2.5 m to 7.5 m thickness is interpreted to occur below the mineral soils; and
- (d) Thinly bedded grey-green siltstones lie below the 'heavily weathered' zone.

Groundwater flow direction is interpreted, from water level monitoring and contouring, to be towards west- northwest.

1.0 INTRODUCTION

1.1 General

Cemex (ROI) Ltd (Cemex) has retained Golder Associates Ireland (Golder) to assess the possible risks posed to the groundwater and surface water environment by a proposed facility for disposal/recovery of inert materials at a worked-out sand and gravel site, at Walshestown, Co Kildare.

The Walshestown Pit is located at Irish National Grid co-ordinate 2932 2157; c. 5 km southeast of Naas, Co. Kildare (approximately halfway between Naas and Blessington), and c. 0.5 km due east of Punchestown racecourse.

The Site covers an area of c. 70 hectares. The southern and eastern parts of the Site have been restored to agricultural grazing land. The central and northern parts consist of bare made ground and a former silt lagoon area respectively (Figure GI/01) There are currently three large ponds on the Site, two along the western boundary (Ponds A1/A2 and A3) and one in the southern part of the Site (Pond B). The water level in the ponds fluctuates seasonally. The ground just south of Pond B is wet underfoot with scattered clumps of rushes, and remains damp throughout the year; in very weather the pond overflows at the southwestern corner.

Golder carried out ground investigations to provide information on the geology, hydrogeological and geotechnical properties of the mineral soils and rock underlying the Site, in order to assist with the design of the proposed facility. The field investigations comprised eight rotary boreholes, one shell a urger borehole, nine window samples and one line of geophysics. A short programme of laboratory testing was undertaken that included classification testing on silts.

Seven rotary boreholes were drilled on the expected upgradient and downgradient perimeters of the Site with respect to groundwater flow. One rotary borehole was drilled in a central location.

The silt-lagoon area in the north of the Site was investigated by means of nine window sample probes and one shell & auger borehole. Further information was obtained through one line of geophysics (2D resistivity), the results of which were correlated with the information obtained from the borehole and window samples.

2.0 SCOPE OF INVESTIGATIONS

The scope of the investigation was to investigate the ground and subsurface conditions by means of walk over surveys, rotary drilling, window sampling probes, shell & auger drilling and geophysics to record information on groundwater and surface water levels, and depths of strata encountered.

3.0 METHOD OF INVESTIGATION

3.1 General

All boreholes and window sample probes were drilled between 11 October and 14 December 2007 by two drilling contractors, Drilling 2000 and Glover Site Investigations Limited. All field investigation activities were supervised, on a full time basis, by technical staff from Golder.

Table 1 identifies which contractor drilled each hole and which investigation/drilling technique was used. The locations of the boreholes and probes are indicated on Figure GI/01. Borehole logs and window sample logs are presented in Attachment A of this report.

Table 1: Record of borehole contractors and drilling methods

Borehole	Drilling Contractor	Drilling Method Used					
Reference		Soils	Rock				
BH1-07	Drilling 2000	Rotary Percussion, air flush	Rock Not Drilled				
BH2-07	Drilling 2000 Drilling 2000 Consent of Con	Rotary Percussion, air flush (water flush from 28.15 m)	Rotary Coring, water flush				
BH3-07	Drilling 2000	Rotary Percussion, air flush	Rotary Percussion, air flush				
BH4-07	Drilling 2000	Rotary Percussion, air flush (water flush from 17.65 m)	Rock Not Drilled				
BH5-07	Drilling 2000	Rotary Percussion, air flush (water flush from 17.75 m)	Rotary Coring, water flush				
BH6-07	Drilling 2000	Rotary Percussion, air flush	Rock Not Drilled				
BH7-07	Glover Site Investigations Ltd	Rotary Percussion, air flush	Rotary Percussion, air flush				
BH8-07	Glover Site Investigations Ltd	Rotary Percussion, air flush	Rock Not Drilled				
SA1-07	Glover Site Investigations Ltd	Cable Percussion	Rock Not Drilled				
WS1-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS2-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS3-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS4-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS5-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS6-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS7-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS8-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				
WS9-07	Glover Site Investigations Ltd	Window Sampling Probe	Rock Not Drilled				

3.2 Drilling in Soils

3.2.1 Rotary Percussion

During October, early November and early December 2007 Golder managed the drilling of rotary boreholes, followed by installation of standpipe piezometers for water monitoring. All locations were set out on site by Golder in advance of the investigation and the boreholes were drilled as close as practicable to the designated locations.

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The initial strategy was to drill two boreholes at each designated location wherever practical, the first being drilled to water level in bedrock (observing unconsolidated strata encountered), and the second being drilled to the depth of water-bearing strata in the mineral soils, and then to install a piezometer in each borehole. This was in fact only practical at two locations, at the other locations either bedrock was encountered below dry mineral soils, or bedrock was not encountered, making it unnecessary to drill a second borehole at this location. In total eight rotary boreholes were drilled, BH1-07 to BH8-07, with BH1-07 and BH2-07 being a pair, and BH7-07 and BH8-07 being a pair (Figure GI/01).

All drilling operations on site were directed, and stratigraphy logged, by a qualified field technician from Golder staff, who also retrieved and labelled any recovered samples. Rotary percussion does not allow retrieval of undisturbed samples: the material which is being drilled through is forced by the flushing medium up the annulus between the drill string and the side of the hole. All material recovered is therefore highly disturbed. Table 1 identifies which boreholes were advanced through the soils using rotary percussive drilling, and using air or water as the flushing medium.

Groundwater conditions were observed and recorded in the open boreholes during drilling. Detailed borehole logs, including groundwater observations, are provided in Attachment A of this report, and a summary of findings is given in Section 4.0.

3.2.2 Window Sampling

On 27 November 2007 window sampling was carried out in the former silt lagoon area in an effort to estimate the thickness of the silts (Figure GI/01). The strategy was to penetrate the silts to refusal at fourteen locations. Of the fourteen planned probes only nine were completed due to unfavourable ground conditions and refusals at shallow depths.

Table 1 identifies which holes were probed using the window sampling technique; one bulk disturbed sample was taken from each probe location. All window sample probes were conducted using a Dando Terrier rig with coring attachment of approximately 100 mm nominal diameter. All sampling operations on site were directed, and stratigraphy logged, by a qualified field technician from Golder staff, who also retrieved and labelled the recovered samples. Of the proposed fourteen locations only nine probes were completed. The remaining five proposed probes were omitted because the ground proved too soft to sample

by this method, the samples not staying in the coring attachment as it was lifted. Detailed logs are provided in Attachment A.

3.2.3 Cable Percussion

Following on from the window sampling, during mid-December 2007 two shell & auger boreholes (cable percussion) were scheduled to extend through the silts to the natural ground below, in order to estimate the thickness of the silts in the former silt lagoon. In fact only one shell & auger borehole (SA1-07) was drilled, to refusal, due to the unfavourable surface conditions (Figure GI/01). The second proposed borehole was omitted as the proposed location proved too soft to support the weight of the cable percussion drilling rig during transportation, and it was not possible to find an alternative location which could support the rig.

Cable percussion boring and sampling were carried out in general accordance with BS 5930: 1999, casing of 200mm nominal diameter was used. Small disturbed samples and bulk samples were collected at regular intervals for inspection and laboratory testing. All drilling and sampling operations on site were directed, and stratigraphy logged, by a qualified field technician from Golder staff, who also retrieved and labelled the recovered samples.

Groundwater conditions were observed and recorder in the open borehole during drilling and sampling. A detailed borehole log, including groundwater observations, is provided in Attachment A. of copyright

3.3 **Drilling in Rock**

Table 1 identifies which of the fotary boreholes were advanced through to bedrock. Drilling 2000 started rotary coring at HQ size in the boreholes in which they used water flush, yielding a core diameter of 61.0 mm; where necessary (in order to drive the long drill-string) the hole size was reduced to NQ size, yielding a core diameter of 47.5 mm. Glover Site Investigations Ltd drilled their sole rock borehole using rotary percussion and air flush; this method was also used by Drilling2000 in BH3-07. No core was obtained from either of these boreholes

3.4 **Geophysics (Resistivity)**

To obtain further information on the depth and extent of the silts in the northern part of the Site, one 400 m line of 2D resistivity geophysics was conducted on 30 April 2008 (Figure GI/01).

3.5 **Survey of Borehole Locations and Geophysics Lines**

Following completion of the field investigation, a topographical survey was undertaken using differential GPS to obtain geographic co-ordinates (Irish National Grid) and ground level elevations for the boreholes and the geophysics line. All elevations are relative to Ordnance Datum (Malin Head).

3.6 Laboratory Testing

All the recovered soil samples were transported to and stored at the Golder's INAB accredited laboratory, GeoTesting Ltd, in Naas, Co. Kildare for further examination and for selective classification testing. A programme of laboratory testing was carried out on a selection of these samples. The suite of soil testing carried out included basic classification testing on mineral soils i.e. particle size distribution analysis, determination of moisture content, and liquid and plastic limits (on one sample only). A number of permeability tests were also carried out using the triaxial cell method. All of the laboratory testing was carried out in accordance with the relevant sections of BS 1377: 1990. Results of laboratory testing are included in Attachment B.

3.7 Slug Testing

In order to assess permeability of the rock and mineral soils, on the 1st, 2nd, 12th and 13th May 2008 a Golder scientist undertook site visits to visually inspect the groundwater monitoring piezometers and carry out hydraulic conductivity evaluation using the slug test method. In total slug tests (both falling and rising head) were carried out on seven of the rotary-drilled boreholes/groundwater monitoring wells (BHF 07, BH3-07, BH4-07, BH5-07, BH6-07, BH7-07 and BH8-07).

