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Natural Resources Wales

St Asaph FRMS (Detailed Design)

Ground investigation 2016

Factual Ground Investigation Report

18th May 2016



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1 Introduction

1.1 Instruction

WYG Environment Planning Transport Ltd (WYG) were commissioned by Natural Resources Wales (NRW) to undertake intrusive ground investigation work along the River Elwy in St Asaph. Contract instructions were issued by John Davies and are dated 7th March 2016.

1.2 Brief

The ground investigation was designed to inform the detailed design of flood defence enhancement works. The proposed works included raising and widening existing flood defences embankments along existing flood defence alignments and also possibly the construction of new defences walls set **back from the river's** edge; increasing the width of the flood corridor for conveyance. Sheet piles will require installation along some of the flood defence alignment. The ground investigation has been devised by Black and Veatch (B&V) the client engineer.

The investigation comprised the following key elements:

- 5 No. Cable percussive boreholes to between 10.0 and 12.0m depth with SPT testing
- 11 No. Machine excavated trial pits to 2.5m depth
- 14 No. Hand excavated trial pits to 1.55m depth
- 3 No. Window samples to 5.0m depth with dynamic probes to 8.0m depth
- Collection of disturbed and undisturbed soil samples
- Geotechnical and environmental laboratory testing of soil samples



1.3 Report Scope

This report summarises the work undertaken and includes the following key elements:

- Full factual records of the site works carried out
- Ground conditions encountered
- In situ testing results
- Geotechnical and environmental laboratory testing results

1.4 Limitations

The recommendations and opinions expressed in this report are based on information obtained as part of the desk study or provided by others. Information provided from other sources is taken in good faith and WYG cannot guarantee its accuracy.

This report has been prepared in accordance with the requirements of Works Package Order *St Asaph FRMS (Detailed Design) Ground Investigation 2016*. It is subject to the report conditions contained in Appendix A.

The information contained in this report is intended for the use of Natural Resources Wales. WYG can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.



2 Site Information

2.1 Location

The site is on embankments that run along the eastern and western banks of River Elwy as it runs from south to north through the city of St Asaph. The coordinates of the north end of the site are 303184E, 375064N. A site location plan is presented as Figure 1.

2.2 Site description

The site consists of two areas, the northern area is situated west of the Farm Pentre-uchaf on the eastern bank of the River Elwy. There is a footbridge across the river. The setting is rural.

The main area stretches along the River Elwy through the centre of St Asaph. The River Elwy runs through both residential and light commercial areas and more rural and recreational areas.

A site layout plan is included as Figure 2.

2.3 Geology

The BGS geology mapping indicates that the site is underlain by Till deposits and Glaciofluvial deposits of devensian age and Alluvium. The Till deposits are described as diamicton meaning poorly sorted deposits that contain a wide range of particle sizes. The bedrock underlying the site consists of the Warwickshire Group which includes mudstones, siltstones and sandstones.

The information provided as part of the Works Package Order highlighted that Made Ground is to be expected in the recreational areas consisting of both cohesive and granular types.

2.4 Hydrogeology

The Alluvium, Glaciofluvial deposits and Warwickshire Group are categorised as Secondary A Aquifers. There are no Source Protection Zones (SPZs) within 1km of the site. The groundwater vulnerability in the area is listed as being intermediate to high.



3 Site Investigation

The site investigation was undertaken between the 14th and 21st March 2016.

Details of the fieldwork methods are given in the notes section at the end of this report.

3.1 Scope

The scope of the site investigation included the following:

- 4 No. Cable percussive boreholes to between 7.5 and 11.0m depth with SPT testing
- 11 No. Machine excavated trial pits to between 0.8 and 2.1m depth
- 1 No. Machine excavated trial trench
- 15 No. Hand excavated trial pits to between 1.10 and 1.55m depth
- 9 No. Window samples between 2.0 and 5.0m depth with dynamic probes in two locations to 4.0m depth
- Collection of disturbed and undisturbed soil samples
- Geotechnical and environmental laboratory testing of soil samples

Figure 2 shows the layout of the exploratory holes advanced during the site investigation. Exploratory hole logs including photographic plates are presented in Appendix B.

