Appendix 10-10: Dublin Airport Central Phase 2

Dublin Airport Central Phase 2 – Ground Investigation

Client:	DAA
Client's Representative:	Arup
Report No.:	18-1467
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Document Control Sheet

Report No.:		18-1467			
Project Title:		Dublin Airport Central Phase 2			
Client:		DAA			
Client's Representative:		Arup			
Revision:	A01	**Status:**	Final for Issue	**Issue Date:**	01 July 2019
Prepared by:		**Reviewed by:**		**Approved by:**	
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The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

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

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler)
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler)
P	Nominal 100mm diameter undisturbed piston sample
B	Bulk disturbed sample
LB	Large bulk disturbed sample
D	Small disturbed sample
C	Core sub-sample (displayed in the Field Records column on the logs)
L	Liner sample from dynamic sampled borehole
W	Water sample
ES / EW	Soil sample for environmental testing / Water sample for environmental testing
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained)
SPT (c)	Standard penetration test using 60 degree solid cone
x,x/x,x,x,x	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
▽	Water strike: initial depth of strike
▼	Water strike: depth water rose to
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum).

Dublin Airport Central Phase 2

1 AUTHORITY

On the instructions of Arup Consulting Engineers, ("the Client's Representative"), acting on the behalf of DAA ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of a proposed commercial development and accompanying multi-story car park.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, trial pits, soil and rock core sampling, environmental sampling, groundwater monitoring, in-situ and laboratory testing, and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted in Dublin Airport, adjacent to the Dublin Airport Central Phase I Development, the ESB International building and the Terminal 2 short term car park. The site was split into 2, with a car park and the DAA site offices to the north and Dublin Airport Central Phase construction site, currently under control of Stewarts Construction, to the south.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 15th April and the 2nd May 2019, comprised:

- five light cable percussion boreholes;
- two boreholes put down by rotary drilling methods;
- a standpipe installation in three boreholes;
- seven machine dug trial pits; and
- an infiltration test performed in two trial pits

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

A total of seven boreholes were put down in a minimum diameter of 150mm through soils and rock strata to their completion depths by a combination of methods, including light cable percussion boring by Dando 2000 rigs, and rotary drilling by a Hanjin-8D tracked rotary drilling rigs.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

4.2.1 Light cable percussion boreholes

Five boreholes (BH101, BH103-BH105 and BH107) were put down to completion in minimum 200mm diameter using Dando 2000 light cable percussion boring rigs. All boreholes were terminated either at their scheduled completion depths, or else on encountering virtual refusal on obstructions above this depth. BH104 and BH107 were moved from their original position due to encountering obstructions and re-drilled as BH104A and BH107A.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken at standard intervals of 0.5, 1.5, 2.5, 3.5 and 4.5m, as directed by the Client's Representative.

Standard penetration tests were carried out in accordance with BS EN 22476-3: 2005 at standard depth intervals using the split spoon sampler ($SPT_{(S)}$) or solid cone attachment ($SPT_{(C)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix I.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

4.2.2 Rotary drilled boreholes

Two boreholes (BH102 and BH106) were put to their completion by rotary drilling techniques only. The boreholes were completed using a Hanjin-8D tracked drilling rig.

Geobor-S drilling was employed to recover continuous core throughout the overburden and bedrock. SPTs were carried out at standard intervals throughout the overburden.

The core was extracted in up to 1.5m lengths using a SK6L core barrel, which produced core of nominal 102mm diameter, and was placed in single channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in BH101, BH105 and BH106.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 Trial Pits

Seven trial pits (TP101–TP107) were excavated using a 6t tracked excavator fitted with a 600mm wide bucket, to a maximum depth of up to 3.0m.

Environmental samples were taken at depths of 0.5, 1.0, 1.5 and 2.5m in each trial pit, as directed by the Client's Representative.

Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix D presents the trial pit logs with photographs of the pits and arising provided in Appendix E.

4.5 Infiltration tests

An infiltration/soakaway test was carried out at two locations (SP101- SP102) in accordance with BRE Digest 365 - Soakaways (BRE, 2016). The tests were conducted in similarly numbered trial pits.

Appendix F presents the results and analysis of the infiltration test. The absence of the outflow from the pits precluded calculation of infiltration coefficients.

4.6 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

4.7 Groundwater monitoring

Following completion of site works, groundwater monitoring was conducted on three rounds. Ground water monitoring was carried out using a water interface probe.

Details of groundwater monitoring are presented in Table 2 of Section 6.3.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **soil chemistry:** pH, water-soluble sulphate content and acid-soluble sulphate extract.

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix G.

5.2 Geotechnical laboratory testing of rock

Laboratory testing of rock sub-samples comprised:

- point load index
- unconfined compressive strength (UCS) tests

Test	Test carried out in accordance with
Point load index	ISRM Suggested Methods (1985) Suggested method for determining point-load strength. Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 22, pp. 53–60
Uniaxial compression strength tests	ISRM Suggested Methods (1981) Suggested method for determining deformability of rock materials in uniaxial compression, Part 2 and ISRM (2007) Ulusay R, Hudson JA (eds) The complete ISRM suggested methods for rock characterization, testing and monitoring, 2007

The test results are presented in Appendix G.

5.3 Environmental laboratory testing of soils

Environmental testing, as specified by the Client's Representative was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out according to the Arup soil suite of testing

- Metals
- Speciated total petroleum hydrocarbons (TPH)
- Speciated polycyclic aromatic hydrocarbons (PAH)
- Cyanides
- Asbestos screen
- pH.

Waste acceptance criteria (WAC) testing was carried out on selected samples.

Results of environmental laboratory testing are presented in Appendix H.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Glacial Till. These deposits are underlain by Waulsortian Limestone which is recorded as outcropping in the west of the site.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Paved surface:** BH103-BH107A, TP103-TP107 and SP101-SP102 encountered 30-150mm of macadam surfacing. In addition, BH106 encountered 100mm of concrete beneath the bitmac surface.

- **Topsoil:** encountered in the north of the site in BH101, BH102 and TP101 with a thickness range of 100 – 300mm.

- **Made Ground (sub-base):** BH103 – BH107, TP103-TP107 and SP101-SP102 encountered varying thicknesses of granular sub-base beneath the paved surfacing.

- **Made Ground (granular fill):** TP102 encountered 300mm of gravelly silty sand fill adjacent to the existing car park.

- **Made Ground (cohesive fill):** BH104, BH107, TP102 encountered reworked sandy gravelly clay fill to a maximum depth of 2.0m in TP102.

- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

- **Bedrock (Limestone):** Rockhead was encountered at depths ranging from 2.40m in BH102 to 12.80m in BH102. Rock recovered comprised two types of limestone, BH106 encountered medium strong to strong fossiliferous limestone, while BH102 encountered dark grey argillaceous limestones and calcareous mudstones.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during percussion boring, and trial pit and trial pit excavation at depths as shown in Table 1 below.

Table 1: Groundwater strikes encountered during the ground investigation

GI Ref	Water level (mbgl)	Comments
BH101	5.00	Rose to 4.90m after 20 mins
BH103	6.80	Rose to 5.40m overnight
BH104	1.50	Seepage
BH105	0.30	Rose to 0.2m after 20 mins
BH105	7.10	Rose to 6.60m after 20 mins
BH107	8.00	Seepage
TP101	1.00	Seepage
TP107	0.2	Seepage

Groundwater was not noted during drilling at any of the other borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any additional groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out.

It should also be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

Groundwater was not noted during excavation of any of the other trial pits.

Table 2: Groundwater monitoring

Date	Water level (mbgl)		
	BH101	BH105	BH106
14/05/2019	1.00	5.88	2.41
24/05/2019	1.10	5.78	2.64
07/06/2019	0.95	5.60	2.70

Seasonal variation in groundwater levels should also be factored into design considerations and continued monitoring of the three installed standpipes will give an indication of the seasonal variation in groundwater level which should be factored into design considerations.

7 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

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

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

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

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

Building Research Establishment (2007), BRE Digest 365: Soakaways.

CAUSEWAY GEOTECH

APPENDIX A

SITE LOCATION PLAN



Project No.:	18-1467	**Client:**	DAA
Project Name:	Dublin Airport Central Phase 2, Dublin Airport	**Client's Representative:**	Arup

Legend Key



Title:

Site Location Plan

Last Revised:	**Scale:**
05/06/2019	1:10000

CAUSEWAY GEOTECH

Project No.:	18-1467	**Client:**	DAA
Project Name:	Dublin Airport Central Phase 2, Dublin Airport	**Client's Representative:**	Arup

Legend Key

- Locations By Type - CP
- Locations By Type - RO + RC
- Locations By Type - TP



Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
05/06/2019	1:1000

CAUSEWAY GEOTECH

APPENDIX D

BOREHOLE LOGS



CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	12.00

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH101

Coordinates: 717118.66 E, 743515.01 N

Client: DAA

Sheet 1 of 2

Client's Representative: Arup

Scale: 1:50

Driller: BM

Ground Level: 65.63 mOD

Dates: 15/04/2019 - 16/04/2019

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
						(0.30)	TOPSOIL: Soft brown sandy gravelly CLAY with rootlets. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
					65.33	0.30	
						(0.20)	
0.50	B8 ES1				65.13	0.50	MADE GROUND: Greyish brown sandy clayey subangular fine to coarse GRAVEL of mixed lithologies. Sand is fine to coarse.
1.00	B9						Stiff brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
1.20	D5						
1.20 - 1.65	SPT (S) N=15	1.20	Dry	N=15 (2,2/3,3,4,5) Hammer SN = 0643		(1.50)	
1.50	ES2						
2.00	B10 D6				63.63	2.00	Stiff becoming very stiff black slightly gravelly sandy silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies. Cobbles are subrounded of mixed lithologies.
2.00 - 2.45	SPT (S) N=24	1.50	Dry	N=24 (4,4/4,6,6,8) Hammer SN = 0643			
2.50	ES3						
3.00	B11 U14	3.00	Dry	Ublow=40 70%			
						(3.00)	
4.00	B12 D7						
4.00 - 4.45	SPT (S) N=50	4.00	Dry	N=50 (7,7/8,8,9,25) Hammer SN = 0643			
4.50	ES4						
5.00	B13 D20				60.63	5.00	Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
5.00 - 5.40	SPT (S)	5.00	Dry	N=50 (11,11/50 for 245mm) Hammer SN = 0643			
		4.50	4.10	16-04-2019		(1.40)	
		4.50	4.90	15-04-2019 Water strike at 5.00m			
6.00	B15 D21				59.23	6.40	Very stiff black slightly gravelly sandy silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies. Cobbles are subrounded of mixed lithologies.
6.00 - 6.33	SPT (S)	6.00	5.70	N=50 (11,18/50 for 180mm) Hammer SN = 0643			
7.50	B16 D22						
7.50 - 7.90	SPT (S)	7.50	7.40	N=50 (8,12/50 for 245mm) Hammer SN = 0643			
						(3.60)	
9.00	B17 D23						
9.00 - 9.45	SPT (S) N=48	9.00	8.00	N=48 (7,8/8,11,12,17) Hammer SN = 0643			
					55.63	10.00	

Water

Backfill

Remarks

Hand dug pit excavated to 1.20m.

Terminated on instruction of the engineer.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.00	5.00	20	4.90

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
12.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
11.90	12.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	12.00

Project No.: 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport
Coordinates: 717118.66 E 743515.01 N	**Client:** DAA
	Client's Representative: Arup
Ground Level: 65.63 mOD	**Dates:** 15/04/2019 - 16/04/2019

Borehole No.: **BH101**

Sheet 2 of 2

Scale: 1:50

Driller: BM

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.50	B18 D24							Very stiff black slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies. Cobbles are subrounded of mixed lithologies.		
10.50 - 10.83	SPT (S)	10.50	10.30	N=50 (9,17/50 for 180mm) Hammer SN = 0643		(2.00)				
12.00	B19 D25				53.63	12.00		End of Borehole at 12.00m		
12.00 - 12.10	SPT (S)	12.00	Dry	N=50 (25 for 60mm/50 for 35mm) Hammer SN = 0643						

Remarks

Hand dug pit excavated to 1.20m.

Terminated on instruction of the engineer.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
12.00	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
11.90	12.10	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Inspection Pit	Hand tools	0.00	1.20
Rotary Drilling	Hanjin 8D	1.20	3.70
Rotary Coring	Hanjin 8D	3.70	16.20

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH102

Coordinates: 717169.60 E, 743508.39 N

Client: DAA

Sheet 1 of 2

Client's Representative: Arup

Scale: 1:50

Driller: MW+SJ

Ground Level: 65.51 mOD

Dates: 26/04/2019 - 02/05/2019

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					65.36	(0.15) 0.15		TOPSOIL		
						(0.55)		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium of mixed lithologies.		
					64.81	0.70				
						(0.50)		Firm becoming very stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies. Cobbles are subangular of mixed lithologies.		
1.20 - 1.65	SPT (S) N=24			N=24 (3,3/4,6,6,8) Hammer SN = 0678	64.31	1.20		Stiff brown sandy gravelly CLAY. (Driller's description).		
						(2.50)				
3.70 - 4.15	SPT (S) N=27			N=27 (4,4/5,6,8,8) Hammer SN = 0678	61.81	3.70		Stiff brown slightly sandy slightly gravelly CLAY with rare cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies. Cobbles are subangular of limestone.		
	53					(1.50)				
5.20 - 5.60				N=50 (6,7/50 for 245mm) Hammer SN = 0678	60.31	5.20		Very stiff brownish grey sandy gravelly CLAY with rare cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies. Cobbles are subangular of limestone.		
5.20	50									
6.70 - 7.01				N=50 (14,11/50 for 160mm) Hammer SN = 0678						
6.70	50									
						(5.30)				
8.20 - 8.38				N=50 (14,25/50 for 30mm) Hammer SN = 0678				*8.30-8.50m; Recovered as slightly sandy subangular fine to coarse gravel of mixed lithologies*		
8.20	100									
9.00								*9.00-9.50m; Recovered mostly as sandy clayey subangular fine to coarse gravel of mixed lithologies with one subangular cobble of limestone*		
	60							*9.90m; One subangular cobble of limestone*		
	TCR	SCR	RQD	FI						

Remarks

Hand dug pit excavated to 1.20m.

No noticeable groundwater strikes.

Terminated at scheduled depth.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
5.50	146

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Inspection Pit	Hand tools	0.00	1.20
Rotary Drilling	Hanjin 8D	1.20	3.70
Rotary Coring	Hanjin 8D	3.70	16.20

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH102

Coordinates: 717169.60 E, 743508.39 N

Client: DAA

Sheet 2 of 2

Client's Representative: Arup

Scale: 1:50

Driller: MW +SJ

Ground Level: 65.51 mOD

Dates: 26/04/2019 - 02/05/2019

Logger: SR

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
10.50 - 10.60					N=50 (25 for 75mm/50 for 20mm) Hammer SN = 0678	55.01	10.50		Very stiff brownish grey sandy gravelly CLAY with rare cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies. Cobbles are subangular of limestone.		
10.50	100						(2.30)		Very stiff brownish grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies.		
12.00	100										
12.80	100	70	60	13		52.71	12.80		Weak to medium strong, thinly to medium bedded, dark grey argillaceous LIMESTONE. Partially weathered. Disc 1: 0 - 10 degrees, sub-horizontal to horizontal, closely to medium spaced (50/120/200), planar, smooth, clean with some rare orangish brown staining on surfaces. Disc 2: 30-45 degrees, probably medium spaced, planar, rough with orangish brown staining on surfaces.		
13.20				7							
	100	90	13	9			(2.20)				
				8					*14.50-14.70; drilling induced sub-vertical fracture*		
14.70				9							
	100	100	15	10		50.51	15.00		Weak to medium strong, locally thinly laminated greyish black MUDSTONE, locally slightly calcareous. Partially weathered. Disc 1: 0 - 10 degrees, closely spaced (30/80/150), planar, smooth, clean.		
				3			(1.20)				
16.20						49.31	16.20		End of Borehole at 16.20m		
	TCR	SCR	RQD	FI							

Remarks

Hand dug pit excavated to 1.20m.

No noticeable groundwater strikes.

Terminated at scheduled depth.

Core Barrel

SK6L

Flush Type

Water

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added	
From (m)	To (m)

Casing Details	
To (m)	Diam (mm)
5.50	146

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	6.80

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH103

Coordinates: 717130.09 E, 743482.70 N

Client: DAA

Sheet 1 of 1

Client's Representative: Arup

Scale: 1:50

Driller: SS

Ground Level: 65.58 mOD

Dates: 30/04/2019 - 30/04/2019

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description
					65.42	(0.15) 0.15		MADE GROUND: Bitmac
						(0.45)		MADE GROUND: Grey slightly sandy angular to subangular fine to coarse GRAVEL of limestone with low cobble content. Sand is fine to coarse. Cobbles are angular of limestone.
0.50	D6 ES1				64.97	0.60		
0.80 - 1.20	B13					(0.70)		Very stiff brown sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies. Cobbles are subrounded of mixed lithologies
1.20 - 1.65	SPT (S) N=34			N=34 (3,5/7,10,8,9) Hammer SN = 0777	64.28	1.30		
1.50	D7 ES2							Very stiff dark greyish black slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies. Cobbles are subrounded of mixed lithologies.
1.80 - 2.20	B14							
2.00 - 2.45	SPT (S) N=34			N=34 (4,5/5,8,10,11) Hammer SN = 0777				
2.50	D8 ES3							
2.80 - 3.20	B15							
3.00 - 3.45	SPT (S) N=33			N=33 (4,5/7,7,10,9) Hammer SN = 0777				
3.50	D9 ES4							
3.80 - 4.20	B16							
4.00 - 4.45	SPT (S) N=42			N=42 (6,7/9,10,10,13) Hammer SN = 0777		(5.40)		
4.50	D10 ES5							
4.80 - 5.20	B17							
5.00 - 5.22	SPT (S)			N=50 (17,18/50 for 66mm) Hammer SN = 0777				
5.50	D11							
5.80 - 6.20	B18							
6.00 - 6.45	SPT (S) N=49			N=49 (7,7/9,11,13,16) Hammer SN = 0777				
6.50	D12							
6.80	B19				58.88	6.70 (0.10)		Grey BOULDER of limestone recovered through chiseling as sandy angular fine to coarse gravel.
6.80 - 6.82	SPT (S)			N=50 (25 for 24mm/50 for 1mm) Hammer SN = 0777 Water strike at 6.80	58.78	6.80		End of Borehole at 6.80m

Water

Backfill

Remarks

Hand dug pit excavated to 1.20m.

Terminated on obstruction - possible boulder.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
6.80	6.80	720	5.40

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
6.80	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
6.70	6.80	01:00

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	1.70

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH104

Coordinates: 717095.41 E 743433.49 N

Client: DAA

Client's Representative: Arup

Ground Level: 65.18 mOD

Dates: 25/04/2019 - 25/04/2019

Sheet 1 of 1

Scale: 1:50

Driller: BM

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					65.08	(0.10) 0.10		MADE GROUND: Bitmac		
						(0.40)		MADE GROUND: Grey very sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.		
0.50	B1 ES5				64.68	0.50		MADE GROUND: Firm greyish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
1.00	B2					(0.90)				
1.20	D3									
1.20 - 1.58	SPT (S)	0.00	Dry	N=50 (2,3/50 for 235mm)	63.78	1.40			▼	
1.50	ES6			Seepage at 1.5m		(0.30)		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
1.70	D4				63.48	1.70		End of Borehole at 1.70m		
1.70 - 1.72	SPT (S)	1.50	1.40	N=50 (25 for 5mm/50 for 10mm)						

Remarks

Hand dug pit excavated to 1.20m.

Terminated on obstruction, moved to re-bore BH104A.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.50			

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
1.70	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)
1.70	1.80	01:00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
18-1467	Dublin Airport Central Phase 2, Dublin Airport	BH104A
Coordinates:	**Client:**	Sheet 1 of 1
717099.48 E	DAA	
743431.72 N	**Client's Representative:** Arup	**Scale:** 1:50
Ground Level: 65.15 mOD	**Dates:** 25/04/2019 - 25/04/2019	**Driller:** BM
		Logger: SR

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	2.40	5.50

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
								See TP106 log.		
						(2.40)				
					62.75	2.40				
2.50	ES7							Very stiff greyish black slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies.		
3.00	B1 D4									
3.00 - 3.44	SPT (S)	3.00	Dry	N=50 (9,9/50 for 285mm)						
						(3.10)				
4.00	B2 D5									
4.00 - 4.38	SPT (S)	4.00	Dry	N=50 (9,10/50 for 225mm)						
4.50	ES8									
5.00	B3 D6									
5.00 - 5.30	SPT (S)	5.00	Dry	N=50 (10,18/50 for 155mm)						
					59.65	5.50		End of Borehole at 5.50m		

Remarks
Hand dug pit excavated to 1.20m.
No noticeable groundwater strikes.

Terminated on obstruction - possible bedrock.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
5.50	200

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	7.20

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH105

Coordinates: 717151.15 E, 717151.15 N

Client: DAA

Client's Representative: Arup

Ground Level: 64.41 mOD

Dates: 29/04/2019 - 29/04/2019

Sheet 1 of 1

Scale: 1:50

Driller: SS

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
					64.31	(0.10) 0.10	MADE GROUND: Bitmac
				Water strike at 0.30m		(0.50)	MADE GROUND: Brownish grey sandy subangular to subrounded fine to coarse GRAVEL of limestone. Sand is fine to coarse.
0.50	D6 ES1				63.81	0.60	
0.80 - 1.20	B11					(0.50)	Firm brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies. Cobbles are subangular of limestone.
1.20 - 1.65	SPT (S) N=34		Dry	N=34 (4,5/7,8,9,10) Hammer SN = 0777	63.31	1.10	
1.50	D7 ES2						Very stiff dark grey slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine. Gravel is subangular fine to medium of mixed lithologies. Cobbles are subrounded of limestone.
1.80 - 2.20	B12						
2.00 - 2.45	SPT (S) N=41	2.00	Dry	N=41 (4,5/6,13,12,10) Hammer SN = 0777			
2.50	D8 ES3						
2.80 - 3.20	B13						
3.00 - 3.30	SPT (S)	3.00	Dry	N=50 (7,12/50 for 146mm) Hammer SN = 0777			
3.50	D9 ES4						
3.80 - 4.20	B14						
4.00 - 4.45	SPT (S) N=43	4.00	Dry	N=43 (6,8/9,9,13,12) Hammer SN = 0777		(6.00)	
4.50	D10 ES5						
4.80 - 5.20	B15						
5.00 - 5.45	SPT (S) N=47	5.00	Dry	N=47 (5,6/9,13,12,13) Hammer SN = 0777			
5.80 - 6.20	B16						
6.00 - 6.36	SPT (S)	6.00	Dry	N=50 (4,9/50 for 205mm) Hammer SN = 0777			
6.80 - 7.20	B17						
				Water strike at 7.10m	57.31	(0.10) 7.10	
7.20 - 7.22	SPT (S)	7.20	6.60	N=50 (25 for 10mm/50 for 14mm) Hammer SN = 0777	57.21	7.20	Very dense grey sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse. (Possible bedrock).
							End of Borehole at 7.20m

Water

Backfill

Remarks

Hand dug pit excavated to 1.20m.