Slug tests were carried out in accordance with the Golder Field Procedure (*CP 725 Well Response Testing 2008*, included in Attachment C). For each borehole a pressure transducer, 'diver', was first placed in the piezometer pipe, this was followed by inserting the slug to create a falling head test with change in water level being recorded by the 'diver'. After allowing sufficient time for equilibrium to be reached the slug was withdrawn, to create a rising head test, and the 'diver' left in the borehole overnight to record the rising water level.

The results of the slug tests were used to calculate hydraulic conductivities using the General and Simple methods (BS 5930:1981, Section 21.4.6.1) for calculating hydraulic conductivities in an unconfined aquifer under steady state flow conditions.

4.0 SUMMARY OF SUBSURFACE CONDITIONS

4.1 General

The following is a summary of the main subsurface soil and groundwater conditions encountered, based on the field testing and laboratory-testing performed as described in this report. The locations of all exploratory holes and the geophysics line are shown on Figure GI/01.

4.2 Soils

Rotary boreholes were drilled to a maximum depth of 52.8 m below ground level (mbgl). Table 2 gives a summary of depth of the rotary boreholes, thickness of soils encountered and depth to waterstrike. The maximum recorded thickness of soils was found to be ca. 38 m (BH2-07, BH4-07, BH5-07).

Table 2: Thickness of soils at Site & depth to waterstrike in rotary boreholes

Borehole Reference	Total Depth (m)	Ground Level Elev (mAOD)	Thickness of Soils (m)	Depth to Weathered Bedrock (m bgl)	Depth to Waterstrike (m bgl)
BH1-07	19.5	147.58	19.5 to	-	12.4
BH2-07	46.0	147.54	37.511ec	37.5	16.2
BH3-07	35.85	157.54	iton 15.1	15.1	29.9
BH4-07	38.0	169.12	150° 0° 38.0+	-	-
BH5-07	52.8	146.91 🎺	yill 37.9	37.9	-
BH6-07	22.15	154.09	22.15+	-	17.0
BH7-07	37.0	155.07	31.5	31.5	29.0
BH8-07	22.0	154.90	22.0+	-	17.5

Notes: 1) All measurements were taken from ground level, not from stickup level

The ground conditions encountered in the boreholes located around the perimeters of the site are summarised in Table 3. Mineral soils consist mainly of sandy gravelly silts (sometimes clayey). Recorded soil thickness ranges from ca.15 m to ca.38 m, and is typically greater than ca.22 m.

Approximately 12 m thickness of running sands were encountered in BH1-07 and BH2-07 starting at a depth of ca. 12.5 or 13 m below ground level. Similar running sands were encountered in BH5-07 (15.6 – 16.7 mbgl). One disturbed bulk sample of this material was collected during rotary percussion drilling (from BH1-07 at 19 m depth). The laboratory particle size distribution (PSD) classification test of this sample describes the material as a loose dark brown grey silty SAND (as described in accordance with BS5930).

^{2) –} indicates a measurement was not obtained (due to water flush being used)

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Table 3: Summary of ground conditions encountered in rotary boreholes

Stratum	Description	Depth to	Stratum	Comments							
		top of	Thickness								
		Stratum (m)	(m)								
Agricultural		0	ca. 2.6 –	Only present in southern part of							
soils			4.1	Site, restored agricultural land, &							
				BH5-07							
	Sands gravels &	2.6 – 3.0	ca. 6 – 31	BH3-07 (6 m) thickening to BH4-							
	silts (varying			07, BH5-07 (ca. 15 m), and to							
	composition)			BH2-07 (25 m) & BH7-07 (31 m)							
Fluvioglacial	Includes:										
deposits	1) CLAY horizon (thickness ca. 1.75 – 5.35 m) Note 1										
	2) Running SAND (loose dark brown grey silty SAND) (thickness ca 1 – 12.15 m)										
	Note 2										
Till	Yellow-brown	10.15 – 28.1	ca. 5 – 21	BH3-07 (ca. 5 m), thickening to							
	sandy gravelly			BH2-07 (9.3 m), and to BH4-07 &							
	CLAY (occasional			BH5-07 (ca. 20 m); highest							
	limestone		200	śelevation in BH3-07, deepest in							
	boulders)		14. WA Off	BH2-07. Not present in BH8-07.							
Weathered	weathered rock,	15.1 – 37.9	ca. 2.5 –	Encountered only in BH2-07, BH3-							
rock	occasional	TUT	Roger 7.5	07, BH5-07 & BH7-07; highest							
	fracture with	ction P	(Soc.)	elevation in BH3-07; most							
	brown clay infill	insper owl		weathered in BH3-07 & BH5-07.							
Bedrock	Thinly bedded	ca. 20 - 45.4	unknown	Encountered only in BH2-07, BH3-							
	grey-green	i of cox		07, BH5-07 &, BH7-07; elevation							
	SILTSTONES 🥳	St.		rising to BH3-07							

Notes: 1: Not present in BH3-67. BH2-07 (1.75 m), thickening to BH5-07 and BH4-07 (ca. 5 m), thinning again to BH7-07 (ca. 3 m).

2: Only present along western boundary: BH5-07, thickening to BH1-07/BH2-07

The formation screened in each piezometer/borehole is indicated in Table 4. The estimated hydraulic conductivity of the mineral soils and bedrock units as calculated from slug tests in piezometers is also presented in that table. Calculated hydraulic conductivity values (often referred to as coefficient of permeability) in the mineral soils ranged from 1.0E-3 m/s to 5.6E-6 m/s.

The data presented suggest the drift material has a greater hydraulic conductivity than the bedrock. Published values of hydraulic conductivity for unconsolidated silty sand range from approximately 1E-3 m/s to 1E-7 m/s (Freeze and Cherry 1979, Table 2.2). Published values for sandstone and fractured rock range from 5E-4 m/s to 1E-10 m/s. The data derived for the Walshestown Site are considered to be fairly consistent with these ranges.

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Table 4	l· Estimate	d hydraulic	conductivity	of mineral	l soils and	hedrock in 1	the field

Borehole Ref.	Screen Depth (mbgl)	Mineral soils/ Bedrock	Geological Strata Screened	Test & Interpretation Method	Hydraulic Conductivity Kv (m/s)
BH1-07	13.4 – 17.4	Mineral soils.	Fine running sands	General rising head method	1.8E-4 – 9.6E-4
BH3-07	32.6 – 35.6	Bedrock	Siltstone	General rising head method	3.8E-4
BH4-07	31.6 – 37.6	Mineral soils	Sandy very gravelly clay /gravel	General rising head method	7.6E-5
BH5-07	35.4 – 38.4	Mineral soils	Gravel & cobbles/weathered bedrock (siltstone)	General rising head method	1.3E-5 – 6.9E-7
BH6-07	19 – 22	Mineral soils	Sand & gravel / sandy, gravelly clay	Simple rising head method	1.0E-3
BH7-07	34 – 37	Bedrock	Siltstone	General rising head method	5.0E-5 – 8.7E-6
BH8-07	19 – 22	Mineral soils	Gravelly sand	Simple rising bead method	5.6E-6

4.2.1 Silt Lagoon

A summary of the window sampling and shelf & auger borehole investigation in the former silt lagoon is given in Table 5.

The results of the laboratory testing on the window samples, and shell & auger and rotary

The results of the laboratory testing on the window samples, and shell & auger and rotary borehole samples, are summarised in Table 6 and Table 7 respectively. Laboratory certificates relating to particle size distribution (PSD), moisture contents, Atterberg Limits and hydraulic conductivity are included in Attachment B.

The maximum depth penetrated by window sampling was 4 m. Window samples from the former silt lagoon were found to be relatively consistent, the material being predominantly a silt with varying quantities of sand (Table 6). Laminations of sand were observed in the field, and no gravel was encountered in the samples analysed for particle size distribution (PSD), supporting evidence that the area where window sampling was carried out was historically used as a siltation lagoon. The sand fraction present is in the form of fine sand bordering the coarse-silt fraction. The laboratory classification tests and the visual examination of samples taken from the window sample probes suggests the material in the former silt lagoon is a compact greyish-brown sandy SILT, as described in accordance with BS5930.

The shell & auger borehole located on the former silt lagoon (SA1-07) was terminated at ca. 12 m depth. Sample no. 3 (taken at a depth of 1.5 - 2 m) had a fines fraction of 87%, and PSD analysis returned a high clay content with representation of all fractions (see Table 7). Samples 10 and 13, taken from below 8.6 m depth, had a coarse fraction of > 65%. Reporting

on the deeper samples, GeoTesting Ltd. states "These samples appear to be taken in natural/unprocessed ground in an area where a sand/gravel bar is located. The presence of defined profiles indicates that this area is natural/unprocessed ground. The soil matrix also contains varying degrees of gravel and clay indicating that this is natural ground."