3.2 Amendments to original scope of Works Package Order

During the site investigation the scope of the site investigation was amended to reflect ground conditions and ease the progression of the works. The following amendments were instructed by the client engineer Black and Veatch:

- BH1605 was cancelled due to access restrictions
- WS1602 was undertaken as a hand pit and trial pit instead of window sample
- BH1603A was an additional hand pit undertaken near BH1603
- HD1614 was cancelled
- TP1609 was undertaken as archaeological trial trench TT1601
- 6 No. Window samples were added



4 Ground Conditions Encountered

4.1 Strata encountered

The sequence of strata encountered beneath the site was:

- Topsoil
- Made Ground
- Alluvium
- Fluvioglacial Deposits
- Glacial Till
- Glacial Deposits

A summary of depth of each stratum is provided in Table 4-1 and descriptions of each stratum are detailed in the subsequent sections. Exploratory hole logs including photographic plates can also be seen in Appendix B.

Table 4-1 - Summary of strata depths (m bgl) for all exploratory holes

Location	Topsoil	Made Ground	Alluvium	Fluvio glacial Deposits	Glacial Till	Glacial Deposits
BH1601	0.00-0.70	ne ^b	ne ^b	0.70-3.40	3.40-7.50 ^a	ne ^b
BH1602	0.00-0.30	ne ^b	0.30-0.60	0.60-2.90	2.90-5.50	5.50-7.50 ^a
BH1603	0.00-0.10	0.10-0.40	0.40-0.70	0.70-3.10	3.10-6.80	6.80-8.50 ^a
BH1604	0.00-0.10	0.10-2.20	ne ^b	2.20-6.40	6.40-11.00 ^a	ne ^b
HD1601	0.00-0.35	ne ^b	ne ^b	0.35-1.25 ^a	ne ^b	ne ^b
HD1602	0.00-0.10	0.10-0.85	ne ^b	0.85-1.40 ^a	ne ^b	ne ^b
HD1603	0.00-0.10	0.10-1.40	ne ^b	1.40-1.55 ^a	ne ^b	ne ^b
HD1604	0.00-0.08	0.08-1.55	ne ^b	ne ^b	ne ^b	ne ^b
HD1605	0.00-0.50	ne ^b	ne ^b	0.50-1.25 ^a	ne ^b	ne ^b
HD1606	ne ^b	0.00-1.55 ^a	ne ^b	ne ^b	ne ^b	ne ^b
HD1607	0.00-0.10	0.10-1.50 ^a	ne ^b	ne ^b	ne ^b	ne ^b
HD1608	0.00-0.10	0.10-1.55 ^a	ne ^b	ne ^b	ne ^b	ne ^b
HD1609	0.00-0.20	0.20-1.45 ^a	ne ^b	ne ^b	ne ^b	ne ^b
HD1610	ne ^b	0.00-1.10 ^a	ne ^b	ne ^b	ne ^b	ne ^b
HD1611	ne ^b	0.00-1.50 ^a	ne ^b	ne ^b	ne ^b	ne ^b
HD1612	0.00-0.10	0.10-1.30	1.30-1.50 ^a	ne ^b	ne ^b	ne ^b