Terminated on possible rock/large boulder

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
0.30	0.30	20	0.20
7.10	7.10	20	6.60

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Inspection Pit	Hand tools	0.00	1.20
Rotary Drilling	Hanjin 8D	1.20	2.20
Rotary Coring	Hanjin 8D	2.20	8.20

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH106

Coordinates: 717094.29 E, 743466.56 N

Client: DAA

Sheet 1 of 1

Client's Representative: Arup

Scale: 1:50

Driller: MW

Ground Level: 65.89 mOD

Dates: 24/04/2019 - 25/04/2019

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					65.74	(0.15)		MADE GROUND: Bitmac		
					65.59	(0.15)		MADE GROUND: Grey sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.		
					65.49	(0.10) 0.40		MADE GROUND: Concrete		
						(0.80)		Firm brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded of mixed lithologies.		
					64.69	1.20				
					64.59	(0.10) 1.30		Brown sandy gravelly CLAY (Driller's description)		
						(0.90)		Grey sandy gravelly CLAY (Driller's description)		
2.20 - 2.40	SPT (S)	2.20		N=50 (6,6/50 for 45mm) Hammer SN = 0678	63.69	2.20				
2.20 - 2.40				N=50 (6,6/50 for 45mm) Hammer SN = 0678	63.49	(0.20) 2.40		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse of mixed lithologies.		
	100 90 70		8					Medium strong to strong medium to thickly bedded light grey to grey argillaceous LIMESTONE with localised calcite veins and veinlets, abundant fossils and pressure dissolution features (stylolite orientated in random directions). Partially weathered. Disc 1: 0-30 degrees, subhorizontal to horizontal, medium spaced (100/500/900), undulating, rough, clean. Generally stylolites which have opened. Disc 2: 45 degrees, widely spaced, undulating rough with orangey brown sandy clay smear on surface.		
3.70										
	100 100 90									
5.20						(5.80)				
	100 100 100		5							
6.70										
	100 100 100									
8.20					57.69	8.20		End of Borehole at 8.20m		
	TCR SCR RQD		FI							

Remarks

Hand dug pit excavated to 1.20m.

No noticeable groundwater strikes.

Terminated on instruction of the engineer.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)
2.20	146

CAUSEWAY GEOTECH

Method	Plant Used	Top	Base
Cable Percussion	Dando 2000	0.00	0.70

Project No.: 18-1467

Project Name: Dublin Airport Central Phase 2, Dublin Airport

Borehole No.: BH107

Coordinates: 717167.97 E, 743442.03 N

Client: DAA

Sheet 1 of 1

Client's Representative: Arup

Scale: 1:50

Driller: BM

Ground Level: 64.56 mOD

Dates: 17/04/2019 - 17/04/2019

Logger: SR

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					64.46	(0.10) 0.10		MADE GROUND: Bitmac		
						(0.40)		MADE GROUND: Grey very sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.		
0.50	B1 ES2				64.06	0.50				
					63.86	(0.20) 0.70		MADE GROUND: Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
								End of Borehole at 0.70m		

Remarks

Hand dug pit excavated to 0.7m.

Terminated on obstruction, moved to re-bore BH107A.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

Project No.:	Project Name:	Borehole No.:
18-1467	Dublin Airport Central Phase 2, Dublin Airport	BH107A
Coordinates:	**Client:**	Sheet 1 of 1
717167.12 E	DAA	
743438.02 N	**Client's Representative:** Arup	**Scale:** 1:50
Ground Level: 64.51 mOD	**Dates:** 17/04/2019 - 18/04/2019	**Driller:** BM
		Logger: SR

Method	Plant Used	Top	Base
Light Percussion	Dando Terrier	0.00	8.30

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water	Backfill
					64.41	(0.10) 0.10		MADE GOURND: Bitmac		
						(0.30)		MADE GROUND: Grey very sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.		
					64.11	0.40		MADE GROUND: Firm brownish grey sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of mixed lithologies.		
0.50	B5 ES1					(0.80)				
1.00	B6									
1.20	D7				63.31	1.20				
1.20 - 1.65	SPT (S) N=20	1.20	Dry	N=20 (2,3/3,5,6,6) Hammer SN = 0643	63.01	(0.30) 1.50		Stiff greyish black sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrouned of limestone.		
1.50	ES2	0.00		17-04-2019				Very stiff black slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies. Cobbles are subrounded of limestone.		
2.00	B8 D14									
2.00 - 2.45	SPT (S) N=41	1.20	Dry	N=41 (3,5/9,10,11,11) Hammer SN = 0643						
2.50	ES3									
3.00	B9 D15									
3.00 - 3.45	SPT (S) N=40	3.00	Dry	N=40 (5,6/8,10,11,11) Hammer SN = 0643						
4.00	B10 D16									
4.00 - 4.45	SPT (S) N=46	3.00	Dry	N=46 (6,8/10,11,11,14) Hammer SN = 0643						
4.50	ES4					(6.80)				
5.00	B11 D17									
5.00 - 5.42	SPT (S)	4.50	Dry	N=50 (6,8/50 for 275mm) Hammer SN = 0643						
6.00	B12 D18									
6.00 - 6.36	SPT (S)	6.00	Dry	N=50 (8,11/50 for 205mm) Hammer SN = 0643						
7.50	B13 D19									
7.50 - 7.78	SPT (S)	7.50	Dry	N=50 (15,25/50 for 125mm) Hammer SN = 0643						
		7.50	7.90	Seepage at 8.00m 18-04-2019	56.21	8.30		End of Borehole at 8.30m		

Remarks
Hand dug pit excavated to 1.20m.

Terminated on instruction of the engineer.

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
8.00	8.00		

Water Added

From (m)	To (m)

Casing Details

To (m)	Diam (mm)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

CAUSEWAY GEOTECH

APPENDIX C

CORE PHOTOGRAPHS





BH102 Box 1 3.70 – 5.20m



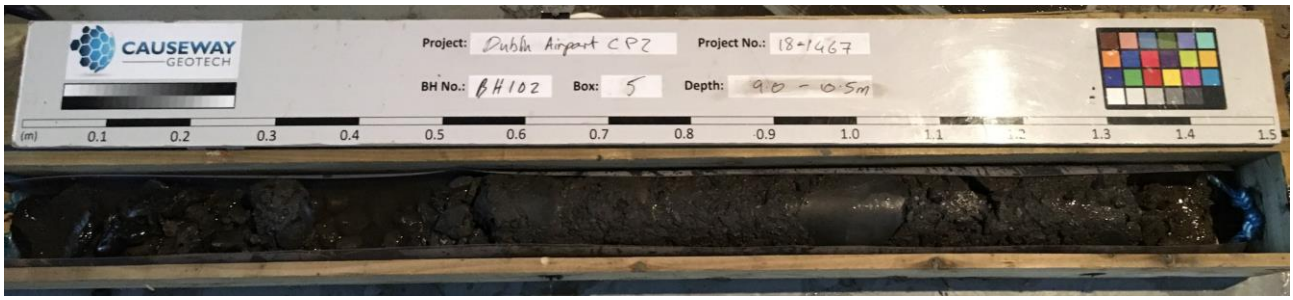
BH102 Box 2 5.20 – 6.70m



BH102 Box 3 6.70 – 8.20m



BH102 Box 4 8.20 – 9.00m



BH102 Box 5 9.00 – 10.50m



BH102 Box 6 10.50 – 12.00m



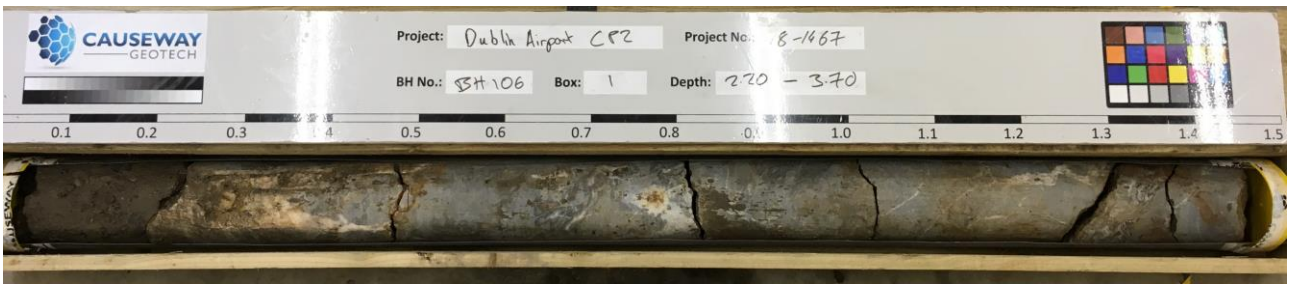
BH102 Box 7 12.00 – 13.20m



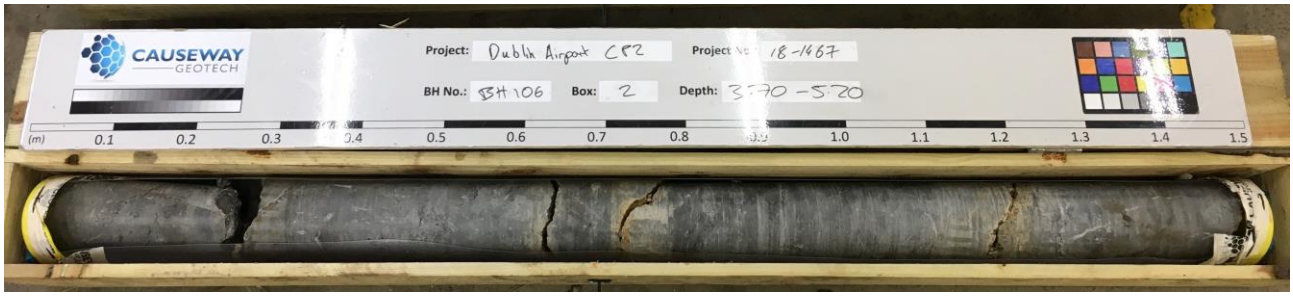
BH102 Box 8 13.20 – 14.70m



BH102 Box 9 14.70 – 16.20m



BH106 Box 1 2.20 – 3.70m



BH106 Box 2 3.70 – 5.20m



BH106 Box 3 5.20 – 6.70m



BH106 Box 4 6.70 – 8.20m

CAUSEWAY GEOTECH

APPENDIX D

TRIAL PIT LOGS



CAUSEWAY GEOTECH

Project No.: 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport		**Trial Pit No.:** **TP101**
Co-ordinates: 717137.50 E	**Client:** DAA		Sheet 1 of 1
Method: Trial Pitting	743511.72 N	**Client's Representative:** Arup	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 65.57 mOD	**Date:** 15/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			65.47	(0.10) 0.10		TOPSOIL	
				(0.45)		Firm greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.	
0.40	B5						
0.40	ES1		65.02	0.55			
				(0.45)		Grey slightly gravelly fine to coarse SAND with high cobble content. Gravel is angular fine to coarse of limestone. Cobbles are angular of limestone.	
0.90	B6						
0.90	ES2	Seepage at 1.00m.	64.57	1.00			▼
				(0.30)		Firm dark grey slightly sandy slightly gravelly organic CLAY with some fibrous material. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of mixed lithologies.	
1.20	B7						
1.20	ES3		64.27	1.30			
						Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of mixed lithologies.	
						below 1.60m: becoming stiff	
1.70	B8			(0.80)			
1.70	ES4						
			63.47	2.10		Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.	
				(0.90)			
			62.57	3.00		End of trial pit at 3.00m	

Remarks

Terminated at scheduled depth.

Water Strikes:

Struck at (m):	Remarks:
1.00	Seepage at 1.00m.

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH	**Project No.:** 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport	**Trial Pit No.:** TP102
	Co-ordinates: 717092.38 E	**Client:** DAA	Sheet 1 of 1
Method: Trial Pitting	743489.70 N	**Client's Representative:** Arup	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 66.35 mOD	**Date:** 15/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
				(0.30)		MADE GROUND: Light grey gravelly slightly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of mixed lithologies.	
			66.05	0.30		MADE GROUND: Firm orangish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.	
0.50	B5			(0.30)			
0.50	ES1		65.75	0.60		MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone.	
1.00	B6						
1.00	ES2						
				(1.40)			
1.50	B7						
1.50	ES3					*below 1.60m: becoming stiff*	
			64.35	2.00		Firm brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone. Cobbles are subrounded to subangular of limestone.	
				(0.80)			
2.50	B8						
2.50	ES4						
			63.55	2.80		Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies	
				(0.20)			
			63.35	3.00		End of trial pit at 3.00m	

Remarks
No groundwater encountered

Terminated at scheduled depth.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Trial Pit No.:
18-1467	Dublin Airport Central Phase 2, Dublin Airport	**TP103**
Co-ordinates: 717171.50 E 743471.73 N	**Client:** DAA	Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Arup	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 65.11 mOD	**Date:** 18/04/2019
		Logger: MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			65.06	(0.05) 0.05		MADE GROUND: Bitmac	
				(0.30)		MADE GROUND: Grey sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
			64.76	0.35		MADE GROUND: Stiff greenish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.	
0.50	B5						
0.50	ES1			(0.45)			
			64.31	0.80		Firm locally stiff brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of limestone.	
1.00	B6						
1.00	ES2			(1.20)			
			63.11	2.00		Dark greyish black slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone.	
2.20	B7						
2.20	ES3			(1.00)			
2.70	B8						
2.70	ES4						
			62.11	3.00		End of trial pit at 3.00m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated at scheduled depth.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH

Project No.:	Project Name:	Trial Pit No.:
18-1467	Dublin Airport Central Phase 2, Dublin Airport	TP104
Co-ordinates:	**Client:**	Sheet 1 of 1
717115.46 E	DAA	
Method: Trial Pitting	**Client's Representative:** 743451.76 N Arup	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 65.21 mOD	**Date:** 18/04/2019
		Logger: MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			65.15	(0.06) 0.06		MADE GROUND: Bitmac	
				(0.16)		MADE GROUND: Dark grey very sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
			64.99	0.22		Stiff brown slightly sandy slightly gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone. Cobbles are subrounded to subangular of limestone.	
0.50	B5						
0.50	ES1						
				(0.93)			
1.00	B6						
1.00	ES2						
			64.06	1.15		Stiff dark grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone. Cobbles are subangular of limestone	
1.50	B7						
1.50	ES3						
				(1.35)			
2.20	B8						
2.20	ES4						
			62.71	2.50		End of trial pit at 2.50m	

Remarks
No groundwater encountered

Terminated in very stiff clay.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH	**Project No.:** 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport	**Trial Pit No.:** **TP105**
	Co-ordinates: 717147.94 E	**Client:** DAA	Sheet 1 of 1
Method: Trial Pitting	743447.88 N	**Client's Representative:** Arup	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 64.91 mOD	**Date:** 18/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			64.83	(0.08) 0.08		MADE GROUND: Bitmac	
				(0.32)		MADE GROUND: Grey very sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
0.50 0.50	B5 ES1		64.51	0.40 (0.60)		Stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone. Cobbles are subangular of limestone.	
1.00 1.00	B6 ES2		63.91	1.00		Stiff dark grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium of limestone. Cobbles are subrounded of limestone.	
1.50 1.50	B7 ES3			(1.00)			
2.10 2.10	B8 ES4		62.91	2.00 (0.40)		Stiff dark grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subrounded of limestone.	
			62.51	2.40		End of trial pit at 2.40m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated on possible large boulder

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH

Project No.: 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport		**Trial Pit No.:** **TP106**
Co-ordinates: 717099.49 E 743431.54 N	**Client:** DAA		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Arup		**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 65.14 mOD	**Date:** 18/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			65.11	(0.03)		MADE GROUND: Bitmac	
				(0.42)		MADE GROUND: Black slightly silty fine to coarse SAND and subangular to angular GRAVEL of limestone.	
0.50	B5		64.69	0.45		Stiff brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subangular of limestone.	
0.50	ES1						
				(0.95)			
1.00	B6						
1.00	ES2						
1.50	B7		63.74	1.40		Stiff dark grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of limestone. Cobbles are subrounded of limestone.	
1.50	ES3						
				(1.10)			
2.30	B8						
2.30	ES4						
			62.64	2.50		End of trial pit at 2.50m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered

Terminated in very stiff clay.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH

Project No.: 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport		**Trial Pit No.:** **TP107**
Co-ordinates: 717162.70 E 743423.87 N	**Client:** DAA		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Arup		**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 64.33 mOD	**Date:** 17/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			64.25	(0.08) 0.08		MADE GROUND: Bitmac	
		Slow seepage at 0.20m		(0.27)		MADE GROUND: Grey very sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	▼
0.50	B5		63.98	0.35		Stiff brown slightly sandy slightly gravelly silty CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of limestone. Cobbles and boulders are subrounded of limestone.	
0.50	ES1						
				(1.00)			
1.00	B6						
1.00	ES2						
1.50	B7		62.98	1.35		Stiff dark grey slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of limestone. Cobbles are subangular to subrounded of limestone.	
1.50	ES3						
				(1.05)			
2.00	B8						
2.00	ES4						
			61.93	2.40		End of trial pit at 2.40m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks

Terminated in very stiff clay.

Water Strikes:

Struck at (m):	Remarks:
0.20	Slow seepage at 0.20m

Stability: Stable

Width: 1.00

Length: 3.00

CAUSEWAY GEOTECH

APPENDIX E

TRIAL PIT PHOTOGRAPHS





TP101



TP101



TP101



TP101



TP101



TP101



TP102



TP102



TP102



TP102



TP102



TP102





TP103



TP103



TP103



TP104



TP104



TP104



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TP105



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TP106



TP106



TP107



TP107



TP107



TP107



TP107

CAUSEWAY GEOTECH

APPENDIX F

INFILTRATION TEST RESULTS



CAUSEWAY GEOTECH

Project No.: 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport		**Trial Pit No.:** **SP101**
Co-ordinates: 717141.34 E 743446.73 N	**Client:** DAA		Sheet 1 of 1
Method: Trial Pitting	**Client's Representative:** Arup		**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 64.92 mOD	**Date:** 23/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			64.83	(0.09) 0.09		MADE GROUND: Bitmac	
			64.77	(0.06) 0.15		MADE GROUND: Dark grey angular fine to medium GRAVEL of limestone.	
			64.62	(0.15) 0.30		MADE GROUND: Grey sandy angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
				(1.15)		Stiff brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies. Cobbles are subrounded of limestone.	
			63.47	1.45		End of trial pit at 1.45m	

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks
No groundwater encountered.

Terminated at scheduled depth.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.80

Length: 2.00

Soakaway Infiltration Test

Project No.: 18-1467
Site: Dublin Airport CP2
Test Location: SP101
Test Date: 23 April 2019

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

	width (m)	length (m)
test pit top dimensions	0.70	1.35
test pit base dimensions	0.35	0.70

test pit depth (m) 1.45

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.34	1.11
1	0.34	1.11
2	0.34	1.11
4	0.34	1.11
6	0.34	1.11
8	0.34	1.11
10	0.34	1.11
15	0.34	1.11
20	0.34	1.11
25	0.34	1.11
30	0.34	1.11
45	0.34	1.11
60	0.34	1.11

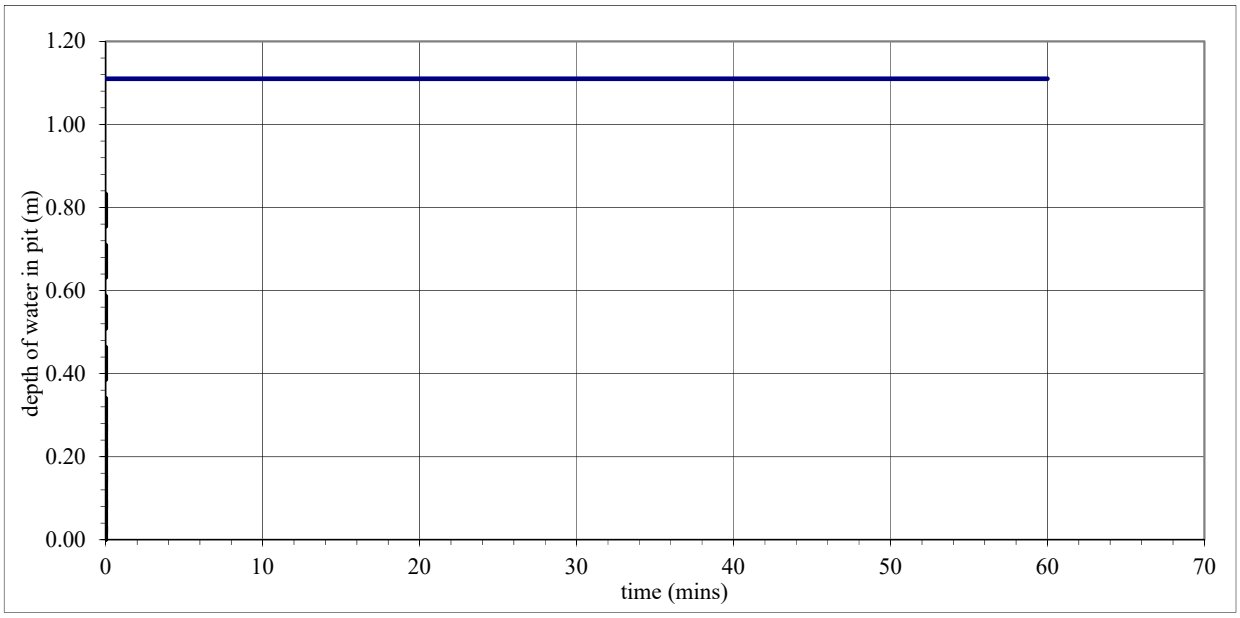
From graph below:

test start - 75% depth at
0.8325 m water depth
time is not determined

test end - 25% depth at
0.2775 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
	0.62	0.8325					
	1.17	0.2775					



CAUSEWAY GEOTECH	**Project No.:** 18-1467	**Project Name:** Dublin Airport Central Phase 2, Dublin Airport	**Trial Pit No.:** **SP102**
	Co-ordinates: 717141.88 E	**Client:** DAA	Sheet 1 of 1
Method: Trial Pitting	743428.83 N	**Client's Representative:** Arup	**Scale:** 1:25
Plant: 6T Tracked Excavator	**Ground Level:** 64.62 mOD	**Date:** 23/04/2019	**Logger:** MMC

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m) (Thickness)	Legend	Description	Water
			64.55	(0.08)		MADE GROUND: Bitmac	
			64.52	(0.10)		MADE GROUND: Dark greyish black angular fine to medium GRAVEL of limestone.	
				(0.30)		MADE GROUND: Grey sandy angular to subangular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
			64.22	0.40		Stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone. Cobbles are subangular of limestone.	
				(0.70)			
			63.52	1.10		Stiff dark grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone.	
				(0.30)			
			63.22	1.40		End of trial pit at 1.40m	

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5

Remarks
No groundwater encountered

Terminated at scheduled depth.