Table 5: Summary of window sample probes, shell & auger borehole and bulk samples

Probe/Borehole Reference	Depth Penetrated (m bgl)	Bulk S	Sample ID & ion (m bgl)	Sample Description (BS5930)
WS1-07	3.9	1	1.0 – 2.0	Compact, greyish-brown very sandy SILT
WS2-07	4.0	1	1.0 – 2.0	Cohesive greyish-brown slightly sandy SILT/CLAY
WS3-07	2.0	1	1.0 – 2.0	Compact, greyish-brown sandy SILT
WS4-07	2.0	1	1.0 – 2.0	Compact, greyish-brown very silty clayey fine SAND
WS5-07	2.0	1	No sample	Sample slipped from rod when pulled
WS6-07	0.3	1	No sample	Sample slipped from rod when pulled
WS7-07	0.5	1	No sample	Sample slipped from rod when pulled
WS8-07	3.0	1	2.0 – 3.0	Compact, greyish-brown sandy SILT
WS9-07	0.2	1	No sample	Sample slipped from rod when pulled
		2	1.0,000,000	Soft light brown slightly sandy SILT
		- 5	citon Parte out	Soft brown slightly gravelly slightly sandy SILT
		FO VI	2.5 – 3.0	Firm light brown slightly sandy slightly
		of eath	4.0 – 4.5	gravelly CLAY/SILT. Sands and gravels
SA1-07	12.0 Conset	7	4.5 – 5.0	well graded.
	Cor	10	8.5 – 9.0	
		11	9.0 – 9.5	
		13	10.4 – 10.5	Soft brown gravelly sandy SILT
		14	10.5 – 10.7	
		17	11.5 – 12.0	

Table 6: Summary of results of laboratory tests on window samples

Table 6	: Summar	Summary of results of laboratory tests on window samples													
Probe	Sample ID	Depth (m)	% Gravel	% Sand	% Coarse	% Silt	% Clay	% Fines	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Perm. (Triaxial) Kv (m/s)	Sample Description (BS5930)	Comments
WS1- 07	1	1.0 – 2.0	0	35	35	55	10	65	18	-	Not Plastic	-	1.03E-07	Compact, greyish- brown very sandy SILT	The material taken from the window samples is similar for all samples taken between 0.0 -4.0m. The material is
WS2- 07	1	1.0 – 2.0	0	8	8	67	25	92	24	- ooses only	Note	- د.	4.00E-09	Cohesive greyish- brown slightly sandy SILT/CLAY	predominantly a SILT matrix with varying amounts of sand. Sand Laminations were observed in the field. No gravels were encountered in
WS3- 07	1	1.0 – 2.0	0	37	37	49	14	63	For Trispection	l durkedik Whet -	Not Plastic	-	-	Compact, greyish- brown sandy SILT	these samples for PSD. The sand fraction present is fine, indicating that this portion of the sand fraction is from a washing process. The clay
WS4- 07	1	1.0 – 2.0	0	51	51	36	13	رو ار ة 49	29	-	Not Plastic	-	6.07E-08	Compact, greyish- brown very silty clayey fine SAND	size fraction is >10% for all samples. The absence of gravel and the presence of thin laminations of sand indicate that the area where these
WS8- 07	1	2.0 – 3.0	0	14	14	60	26	86	-	-	-	-	-	Compact, greyish- brown sandy SILT	samples were taken was likely to be where a siltation pond was located.

Table 7: Summary of results of laboratory tests on shell & auger and rotary borehole samples

rable /: S	ummary o	n results	oi iabora	tory test	s on snell	œ aug	ger and	rotary t	orehole san	_					
Borehole	Sample ID	Depth (m)	% Gravel	% Sand	% Coarse	% Silt	% Clay	% Fines	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Perm. (Triaxial) Kv (m/s)	Sample Description (BS5930)	Comments
SA1-07	3	1.5 – 2.0	6	7	13	42	45	87	39	35	18	17	7.99E-10	Soft brown slightly gravelly slightly sandy SILT/CLAY	
SA1-07	7	4.5 – 5.0								only.	any other use	-	2.23E-07	Medium dense brown sandy SILT	These samples appear to be taken in natural/unprocessed ground in an area where a
SA1-07	10	8.6 – 9.0	33	33	66	24	10	34	14 mg	required to	Not Plastic	-	2.27E-07	Soft brown gravelly sandy SILT	sand/gravel bar is located. The presence of defined profiles indicates that this area is natural/unprocessed
SA1-07	13	10.4 – 10.5	34	38	72	22	6	28 consent	A CODA	-	Not Plastic	-	-	Soft brown very silty very gravelly SAND	ground. The soil matrix also contains varying degrees of gravel and clay indicating that this is natural ground.
SA1-07	17	11.5 – 12.0	22	30	52	38	10	48	13	-	Not Plastic	-	-	Soft brown gravelly sandy SILT	The structure and texture of the soil matrix varies also, indicating natural or unprocessed ground
BH1-07	1	ca. 19.0	0	97	97	3	0	3	-	-	-	-	-	Loose dark brown grey silty SAND	

One 400 m line of 2D resistivity geophysics was conducted on the former silt lagoon 30 April 2008. A conceptual cross-section, based on the results of the geophysics, is shown in Figure GI/02, and a summary of the ground conditions encountered is given in Table 8. It can be seen that the soft silts of the former lagoon range in thickness from ca 1.5 m to 8.0 m, and they overlie natural ground (fine, sandy silts) which extend up to 30 m in depth below the former lagoon area. In the location of the shell & auger borehole the 2D resistivity geophysics indicates that approximately 4 m of soft silts overlie fine sandy silts (natural ground), which is broadly-speaking in agreement with the sample descriptions. The geophysics line also passed close to window sample probe locations WS5-07 and WS7-07. The former encountered sand and gravel at 1.2 m depth before collapsing, the latter collapsed at 0.5 m depth.

Table 8: Summary of ground conditions encountered in former silt lagoon area

Stratum	Depth to top of	Stratum	Comments
	Stratum (m)	Thickness (m)	
Soft SILT	0	ca. 1.5 – 8	
Fine sandy SILT	ca. 1.5 – 8.0	ca. 10.5 – 30	
Till	ca. 1.5 – 15	ca 5 – 27	Ţ <mark>hic</mark> kness varies considerably
Bedrock elevation	ca. 33	unknown	3 offer

Atterberg Limits (liquid and plastic limits) were obtained for only one of the samples (sample 3 from the shell & auger borehole, SA1-07). Results indicated that this SILT/CLAY material falls in the CL sector of the Casagrande Classification system. Bulk samples from the window samples were described by Geotesting as not being plastic.

The co-efficient of permeability of remoulded bulk samples of silt was determined using the triaxial cell method. The results of these tests are presented in Table 6 and Table 7. Test results indicated hydraulic conductivity/permeability values ranging from 1.03×10^{-7} m/s to 7.99×10^{-10} m/s.

4.3 Bedrock

All of the boreholes drilled into the bedrock encountered thinly bedded grey-green siltstones, which are likely to belong to the Carrighill Formation as suggested by the GSI (GSI, 1994). A zone of 'heavily weathered' 'bedrock', ranging from between 2.5 m to 7.5 m thickness is interpreted to occur below the mineral soils.

In BH4-07 no water was struck while drilling to 17.65 mbgl (on 22 October 2007), only damp clays were encountered at approximately 16 mbgl. Waterlevel was measured at 18 mbgl in the borehole before drilling resumed on the morning of 23 October 2007.

BH5-07 was drilled to a depth of ca. 53 mbgl into strong bedrock. The borehole was backfilled from to 42.7 mbgl, prior to installing the piezometer, and sealed with bentonite

grout from 42.7 mbgl to 38.7 mbgl. The installation monitors peizometric water level in the weathered rock with a screened section between 35.4 mbgl-38.4 mbgl.

The bedrock is a fine-grained rock which is likely to have a negligible inter-granular (or matrix) permeability. However, it appears to have fine joints and fractures through which water may be able to flow, increasing the permeability of the unit as a whole to some small extent. Calculated hydraulic conductivity values in the bedrock ranged from 3.8E-4 m/s to A published range for fractured igneous and metamorphic bedrock varies between approximately 8E-9 m/s to 2E-4 m/s respectively (Freeze and Cherry 1979). The data derived for Walshestown are considered to be fairly consistent with this range.

4.4 Groundwater

Table 2 summarises the groundwater strike levels encountered in the boreholes during drilling. Table 9 shows the groundwater levels recorded in the borehole installations, and in Ponds A1/A2, A3 and B, for the period since drilling up to and including 31 August 2008.

4.4.1 Bedrock

Confirmed groundwater elevations in the bedrock or Site are available for BH2-07, BH3-07, and BH7-07 (BH5-07 is installed across the soil/weathered rock horizon). Elevations in BH3-07 towards the south of the site suggest the bedrock is not fully saturated and it therefore forms a concealed aquifer beneath the overlying soils (which are 15.1 m thick). Groundwater elevations in BH2-07 towards the west of the Site and BH7-07 toward the northeast indicate that the bedrock is perennially saturated at these locations and that hydraulic heads are elevated within the overlying soils. Hydraulic head elevations in the bedrock vary across the Site from approximately 132 mAOD at BH2-07 to about 145 mAOD at BH7-07, with ranges in individual holes being less than 5 m.

A groundwater contour plot has been generated from the three piezometers that are installed in the bedrock only, for water levels monitored on 15 February 2008 (Figure GI/03). This plot indicates that drainage in the bedrock beneath the site footprint is towards the west northwest, and down a gradient of approximately 0.016. The flow direction, towards westnorthwest, is in agreement with the topography across the site. Groundwater elevations recorded in BH5-07, which is installed across the bedrock/soil interface, are considered to be not inconsistent with the water table contour plot for the bedrock.

4.4.2 Soils

Confirmed groundwater elevations in the soils are available for BH1-07, BH4-07, BH6-07, and BH8-07. These provide for a variation of between ca. 137 mAOD towards the west of the site (BH1-07) to ca. 151 mAOD to the northeast (BH4-07).