Location	Topsoil	Made Ground	Alluvium	Fluvio glacial Deposits	Glacial Till	Glacial Deposits
HD1613	ne ^b	ne ^b	0.00-1.15	1.15-1.30 ^a	ne ^b	ne ^b
BH1613A	0.00-0.08	0.80-1.45	1.45-1.50 ^a	ne ^b	ne ^b	ne ^b
WS1602-HD	ne ^b	ne ^b	ne ^b	0.00-1.10 ^a	ne ^b	ne ^b
TT1601	0.00-0.20	0.20-1.60	ne ^b	1.60-1.80 ^a	ne ^b	ne ^b
TP1601	0.00-0.10	0.10-1.10	ne ^b	1.10-1.50 ^a	ne ^b	ne ^b
TP1602	0.00-0.06	0.06-0.60	ne ^b	0.60-1.20 ^a	ne ^b	ne ^b
TP1603	0.00-0.10	0.10-0.90	ne ^b	0.90-2.10 ^a	ne ^b	ne ^b
TP1604	0.00-0.10	0.10-0.95	ne ^b	0.95-1.20 ^a	ne ^b	ne ^b
TP1605	0.00-0.15	0.15-0.70	ne ^b	0.70-1.40 ^a	ne ^b	ne ^b
TP1606	0.00-0.10	0.10-0.90	0.90-1.40	1.40-1.80 ^a	ne ^b	ne ^b
TP1607	0.00-0.15	0.15-0.70	0.70-0.75	0.75-1.55 ^a	ne ^b	ne ^b
TP1608	0.00-0.15	0.15-1.10	1.10-1.45	1.145-1.60 ^a	ne ^b	ne ^b
TP1609	0.00-0.10	ne ^b	0.10-0.50	0.50-0.80 ^a	ne ^b	ne ^b
TP1610	0.00-0.10	ne ^b	0.10-0.60	0.60-0.80 ^a	ne ^b	ne ^b
WS1602-TP	0.00-0.30	ne ^b	0.30-0.40	0.40-1.10 ^a	ne ^b	ne ^b
WS1601A	0.00-0.15	0.15-2.80	ne ^b	2.80-4.00 ^a	ne ^b	ne ^b
WS1601B	ne ^b	0.00-3.00	ne ^b	3.00-3.40 ^a	ne ^b	ne ^b
WS1601C	ne ^b	0.00-3.00	ne ^b	3.00-3.20 ^a	ne ^b	ne ^b
WS1601D	0.00-0.35	0.35-3.00	ne ^b	3.00-4.00 ^a	ne ^b	ne ^b
WS1603	0.00-0.10	0.10-1.95	ne ^b	ne ^b	1.95-3.90	3.90-4.40 ^a
WS1604	0.00-0.05	0.05-3.70	ne ^b	3.70-4.65	4.65-5.00 ^a	ne ^b
WS1605	0.00-0.05	0.05-2.00 ^a	ne ^b	ne ^b	ne ^b	ne ^b
WS1606	0.00-0.18	0.18-3.00	ne ^b	3.00-4.00 ^a	ne ^b	ne ^b
WS1607	0.00-0.15	0.15-2.00	ne ^b	ne ^b	ne ^b	ne ^b

^aBase of stratum not proven

^bne denotes not encountered

4.1.1 Topsoil

The topsoil encountered consisted mainly of brown clayey sandy organic silt with varying amounts of fine to coarse rounded sandstone and mudstone gravel. The topsoil was described as soft to firm brown clay in two locations (TT1601 and WS1601A).



4.1.2 Made Ground

Made Ground was encountered in the majority of exploratory locations. At the locations on the existing flood bund several layers of Made Ground were encountered comprising firm brown clay and stiff reddish brown silty sandy gravelly clay overlying dark brown black ashy silty very sandy gravel of brick coal mudstone, glass and pottery.

In various fill material was encountered on the eastern side of the River Elwy around TP1606 to TP1608 consisting of mainly gravel with varying amounts of subconstituents.

4.1.3 Alluvium

The Alluvium encountered on site was composed mainly of brown or brown grey silt with varying amounts of sub constituents. If cobbles were present they were described as rounded sandstone and the gravel consisted of fine to coarse rounded sandstone, mudstone and siltstone.

4.1.4 Fluvio glacial deposits

Fluvio glacial deposits were encountered in the majority of positions and were described as brown grey sandy gravel with varying cobble content. The gravel and cobbles consisted of fine to coarse subangular to mainly rounded sandstone and mudstone.

4.1.5 Glacial Till

The Glacial Till consisted of firm to very stiff light brown to red brown clay with varying amounts of sub constituents (sand and gravel). The gravel was described as fine to coarse rounded sandstone, mudstone and siltstone.