Water Strikes:	
Struck at (m):	Remarks:

Stability: Stable

Width: 0.70

Length: 1.60

Soakaway Infiltration Test

Project No.: 18-1467
Site: Dublin Airport CP2
Test Location: SP102
Test Date: 23 April 2019

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

	width (m)	length (m)
test pit top dimensions	0.70	1.60
test pit base dimensions	0.70	1.00

test pit depth (m) 1.40

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.37	1.03
1	0.37	1.03
2	0.37	1.03
4	0.37	1.03
6	0.37	1.03
8	0.37	1.03
10	0.37	1.03
15	0.37	1.03
20	0.37	1.03
25	0.37	1.03
30	0.37	1.03
45	0.37	1.03
60	0.37	1.03

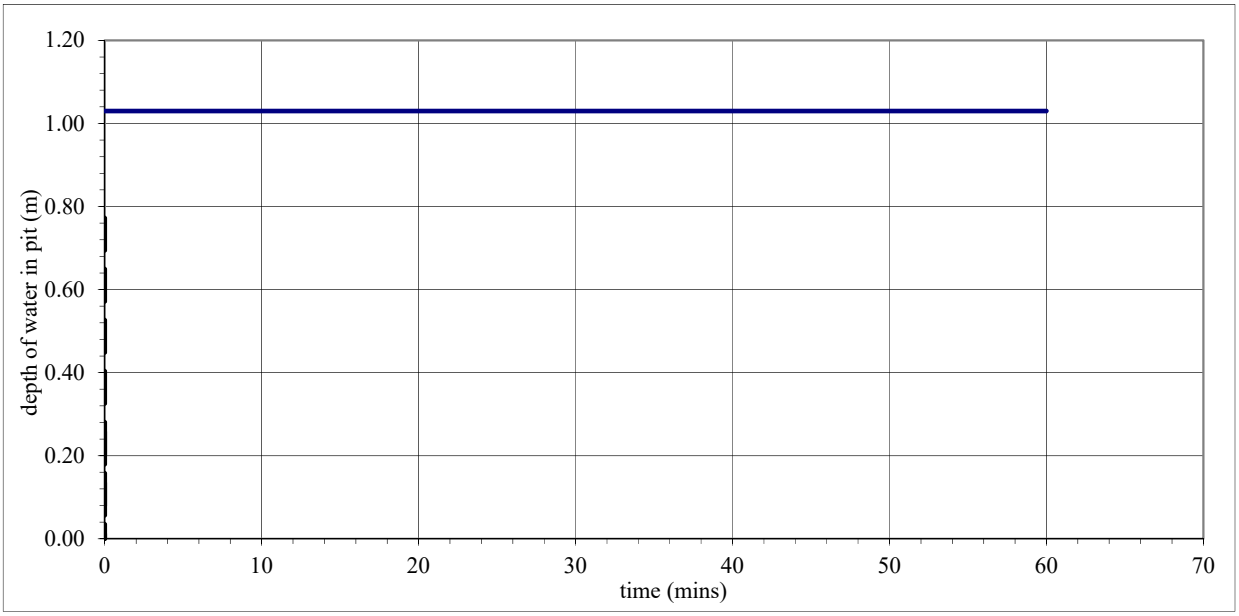
From graph below:

test start - 75% depth at
0.7725 m water depth
time is not determined

test end - 25% depth at
0.2575 m water depth
time is not determined

infiltration rate (q) is very low

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
	0.63	0.7725					
	1.14	0.2575					



CAUSEWAY GEOTECH

APPENDIX G

GEOTECHNICAL LABORATORY TEST RESULTS



CAUSEWAY GEOTECH

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SOIL AND ROCK SAMPLE ANALYSIS
LABORATORY TEST REPORT

Project Name:	Dublin Airport Central Phase 2, Dublin Airport
Project No.:	18-1467
Client:	DAA
Engineer:	ARUP
Date:	07/06/19

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s).

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Approved Signatory



Stephen Watson
Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

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Project Name: Dublin Airport Central Phase 2, Dublin Airport

Report Reference: Schedule 1

The table below details the tests carried out, the specifications used, and the number of tests included in this report.

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	30
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	20
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	20
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	20
ROCK	Point load index	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985	8
ROCK	Uniaxial Compressive Strength (UCS)*	ISRM Suggested Methods -Rock Characterization Testing and Monitoring, Ed. E T Brown - 1981	2

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SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Pro Soils Limited *(UKAS 2183)*	pH Value of Soil		8
SOIL – Subcontracted to Chemtest Ltd *(UKAS 2183)*	Sulphate Content water extract		8
SOIL – Subcontracted to Chemtest Ltd *(UKAS 2183)*	Sulphate Content water of acid extract		8

Summary of Classification Test Results

Project No.	Project Name
18-1467	Dublin Airport Central Phase 2, Dublin Airport

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
BH101	11	3.00		B	Grey sandy gravelly silty CLAY.			9.5	57	26 -1pt	14	12		CL
BH101	20	5.00		D	Grey sandy gravelly silty CLAY.			10.0						
BH101	16	7.50		B	Grey sandy gravelly silty CLAY.			13.0	61	31 -1pt	14	17		CL
BH101	18	10.50		B	Grey sandy slightly gravelly silty CLAY.			12.0	66	30 -1pt	16	14		CL
BH103	7	1.50		D	Grey sandy slightly gravelly silty CLAY.			13.0						
BH103	16	3.80		B	Grey sandy gravelly silty CLAY.			11.0	62	30 -1pt	16	14		CL
BH103	10	4.50		D	Grey sandy gravelly silty CLAY.			11.0						
BH103	18	5.80		B	Grey sandy gravelly silty CLAY.			14.0	63	34 -1pt	16	18		CL
BH104	3	1.20		D	Grey sandy slightly gravelly silty CLAY.			11.0						
BH104A	1	3.00		B	Grey sandy slightly gravelly silty CLAY.			14.0	75	29 -1pt	14	15		CL
BH104A	3	5.00		B	Grey sandy slightly gravelly silty CLAY			18.0	79	29 -1pt	13	16		CL
BH105	12	1.80		B	Grey sandy gravelly silty CLAY.			11.0	54	27 -1pt	14	13		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

06/05/2019 00:00

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

Project No.	Project Name
18-1467	Dublin Airport Central Phase 2, Dublin Airport

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
BH105	8	2.50		D	Grey sandy gravelly silty CLAY.			11.0						
BH105	14	3.80		B	Grey sandy slightly gravelly silty CLAY.			13.0	72	34 -1pt	16	18		CL
BH105	16	5.80		B	Grey sandy slightly gravelly silty CLAY.			14.0	72	31 -1pt	15	16		CL
BH107A	8	2.00		B	Grey sandy slightly gravelly silty CLAY.			12.0	61	30 -1pt	16	14		CL
BH107A	15	3.00		D	Grey sandy slightly gravelly silty CLAY.			9.6						
BH107A	17	5.00		D	Grey sandy slightly gravelly silty CLAY.			11.0						
BH107A	13	7.50		B	Grey sandy gravelly silty CLAY.			13.0	64	27 -1pt	16	11		CL
TP101	8	1.70		B	Grey sandy gravelly silty CLAY.			12.0	61	29 -1pt	17	12		CL
TP102	8	2.50		B	Grey sandy gravelly silty CLAY.			9.6						
TP103	6	1.00		B	Grey sandy gravelly silty CLAY.			11.0	59	29 -1pt	17	12		CL
TP104	5	0.50		B	Grey sandy slightly gravelly silty CLAY.			9.9						
TP104	7	1.50		B	Grey sandy gravelly silty CLAY.			8.7	70	30 -1pt	15	15		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

06/05/2019 00:00

Approved By

Stephen.Watson

UKAS TESTING

10122

Summary of Classification Test Results

Project No.	Project Name
18-1467	Dublin Airport Central Phase 2, Dublin Airport

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
						Mg/m3		%	%	%	%	%	Mg/m3	
TP105	6	1.00		B	Grey sandy gravelly silty CLAY.			10.0	62	30 -1pt	16	14		CL
TP105	8	2.10		B	Grey sandy gravelly silty CLAY with some cobbles.			6.7	67	26 -1pt	15	11		CL
TP106	7	1.50		B	Grey sandy gravelly silty CLAY.			9.9						
TP106	8	2.30		B	Grey sandy gravelly silty CLAY.			9.1	69	28 -1pt	14	14		CL
TP107	6	1.00		B	Grey sandy gravelly silty CLAY.			14.0	65	28 -1pt	16	12		CL
TP107	8	2.00		B	Grey sandy gravelly silty CLAY.			11.0	68	28 -1pt	15	13		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

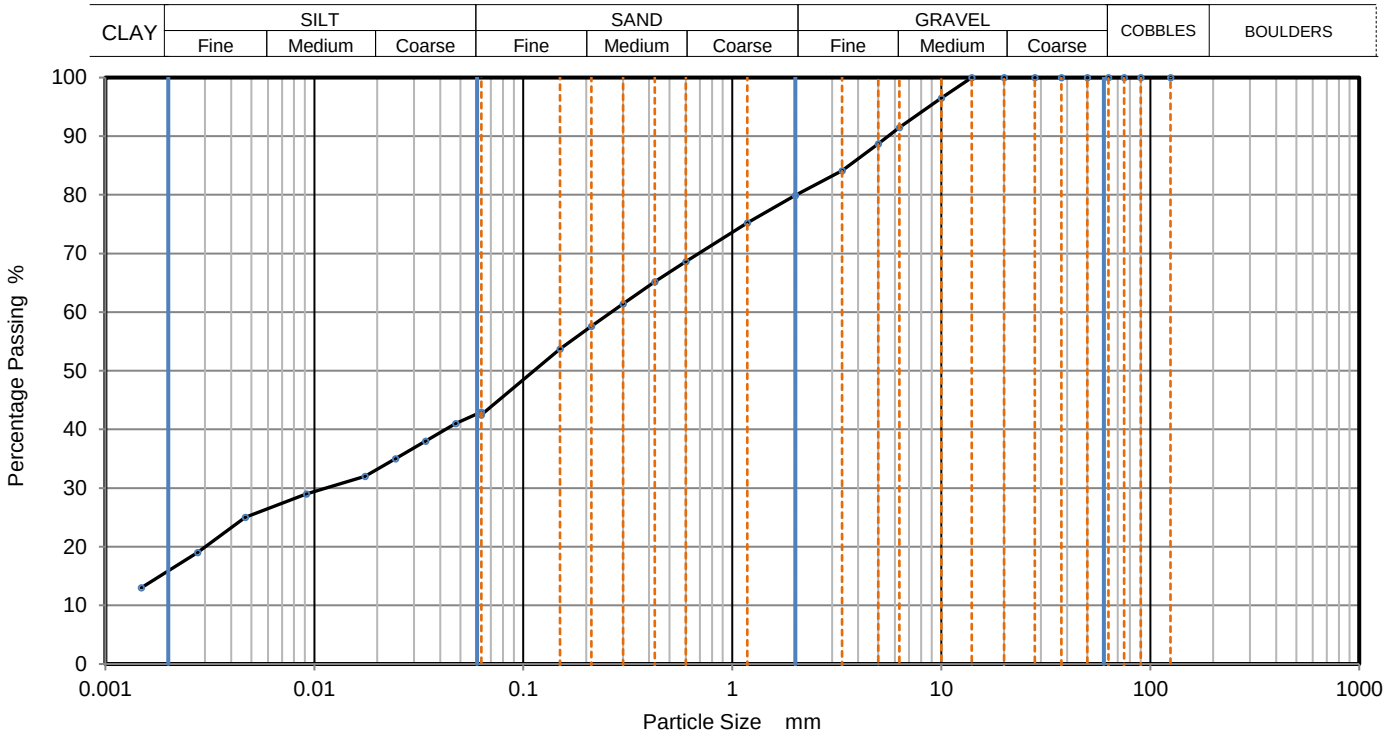
Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed: 06/05/2019 00:00

Approved By: Stephen.Watson

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH101
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	11
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	3.00
Specimen Reference	9	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513147



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	43
90	100	0.0475	41
75	100	0.0341	38
63	100	0.0244	35
50	100	0.0175	32
37.5	100	0.0092	29
28	100	0.0047	25
20	100	0.0028	19
14	100	0.0015	13
10	97		
6.3	92		
5	89		
3.35	84		
2	80		
1.18	75		
0.6	69	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	61		
0.212	58		
0.15	54		
0.063	43		

Dry Mass of sample, g	499

Sample Proportions	% dry mass
Cobbles	0
Gravel	20
Sand	37
Silt	27
Clay	16

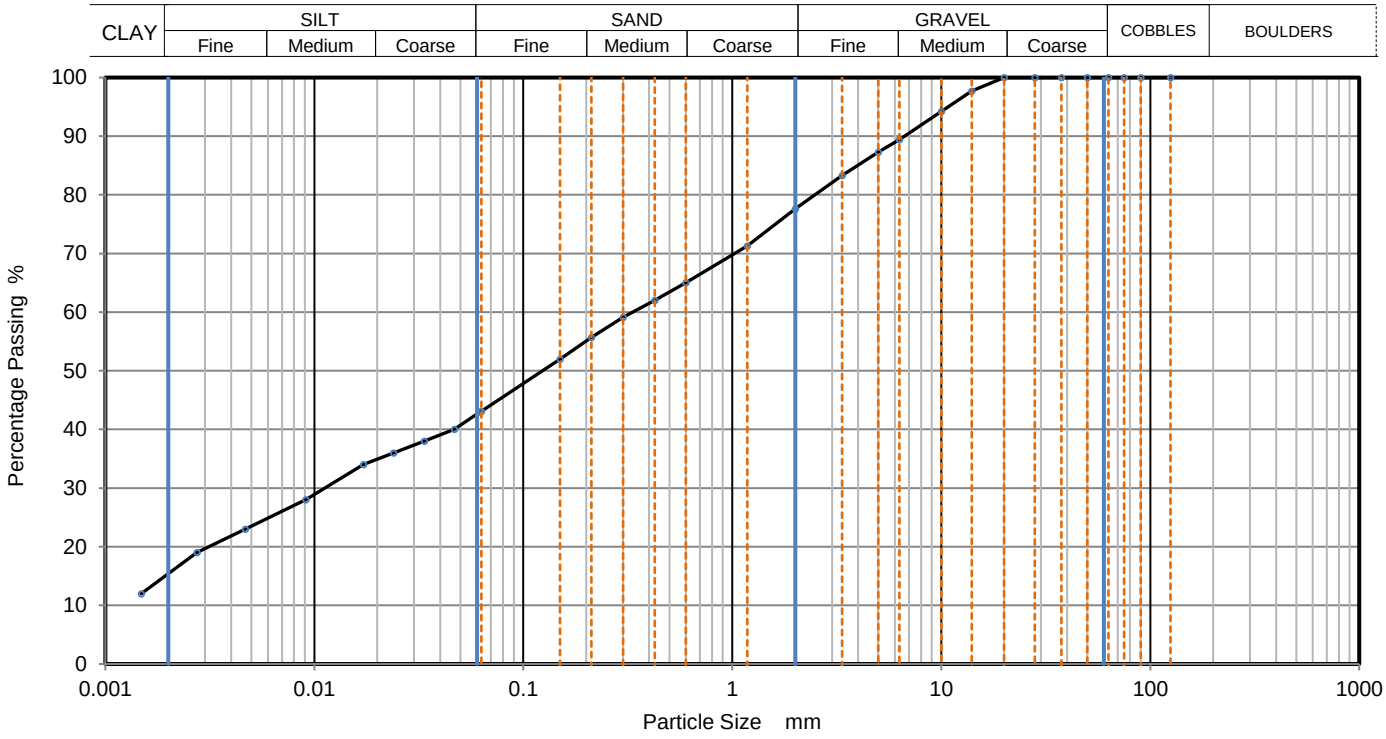
Grading Analysis		
D100	mm	
D60	mm	0.264
D30	mm	0.0107
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH101
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	16
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	7.50
Specimen Reference	9	Specimen Depth	7.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513149



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0620	43
90	100	0.0468	40
75	100	0.0336	38
63	100	0.0239	36
50	100	0.0172	34
37.5	100	0.0091	28
28	100	0.0047	23
20	100	0.0027	19
14	98	0.0015	12
10	94		
6.3	89		
5	87		
3.35	83		
2	78		
1.18	71		
0.6	65	Particle density	(assumed)
0.425	62	2.65	Mg/m3
0.3	59		
0.212	56		
0.15	52		
0.063	43		

Dry Mass of sample, g	532

Sample Proportions	% dry mass
Cobbles	0
Gravel	22
Sand	35
Silt	28
Clay	15

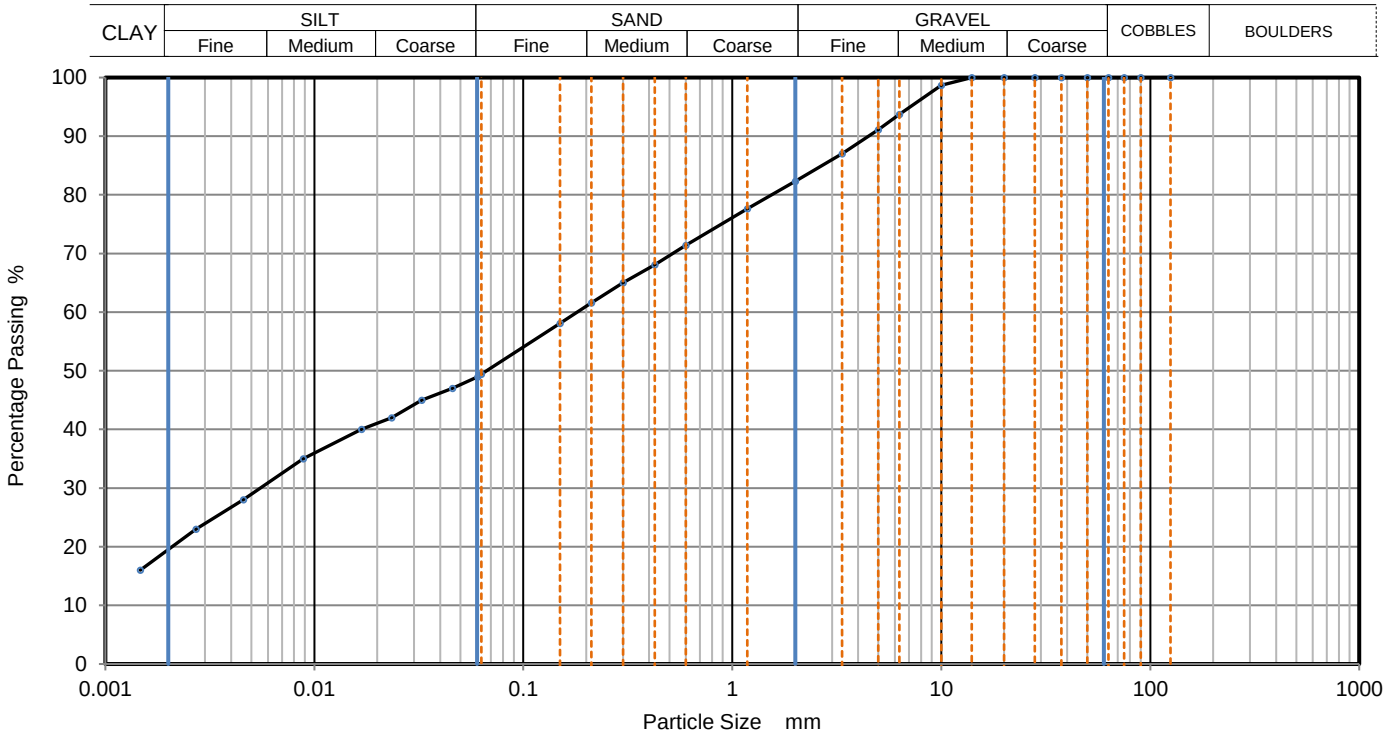
Grading Analysis		
D100	mm	
D60	mm	0.336
D30	mm	0.0111
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH101
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	18
Soil Description	Grey sandy slightly gravelly silty CLAY.			Depth, m	10.50
Specimen Reference	9	Specimen Depth	10.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513150



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0606	49
90	100	0.0458	47
75	100	0.0326	45
63	100	0.0234	42
50	100	0.0168	40
37.5	100	0.0089	35
28	100	0.0046	28
20	100	0.0027	23
14	100	0.0015	16
10	99		
6.3	94		
5	91		
3.35	87		
2	82		
1.18	78		
0.6	71	Particle density	(assumed)
0.425	68	2.65	Mg/m3
0.3	65		
0.212	62		
0.15	58		
0.063	49		