Table 9: Monitored groundwater levels (m AOD)

Borehole Reference	Screen Formation	Top of casing reference level (mAOD)	01/11/07	29/11/07	20/12/07	14/01/08	15/02/08	27/03/08	09/04/08	13/05/08	23/06/08	28/07/08	31/08/08
BH1-07	Soils	148.276	136.84	136.89	-	137.53	137.97	137.76	137.86	137.62	137.21	137.03	137.54
BH2-07	Bedrock	148.080	132.68	132.54	-	133.14	133.93	133.72	133.72	133.32	132.89	132.43	132.90
BH3-07	Bedrock	158.121	134.40	134.12	-	135.72	138.40	136.70	136.66	135.84	134.52	133.69	134.73
BH4-07	Soils	169.705	150.82	150.86	-	151.78	151.94	\$51.45	-	151.09	150.67	150.47	151.45
BH5-07	Soils	147.515	133.31	133.30	-	133.88	134.55	134.29	134.29	133.76	133.49	132.90	133.55
BH6-07	Soils	154.900	138.26	138.12	-	138.75	39.45	139.20	139.14	138.86	138.32	137.97	138.46
BH7-07	Bedrock	155.710	-	-	144.09	144.30 70	edi 144.82	144.13	143.98	143.94	143.65	143.49	144.26
BH8-07	Soils	155.500	-	-	144.09	144.32 ne	144.83	144.17	144.03	143.97	143.69	143.53	144.28
Pond A1/A2	n/a	139.409	-	137.49	- ,	For its Philo	138.48	138.25	=	137.97	137.64	137.37	137.70
Pond A3	n/a	-	-	137.89	- 📈	-	138.95	-	-	-	-	1	-
Pond B	n/a	142.89	-	141.80	Conser	-	142.64	-	-	142.22	141.92	141.80	142.24

Notes: - indicates a measurement was not obtained

A water strike was not reported in the soils during the drilling of BH3-07 towards the south of the site. This, together with the fact that the bedrock at this location is not fully saturated, suggests that the overlying soils are dry at this location and do not support a water table.

Neighbouring boreholes BH1-07 and BH2-07, installed in the soils and bedrock respectively, indicate significantly different groundwater elevation, with piezometric level in bedrock being consistently lower in bedrock by ca 4 to 5 m. These data suggest that the groundwater in the soils at BH1-07 is perched above a significant till layer recorded at the base of the fluvioglacial deposits in the log of the neighbouring borehole, BH2-07 (see Attachment A).

A similar pair of installations is provided by BH7-07 (bedrock) and BH08-07 (soils) towards the north-eastern end of the site. However, at this location the boreholes in both the bedrock and soils report very similar hydraulic heads (always less than 5 cm difference between the boreholes even though the hydraulic head elevation has ranged by ca. 1.3 m since monitoring began). The data suggests that at this location there is a strong degree of hydraulic continuity between the soils and bedrock, probably due to the absence of any basal till unit below the fluvioglacial deposits. Values in the order of 144 mAOD are representative of groundwater elevation in this location.

Pond B in the southern half of the site is considered likely to be perched above any groundwater table in the bedrock, since it is to the northwest and technically down-gradient of BH3-07 (installed in the bedrock), yet its elevation is greater than water elevations recorded at BH3-07. It is considered possible that Pond B is perched above clay units observed in the top half of the logs from BH1-07 and BH2-07, or it may represent a 'silted up' depression allowing for some surface water collection in the floor of the former quarry. Either way, it is concluded that a conventional groundwater table does not exist in the soils across the southern half of the site, and development of any such water table would occur only locally.

The northern part of the site contains two ponds, A1/A2 and A3, which are at an elevation of about 3-4 m above the groundwater elevation reported for BH5-07 (located about 120 m to the south-southeast of these ponds), and about 3-4 m below groundwater elevations reported for Pond B towards the south of the site. It has been suggested above that in the vicinity of BH7-07/BH8-07 a single groundwater elevation (in the order of 144 mAOD) is representative of both the soils and bedrock. Given that groundwater in the bedrock drains to the west (or slightly north of west), it is plausible and indeed expected that the Ponds at A1/A2 and A3 are an expression on the surface of this groundwater table.

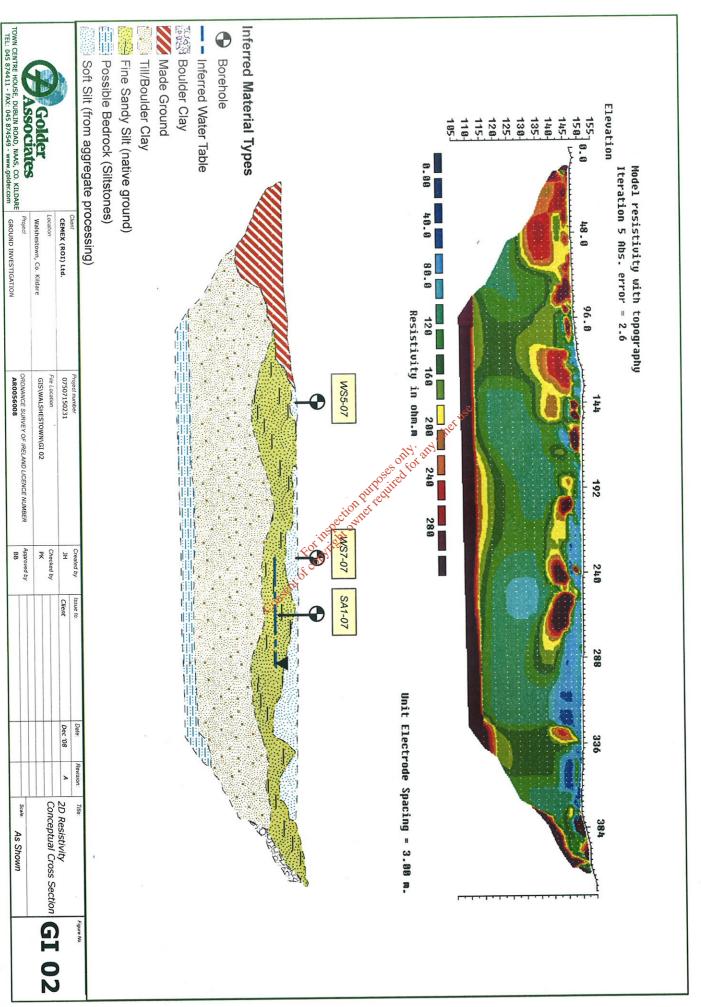
In summary, the groundwater table across the site is expected to drain to the west-northwest. Towards the south the soils are unsaturated, and towards the north and west of the site where the soils are thicker and the bedrock surface elevation drops, the groundwater table lies within the soils. Ponds to the northwest of the site (A1/A2 and A3) are expected to be a surface expression of this groundwater table, whereas the pond towards the south of the site (Pond B) is considered more likely to be perched on a clay horizon within the glacial deposits and not part of any main water table. In other areas where clays occur within the glacial deposits localised water tables may also be present.

5.0 REFERENCES

Freeze R.A. & Cherry J.A. (1979). Groundwater. Prentice Hall.

GSI (1994). Geology of Kildare-Wicklow: A Geological Description, with accompanying Bedrock Geology 1:100,000 Scale Map, Sheet 16, Kildare-Wicklow. GSI Publications.

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RECORD OF MONITORING WELL BH 1-07

BORING DATE: 11-12 Oct 2007

DATUM: Malin Head

SHEET 1 OF 1

LOCATION: Western boundary (see Fig. GI/01) FASTING: 292609 NORTHING: 215283 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING k, cm/s INSTALLATION AND GROUNDWATER ELEVATION 10⁻⁴ 40 NUMBER ELEV nat V. + Q - ● rem V. ⊕ U - O TYPE SHEAR STRENGTH WATER CONTENT PERCENT DESCRIPTION OBSERVATIONS OW DEPTH (m) lockable cover **GROUND SURFACE** Firm, medium-brown, sandy, gravelly, CLAY diameter) cement cap 146 2 144.98 2.60 Loose, gravelly SAND 0 144 0 0 50 mm plain riser backfilled 0 142 with local sand 0 140.88 Boulder 140.53 Loose, gravelly SAND 0 140 139.58 Loose, dark-grey, silty, very gravelly, SAND ХО 8.00 Symmetrix (rotary percussion) 6" casing Loose, brown SAND 138 ó COPY 10 stallation 12/10/07 Loose, silty, very gravelly, SAND œ 10.15 12/10/07 <u>V</u> 01/11/07 <u>V</u> 0 × 136 bentonite seal 폿 12 xo DATA INPUT: 135.13 water strike 11/10/07 Loose, brown-grey, fine SAND (running) natural sands 134 caved in WALSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT 50 mm slotted screen with geosock, 132 natural sands caved in around 16 screen piezometer silted-up to 15.4 m during 130 installation 18 hole caved in В PSD EOH 128.08 EOH 20 IRELAND **DEPTH SCALE** LOGGED: PK Golder **Associates** CHECKED: BB 1:100

DEPTH SCALE

1:100

RECORD OF MONITORING WELL BH 2-07

SHEET 1 OF 3

BORING DATE: 12-17 Oct 2007 LOCATION: Western boundary (see Fig. GI/01) DATUM: Malin Head FASTING: 292611 NORTHING: 215299 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING k, cm/s INSTALLATION AND GROUNDWATER ELEVATION 10⁻⁶ 10⁻⁵ 10⁻⁴ 40 NUMBER ELEV. nat V. + Q - ● rem V. ⊕ U - O TYPE SHEAR STRENGTH WATER CONTENT PERCENT DESCRIPTION OBSERVATIONS OW DEPTH (m) lockable cover (100 mm GROUND SURFACE Firm, medium-brown, sandy, gravelly, CLAY diameter) cement cap bentonite seal 146 2 145.04 Loose, gravelly, SAND, with 0 occasional cobble 0 144 8 Ç 0 Ġ 142 0 **@** Ò 0 140 0 0,0 139.04 0 Symmetrix (rotary percussion) 6" casing Loose, brown, SAND 138 or COPY 50 mm plain riser backfilled with local sand 136.14 Brown, sandy, gravelly CLAY 136 0 12 DATA INPUT: _0 134.39 Loose, brown-grey, fine SAND (running) 13.15 134 LSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT before installation 17/10/07 ₩. 01/11/07 132 water strike 15/10/07 16 130 18 20 --- CONTINUED NEXT PAGE ---IRELAND

Golder

Associates

LOGGED: PK

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1:100

LOCATION: Western boundary (see Fig. GI/01)

RECORD OF MONITORING WELL BH 2-07

BORING DATE: 12-17 Oct 2007

SHEET 2 OF 3 DATUM: Malin Head FASTING: 292611

NORTHING: 215299 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING k, cm/s INSTALLATION AND GROUNDWATER ELEVATION 10⁻⁴ 40 NUMBER ELEV. SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O TYPE WATER CONTENT PERCENT DESCRIPTION OBSERVATIONS OW DEPTH Wp 📙 (m) --- CONTINUED FROM PREVIOUS PAGE -20 Loose, brown-grey, fine SAND (running) 126 22 124 24 °-0-£ Brown, sandy, clayey, GRAVEL 122 26 120 28 Yellow-brown, sandy, gravelly, CLAY with limestone boulders (casing held tightly) 0_ 50 mm plain riser backfilled 118 ó 30 with local sand 116 32 Rotary percussion HQ casing 114 WALSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT 112 36 0 _0_ 110.04 37.50 Grey-green SILTSTONE (3.5m weathered zone) 110 38 108 bentonite seal --- CONTINUED NEXT PAGE ---IRELAND DEPTH SCALE LOGGED: PK Golder **Associates** CHECKED: BB

RECORD OF MONITORING WELL BH 2-07

BORING DATE: 12-17 Oct 2007

DATUM: Malin Head

SHEET 3 OF 3

LOCATION: Western boundary (see Fig. GI/01) FASTING: 292611 NORTHING: 215299 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, k, cm/s SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING INSTALLATION AND GROUNDWATER ELEVATION 10⁻⁶ 10⁻⁵ 10⁻⁴ STRATA PLOT 40 NUMBER ELEV. nat V. + Q - ● rem V. ⊕ U - O TYPE SHEAR STRENGTH Cu, kPa WATER CONTENT PERCENT DESCRIPTION OBSERVATIONS -OW 1 DEPTH Wp ⊢ (m) --- CONTINUED FROM PREVIOUS PAGE --40 Grey-green SILTSTONE (3.5m weathered zone) silica sand 106 Rotary percussion HQ casing 42 104 50 mm slotted screen with geosock, backfilled with silica sand & caved-in natural sands 101.54 46.00 EOH 46 EOH 48 50 52 WALSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT 26/9/08 DATA INPUT: 54 56 58 60 GOLDER-IRELAND DEPTH SCALE Golder Associates LOGGED: PK CHECKED: BB 1:100

RECORD OF MONITORING WELL BH 3-07

BORING DATE: 18-19 Oct 2007

DATUM: Malin Head FASTING: 292791

SHEET 1 OF 2

LOCATION: Eastern boundary (see Fig. GI/01) NORTHING: 214827 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING k, cm/s INSTALLATION AND GROUNDWATER ELEVATION 40 10⁻⁴ NUMBER ELEV nat V. + Q - ● rem V. ⊕ U - O TYPE SHEAR STRENGTH WATER CONTENT PERCENT DESCRIPTION OBSERVATIONS DEPTH OW (m) lockable cover **GROUND SURFACE** Firm, medium-brown, sandy, gravelly, CLAY diameter) • cement cap 156 154 153.39 GRAVEL, with some cobbles/boulders 8 Solo 151.89 5.65 152 Gravelly SAND, with minor clay 0 0 150.39 7.15 Light-brown, fine SAND, with occasional gravel 150 148.89 Brown, clayey, coarse SAND 8.6 O Rotary percussion Air flush cased 148 ó COPY 50 mm plain riser backfilled Yellow-brown, sandy, gravelly, CLAY 10.15 with local sand 146.84 Light-brown, fine, SAND and GRAVEL, some clay (casing very tight) 146 12 144 GLDR_LDN.GDT Grey SILTSTONE (5m slightly weathered zone: very occasional fracture with brown clay infill) 15.10 142 16 140 18 138 20 --- CONTINUED NEXT PAGE ---IRELAND DEPTH SCALE LOGGED: PK Golder CHECKED: BB 1:100 Associates

LOCATION: Eastern boundary (see Fig. GI/01)

RECORD OF MONITORING WELL BH 3-07

BORING DATE: 18-19 Oct 2007

SHEET 2 OF 2 DATUM: Malin Head EASTING: 292791

																			ASTING: 292791 ORTHING: 214827
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RECORD OF MONITORING WELL BH 4-07

SHEET 1 OF 2 DATUM: Malin Head EASTING: 293196 BORING DATE: 19-23 Oct 2007 LOCATION: Eastern boundary (see Fig. GI/01) NORTHING: 215360 DYNAMIC PENETRATION Q SAMPLES HYDRAULIC CONDUCTIVITY, SOIL PROFILE

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DEPTH SCALE 1:100

GOLDER-IRELAND WALSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT 26/9/08 DATA INPUT: PK

Golder Associates

LOGGED: PK CHECKED: BB

LOCATION: Eastern boundary (see Fig. GI/01)

RECORD OF MONITORING WELL BH 4-07

BORING DATE: 19-23 Oct 2007

SHEET 2 OF 2

DATUM: Malin Head EASTING: 293196 NORTHING: 215360

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LOCATION: Western boundary (see Fig. GI/01)

RECORD OF MONITORING WELL BH 5-07

BORING DATE: 25-31 Oct 2007

SHEET 1 OF 3

DATUM: Malin Head EASTING: 292659 NORTHING: 215654

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BORING METHOD			STRATA PLOT	ELEV	0	<u>ц</u> ш		ELEVATION				1	30	10				0 ⁻³	ADDITIONAL LAB. TESTING	AND GROUNDWAT
l S		DESCRIPTION	ZATA	DEPT		TYPE		ELE	Cu, kP	R STREN a	IGIH I	em V. \oplus	Ū- Ŏ			ONTENT F			ADD ABB.	OBSERVATIO
Ĭ	1		ST	(m)	Ļ		4		2	.5 5 T	60 7	75 <u>1</u>	00	5				20		lockable cover
Н		GROUND SURFACE CLAY (topsoil?)	۵	0.0	0	+++	+													diameter) cement cap
		,	Δ.																	
								146												bentonite seal
			Δ.																	Į .
			Δ																	
Ш			Δ																	
			Δ					144												
			Δ,																	
	L		Δ	142.7	6															
		Slightly damp CLAY	E	4.1	5															
			\vdash					142												ļ
			\vdash	1									ei ise.							
Ш			E					140				10							ł	
sasing				1						purpose	ouly.	ally								before installation 30/10/07
9 (uc			=	-						205°	Sogra									installation 30/10/07
roussi	ųs _			138.2					^	Sing	A.									
Symmetrix (rotary percussion) 6" casing	Air flush	Clayey, sandy, GRAVEL	°0-	8.7	0			138		SQ. A									i	l .
trix (ro			2					ot inst	Mo											
ymme			0 2	2			Ŷ ^c	COBAL	10											
			07				1	0												50 mm plain riser backfilled
			00			Conser	in line	136												with local sand
			07		(Cor														
			₽ `																	
			07	ج م																
			0					134												
			0/0/																	01/11/07
			6	1				132												
			0 0	1				132												
	\dagger	Loose, brown-grey, fine SAND	0_	131.3 15.6																
		(running)																		ľ
	+	Yellow-brown, clayey, sandy, GRAVEL	° <u></u>	130.2	0			130												
		(very slow progress: 3m/hr)	0-					.50												ľ
Bug	\dashv		9	4																[
오 연 명	اء		07	1																
Balon	Water flush		0~	1				128					\sqcup							l (
Rotary percussion HQ casing	Wa		9	2				•												
Rotar			00	4			\perp													ľ
\Box		CONTINUED NEXT PAGE																		
									A	1										

LOCATION: Western boundary (see Fig. GI/01)