Dry Mass of sample, g: 490

Sample Proportions	% dry mass
Cobbles	0
Gravel	18
Sand	33
Silt	30
Clay	19

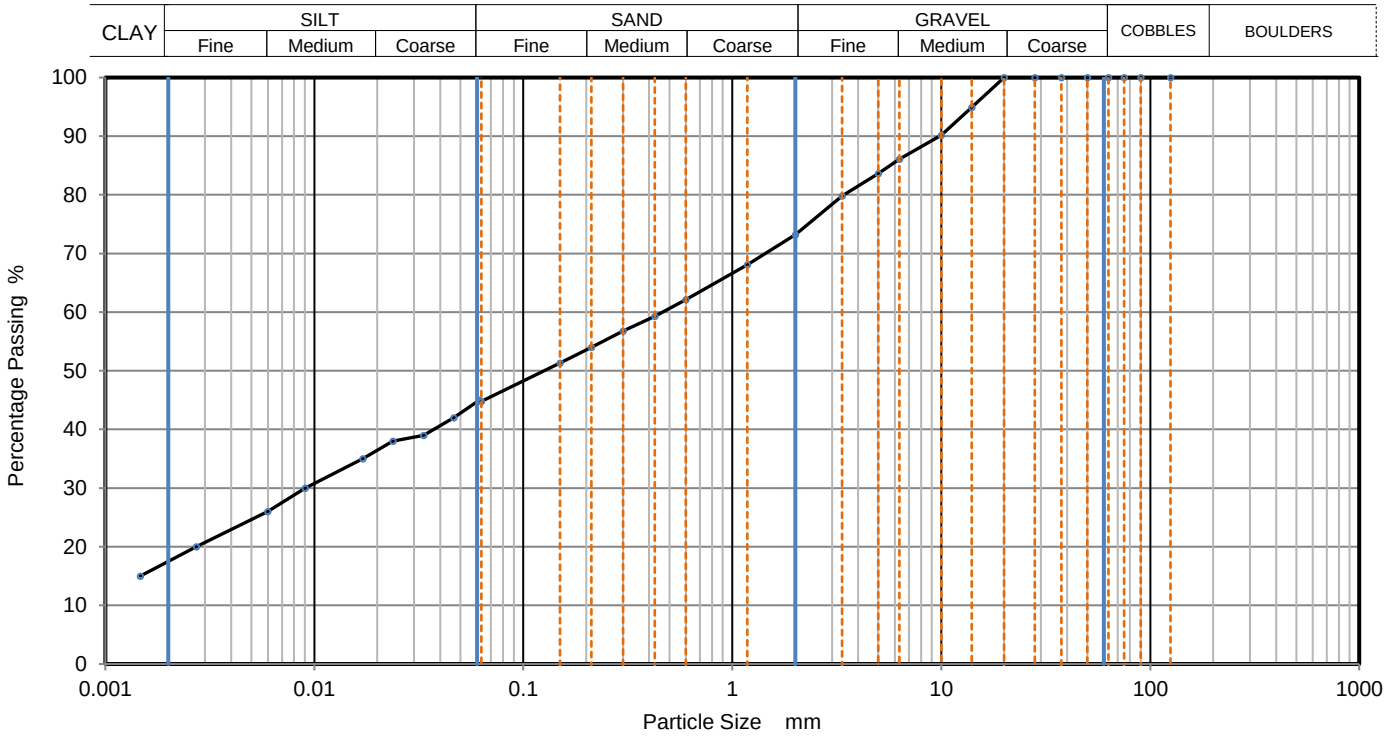
Grading Analysis		
D100	mm	
D60	mm	0.181
D30	mm	0.0054
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	18-1467
					Borehole/Pit No.	BH103
Site Name	Dublin Airport Central Phase 2, Dublin Airport				Sample No.	16
Soil Description	Grey sandy gravelly silty CLAY.				Depth, m	3.80
Specimen Reference	9	Specimen Depth	3.8	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus20190513152



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0616	45
90	100	0.0465	42
75	100	0.0334	39
63	100	0.0238	38
50	100	0.0170	35
37.5	100	0.0090	30
28	100	0.0060	26
20	100	0.0027	20
14	95	0.0015	15
10	90		
6.3	86		
5	84		
3.35	80		
2	73		
1.18	68		
0.6	62	Particle density	(assumed)
0.425	59	2.65	Mg/m3
0.3	57		
0.212	54		
0.15	51		
0.063	45		

Dry Mass of sample, g	526

Sample Proportions	% dry mass
Cobbles	0
Gravel	27
Sand	28
Silt	27
Clay	18

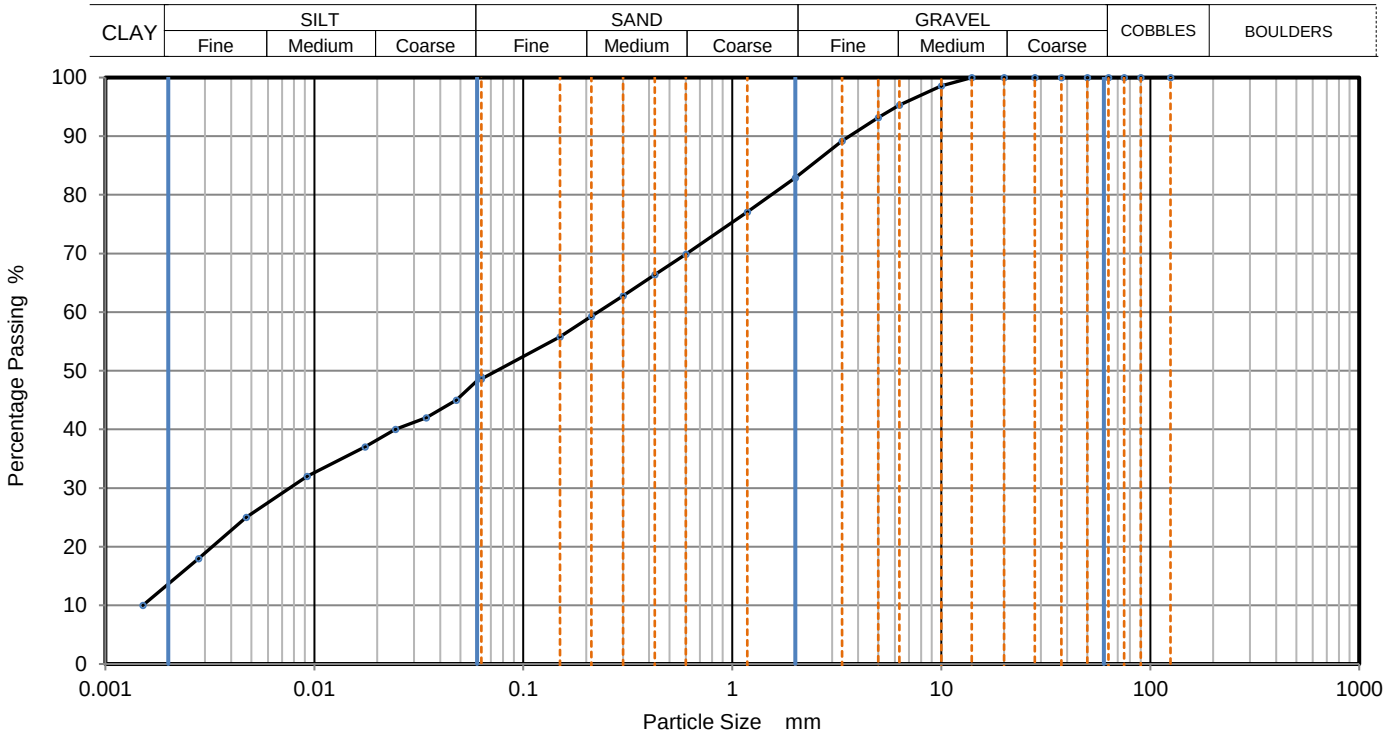
Grading Analysis		
D100	mm	
D60	mm	0.463
D30	mm	0.00918
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH103
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	18
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	5.80
Specimen Reference	9	Specimen Depth	5.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513154



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	49
90	100	0.0479	45
75	100	0.0343	42
63	100	0.0244	40
50	100	0.0175	37
37.5	100	0.0092	32
28	100	0.0047	25
20	100	0.0028	18
14	100	0.0015	10
10	99		
6.3	95		
5	93		
3.35	89		
2	83		
1.18	77		
0.6	70	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	63		
0.212	59		
0.15	56		
0.063	49		

Dry Mass of sample, g	528

Sample Proportions	% dry mass
Cobbles	0
Gravel	17
Sand	34
Silt	35
Clay	14

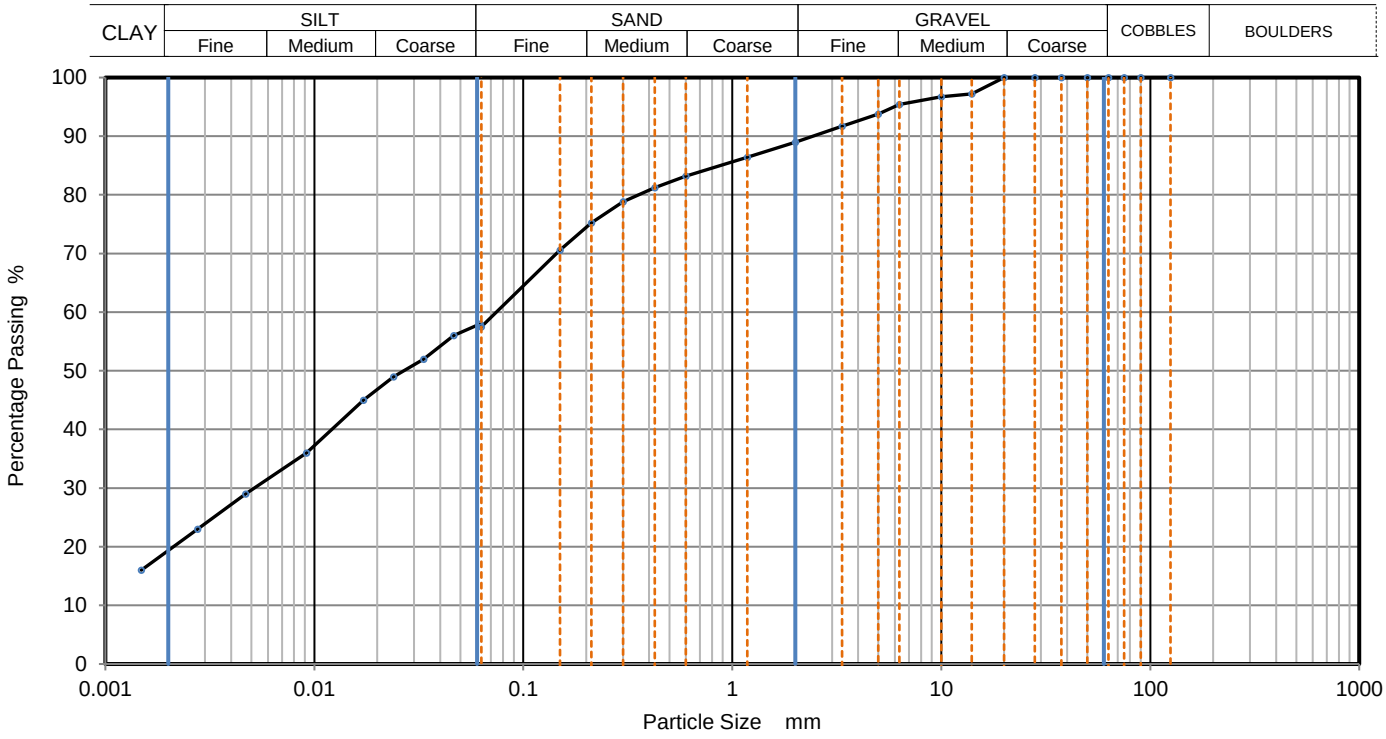
Grading Analysis		
D100	mm	
D60	mm	0.228
D30	mm	0.00767
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref	18-1467
				Borehole/Pit No.	BH104A
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	1
Soil Description	Grey sandy slightly gravelly silty CLAY.			Depth, m	3.00
Specimen Reference	9	Specimen Depth	3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513156



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0620	58
90	100	0.0465	56
75	100	0.0334	52
63	100	0.0239	49
50	100	0.0172	45
37.5	100	0.0092	36
28	100	0.0047	29
20	100	0.0028	23
14	97	0.0015	16
10	97		
6.3	95		
5	94		
3.35	92		
2	89		
1.18	86		
0.6	83	Particle density	(assumed)
0.425	81	2.65	Mg/m3
0.3	79		
0.212	75		
0.15	71		
0.063	58		

Dry Mass of sample, g	510

Sample Proportions	% dry mass
Cobbles	0
Gravel	11
Sand	32
Silt	38
Clay	20

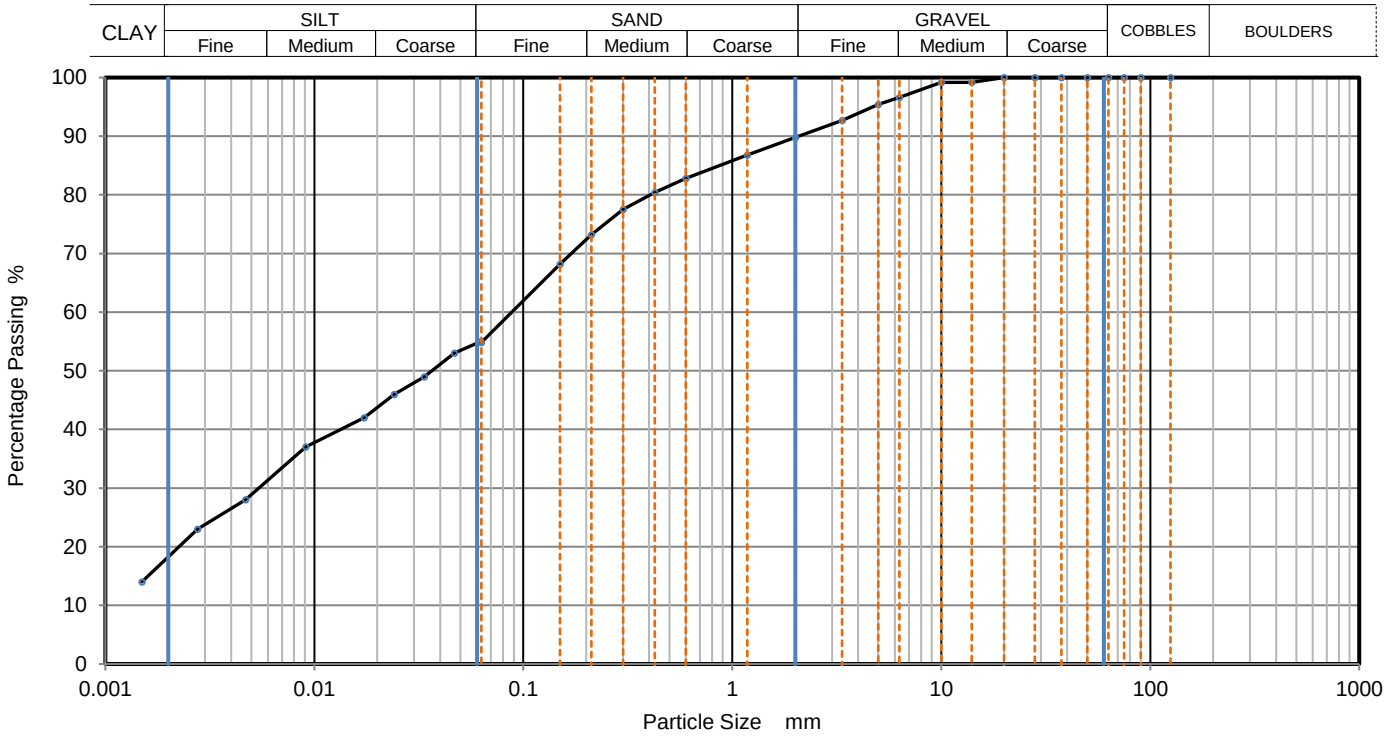
Grading Analysis		
D100	mm	
D60	mm	0.0746
D30	mm	0.00527
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH104A
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	3
Soil Description	Grey sandy slightly gravelly silty CLAY			Depth, m	5.00
Specimen Reference	9	Specimen Depth	5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513157



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0625	55
90	100	0.0468	53
75	100	0.0336	49
63	100	0.0241	46
50	100	0.0173	42
37.5	100	0.0091	37
28	100	0.0047	28
20	100	0.0028	23
14	99	0.0015	14
10	99		
6.3	97		
5	95		
3.35	93		
2	90		
1.18	87		
0.6	83	Particle density	(assumed)
0.425	80	2.65	Mg/m3
0.3	78		
0.212	73		
0.15	68		
0.063	55		

Dry Mass of sample, g	509

Sample Proportions	% dry mass
Cobbles	0
Gravel	10
Sand	35
Silt	37
Clay	18

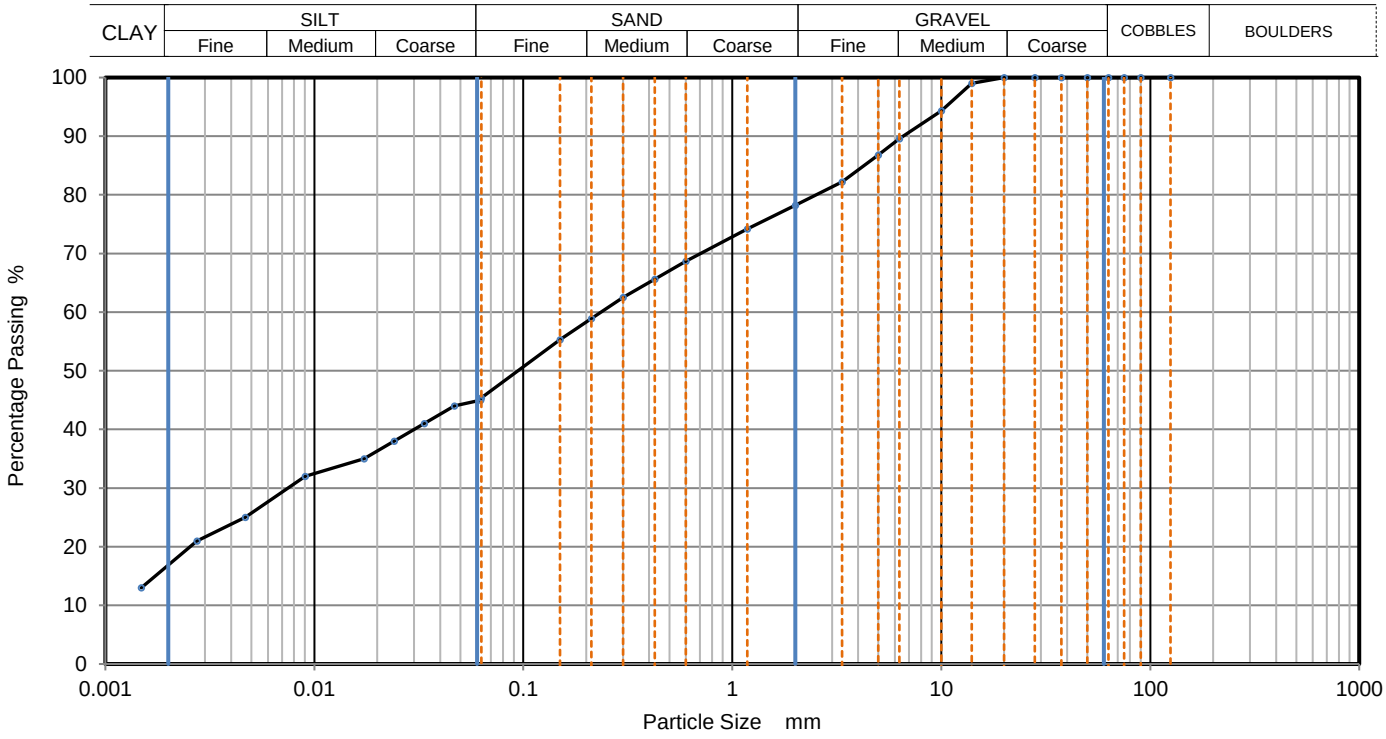
Grading Analysis		
D100	mm	
D60	mm	0.0883
D30	mm	0.00534
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH105
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	12
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	1.80
Specimen Reference	9	Specimen Depth	1.8 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513158



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0625	45
90	100	0.0468	44
75	100	0.0336	41
63	100	0.0241	38
50	100	0.0173	35
37.5	100	0.0090	32
28	100	0.0047	25
20	100	0.0027	21
14	99	0.0015	13
10	94		
6.3	90		
5	87		
3.35	82		
2	78		
1.18	74		
0.6	69	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	63		
0.212	59		
0.15	55		
0.063	45		

Dry Mass of sample, g: 513

Sample Proportions	% dry mass
Cobbles	0
Gravel	22
Sand	33
Silt	29
Clay	17

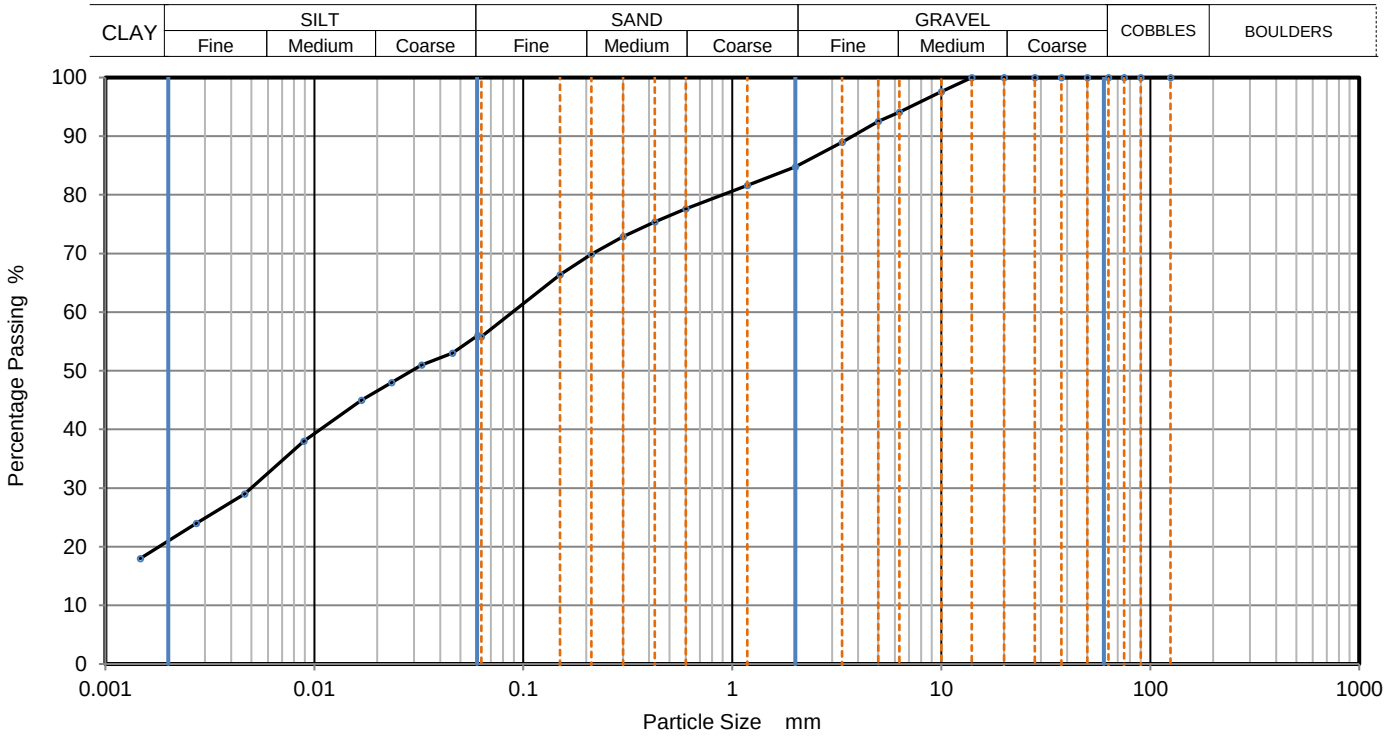
Grading Analysis		
D100	mm	
D60	mm	0.235
D30	mm	0.0074
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	18-1467
					Borehole/Pit No.	BH105
Site Name	Dublin Airport Central Phase 2, Dublin Airport				Sample No.	14
Soil Description	Grey sandy slightly gravelly silty CLAY.				Depth, m	3.80
Specimen Reference	9	Specimen Depth	3.8	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus20190513160



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0606	56
90	100	0.0458	53
75	100	0.0326	51
63	100	0.0234	48
50	100	0.0168	45
37.5	100	0.0089	38
28	100	0.0046	29
20	100	0.0027	24
14	100	0.0015	18
10	98		
6.3	94		
5	93		
3.35	89		
2	85		
1.18	82		
0.6	78	Particle density	(assumed)
0.425	75	2.65	Mg/m3
0.3	73		
0.212	70		
0.15	66		
0.063	56		

Dry Mass of sample, g	509

Sample Proportions	% dry mass
Cobbles	0
Gravel	15
Sand	29
Silt	35
Clay	21

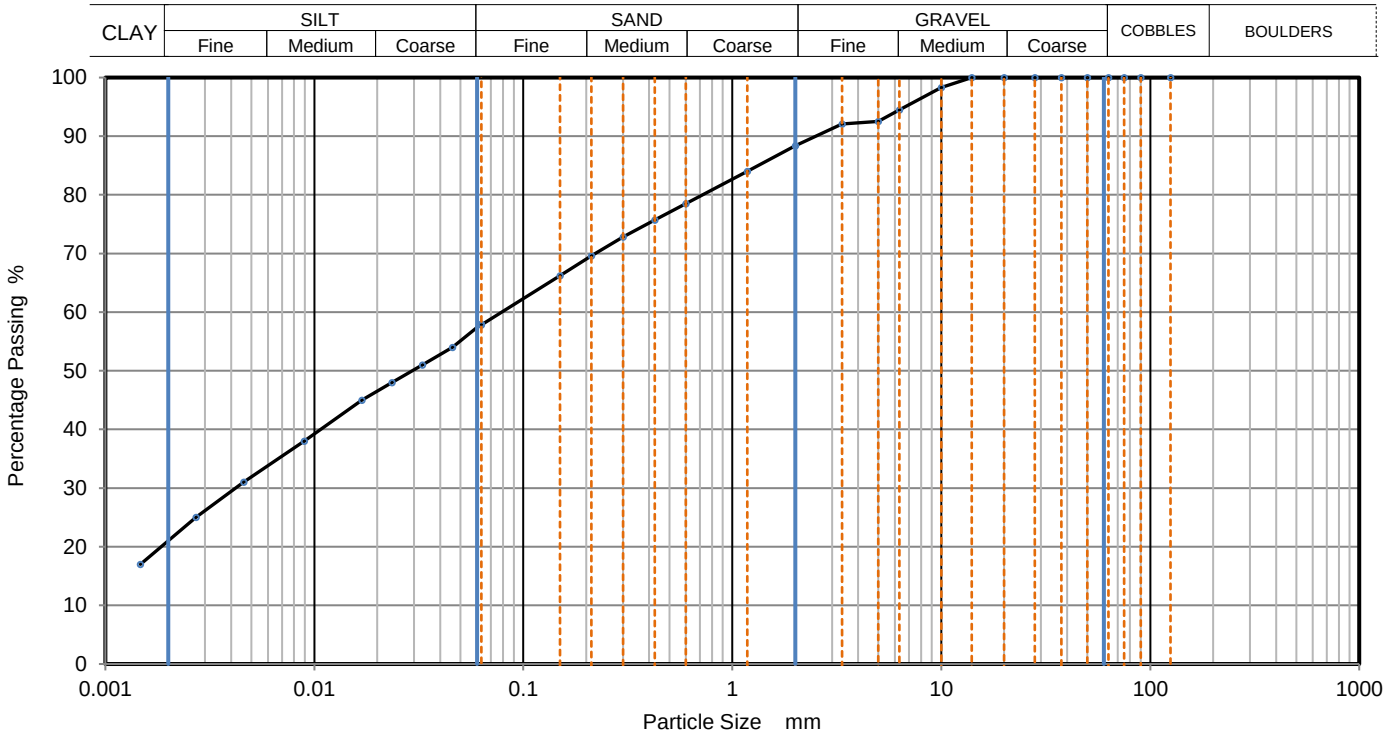
Grading Analysis		
D100	mm	
D60	mm	0.0889
D30	mm	0.00507
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	18-1467
					Borehole/Pit No.	BH105
Site Name	Dublin Airport Central Phase 2, Dublin Airport				Sample No.	16
Soil Description	Grey sandy slightly gravelly silty CLAY.				Depth, m	5.80
Specimen Reference	9	Specimen Depth	5.8	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus20190513161



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	58
90	100	0.0457	54
75	100	0.0328	51
63	100	0.0235	48
50	100	0.0169	45
37.5	100	0.0090	38
28	100	0.0046	31
20	100	0.0027	25
14	100	0.0015	17
10	98		
6.3	95		
5	93		
3.35	92		
2	88		
1.18	84		
0.6	79	Particle density	(assumed)
0.425	76	2.65	Mg/m3
0.3	73		
0.212	70		
0.15	66		
0.063	58		

Dry Mass of sample, g	504

Sample Proportions	% dry mass
Cobbles	0
Gravel	12
Sand	31
Silt	37
Clay	21

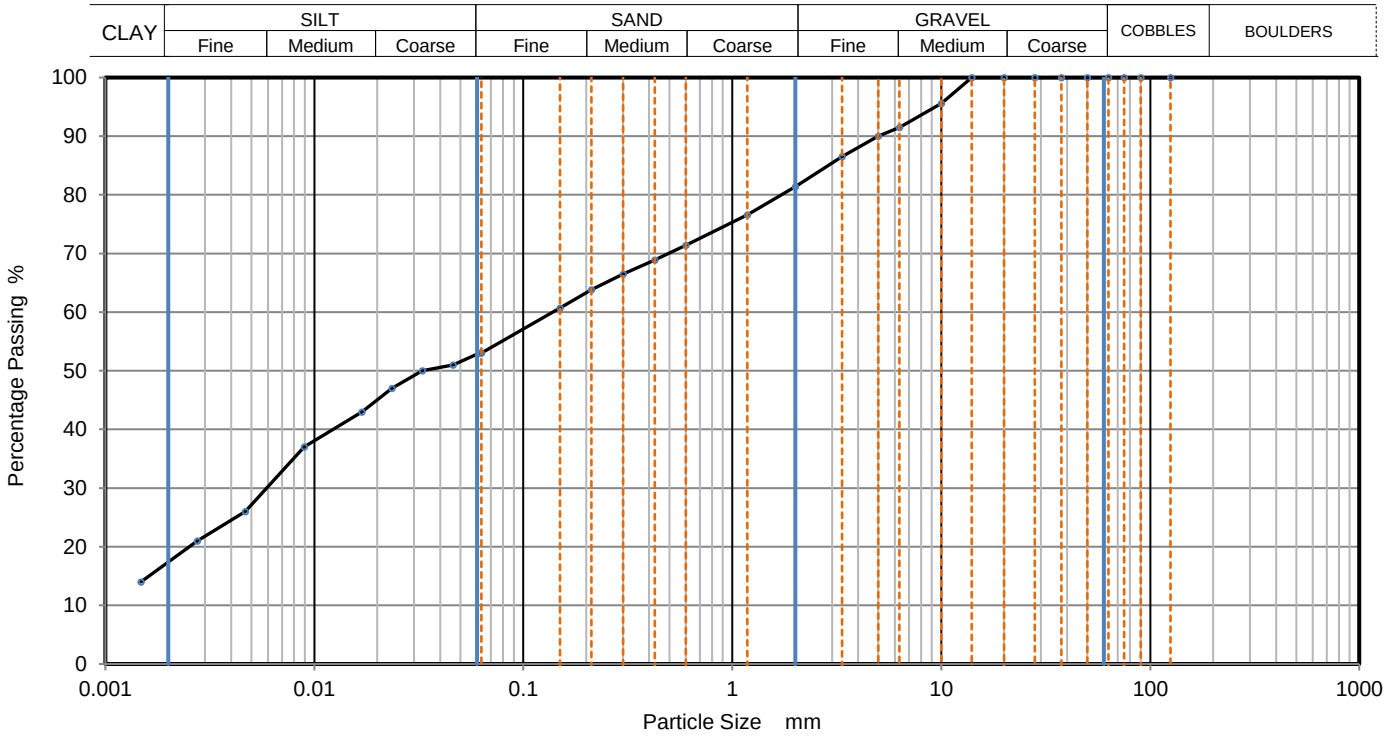
Grading Analysis		
D100	mm	
D60	mm	0.0788
D30	mm	0.00412
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH107A
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	8
Soil Description	Grey sandy slightly gravelly silty CLAY.			Depth, m	2.00
Specimen Reference	9	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513162



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0615	53
90	100	0.0461	51
75	100	0.0328	50
63	100	0.0235	47
50	100	0.0169	43
37.5	100	0.0090	37
28	100	0.0047	26
20	100	0.0027	21
14	100	0.0015	14
10	96		
6.3	92		
5	90		
3.35	87		
2	81		
1.18	77		
0.6	71	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	67		
0.212	64		
0.15	61		
0.063	53		

Dry Mass of sample, g	501

Sample Proportions	% dry mass
Cobbles	0
Gravel	19
Sand	28
Silt	35
Clay	18

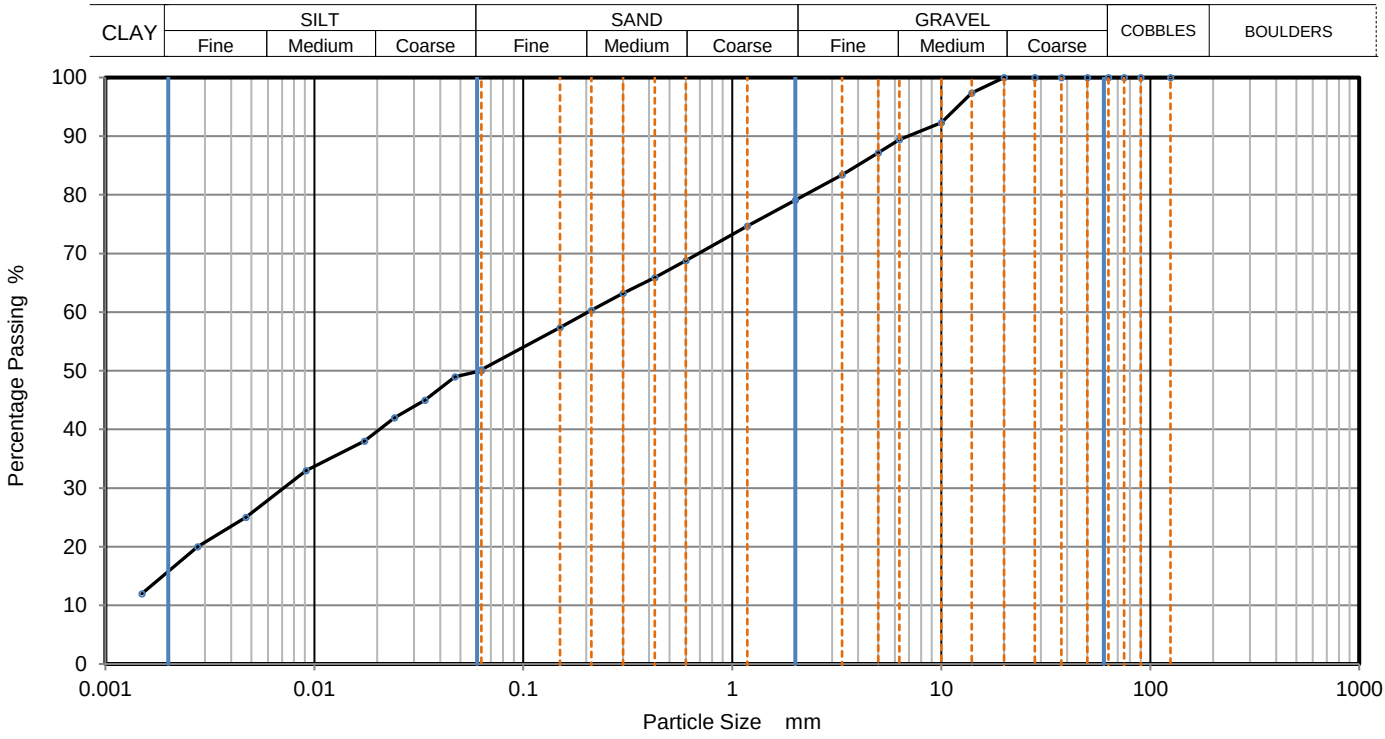
Grading Analysis		
D100	mm	
D60	mm	0.138
D30	mm	0.006
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	BH107A
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	13
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	7.50
Specimen Reference	9	Specimen Depth	7.5 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513165



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0629	50
90	100	0.0471	49
75	100	0.0338	45
63	100	0.0242	42
50	100	0.0173	38
37.5	100	0.0091	33
28	100	0.0047	25
20	100	0.0028	20
14	97	0.0015	12
10	92		
6.3	89		
5	87		
3.35	83		
2	79		
1.18	75		
0.6	69	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	63		
0.212	60		
0.15	57		
0.063	50		

Dry Mass of sample, g	526

Sample Proportions	% dry mass
Cobbles	0
Gravel	21
Sand	29
Silt	35
Clay	16

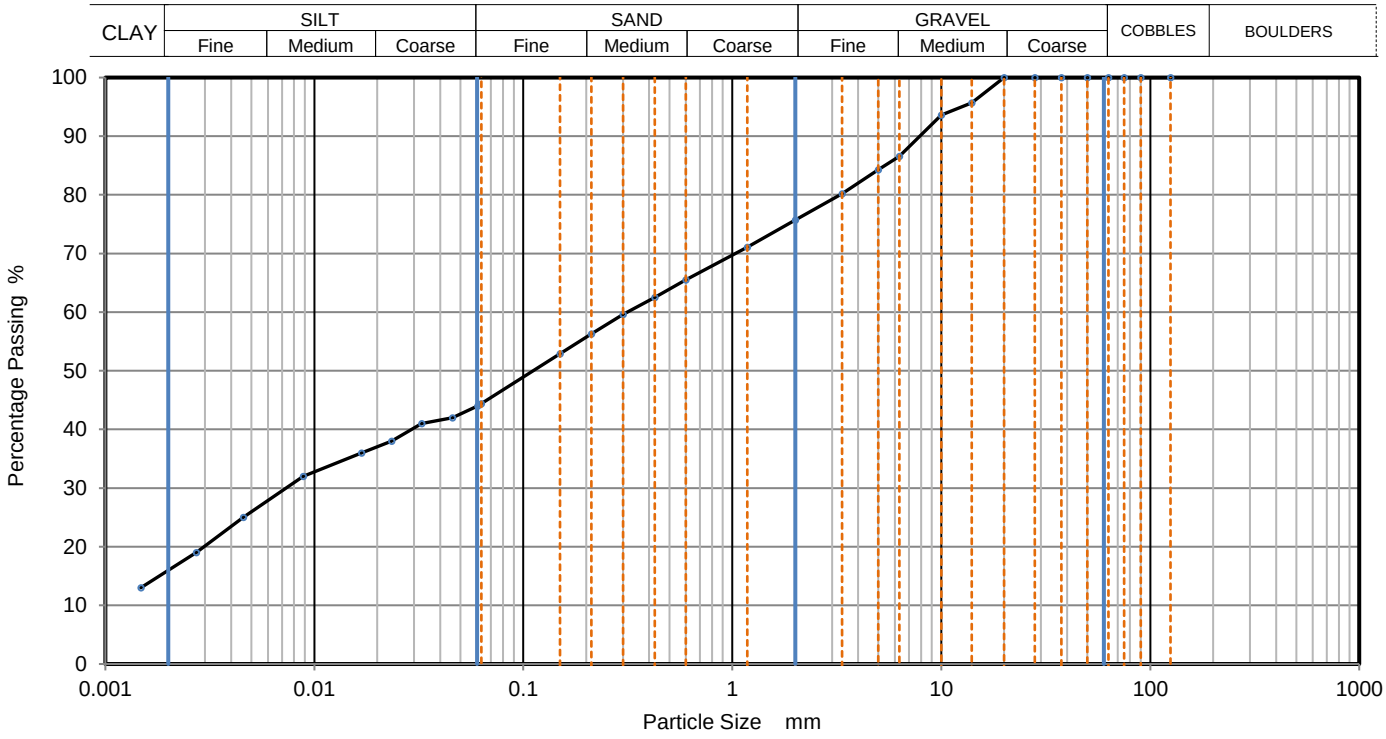
Grading Analysis		
D100	mm	
D60	mm	0.205
D30	mm	0.00694
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP101
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	8
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	1.70
Specimen Reference	9	Specimen Depth	1.7 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513166



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0606	44
90	100	0.0458	42
75	100	0.0326	41
63	100	0.0234	38
50	100	0.0168	36
37.5	100	0.0089	32
28	100	0.0046	25
20	100	0.0027	19
14	96	0.0015	13
10	94		
6.3	87		
5	84		
3.35	80		
2	76		
1.18	71		
0.6	66	Particle density	(assumed)
0.425	63	2.65	Mg/m3
0.3	60		
0.212	56		
0.15	53		
0.063	44		

Dry Mass of sample, g	512

Sample Proportions	% dry mass
Cobbles	0
Gravel	24
Sand	31
Silt	29
Clay	16

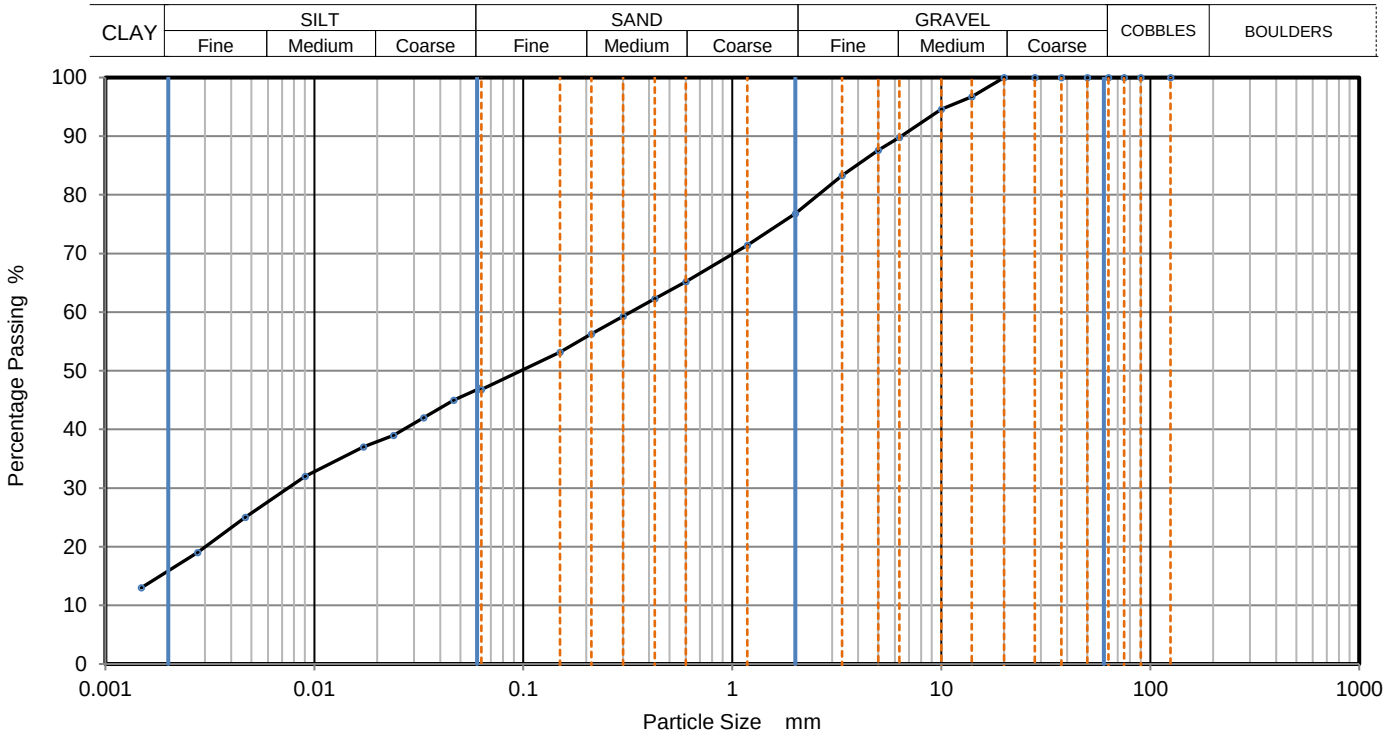
Grading Analysis		
D100	mm	
D60	mm	0.315
D30	mm	0.00741
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP103
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	6
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	1.00
Specimen Reference	9	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513168



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0620	47
90	100	0.0465	45
75	100	0.0334	42
63	100	0.0239	39
50	100	0.0172	37
37.5	100	0.0090	32
28	100	0.0047	25
20	100	0.0028	19
14	97	0.0015	13
10	95		
6.3	90		
5	88		
3.35	83		
2	77		
1.18	71		
0.6	65	Particle density	(assumed)
0.425	62	2.65	Mg/m3
0.3	59		
0.212	56		
0.15	53		
0.063	47		