RECORD OF MONITORING WELL BH 5-07

BORING DATE: 25-31 Oct 2007

SHEET 2 OF 3

DATUM: Malin Hear

DATUM: Malin Head EASTING: 292659 NORTHING: 215654

																		N	ORTHING: 215654
Ş	2	SOIL PROFILE			SA	MPLE		DYNA RESIS	MIC PEN STANCE,	IETRATIO BLOWS	ON /0.3m	\	HYDRA	k, cm/s	ONDUCT	ΓΙVΙΤΥ,	T	ا	INSTALLATION
METRES RORING METHOD	IME		STRATA PLOT	ELEV.	ER.		ELEVATION	2				30	10) ⁻⁶ 1	0 ⁻⁵ 10		10 ⁻³	ADDITIONAL LAB. TESTING	AND GROUNDWATER
ME NE		DESCRIPTION	RATA	DEPTH	NUMBER	TYPE	ELEV	SHEA Cu, kF	R STREN a	NGTH r	nat V. + em V. ⊕	Q - • U - O			ONTENT OW			ADDI ⁻	OBSERVATIONS
	1		STF	(m)	Ĺ				25 5	50 7	75 1	00					20	—	
20		CONTINUED FROM PREVIOUS PAGE Yellow-brown, clayey, sandy, GRAVEL	<u>°</u> _0		┢		+												[4]
		(very slow progress: 3m/hr)	0-																
			90	4			126	;										1	[4]
																			[à [
2			07	7															
			0/	1															
			00				124	·										1	31
			000000																
4			2/2	2															[3]
			07	1															l A
			0000				122											1	
			0 / 0 /																
6			9 /	2								et use.							(4),8
			0-	9			120	, 📙			×	ei						1	50 mm plain
			\$ \(\)	4						93.	आंत्रे ०.								50 mm plain riser backfilled with local sand
8			07						جي ج	Porto									, , , , , , , , , , , , , , , , , , ,
			07	2					MIPO!	Hec									Ş
2							118	ettalisti ori	(S) (SO)									┨	ক্যুক
ф Ф	ء		0	7			1.4	ES ALOW	Y										N
salon)	Water flush		00000				Fori	Ti Sili											
Cotary percussion HQ casing	Wa		2	2			700												<u>, </u>
Rotar			000	7		onser	116	;										┨	
			°0	1	Ċ	Offic													
2			0/0																
			9 2	2															
			0-2				114											1	<u> </u>
			2	4															\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
4			07	4															ক, ক
			07				112	, L											
			₩ /	1															
6			0	1															
			0000	1															50 mm slotted screen with
			7.7 9.2	103.31			110	,										-	geosock, backfilled with
		Limestone boulder/cobbles	(37.00	Ï														local washed sand & fine
8	ŀ	Grey-green SILTSTONE (ca. 7.5m	<u>ک</u> را اااا	109.01 37.90															50 mm slotted screen with geosock, backfilled with local washed sand & fine gravel
		heavily weathered zone)																	
							108	·										1	
																			bentonite seal
∘∐	\dashv	CONTINUED NEXT PAGE		1	\vdash	\forall	+	+										+	*****
	_			1	_				<u> </u>	<u> </u>				<u> </u>		<u> </u>	1	1	
		SCALE							Go Ass	lder	,								LOGGED: PK
: 100)							V	ASS(ocia	tes								CHECKED: BB

RECORD OF MONITORING WELL BH 5-07

SHEET 3 OF 3

HODE	SOIL PROFILE	_	ı	SAI	MPLES	Z	DYNAMIC PEI RESISTANCE				HYDRAULIC (- AL	INSTALLATION
BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	ELEVATION	SHEAR STRE Cu, kPa	NGTH	60 80 I I nat V. + rem V. ⊕	Q - • U - O	WATER C	PERCENT WI	ADDITIONAL LAB. TESTING	AND GROUNDWATEI OBSERVATIONS
42 44 46 46 66 60 44 46 66 66 66 66 66 66 66 66 66 66 66	Grey-green SILTSTONE (ca. 7.5m heavily weathered zone)		94.11 52.80		n set l	CODA	BUTTON TO THE OF	s of the	The other states of the states	The second secon				bentonite seal hole infilled with local sand

RECORD OF MONITORING WELL BH 6-07 PROJECT: 07507150230 Walshestown

SHEET 1 OF 2

1	00	SOIL PROFILE			SAM	//PLES	l _	DYNAM RESIS	MIC PEN TANCE,	ETRATIONS/	ON /0.3m	\	HYDRAL k	ILIC CO , cm/s	NDUCTIV	/ITY,	ی, ا⊤	
	BORING METHOD	DESCRIPTION	A PLOT	ELEV.	BER	H.	ELEVATION	2	0 4	0 6	60 E	30 Q - •	10 ⁻⁶	10 ⁻⁴	10 ⁻⁴		ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATE
	BORIN	DESCRIPTION	STRATA PLOT	DEPTH (m)	NUMBER	TYPE	ELE					Q - • U - O			-OW	WI	ADD LAB.	OBSERVATION
,		GROUND SURFACE		0.00			154		5 3	,			Ĭ	Ï		20		(100 mm diameter)
		GRAVEL (likely Made Ground)	00000															bentonite seal
2		Slightly sandy CLAY		151.89 2.20			152											
6		GRAVEL SAND, occasional gravel lenses		149.69 4.40 149.09 5.00			150											
8							148	etion of the state	چو	only.	anyou	eruse.						50 mm plain riser, backfilled
0	Symmetrix (rotary percussion) 6" casing Air flush						140	ection ection	purgo let redi	jie .								with local sand
2	Symmetrix (rotary Air				Ċ	in Sent	142											
4							140											
6							138											bentonite seal
																		water strike 31/10/07
8							136											50 mm plain riser, backfilled with local sand
۰		CONTINUED NEXT PAGE	1		\vdash									_	+		+	

38

40

DEPTH SCALE

1:100

GOLDER-IRELAND

RECORD OF MONITORING WELL BH 6-07

BORING DATE: 31 Oct - 1 Nov 2007

SHEET 2 OF 2 DATUM: Malin Head

LOCATION: Central, beside access track (see Fig. GI/01) FASTING: 292904 NORTHING: 215579 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, k, cm/s SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING INSTALLATION AND GROUNDWATER OBSERVATIONS ELEVATION 40 10⁻⁶ 10⁻⁵ 10-4 NUMBER ELEV. nat V. + Q - ● rem V. ⊕ U - O TYPE SHEAR STRENGTH Cu, kPa WATER CONTENT PERCENT DESCRIPTION -OW 1 DEPTH Wp 📙 (m) --- CONTINUED FROM PREVIOUS PAGE --20 SAND, occasional gravel lenses 134 133.69 Sandy, gravelly, CLAY _0. 20.40 50 mm slotted screen with geosock, backfilled with _0_ local sand 22 132 EOH EOH 22.15 24 26 28 30 32 WALSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT 26/9/08 DATA INPUT: 34

Golder Associates

LOGGED: PK CHECKED: BB

RECORD OF MONITORING WELL BH 7-07 PROJECT: 07507150230 Walshestown BORING DATE: 11-12 Dec 2007 LOCATION: Just inside entrance (see Fig. GI/01)

SHEET 1 OF 2

DATUM: Malin Head

	9	SOIL PROFILE			SAM	IPLES		DYNAN RESIS	IIC PEN TANCE,	ETRATION S	ON /0.3m		HYDRAI	JLIC CO k, cm/s	NDUCT	IVITY,	TI.	D D	INSTALLATIO
NE INC	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	ELEVATION	2 SHEAR	R STREN			Q - • U - O		TER CO	NTENT I	PERCE	0 ⁻³ \$	ADDITIONAL LAB. TESTING	AND GROUNDWATE OBSERVATION
1	30RII		TRAT	DEPTH (m)	ž		=	Cu, kPa										Z B	
+			· S		Н	+	+	2	5 5	0 7	75 <u>1</u>	00	5	10	15	5 2	20		lockable cover (150 mm
٥	Т	GROUND SURFACE Made Ground (gravel)					+												diameter)
2		Loose, brown SAND and GRAVEL	000000000000000000000000000000000000000	0.20			154												bentonite seal
			0000				152												
4			000000000000000000000000000000000000000	1			150												
6			0.7				148	ion w		74.	any of	eruse.							
8	casing .	Grey-brown, gravelly CLAY	0.0.	7.80	-		146	ion	pitposé et teal	soni, ited for	di								
0	Symmetrix (rotary percussion) 6" casing Air flush	Loose, grey-brown SAND and GRAVEL	000	144.67			CODA	ect out	•										water strike 11/12/07 50 mm plain
2	Symmetri	GNAVEL	0 6	, , ,	උප්	ns ni	144												riser, backfilled with local sand
		Grey-black CLAY/SILT	×	<			142												
4		Compact, light-brown, gravelly, fine SAND	0	14.10			140												
6			0				138												202020 202020
8			0				136												
20		CONTINUED NEXT PAGE	0				130												2 2 2 2 2

PROJECT: 07507150230 Walshestown

1:100

RECORD OF MONITORING WELL BH 7-07

SHEET 2 OF 2

BORING DATE: 11-12 Dec 2007 DATUM: Malin Head LOCATION: Just inside entrance (see Fig. GI/01) FASTING: 293319 NORTHING: 215790 DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING k, cm/s INSTALLATION AND GROUNDWATER ELEVATION 10⁻⁴ 40 NUMBER ELEV. SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O TYPE WATER CONTENT PERCENT DESCRIPTION OBSERVATIONS OW DEPTH Wp 📙 (m) --- CONTINUED FROM PREVIOUS PAGE --20 Compact, light-brown, gravelly, fine SAND 0 0 134 0 22 0 132 0 24 0 50 mm plain riser, backfilled with local sand 130 0 26 0 128 Symmetrix (rotary percussion) 6" casing ο. 28 0 126 0 water strike 12/12/07 ó 30 0 0 124 123.57 31.50 SILTSTONE (2.5m weathered zone: bentonite seal clay infill) 32 122 34 WALSHESTOWN MONITORING WELLS 2007.GPJ GLDR_LDN.GDT 50 mm slotted 120 screen with geosock, backfilled with local sand 36 118.07 EOH EOH 38 40 IRELAND DEPTH SCALE LOGGED: PK Golder