Dry Mass of sample, g	514

Sample Proportions	% dry mass
Cobbles	0
Gravel	23
Sand	30
Silt	31
Clay	16

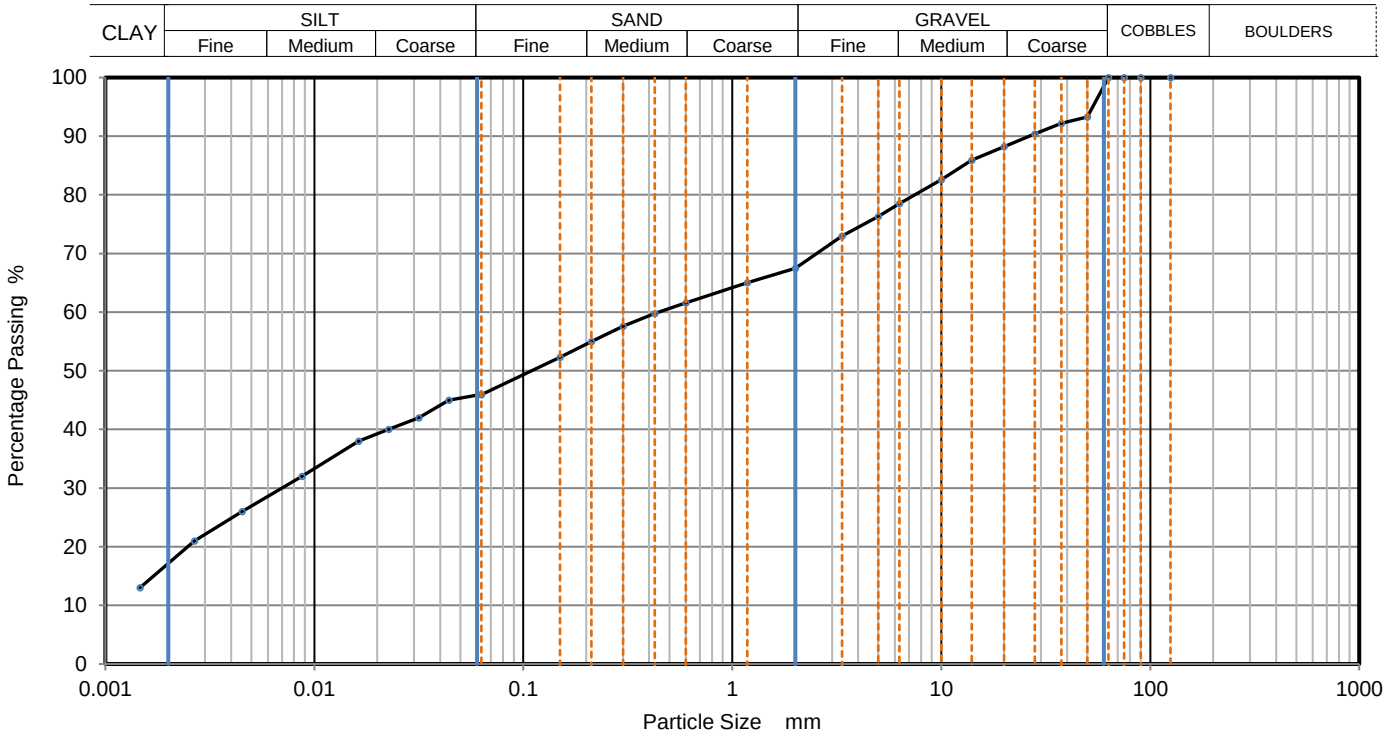
Grading Analysis		
D100	mm	
D60	mm	0.326
D30	mm	0.00743
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION				Job Ref	18-1467
					Borehole/Pit No.	TP104
Site Name	Dublin Airport Central Phase 2, Dublin Airport				Sample No.	7
Soil Description	Grey sandy gravelly silty CLAY.				Depth, m	1.50
Specimen Reference	9	Specimen Depth	1.5	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5				KeyLAB ID	Caus20190513170



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	46
90	100	0.0440	45
75	100	0.0316	42
63	100	0.0227	40
50	93	0.0163	38
37.5	92	0.0087	32
28	90	0.0045	26
20	88	0.0027	21
14	86	0.0015	13
10	83		
6.3	79		
5	76		
3.35	73		
2	68		
1.18	65		
0.6	62	Particle density	(assumed)
0.425	60	2.65	Mg/m3
0.3	58		
0.212	55		
0.15	52		
0.063	46		

Dry Mass of sample, g	7748

Sample Proportions	% dry mass
Cobbles	0
Gravel	33
Sand	22
Silt	29
Clay	17

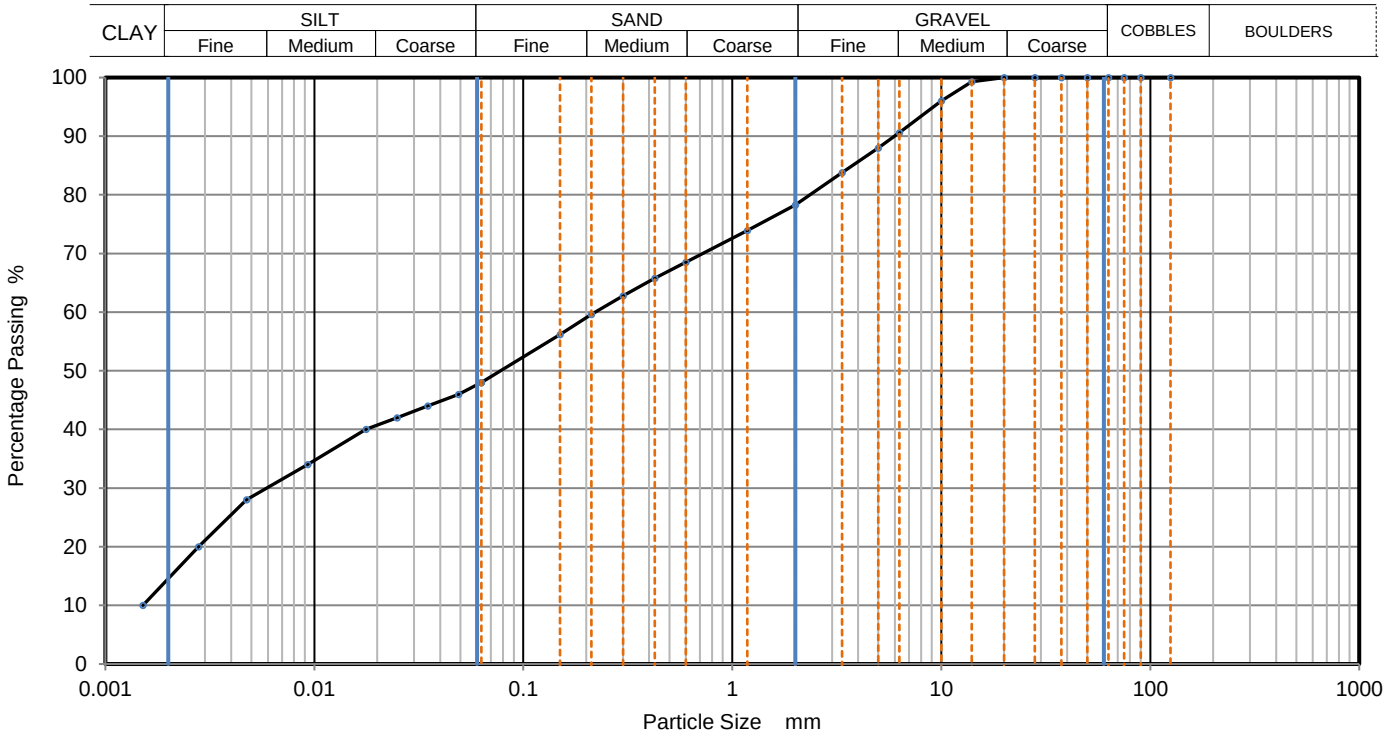
Grading Analysis		
D100	mm	
D60	mm	0.44
D30	mm	0.00714
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP105
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	6
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	1.00
Specimen Reference	9	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513171



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	48
90	100	0.0491	46
75	100	0.0349	44
63	100	0.0248	42
50	100	0.0177	40
37.5	100	0.0093	34
28	100	0.0047	28
20	100	0.0028	20
14	99	0.0015	10
10	96		
6.3	91		
5	88		
3.35	84		
2	78		
1.18	74		
0.6	69	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	63		
0.212	60		
0.15	56		
0.063	48		

Dry Mass of sample, g	529

Sample Proportions	% dry mass
Cobbles	0
Gravel	22
Sand	30
Silt	34
Clay	15

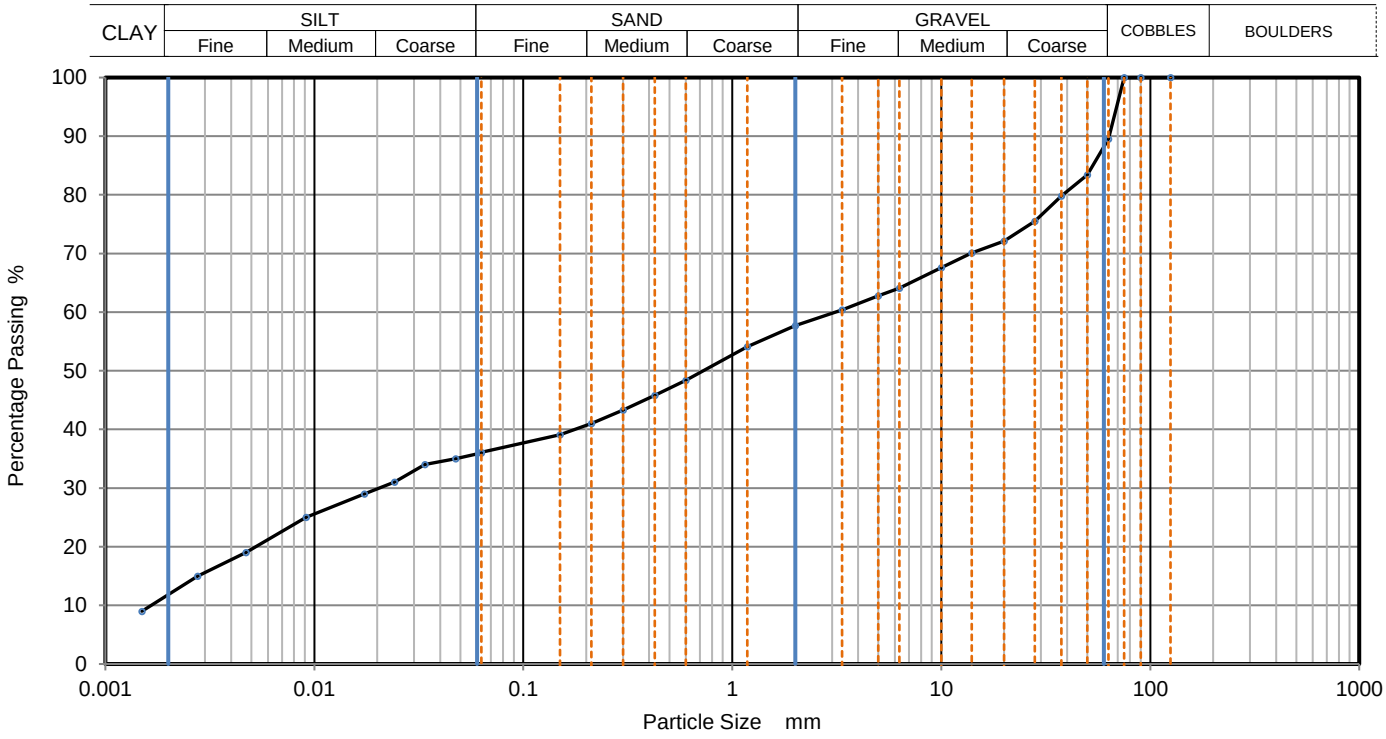
Grading Analysis		
D100	mm	
D60	mm	0.221
D30	mm	0.00593
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP105
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	8
Soil Description	Grey sandy gravelly silty CLAY with some cobbles.			Depth, m	2.10
Specimen Reference	9	Specimen Depth	2.1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513172



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	36
90	100	0.0474	35
75	100	0.0338	34
63	90	0.0242	31
50	83	0.0173	29
37.5	80	0.0091	25
28	76	0.0047	19
20	72	0.0028	15
14	70	0.0015	9
10	68		
6.3	64		
5	63		
3.35	60		
2	58		
1.18	54		
0.6	48	Particle density	(assumed)
0.425	46	2.65	Mg/m3
0.3	43		
0.212	41		
0.15	39		
0.063	36		

Dry Mass of sample, g	9625

Sample Proportions	% dry mass
Cobbles	11
Gravel	32
Sand	22
Silt	25
Clay	12

Grading Analysis		
D100	mm	
D60	mm	3.09
D30	mm	0.0208
D10	mm	0.0017
Uniformity Coefficient		1800
Curvature Coefficient		0.083

Remarks

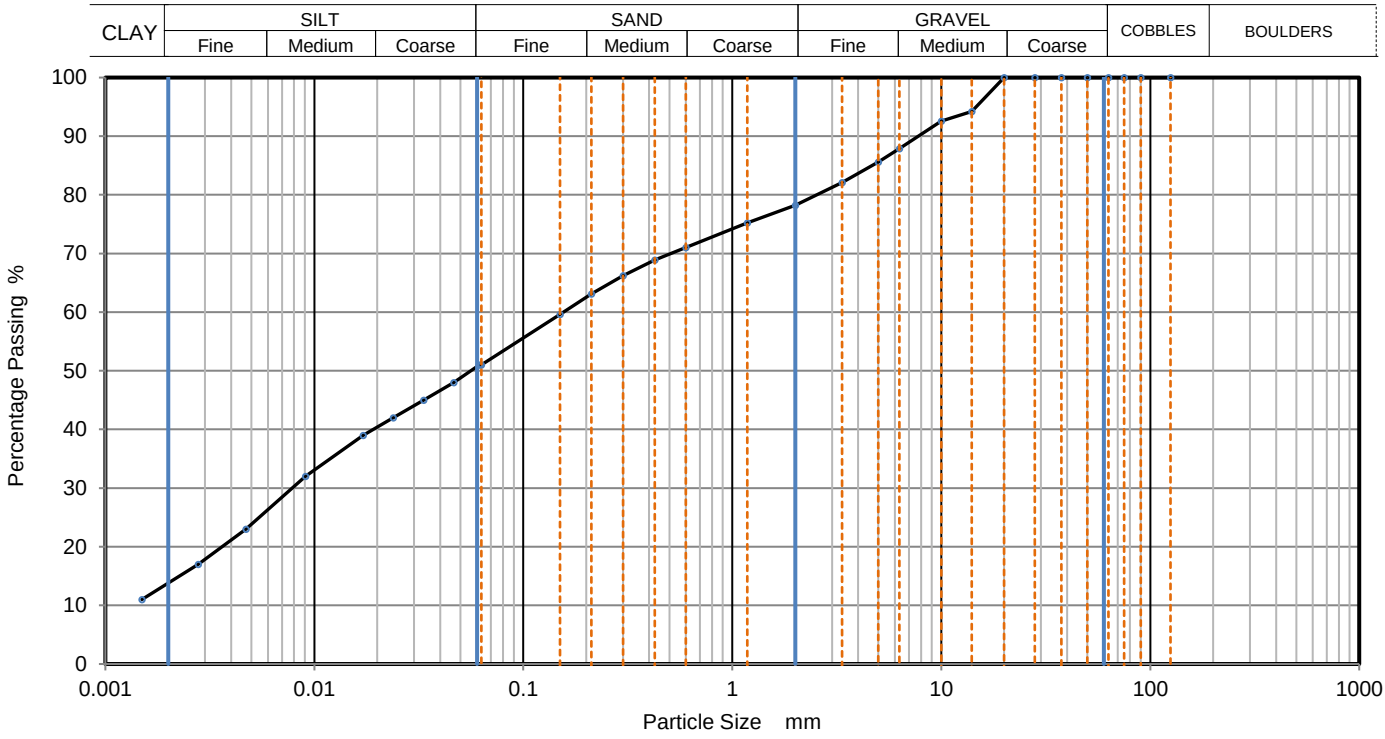
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP106
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	8
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	2.30
Specimen Reference	9	Specimen Depth	2.3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513174



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0615	51
90	100	0.0464	48
75	100	0.0333	45
63	100	0.0239	42
50	100	0.0171	39
37.5	100	0.0091	32
28	100	0.0047	23
20	100	0.0028	17
14	94	0.0015	11
10	93		
6.3	88		
5	86		
3.35	82		
2	78		
1.18	75		
0.6	71	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	66		
0.212	63		
0.15	60		
0.063	51		

Dry Mass of sample, g	508

Sample Proportions	% dry mass
Cobbles	0
Gravel	22
Sand	27
Silt	37
Clay	14

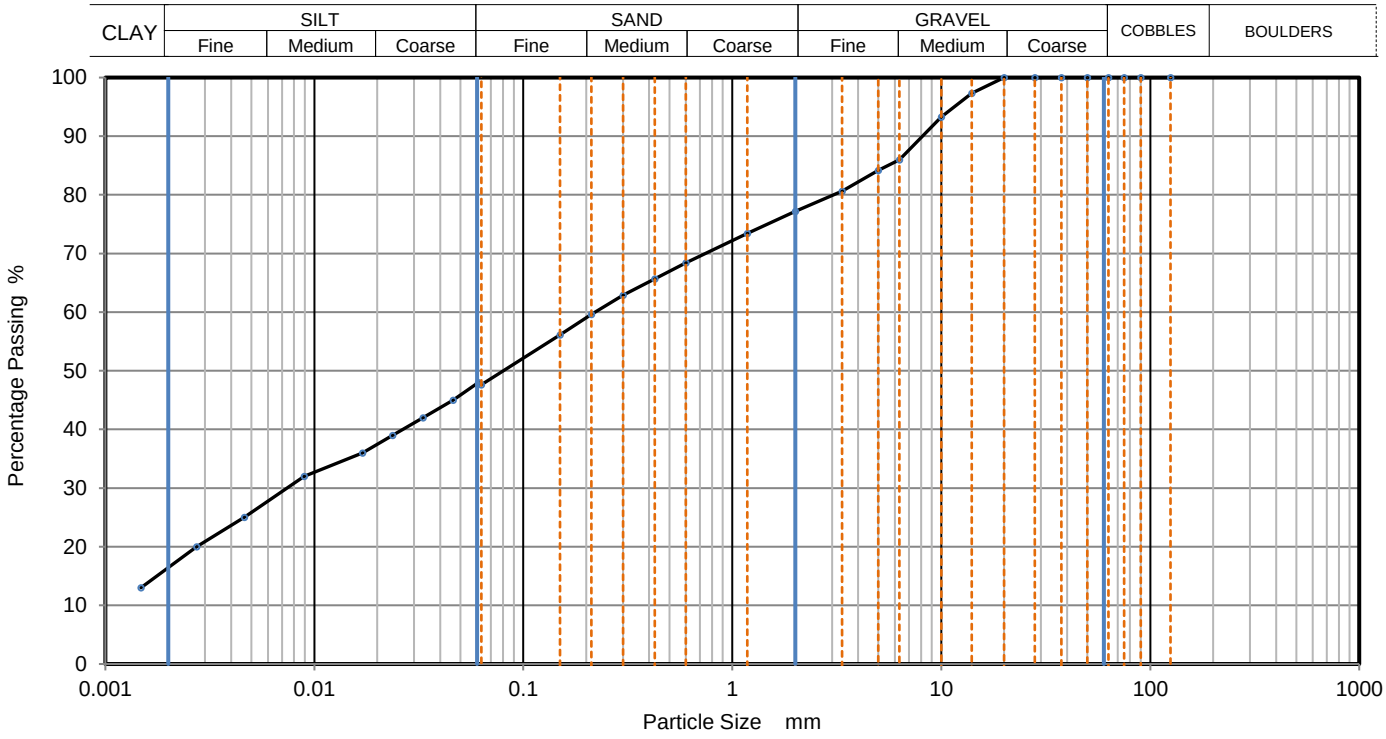
Grading Analysis		
D100	mm	
D60	mm	0.156
D30	mm	0.00763
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP107
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	6
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	1.00
Specimen Reference	9	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513175



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0610	48
90	100	0.0461	45
75	100	0.0331	42
63	100	0.0237	39
50	100	0.0170	36
37.5	100	0.0090	32
28	100	0.0046	25
20	100	0.0027	20
14	97	0.0015	13
10	93		
6.3	86		
5	84		
3.35	81		
2	77		
1.18	73		
0.6	68	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	63		
0.212	60		
0.15	56		
0.063	48		

Dry Mass of sample, g	494

Sample Proportions	% dry mass
Cobbles	0
Gravel	23
Sand	30
Silt	32
Clay	16

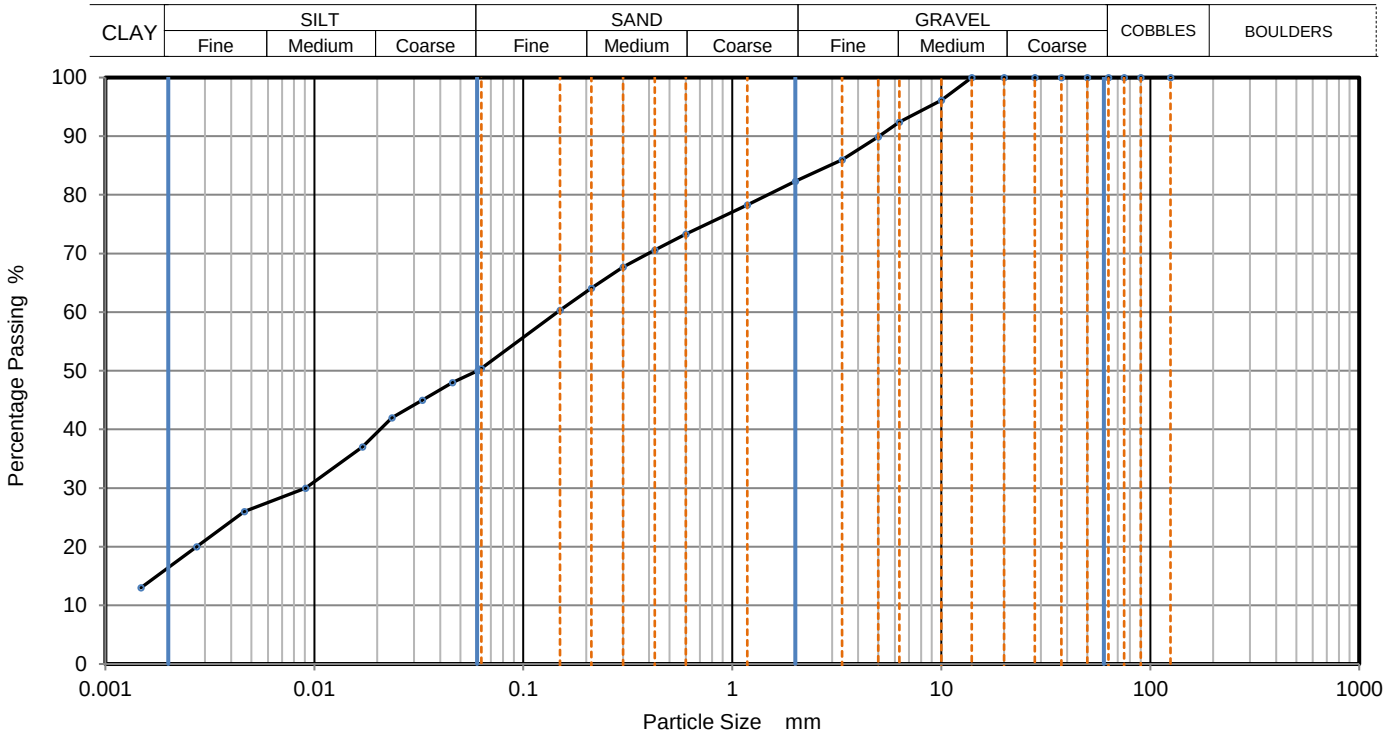
Grading Analysis		
D100	mm	
D60	mm	0.22
D30	mm	0.00728
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**18-1467**
				Borehole/Pit No.	TP107
Site Name	Dublin Airport Central Phase 2, Dublin Airport			Sample No.	8
Soil Description	Grey sandy gravelly silty CLAY.			Depth, m	2.00
Specimen Reference	9	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus20190513176