Associates

CHECKED: BB

PROJECT: 07507150230 Walshestown RECORD OF MONITORING WELL BH 8-07

LOCATION: Just inside entrance (see Fig. GI/01) BORING DATE: 13-14 Dec 2007

DATUM: Malin Head EASTING: 293315

SHEET 1 OF 2

	Д ОР	SOIL PROFILE			SA	MPLES		DYNAI RESIS	MIC PEN TANCE,	ETRATIONS.	ON /0.3m		HYDRA	ULIC CO k, cm/s	NDUCT	VITY,	Τl	그 일	INSTALLATIO
	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	ELEVATION	SHEAL	R STREN			B0 · Q - ● • U - O	10 ⁻ WA		5 10 NTENT I		0 ⁻³	ADDITIONAL LAB. TESTING	AND GROUNDWAT OBSERVATION
١	30RII		TRAT	DEPTH (m)	N			Cu, kP	a	r	rem V. €	0 - O	Wp	—	O _W		WI	88	OBOLIKVATIO
+			S		H		+	2	25 5	0 7	75 <u>1</u>	00	5	10) 15	2	20		lockable cover (150 mm
ŀ	Т	GROUND SURFACE Made Ground (gravel)			┢		+												diameter)
ı		Brown, gravelly CLAY		0.20	1														
l]			154												bentonite seal
ı																			
2		SAND and GRAVEL	[153.00															
		SAND and GRAVEL	00	1.50															l K
ı			0.0	1			152												
ı			000				102												
l			0.7	4															
۱			00.																
١			1.0 (
ı			000				150												
ı			0,7]															ľ
,			0. 7)															
l			00	4								ei Use.							
l			1. 4	1			148				- 3	er							
l			0 2	}						39.	any								
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3			0. /	1					1005	red									
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			00	1			146	CLION	(C)										
ŀ	lasion		ام. ~	1			175	2010											
	ary percue Air flush		0.	1			ROLLY	30											water strike 13/12/07
	Symmetrix (rotary percussion) 6" casing Air flush		o'n'	144.30			148 146 146 144												13/12/07
ŀ	¥ L	Grey-black CLAY/SILT, with some gravel	×-	10.60	1	, gri	144												50 mm plain
-	E S	Stiff, grey, sandy, gravelly CLAY		143.50	اح	onsent													riser, backfilled with local sand
2		cum, groy, canay, gravery czrv])
l			-																ľ
ı							142												į.
ı			-				'												N-
ı			 - -	-															
1		Compact, light-brown, gravelly SAND	0	140.80															
ı		(more gravelly below 20 m)																	
ı			. 0				140												
ı																			
3			0																
l																			
			0				138												
																			water strike 14/12/07
$\ $			0																14/12/07 -
							1												
			0				126												
			: :				136												
			0																
╁		CONTINUED NEXT PAGE	+ -		H		+												
L					<u> </u>		1												

PROJECT: 07507150230 Walshestown

LOCATION: Just inside entrance (see Fig. GI/01)

RECORD OF MONITORING WELL BH 8-07

BORING DATE: 13-14 Dec 2007

DATUM: Malin Head EASTING: 293315

SHEET 2 OF 2

												•						E	EASTING: 293315 NORTHING: 215797	
Щ	dob	SOIL PROFILE			SA	MPLES	3 7	DYNA RESIS	MIC PEN STANCE,	IETRATI BLOWS	ON /0.3m	\	HYDRAL k	JLIC Co	ONDUC	TIVITY,		ور ۲	INSTALLATION	
DEPIH SCALE METRES	BORING METHOD		LOT		2		ELEVATION					80	10 ⁻⁶				10 ⁻³	ADDITIONAL LAB. TESTING	AND GROUNDWATER	
	SING	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	l.EV	SHEA Cu, kF	R STREN	NGTH	nat V. + rem V. €	Q - • U - O	WA			T PERC		DDIT B. TE	OBSERVATIONS	
ă	BOF		STR/	(m)	ž		"					00	Wp I 5		0 0	15	1 WI 20	145		
20		CONTINUED FROM PREVIOUS PAGE																		
20		Compact, light-brown, gravelly SAND (more gravelly below 20 m)	0																50 mm slotted	▋
	hsr	, , ,					134												screen with	
	Air flush		0				134												geosock, backfilled with local sand	
	1																		local sand	
22		ЕОН	0	132.90 22.00)														EOH LÆ	∄.
24																				
26							rofyi d copyi													
												15°								
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										23.	OKIO.									
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28									1205	ned .										
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38																				
40																				
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DEI	PTH S	SCALE					(G Ass	older	•								LOGGED: PK	
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RECORD OF AUGER HOLE SA1-07

SHEET 1 OF 2

BORING DATE: 13/12/2007 LOCATION: Silt Pond (See Fig. GI/01)

_	HOD	SOIL PROFILE	1.		SA	MPL		DYNA RESI	MIC PEN STANCE,	IETRATI BLOWS	/0.3m	\	l	cm/s			J & W	INSTALLATION
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	ELEVATION		20 4 R STREM Pa			0 · Q · ● • U · O	10 ⁻⁶ WATI Wp H		TENT I	PERCENT WI	ADDITIONAL LAB. TESTING	AND GROUNDWATE OBSERVATIONS
0		GROUND SURFACE							25 5	50	75 1	00	5	10	15	5 20		
		Soft light brown slightly sandy SILT.	×															
			× >		1	SDS												-
			×	<														
1			× ·			1												
			× . . > × .		2	В												
		Firm light brown slighty sandy CLAY.		1.50	3	В												
2		Firm light brown slightly sandy slighty		2.00														
		fine gravelly CLAY. Sand is well graded.																
		Firm light brown slightly sandy slighty	0	2.60	_													
3		Firm light brown slightly sandy slightly gravelly CLAY/SILT. Sands and gravels are well graded.			4	В												
1			0									, USO.						
					5	SDS					108	367						
										ould.	any							
4			<u>•</u>			1			1705	redite								
			-	1	6	В		200	Si ied									
- -	ussion				7	В	l I	Specifica	N.C									Hole
5	Shell & Auger		0				Roi	AL SHIP										backfilled with cuttings
	Light Cable Predussion Shell & Auger		0.				ko o	, -										and original ground
ľ	1					M.	entar											
6			_ 0_															
			-															
7			-															
		Firm light brown to grey slightly sandy gravelly SILT. Gravel is medium and	×0,	7.30	8	В												
		coarse in size.	× × o _{>}															
8		Firm light brown to grey slightly sandy	× .			-												
		gravelly CLAY/SILT with occasional cobbles. Gravel is medium and coarse in size.	5		9	SDS	5											
		III SIZE.	3															
9			ô	1	10	В												
۱			0	}	11	В												
		Firm light brown to grey slightly sandy	\(\frac{\partial}{\partial}\)		12	SDS												
		Firm light brown to grey slightly sandy gravelly SILT with frequent cobbles. Gravel is medium and coarse in size.	×Ô×															
10	\perp	Rare large cobbles CONTINUED NEXT PAGE	×			H	+	+										
_				•					<u>.</u>		•		· '				_	LOGGED: AC

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RECORD OF AUGER HOLE SA1-07

SHEET 2 OF 2

10 Industrial 11	DESCRIP CONTINUED FROM I Firm light brown to grigavelly SILT with free Gravel is medium and Rare large cobbles.	ey slightly sandy quent cobbles. It coarse in size.	× × × × ×	16 SDS 16		20 SHEAR ST Cu, kPa 25	RENGTH	60 80 nat V. + Q. • rem V. ⊕ U - ○	WATER C	10 ⁵ 10 ⁴ 10 ³ CONTENT PERCENT	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATEI OBSERVATIONS
11 Table Precussion	Firm light brown to gr gravelly SILT with free Gravel is medium and Rare large cobbles.	ey slightly sandy quent cobbles. If coarse in size.	× × × × ×									
13			12.00	17 SDS								Hole backfilled with cuttings and original ground
14					kot ins	ection but	os out of or other or	RIN ME LISE				
16				Cours	in or							
18												
19												

RECORD OF WINDOW SAMPLE WS1-07

SHEET 1 OF 1

	QQ	SOIL PROFILE			SAI	MPLES		DYNA RESIS	MIC PEN	ETRATION BLOWS	ON ⁄0.3m	\	HYDRA	AULIC C k, cm/s	ONDUCTI	VITY,	Τ		INICTALLATION
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	ELEVATION	SHEAI Cu, kP	20 4 L R STREN a	0 6 L IGTH r	60 8 L nat V. + em V. ⊕	Q - • U - O	10 W	0 ⁶ 1 ATER C	0 ⁻⁵ 10 ⁻¹ ONTENT F	⁴ 10 PERCEN	NT WI	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATE OBSERVATION
0		GROUND SURFACE								,				,					
		Greyish brown fine SAND.		0.00															
1		Compact greyish brown SILT.	×	0.50															
1		Compact greyish brown Sich.	× ,																
1		Greyish brown very fine SAND.	× ,	1.00	\mathbb{H}														
1		Compact, grevish-brown, very sandy	× ·>	1 20															
1		SILT (sand slightly cemented from 2.7-3.0 m).	× .>		1	В													
1	Terrier Rig	ampler	× >	<															
2	errier.	N N N N N N N N N N N N N N N N N N N	× >		\vdash														
1	-	Win	× ·																
1			× .																
1			××	<															
3			× ,									01.							
1		Greyish-brown, fine SAND.		3.15			kodyt kodyt kodyt					ex 1150							
1											400								
									l .	ouly	Mr.								
4		EOH. (Dense sands, too compact to probe).		3.90	1				1005g	redit									
								-0	bir teal										
1								ectio,	et										
1							1115	Shro											
5							KorAi												
1						J.N	d con												
						Uzel)	,												
					C														
6																			
1																			
7																			
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0																			
									4										

RECORD OF WINDOW SAMPLE WS2-07

SHEET 1 OF 1

1	8	SOIL PROFILE			SA	MPLE		DYNA RESIS	MIC PEN TANCE,	BLOWS/	ON '0.3m		HYDRA	k, cm/s	ONDUCTIVITY	· T		INOTALL ATION
	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	ELEVATION	SHEAI Cu, kP	20 4 L R STREN a	0 6 L IGTH r	i0 8 L nat V. + em V. ⊕	Q - • U - O	10 W	ATER CO	0 ⁻⁵ 10 ⁻⁴ ONTENT PERC	10 ⁻³	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATE OBSERVATION
0		GROUND SURFACE Compact greyish brown, sandy SILT.	×	0.00						7	5 1			' '	0 15	20		
1		Laminations clearly visible.	× × × × × × × × × × × × × × × × × × ×															
	Terrier Rig	Cohesive greyish brown, slightly sandy SILT/CLAY. Laminations clearly visible.	× × × × × ×		1	В												
2	Terrie		×	2.00														
		Greyish brown SILT/CLAY	×	2.30														
3		Greyish brown fine SAND.	×_,	2.70								<u>ر</u> ق.						
		Very wet, greyish brown SILT.	× × ×	3.15						٠4.	240th	erus						
4		Greyish brown fine sandy SILT.	×·×	3.70					.8	only	Mr.							
5					C	M.Se.	rodys rodys rodys	and a second										
7																		
8																		
9																		
0																		

RECORD OF WINDOW SAMPLE WS3-07

SHEET 1 OF 1

	阜	SOIL PROFILE			SAMI	PLES		RESIS	MIC PEN TANCE,	BLOWS/	0.3m	l	HIDKA	k, cm/s	ONDUCT	IVIII,	T	ڳِ	INSTALLATION
MEIRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	_ 	ELEVATION	SHEAI Cu, kP	R STREN a	IGTH r	60 80 lat V. + C em V. ⊕ U		10 WA Wp 5	TER C	0 ⁻⁵ 10 DNTENT W	PERCEN	IT VI	ADDITIONAL LAB. TESTING	AND GROUNDWATER OBSERVATIONS
0		GROUND SURFACE Greyish brown, very fine sandy SILT. Laminations visible.	× × × × × × × × × × × × × × × × × × ×											•					
1	Terrier Rig	Very wet, greyish brown SILT. Compacted greyish brown sandy SILT. Some sand & black-grey clay lenses visible.	× × × × × × × × × × × × × × × × × × ×	1.00															
2		EOH. Hole collapsing.	× · ×	2.00															
3											Sizer	USC.							
4								. 01	onto se	red for	any								
5							korinst copyri	ectic wi			nery other								
6					Ca	Str													
7																			
8																			
9																			
10																			

RECORD OF WINDOW SAMPLE WS4-07

SHEET 1 OF 1

- 1	ō	SOIL PROFILE			SAMF	PLES		RESIS	MIC PEN TANCE,	BLOWS/	0.3m	l	IIIIDIKA	k, cm/s	ONDUCTIV	,,,	TI_o	1510741147105
	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	J .	ELEVATION	SHEAI Cu, kP	20 4 L R STREN a	0 6 I IGTH n	i0 8 L lat V. + em V. ⊕	Q - • U - O	10 W.A	TER CO	0 ⁻⁵ 10 ⁻⁴ ONTENT PI	10 ⁻³ ERCENT	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATE OBSERVATION
0		GROUND SURFACE		0.00									Ĭ					
		Greyish brown SILT with some fine sand. Laminations clearly visible.	×	<														
i	ample	Very wet, greyish brown SILT/CLAY.	×-	0.80														
1 3	Window Sample	Very wet greyish brown very silty, clayey fine SAND.	×	1.00														
	Win	Clayey line SAND.	×		1 B													
2	-	EOH. Hole collapsing.		2.00														
3							of copyri					of Ise.						
4									ميوا	only.	श्राप् जो							
								.on	out to chi	He.								
							ins	ectic w										
5							KorAi											
					C00	ig Mi												
6																		
7																		
8																		
9																		
0																		

RECORD OF WINDOW SAMPLE WS5-07

SHEET 1 OF 1

LOCATION: Silt Pond (See Fig. GI/01)

	9		SOIL PROFILE			SAN	PLES		DYNA RESIS	MIC PEN STANCE,	ETRATION S	ON /0.3m		HYDRAU k,	LIC CON cm/s	NDUCTIV	ITY,		INSTALLATION
METRES	BORING METHOD			STRATA PLOT		~		ELEVATION					80	10 ⁻⁶	10 ⁻⁵	10-4	10 ⁻³	ADDITIONAL LAB. TESTING	AND
Ë l	9		DESCRIPTION	A PI	ELEV.	IBE	TYPE	M ¥				nat V. +	Q - • U - O	WAT	ER CON	NTENT PI	ERCENT	E E E	GROUNDWATER OBSERVATIONS
≥	OR II		52001 1.0.N	RAT	DEPTH (m)	NUMBER	F	日日	Cu, kP	Pa .	r	em V. €	0 - O	Wp ⊢		-0^{W}	WI	P _B	OBOLIVATIONS
_	ă	_		ST	(111)				2	25 5	0 7	5 1	00	5	10		20	\perp	
0			GROUND SURFACE																
Ĭ			Greyish brown, fine sandy SILT.	×	0.00														
		Ī	Very wet greyish brown SILT/CLAY.	$\overline{}$	0.00	1													
				× ×]														
		<u>-</u>				1													
	Terrier Rig	ample	Compact, greyish brown gravelly (<10%) SILT.	×	0.70														
1	10	ış _	Very wet, greyish brown SILT.	×	1.00	1													
	Ē	- lindo	Grey, fine to coarse SAND and	l >	(1														
		>	GRAVEL.	00	1.20														
				.0°	3														
				60,	1	1													
٦			Greyish brown fine sandy SILT.	× ·>		1													
2			EOH. Hole collapsing.		2.00	1													
								rot inst											
3																			
													1150.						
												5	ger "						
											4 .	70	7						
											ally.	SILL							
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4										2002	Jell								
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RECORD OF WINDOW SAMPLE WS6-07 PROJECT: Walshestown 07507150296 SHEET 1 OF 1 BORING DATE: 27/11/2007 LOCATION: Silt Pond (See Fig. GI/01) DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, k, cm/s SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING INSTALLATION AND GROUNDWATER OBSERVATIONS ELEVATION 40 10⁻⁶ 10⁻⁵ 10-4 STRATA PLOT NUMBER ELEV. TYPE SHEAR STRENGTH nat V. + Q - ● rem V. ⊕ U - ○ WATER CONTENT PERCENT DESCRIPTION -OW DEPTH (m) GROUND SURFACE
Greyish brown sandy SILT. 0.00 EOH. Hole collapsing. 2 5

> Golder Associates

10

1:50

DEPTH SCALE

EPA Export 26-07-2013:03:32:36

LOGGED: CC CHECKED: PK

RECORD OF WINDOW SAMPLE WS7-07

SHEET 1 OF 1

LOCATION: Silt Pond (See Fig. GI/01) BORING DATE: 27/11/2007

္က		SOIL PROFILE	 			MPLES				BLOWS		<u> </u>	HYDRAULIC (k, cm/			[AF]	INSTALLATION
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	ELEVATION	SHEAI Cu, kP	R STREN a	NGTH r	nat V. + rem V. ⊕	Q - • U - O	WATER (10 ⁻⁵ 10 ⁻⁴ CONTENT PE	— wı	ADDITIONAL LAB. TESTING	AND GROUNDWATER OBSERVATIONS
0	\exists	GROUND SURFACE			L			2	5 5	50 7	75 1	00	5	10 15	20		
	Window Sampler	Very wet, greyish brown silty fine SAND. Laminations visible. EOH. Hole collapsing.	×	0.50						.50	त्वा ^भ औ	et use.					
5 6					C	on seri	For its	ection gu out	putpose let tedi	ned for							
8																	
9																	

RECORD OF WINDOW SAMPLE WS8-07

SHEET 1 OF 1

	О	SOIL PROFILE			SAM	PLES		DYNA RESIS	MIC PEN TANCE,	ETRATION BLOWS	ON 0.3m	\	HYDRA	NULIC C k, cm/s	ONDUCT	IVITY,	ŢΪ	밀	INICTALLATION
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	IYPE	ELEVATION	SHEAI Cu, kP	20 4 L R STREN a	0 6 L IGTH r	0 8	Q - • U - O	10 W	TATER C	0 ⁻⁵ 10 ONTENT OW 10 15	PERCENT		ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
1	Terrier Rig	GROUND SURFACE Very wet, greyish brown, very fine sandy SILT, interbedded with silt. Laminations visible.	×																
2 -		Very wet, greyish brown sandy SILT/CLAY.	× × × × × × × × × × × × × × × × × × ×		1 1	В													
3		Compact, greyish brown fine sandy SILT. EOH. Hole collapsing.	××	3.00								ટા પડિ ^છ .							
5						Sent	kotins konyti	ection on other	outpose let redi	sonly.	BITYOU								
7					Co														
8																			
9																			

RECORD OF WINDOW SAMPLE WS9-07 PROJECT: Walshestown 07507150296 SHEET 1 OF 1 BORING DATE: 27/11/2007 LOCATION: Silt Pond (See Fig. GI/01) DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m HYDRAULIC CONDUCTIVITY, k, cm/s SOIL PROFILE SAMPLES BORING METHOD DEPTH SCALE METRES ADDITIONAL LAB. TESTING INSTALLATION AND GROUNDWATER OBSERVATIONS ELEVATION 40 10⁻⁶ 10⁻⁵ 10-4 STRATA PLOT NUMBER ELEV. TYPE SHEAR STRENGTH nat V. + Q - ● rem V. ⊕ U - ○ WATER CONTENT PERCENT DESCRIPTION OW DEPTH (m) GROUND SURFACE
Greyish brown, fine SAND. 0.00 EOH. Hole collapsed. 2 5

10

1:50

DEPTH SCALE

Golder CHECKED: PK