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0606	50
90	100	0.0457	48
75	100	0.0328	45
63	100	0.0235	42
50	100	0.0170	37
37.5	100	0.0091	30
28	100	0.0046	26
20	100	0.0027	20
14	100	0.0015	13
10	96		
6.3	92		
5	90		
3.35	86		
2	82		
1.18	78		
0.6	73	Particle density	(assumed)
0.425	71	2.65	Mg/m3
0.3	68		
0.212	64		
0.15	60		
0.063	50		

Dry Mass of sample, g	512

Sample Proportions	% dry mass
Cobbles	0
Gravel	18
Sand	32
Silt	34
Clay	17

Grading Analysis		
D100	mm	
D60	mm	0.146
D30	mm	0.00874
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

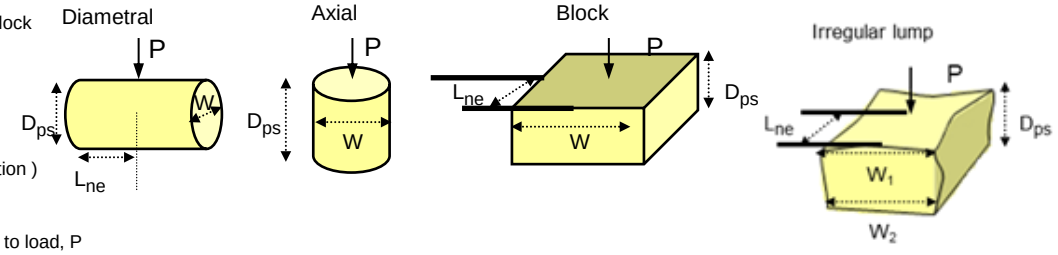
CAUSEWAY GEOTECH

Point Load Strength Index Tests
Summary of Results

Project No.	Project Name
18-1467	Dublin Airport Central Phase 2, Dublin Airport

Borehole No.	Sample			Specimen		Rock Type	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Depth	Ref.	Type	Ref.	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m				m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH102	13.10		C	1	13.10	LIMESTONE	A	U	NO		101.4	72.0	66.0	38.0	92.3	4.5	5.9	
BH102	13.20		C	2	13.20	LIMESTONE	D	U	YES		101.5	101.2	98.0	26.2	99.7	2.6	3.6	
BH102	13.40		C	3	13.40	LIMESTONE	A	U	YES		101.5	65.0	58.0	20.4	86.6	2.7	3.5	
BH102	14.20		C	4	14.20	LIMESTONE	A	U	YES		101.3	48.0	43.0	30.0	74.5	5.4	6.5	
BH106	2.40		C	1	2.40	LIMESTONE	I	U	NO	48.5	80.6	64.0	61.0	21.6	79.1	3.5	4.2	
BH106	3.00		C	2	3.00	LIMESTONE	A	U	YES		101.1	47.0	46.0	14.9	77.0	2.5	3.1	
BH106	3.20		C	3	3.20	LIMESTONE	A	U	NO		101.3	62.0	60.0	33.2	88.0	4.3	5.5	
BH106	3.70		C	4	3.70	LIMESTONE	D	U	YES	72.0	76.0	76.0	73.0	43.6	74.5	7.9	9.4	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise

Detailed legend for test and dimensions, based on ISRM, is shown above.

Size factor, F = (De/50)0.45 for all tests.

LAB 17R Version 4

Date Printed: 06/08/2019 00:00

Approved By: Stephen.Watson

UKAS TESTING
10122

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Project No.	Project Name
18-1467	Dublin Airport Central Phase 2, Dublin Airport

Hole No.	Sample				Rock Type	Specimen Dimensions2			Bulk Density2	Water Content 1	Uniaxial Compression3			Remarks
	Ref	Top	Base	Type		Dia. mm	Length mm	H/D	Mg/m3	%	Condition	Mode of failure	UCS MPa	
BH106		2.70	3.00	C	LIMESTONE	101.2	232.4	2.3	2.66	0.5	as received	S	5.0	
BH106		3.90	4.20	C	LIMESTONE	101.2	230.1	2.3	2.72	0.3	as received	AC	57.0	

Notes

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

Test Specification	Date Printed	Approved By	Table
International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007	06/08/2019 00:00	Stephen.Watson	1 sheet 1

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.: 19-18386-1

Initial Date of Issue: 06-Jun-2019

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): Carin Cornwall
Colm Hurley
Darren O'Mahony
Gabriella Horan
Joe Gervin
John Cameron
Lucy Newland
Matthew Gilbert
Neil Haggan
Paul Dunlop
Paul McNamara
Sean Ross
Stephen Franey
Stephen McCracken
Stephen Watson
Stuart Abraham

Project 18-1467 Dublin Airport Central Phase 2, Dublin Airport

Quotation No.:		**Date Received:**	31-May-2019
Order No.:		**Date Instructed:**	31-May-2019
No. of Samples:	8		
Turnaround (Wkdays):	5	**Results Due:**	06-Jun-2019
Date Approved:	06-Jun-2019		

Approved By:



Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Results - Soil

Project: 18-1467 Dublin Airport Central Phase 2, Dublin Airport

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-18386	19-18386	19-18386	19-18386	19-18386	19-18386	19-18386	19-18386
Quotation No.:			**Chemtest Sample ID.:**		835276	835277	835278	835279	835280	835281	835282	835283
Order No.:			Client Sample Ref.:		21	8	5	10	14	7	6	7
			Sample Location:		BH101	BH103	BH104A	BH105	BH107A	TP101	TP104	TP107
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		6.00	2.50	4.00	4.50	2.00	1.20	1.00	1.50
			Date Sampled:		30-May-2019	30-May-2019	30-May-2019	30-May-2019	30-May-2019	30-May-2019	30-May-2019	30-May-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Moisture	N	2030	%	0.020	5.0	9.2	21	8.0	14	7.0	6.4	10
pH	U	2010		N/A	8.9	8.2	8.3	8.6	8.5	8.5	8.7	8.7
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.23	0.36	0.19	0.062	0.16	0.14	< 0.010	< 0.010
Sulphate (Acid Soluble)	U	2430	%	0.010	0.075	0.17	0.086	0.016	0.066	0.044	< 0.010	0.011

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

CAUSEWAY GEOTECH

APPENDIX H

ENVIRONMENTAL LABORATORY TEST RESULTS



Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.:	19-13511-1
Initial Date of Issue:	09-May-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Lucy Peaker Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen Watson Stuart Abraham
Project	18-1467 Dublin Airport CP2

Quotation No.:	Q19-16291	**Date Received:**	23-Apr-2019
Order No.:		**Date Instructed:**	02-May-2019
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	09-May-2019
Date Approved:	09-May-2019		
Approved By:			



Details: Robert Monk, Technical Manager

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Email: info@chemtest.com

Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd				Chemtest Job No.:	19-13511	19-13511
Quotation No.: Q19-16291				Chemtest Sample ID.:	813815	813816
				Sample Location:	BH101	BH101
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.50
				Date Sampled:	15-Apr-2019	15-Apr-2019
				Asbestos Lab:	LIVERPOOL	LIVERPOOL
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	9.8	10
pH	U	2010		N/A	[B] 8.7	[B] 8.7
Barium	U	2450	mg/kg	10	56	100
Cadmium	U	2450	mg/kg	0.10	1.3	1.8
Mercury Low Level	U	2450	mg/kg	0.05	0.06	< 0.05
Molybdenum	U	2450	mg/kg	2.0	3.3	4.8
Antimony	N	2450	mg/kg	2.0	< 2.0	2.1
Copper	U	2450	mg/kg	0.50	18	25
Nickel	U	2450	mg/kg	0.50	31	43
Lead	U	2450	mg/kg	0.50	21	21
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50	38	57
Chromium (Trivalent)	N	2490	mg/kg	1.0	12	13
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	[B] 0.53	[B] 0.40
Total TPH >C6-C40	U	2670	mg/kg	10	[B] < 10	[B] < 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[B] < 5.0	[B] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[B] < 5.0	[B] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[B] < 10	[B] < 10

Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd					Chemtest Job No.:	19-13511	19-13511
Quotation No.: Q19-16291					Chemtest Sample ID.:	813815	813816
					Sample Location:	BH101	BH101
					Sample Type:	SOIL	SOIL
					Top Depth (m):	0.50	1.50
					Date Sampled:	15-Apr-2019	15-Apr-2019
					Asbestos Lab:	LIVERPOOL	LIVERPOOL
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Naphthalene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Acenaphthylene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Acenaphthene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Fluorene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Phenanthrene	U	2700	mg/kg	0.10		[B] < 0.10	[B] 0.26
Anthracene	U	2700	mg/kg	0.10		[B] < 0.10	[B] 0.13
Fluoranthene	U	2700	mg/kg	0.10		[B] < 0.10	[B] 0.16
Pyrene	U	2700	mg/kg	0.10		[B] < 0.10	[B] 0.20
Benzo[a]anthracene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Chrysene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Coronene	N	2700	mg/kg	0.10		[B] < 0.10	[B] < 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0		[B] < 2.0	[B] < 2.0
Benzene	U	2760	µg/kg	1.0		[B] < 1.0	[B] < 1.0
Toluene	U	2760	µg/kg	1.0		[B] < 1.0	[B] < 1.0
Ethylbenzene	U	2760	µg/kg	1.0		[B] < 1.0	[B] < 1.0
m & p-Xylene	U	2760	µg/kg	1.0		[B] < 1.0	[B] < 1.0
o-Xylene	U	2760	µg/kg	1.0		[B] < 1.0	[B] < 1.0
PCB 28	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
PCB 52	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
PCB 90+101	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
PCB 118	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
PCB 153	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
PCB 138	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
PCB 180	U	2815	mg/kg	0.010		[B] < 0.010	[B] < 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10		[B] < 0.10	[B] < 0.10

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Results - Single Stage WAC

Project: 18-1467 Dublin Airport CP2

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-13511						
Chemtest Sample ID:	813815						
Sample Ref:							
Sample ID:							
Sample Location:	BH101						
Top Depth(m):	0.50						
Bottom Depth(m):							
Sampling Date:	15-Apr-2019				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon					3	5	6
Loss on Ignition					--	--	10
Total BTEX					6	--	--
Total PCBs (7 congeners)					1	--	--
TPH Total WAC (Mineral Oil)					500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.062	0.62	20	100	300
Cadmium	1450	U	0.00012	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.023	0.23	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0029	0.029	0.06	0.7	5
Selenium	1450	U	0.042	0.42	0.1	0.5	7
Zinc	1450	U	0.0059	< 0.50	4	50	200
Chloride	1220	U	16	160	800	15000	25000
Fluoride	1220	U	0.46	4.6	10	150	500
Sulphate	1220	U	94	940	1000	20000	50000
Total Dissolved Solids	1020	N	140	1400	4000	60000	100000
Phenol Index					1	-	-
Dissolved Organic Carbon	1610	U	3.0	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.8

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Results - Single Stage WAC

Project: 18-1467 Dublin Airport CP2

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-13511						
Chemtest Sample ID:	813816						
Sample Ref:							
Sample ID:							
Sample Location:	BH101						
Top Depth(m):	1.50						
Bottom Depth(m):							
Sampling Date:	15-Apr-2019				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon					3	5	6
Loss on Ignition					--	--	10
Total BTEX					6	--	--
Total PCBs (7 congeners)					1	--	--
TPH Total WAC (Mineral Oil)					500	--	--
Total (of 17) PAHs					100	--	--
pH					--	>6	--
Acid Neutralisation Capacity					--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.031	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.021	0.21	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0012	0.012	0.06	0.7	5
Selenium	1450	U	0.059	0.59	0.1	0.5	7
Zinc	1450	U	0.0024	< 0.50	4	50	200
Chloride	1220	U	19	190	800	15000	25000
Fluoride	1220	U	0.24	2.4	10	150	500
Sulphate	1220	U	66	660	1000	20000	50000
Total Dissolved Solids	1020	N	160	1600	4000	60000	100000
Phenol Index					1	-	-
Dissolved Organic Carbon	1610	U	2.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
813815			BH101	15-Apr-2019	B	Amber Glass 250ml
813815			BH101	15-Apr-2019	B	Amber Glass 60ml
813815			BH101	15-Apr-2019	B	Plastic Tub 500g
813816			BH101	15-Apr-2019	B	Amber Glass 250ml
813816			BH101	15-Apr-2019	B	Amber Glass 60ml
813816			BH101	15-Apr-2019	B	Plastic Tub 500g

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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UKAS TESTING
2183

Final Report

Report No.:	19-13684-1
Initial Date of Issue:	09-May-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Lucy Peaker Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen Watson Stuart Abraham
Project	18-1476 Dublin Airport CP2

Quotation No.:	Q19-16291	**Date Received:**	23-Apr-2019
Order No.:		**Date Instructed:**	02-May-2019
No. of Samples:	7		
Turnaround (Wkdays):	5	**Results Due:**	09-May-2019
Date Approved:	09-May-2019		
Approved By:			



Details: Martin Dyer, Laboratory Manager

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Results - Leachate

Project: 18-1476 Dublin Airport CP2

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	19-13684	19-13684	19-13684	19-13684	19-13684	19-13684	19-13684
Quotation No.: Q19-16291				**Chemtest Sample ID.:**	814711	814713	814714	814715	814717	814719	814721
Order No.:				Client Sample Ref.:	1	3	4	1	3	1	3
				Sample Location:	TP101	TP101	TP101	TP102	TP102	TP107	TP107
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.4	1.2	1.7	0.5	1.5	0.5	1.5
				Date Sampled:	15-Apr-2019	15-Apr-2019	15-Apr-2019	15-Apr-2019	15-Apr-2019	17-Apr-2019	17-Apr-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
Total Dissolved Solids	N	1020	mg/l	1.0	27	51	45	49	53	55	43
Chloride	U	1220	mg/l	1.0	1.3	< 1.0	< 1.0	< 1.0	1.5	2.3	1.2
Fluoride	U	1220	mg/l	0.050	0.28	0.21	0.20	0.18	0.20	0.22	0.17
Sulphate	U	1220	mg/l	1.0	1.7	3.9	1.5	12	3.3	3.5	< 1.0
Arsenic (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium (Dissolved)	U	1450	µg/l	5.0	< 5.0	< 5.0	6.1	6.5	< 5.0	< 5.0	< 5.0
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Molybdenum (Dissolved)	U	1450	µg/l	1.0	< 1.0	5.0	4.0	< 1.0	< 1.0	< 1.0	< 1.0
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.4	< 1.0
Dissolved Organic Carbon	U	1610	mg/l	2.0	4.9	5.1	7.0	6.6	8.9	9.1	8.7

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Results - Soil

Project: 18-1476 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-13684	19-13684	19-13684	19-13684	19-13684	19-13684	19-13684
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		814711	814713	814714	814715	814717	814719	814721
Order No.:			Client Sample Ref.:		1	3	4	1	3	1	3
			Sample Location:		TP101	TP101	TP101	TP102	TP102	TP107	TP107
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.4	1.2	1.7	0.5	1.5	0.5	1.5
			Date Sampled:		15-Apr-2019	15-Apr-2019	15-Apr-2019	15-Apr-2019	15-Apr-2019	17-Apr-2019	17-Apr-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type	U	2192		N/A	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	18	10	9.4	11	11	13	9.2
pH	U	2010		N/A	8.1	8.4	8.5	8.1	8.5	8.5	8.5
Barium	U	2450	mg/kg	10	78	76	85	180	65	78	79
Cadmium	U	2450	mg/kg	0.10	1.9	1.8	1.9	4.1	1.7	1.4	1.5
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05
Molybdenum	U	2450	mg/kg	2.0	3.2	5.3	4.7	2.0	3.3	3.0	3.6
Antimony	N	2450	mg/kg	2.0	2.0	2.0	< 2.0	7.0	2.1	2.6	< 2.0
Copper	U	2450	mg/kg	0.50	30	25	23	190	25	35	26
Nickel	U	2450	mg/kg	0.50	41	45	45	40	40	63	49
Lead	U	2450	mg/kg	0.50	42	22	19	430	28	26	21
Selenium	U	2450	mg/kg	0.20	< 0.20	6.1	1.3	< 0.20	< 0.20	< 0.20	0.88
Zinc	U	2450	mg/kg	0.50	82	53	60	1500	81	99	68
Chromium (Trivalent)	N	2490	mg/kg	1.0	22	14	13	15	14	26	22
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	1.8	1.3	0.60	1.5	0.56	0.71	0.54
Total TPH >C6-C40	U	2670	mg/kg	10	[B] 48	[B] < 10	[B] < 10	[B] < 10	[B] < 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] 25	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] 160	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[B] 190	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[B] 5.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[B] 18	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[B] 23	[B] < 5.0	[B] < 5.0	[B] < 5.0	[B] < 5.0	< 5.0	< 5.0

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Results - Soil

Project: 18-1476 Dublin Airport CP2

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			19-13684	19-13684	19-13684	19-13684	19-13684	19-13684	19-13684
Quotation No.: Q19-16291		**Chemtest Sample ID.:**			814711	814713	814714	814715	814717	814719	814721
Order No.:		Client Sample Ref.:			1	3	4	1	3	1	3
		Sample Location:			TP101	TP101	TP101	TP102	TP102	TP107	TP107
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.4	1.2	1.7	0.5	1.5	0.5	1.5
		Date Sampled:			15-Apr-2019	15-Apr-2019	15-Apr-2019	15-Apr-2019	15-Apr-2019	17-Apr-2019	17-Apr-2019
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[B] 210	[B] < 10	[B] < 10	[B] < 10	[B] < 10	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	[B] < 1.0	< 1.0	< 1.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

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Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
814711	1		TP101	15-Apr-2019	B	Amber Glass 250ml
814711	1		TP101	15-Apr-2019	B	Amber Glass 60ml
814711	1		TP101	15-Apr-2019	B	Plastic Tub 500g
814713	3		TP101	15-Apr-2019	B	Amber Glass 250ml
814713	3		TP101	15-Apr-2019	B	Amber Glass 60ml
814713	3		TP101	15-Apr-2019	B	Plastic Tub 500g
814714	4		TP101	15-Apr-2019	B	Amber Glass 250ml
814714	4		TP101	15-Apr-2019	B	Amber Glass 60ml
814714	4		TP101	15-Apr-2019	B	Plastic Tub 500g
814715	1		TP102	15-Apr-2019	B	Amber Glass 250ml
814715	1		TP102	15-Apr-2019	B	Amber Glass 60ml
814715	1		TP102	15-Apr-2019	B	Plastic Tub 500g
814717	3		TP102	15-Apr-2019	B	Amber Glass 250ml
814717	3		TP102	15-Apr-2019	B	Amber Glass 60ml
814717	3		TP102	15-Apr-2019	B	Plastic Tub 500g

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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UKAS TESTING
2183

Final Report

Report No.: 19-13922-1

Initial Date of Issue: 09-May-2019

Client Causeway Geotech Ltd

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Project 18-1467 Dublin Airport CP2

Quotation No.:	Q19-16291	**Date Received:**	25-Apr-2019
Order No.:		**Date Instructed:**	02-May-2019
No. of Samples:	10		
Turnaround (Wkdays):	5	**Results Due:**	09-May-2019
Date Approved:	09-May-2019		
Approved By:			



Details: Martin Dyer, Laboratory Manager

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Results - Leachate

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922
Quotation No.: Q19-16291				**Chemtest Sample ID.:**	815660	815661	815664	815666	815667	815668	815670	815671	815672
Order No.:				Client Sample Ref.:	1	2	1	3	4	1	3	4	1
				Sample Location:	TP103	TP103	TP104	TP104	TP104	TP105	TP105	TP105	TP106
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.5	1.0	0.5	1.5	2.2	0.5	1.5	2.1	0.5
				Date Sampled:	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total Dissolved Solids	N	1020	mg/l	1.0	120	85	72	78	100	78	100	150	72
Chloride	U	1220	mg/l	1.0	9.8	5.5	2.2	2.0	3.9	2.9	5.7	11	1.8
Fluoride	U	1220	mg/l	0.050	0.40	0.41	0.32	0.39	0.29	0.28	0.38	0.35	0.22
Sulphate	U	1220	mg/l	1.0	13	4.2	3.1	8.4	22	3.6	39	53	15
Arsenic (Dissolved)	U	1450	µg/l	1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium (Dissolved)	U	1450	µg/l	5.0	14	9.6	< 5.0	7.8	21	8.2	21	36	< 5.0
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Molybdenum (Dissolved)	U	1450	µg/l	1.0	< 1.0	23	13	15	11	18	26	21	7.3
Nickel (Dissolved)	U	1450	µg/l	1.0	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	µg/l	1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	3.4	13	< 1.0	13	45	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dissolved Organic Carbon	U	1610	mg/l	2.0	17	11	6.8	9.3	10	6.8	7.5	7.1	9.0

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Results - Leachate

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-13922
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		815674
Order No.:			Client Sample Ref.:		3
			Sample Location:		TP106
			Sample Type:		SOIL
			Top Depth (m):		1.5
			Date Sampled:		18-Apr-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Total Dissolved Solids	N	1020	mg/l	1.0	78
Chloride	U	1220	mg/l	1.0	2.1
Fluoride	U	1220	mg/l	0.050	0.33
Sulphate	U	1220	mg/l	1.0	9.0
Arsenic (Dissolved)	U	1450	µg/l	1.0	< 1.0
Barium (Dissolved)	U	1450	µg/l	5.0	6.8
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50
Molybdenum (Dissolved)	U	1450	µg/l	1.0	15
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0
Antimony (Dissolved)	U	1450	µg/l	1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	1.5
Zinc (Dissolved)	U	1450	µg/l	1.0	< 1.0
Dissolved Organic Carbon	U	1610	mg/l	2.0	10

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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922
Quotation No.: Q19-16291		**Chemtest Sample ID.:**			815660	815661	815664	815666	815667	815668	815670	815671	815672
Order No.:		Client Sample Ref.:			1	2	1	3	4	1	3	4	1
		Sample Location:			TP103	TP103	TP104	TP104	TP104	TP105	TP105	TP105	TP106
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.5	1.0	0.5	1.5	2.2	0.5	1.5	2.1	0.5
		Date Sampled:			18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	18	10	7.9	8.8	8.0	9.4	8.3	8.0	5.4
pH	U	2010		N/A	8.3	8.7	8.6	8.6	8.5	8.7	8.6	8.4	8.5
Barium	U	2450	mg/kg	10	130	81	87	87	80	83	93	78	60
Cadmium	U	2450	mg/kg	0.10	2.6	2.3	1.3	1.8	1.6	2.0	1.9	1.1	0.91
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum	U	2450	mg/kg	2.0	4.4	5.1	2.9	3.9	3.5	5.9	5.6	4.7	2.1
Antimony	N	2450	mg/kg	2.0	2.2	2.1	< 2.0	< 2.0	< 2.0	2.5	< 2.0	2.4	< 2.0
Copper	U	2450	mg/kg	0.50	32	26	32	32	29	32	24	20	29
Nickel	U	2450	mg/kg	0.50	68	54	62	61	57	65	43	38	46
Lead	U	2450	mg/kg	0.50	31	20	19	21	19	27	22	35	18
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	1.3	1.1	< 0.20	1.6	1.3	< 0.20
Zinc	U	2450	mg/kg	0.50	87	57	78	82	73	73	55	62	66
Chromium (Trivalent)	N	2490	mg/kg	1.0	29	15	26	23	21	16	13	12	23
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	0.74	0.38	0.23	0.58	0.67	0.43	0.83	0.99	0.36
Total TPH >C6-C40	U	2670	mg/kg	10	350	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Chemtest
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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922	19-13922
Quotation No.: Q19-16291				**Chemtest Sample ID.:**	815660	815661	815664	815666	815667	815668	815670	815671	815672
Order No.:				Client Sample Ref.:	1	2	1	3	4	1	3	4	1
				Sample Location:	TP103	TP103	TP104	TP104	TP104	TP105	TP105	TP105	TP106
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.5	1.0	0.5	1.5	2.2	0.5	1.5	2.1	0.5
				Date Sampled:	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019	18-Apr-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-13922
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		815674
Order No.:			Client Sample Ref.:		3
			Sample Location:		TP106
			Sample Type:		SOIL
			Top Depth (m):		1.5
			Date Sampled:		18-Apr-2019
			Asbestos Lab:		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	8.6
pH	U	2010		N/A	8.5
Barium	U	2450	mg/kg	10	81
Cadmium	U	2450	mg/kg	0.10	1.6
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05
Molybdenum	U	2450	mg/kg	2.0	3.5
Antimony	N	2450	mg/kg	2.0	< 2.0
Copper	U	2450	mg/kg	0.50	35
Nickel	U	2450	mg/kg	0.50	68
Lead	U	2450	mg/kg	0.50	20
Selenium	U	2450	mg/kg	0.20	2.0
Zinc	U	2450	mg/kg	0.50	99
Chromium (Trivalent)	N	2490	mg/kg	1.0	20
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	0.61
Total TPH >C6-C40	U	2670	mg/kg	10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0

Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-13922
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		815674
Order No.:			Client Sample Ref.:		3
			Sample Location:		TP106
			Sample Type:		SOIL
			Top Depth (m):		1.5
			Date Sampled:		18-Apr-2019
			Asbestos Lab:		COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0
PCB 28	U	2815	mg/kg	0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.:	19-14179-1
Initial Date of Issue:	09-May-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	18-1467 Dublin Airport CP2

Quotation No.:	Q19-16291	**Date Received:**	26-Apr-2019
Order No.:		**Date Instructed:**	02-May-2019
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	09-May-2019
Date Approved:	09-May-2019		
Approved By:			



Details: Robert Monk, Technical Manager

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2183

Final Report

Report No.: 19-14886-1

Initial Date of Issue: 15-May-2019

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): Carin Cornwall
Colm Hurley
Darren O'Mahony
Gabriella Horan
John Cameron
Lucy Newland
Matthew Gilbert
Neil Haggan
Paul Dunlop
Paul McNamara
Sean Ross
Stephen Franey
Stephen McCracken
Stephen Watson
Stuart Abraham

Project 18-1467 Dublin Airport CP2

Quotation No.: Q19-16291 **Date Received:** 02-May-2019

Order No.: **Date Instructed:** 09-May-2019

No. of Samples: 3

Turnaround (Wkdays): 5 **Results Due:** 15-May-2019

Date Approved: 15-May-2019

Approved By:



Details: Martin Dyer, Laboratory Manager

Chemtest Ltd.
Depot Road
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Email: info@chemtest.com

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Results - Leachate

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-14886	19-14886	19-14886
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		819686	819687	819688
			Sample Location:		BH103	BH103	BH103
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.50	2.50	3.50
			Date Sampled:		30-Apr-2019	30-Apr-2019	30-Apr-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Dissolved Solids	N	1020	mg/l	1.0	72	140	140
Chloride	U	1220	mg/l	1.0	2.7	16	11
Fluoride	U	1220	mg/l	0.050	0.29	0.28	0.47
Sulphate	U	1220	mg/l	1.0	6.2	44	43
Arsenic (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Barium (Dissolved)	U	1450	µg/l	5.0	13	30	45
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50	0.60	2.2	0.70
Molybdenum (Dissolved)	U	1450	µg/l	1.0	31	18	25
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.3	2.4
Selenium (Dissolved)	U	1450	µg/l	1.0	6.8	52	55
Zinc (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	1.6
Dissolved Organic Carbon	U	1610	mg/l	2.0	6.4	7.1	7.3

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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	19-14886	19-14886	19-14886
Quotation No.: Q19-16291				**Chemtest Sample ID.:**	819686	819687	819688
				Sample Location:	BH103	BH103	BH103
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	1.50	2.50	3.50
				Date Sampled:	30-Apr-2019	30-Apr-2019	30-Apr-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-
Moisture	N	2030	%	0.020	11	9.8	11
pH	U	2010		N/A	8.5	8.4	8.1
Barium	U	2450	mg/kg	10	100	84	98
Cadmium	U	2450	mg/kg	0.10	1.9	2.2	2.1
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Molybdenum	U	2450	mg/kg	2.0	5.7	5.3	5.7
Antimony	N	2450	mg/kg	2.0	2.2	2.2	2.2
Copper	U	2450	mg/kg	0.50	27	30	30
Nickel	U	2450	mg/kg	0.50	54	59	53
Lead	U	2450	mg/kg	0.50	23	21	22
Selenium	U	2450	mg/kg	0.20	6.9	3.5	3.5
Zinc	U	2450	mg/kg	0.50	72	90	74
Chromium (Trivalent)	N	2490	mg/kg	1.0	15	13	14
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	0.92	0.62	0.77
Total TPH >C6-C40	U	2670	mg/kg	10	< 10	< 10	25
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10

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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-14886	19-14886	19-14886
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		819686	819687	819688
			Sample Location:		BH103	BH103	BH103
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.50	2.50	3.50
			Date Sampled:		30-Apr-2019	30-Apr-2019	30-Apr-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	1.4	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.: 19-14892-1

Initial Date of Issue: 15-May-2019

Client Causeway Geotech Ltd

Client Address: 8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s): Carin Cornwall
Colm Hurley
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Gabriella Horan
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Matthew Gilbert
Neil Haggan
Paul Dunlop
Paul McNamara
Sean Ross
Stephen Franey
Stephen Watson
Stuart Abraham

Project 18-1467 Dublin Airport CP2

Quotation No.: Q19-16291 **Date Received:** 02-May-2019

Order No.: **Date Instructed:** 09-May-2019

No. of Samples: 4

Turnaround (Wkdays): 5 **Results Due:** 15-May-2019

Date Approved: 15-May-2019

Approved By:



Details: Martin Dyer, Laboratory Manager

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
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Results - Leachate

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-14892	19-14892	19-14892	19-14892
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		819738	819740	819741	819742
			Sample Location:		BH105	BH105	BH104	BH104
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		2.50	4.50	0.50	1.50
			Date Sampled:		29-Apr-2019	29-Apr-2019	25-Apr-2019	25-Apr-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Total Dissolved Solids	N	1020	mg/l	1.0	110	120	60	85
Chloride	U	1220	mg/l	1.0	5.4	9.7	7.7	3.1
Fluoride	U	1220	mg/l	0.050	0.39	0.42	0.30	0.27
Sulphate	U	1220	mg/l	1.0	24	24	6.0	8.3
Arsenic (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium (Dissolved)	U	1450	µg/l	5.0	29	32	24	5.8
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Molybdenum (Dissolved)	U	1450	µg/l	1.0	15	17	4.1	13
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	µg/l	1.0	1.5	< 1.0	1.6	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	17	14	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	< 1.0	1.0	< 1.0	< 1.0
Dissolved Organic Carbon	U	1610	mg/l	2.0	11	11	5.9	12

Chemtest
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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	19-14892	19-14892	19-14892	19-14892
Quotation No.: Q19-16291				**Chemtest Sample ID.:**	819738	819740	819741	819742
				Sample Location:	BH105	BH105	BH104	BH104
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	2.50	4.50	0.50	1.50
				Date Sampled:	29-Apr-2019	29-Apr-2019	25-Apr-2019	25-Apr-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-
Moisture	N	2030	%	0.020	11	11	3.3	15
pH	U	2010		N/A	8.6	8.5	8.9	8.7
Barium	U	2450	mg/kg	10	78	78	62	81
Cadmium	U	2450	mg/kg	0.10	1.7	2.0	0.46	1.6
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum	U	2450	mg/kg	2.0	3.5	4.3	< 2.0	3.3
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	2.7	2.0
Copper	U	2450	mg/kg	0.50	30	35	10	32
Nickel	U	2450	mg/kg	0.50	59	64	22	63
Lead	U	2450	mg/kg	0.50	19	20	38	24
Selenium	U	2450	mg/kg	0.20	0.69	1.2	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50	78	84	140	99
Chromium (Trivalent)	N	2490	mg/kg	1.0	21	21	4.9	20
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	0.53	0.89	1.4	0.58
Total TPH >C6-C40	U	2670	mg/kg	10	< 10	< 10	1000	33
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	5.2	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	32	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	5.9	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	100	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	150	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	270	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	200	10
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	140	23
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	8.6
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	620	42
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	760	42

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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-14892	19-14892	19-14892	19-14892
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		819738	819740	819741	819742
			Sample Location:		BH105	BH105	BH104	BH104
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		2.50	4.50	0.50	1.50
			Date Sampled:		29-Apr-2019	29-Apr-2019	25-Apr-2019	25-Apr-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	1.1	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

Report Information

Key

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N	Unaccredited
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I/S	Insufficient Sample
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<	"less than"
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The results relate only to the items tested
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None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
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If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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The right chemistry to deliver results
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Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.:	19-15335-1
Initial Date of Issue:	15-May-2019
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	18-1467 Dublin Airport CP2

Quotation No.:	Q19-16291	**Date Received:**	07-May-2019
Order No.:		**Date Instructed:**	09-May-2019
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	15-May-2019
Date Approved:	15-May-2019		

Approved By:



Details: Robert Monk, Technical Manager

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

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The right chemistry to deliver results

Results - Leachate

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-15335	19-15335
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		821498	821500
Order No.:			Client Sample Ref.:		1	3
			Sample Location:		BH102A	BH102A
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.50	1.50
			Date Sampled:		01-May-2019	01-May-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Dissolved Solids	N	1020	mg/l	1.0	110	280
Chloride	U	1220	mg/l	1.0	2.9	2.7
Fluoride	U	1220	mg/l	0.050	0.64	0.23
Sulphate	U	1220	mg/l	1.0	4.4	81
Arsenic (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.0
Barium (Dissolved)	U	1450	µg/l	5.0	5.1	32
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50
Molybdenum (Dissolved)	U	1450	µg/l	1.0	5.0	13
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Antimony (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.3
Selenium (Dissolved)	U	1450	µg/l	1.0	< 1.0	1.4
Zinc (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.9
Dissolved Organic Carbon	U	1610	mg/l	2.0	15	19

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Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-15335	19-15335
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		821498	821500
Order No.:			Client Sample Ref.:		1	3
			Sample Location:		BH102A	BH102A
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.50	1.50
			Date Sampled:		01-May-2019	01-May-2019
			Asbestos Lab:		COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	17	31
pH	U	2010		N/A	8.3	8.0
Barium	U	2450	mg/kg	10	95	88
Cadmium	U	2450	mg/kg	0.10	2.0	1.9
Mercury Low Level	U	2450	mg/kg	0.05	< 0.05	< 0.05
Molybdenum	U	2450	mg/kg	2.0	3.5	3.0
Antimony	N	2450	mg/kg	2.0	2.1	< 2.0
Copper	U	2450	mg/kg	0.50	40	27
Nickel	U	2450	mg/kg	0.50	63	40
Lead	U	2450	mg/kg	0.50	48	48
Selenium	U	2450	mg/kg	0.20	0.27	1.5
Zinc	U	2450	mg/kg	0.50	130	110
Chromium (Trivalent)	N	2490	mg/kg	1.0	23	25
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	1.4	4.1
Total TPH >C6-C40	U	2670	mg/kg	10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 18-1467 Dublin Airport CP2

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		19-15335	19-15335
Quotation No.: Q19-16291			**Chemtest Sample ID.:**		821498	821500
Order No.:			Client Sample Ref.:		1	3
			Sample Location:		BH102A	BH102A
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.50	1.50
			Date Sampled:		01-May-2019	01-May-2019
			Asbestos Lab:		COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	< 2.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

CAUSEWAY GEOTECH

APPENDIX I

SPT HAMMER ENERGY MEASUREMENT REPORT



SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	0777
Test Date:	23/02/2019
Report Date:	26/02/2019
File Name:	0777.spt
Test Operator:	NPB

Instrumented Rod Data

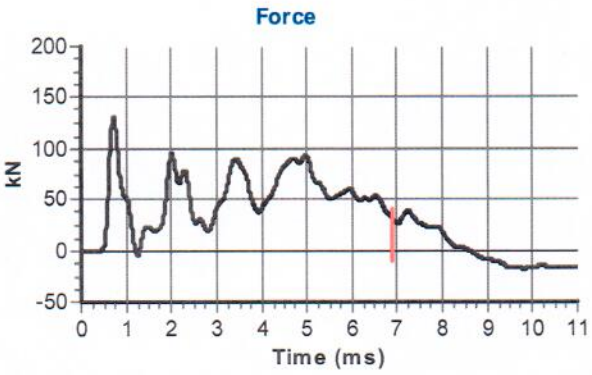
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

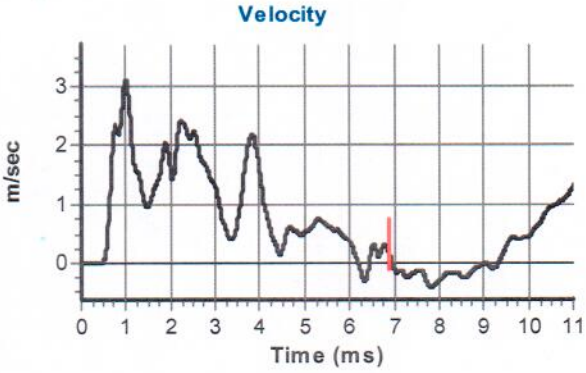
SPT Hammer Information

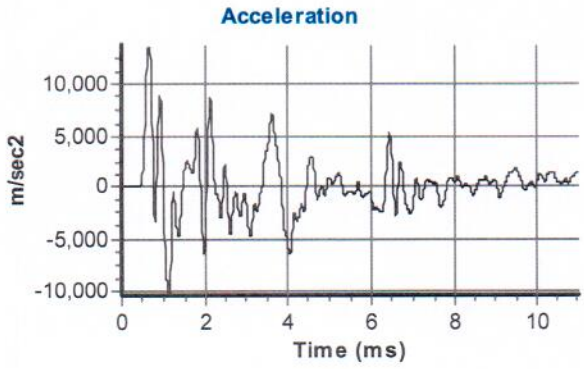
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

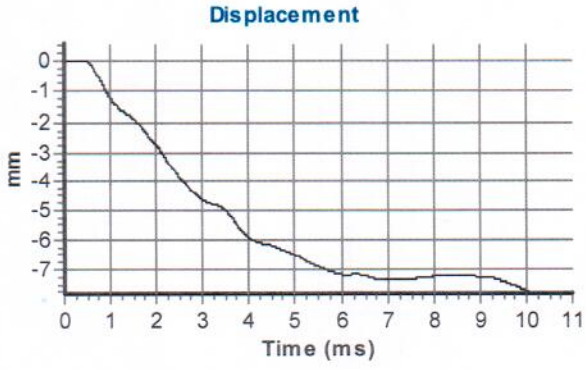
Comments / Location

CAUSEWAY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	376

Energy Ratio E_r (%): 80

N P Burrows

Signed: N P Burrows

Title: Field Operations Manager

The recommended calibration interval is 12 months

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	0678
Test Date:	23/02/2019
Report Date:	26/02/2019
File Name:	0678.spt
Test Operator:	NPB

Instrumented Rod Data

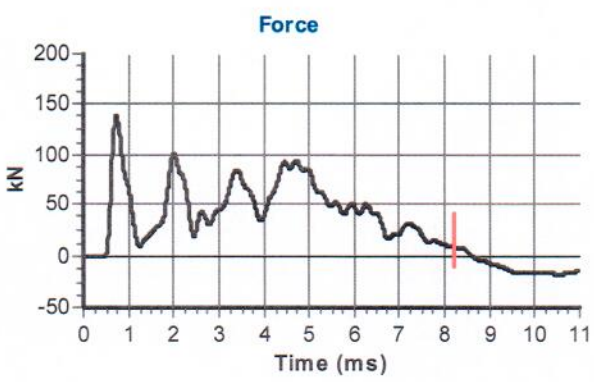
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

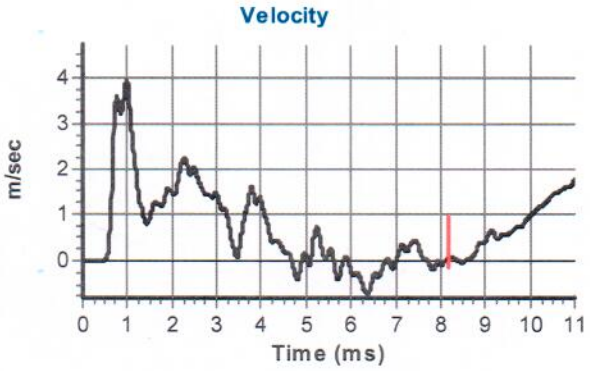
SPT Hammer Information

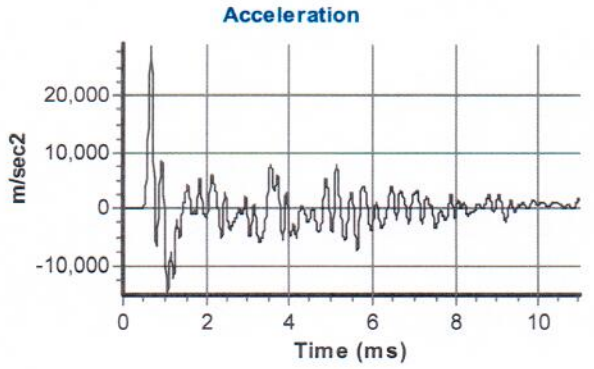
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

CAUSEWAY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	363

Energy Ratio E_r (%): 77

Signed: N P Burrows

Title: Field Operations Manager

The recommended calibration interval is 12 months

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Neil Burrows
Southern Testing Laboratories
Unit 11
Charlwoods Road
East Grinstead
RH19 2HU

SPT Hammer Ref:	0643
Test Date:	23/02/2019
Report Date:	26/02/2019
File Name:	0643.spt
Test Operator:	NPB

Instrumented Rod Data

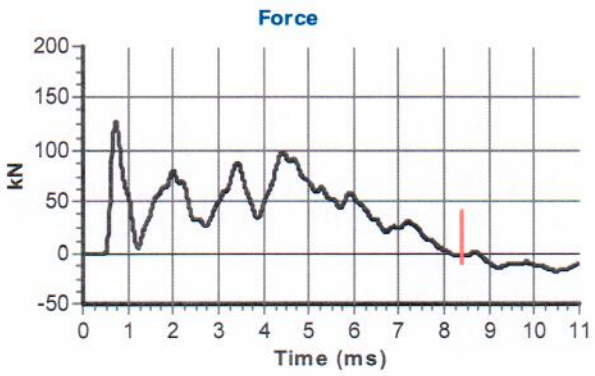
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

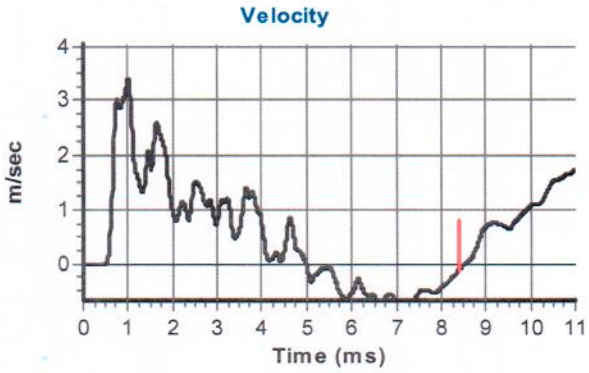
SPT Hammer Information

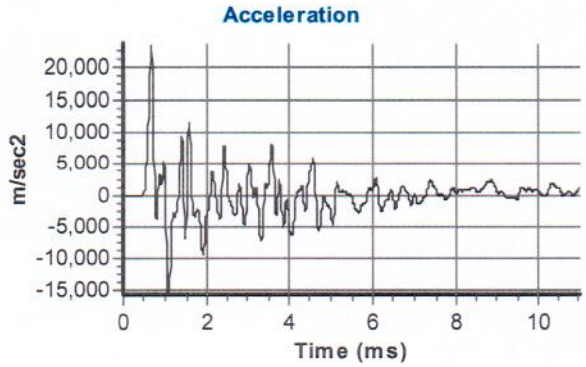
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

CAUSEWAY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	388

Energy Ratio E_r (%): 82

The recommended calibration interval is 12 months

Signed: N P Burrows

Title: Field Operations Manager

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