4.1.6 Glacial Deposits

Glacial deposits were encountered in three locations (BH1602, BH1603 and WS1603). It was described as brown grey or grey clay. In BH1602 and BH1603 where it was encountered at depth below the Glacial Till from 5.5 and 6.8m depth respectively, the clay was firm to stiff. At WS1603 where it was encountered at shallower depth (3.9m bgl), it was soft.



4.2 Groundwater

Groundwater was encountered in all cable percussion boreholes (BH1601-1604) and in several window sample holes the arisings were wet. The depths are summarised in Table 4-2.

Table 4-2 - Summary of groundwater strikes

Location	Depth of groundwater strike (m bgl)	Rest water level (m bgl)	Time to reach rest water level (mins)	Stratum
BH1601	2.70	2.60	20	Fluvio glacial deposits
BH1602	1.70	1.60	20	Fluvio glacial deposits
BH1603	1.80	1.74	20	Fluvio glacial deposits
	8.00	0.60	20	Glacial Deposits
BH1604	4.20	4.05	20	Fluvio glacial deposits
WS1601C	2.70-2.95 ^a	-	-	Made Ground
WS1601D	2.70-2.90 ^a	-	-	Made Ground
WS1603	3.40-3.50 ^a	-	-	Glacial Till
	4.00-4.40 ^a	-	-	Glacial Deposits
WS1604	4.00-4.60 ^a	-	-	Probable Glacial Deposits

^aArisings are wet.

4.3 In Situ Testing

4.3.1 Standard Penetration Testing

Standard Penetration Tests (SPTs) were undertaken in all boreholes. The results are presented on the exploratory hole logs included in Appendix B and summarised on Figure 3.

4.3.2 Super Heavy Dynamic Probes (SHDP)

SHDP testing was carried out in conjunction with two windowless sample boreholes (WS1601A and WS1606). The results are presented on the exploratory borehole logs (see Appendix B) and SPT N values calculated from the dynamic probing are plotted on Figure 3.

4.4 Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of contamination was encountered in any of the exploratory positions.

4.5 Obstructions

No obstructions were encountered in any of the exploratory positions.



5 Laboratory Testing

5.1 Geotechnical Testing

A programme of laboratory testing is being carried out at the time of writing. Geotechnical testing was scheduled by client engineer Black and Veatch and undertaken by GSTL Ltd, an approved supplier in accordance with the requirements of WYG quality system and are UKAS accredited for a range of geotechnical tests. The test procedures used in each case are given in Table 5-1. Laboratory geotechnical are included in Appendix C.

Table 5-1 - Summary of geotechnical testing

Test	Standard (BS1377:1990)	No.
Moisture Content	Part 2 Clause 3.2	12
Atterberg Limits (4 point)	Part 2 Clause 4.3 and 5.3	11
Particle size distribution by wet sieving	Part 2 Clause 9.2	35
Particle size distribution by pipette	Part 2 Clause 9.4	4
Lab permeability test	Part 6 Clause 6	1
Consolidated Drained Triaxial Tests	Part 8 Clause 7	5
pH and Sulphate	Part 3 Clause 5 and 9	3



5.2 Environmental Testing

The environmental chemistry was investigated by specialist chemical analysis of selected soil and groundwater samples carried out by Jones Environmental Forensics Ltd, which is an approved supplier in accordance with the requirements of WYG quality system and is UKAS and MCERTS accredited for a range of chemical analyses. The testing was scheduled by client engineer Black and Veatch and is summarised in Table 5-2. The test suites are detailed in Appendix D. The test results for the soil samples are included in Appendix E. The results for the groundwater testing are outstanding and will be reported in an addendum to this report.

Table 5-2 - Summary of environmental testing

Test suite	No.
Soil Suite E1	7
Soil Suite E2	7
Soil Suite E3	7
Soil Suite E4	7
Soil Suite E8	7
Leachate Suite F1	2
Leachate Suite F2	2
Leachate Suite F3	2



Notes

1. Standards

All boring operations, sampling of soils, *in situ* testing and geotechnical laboratory testing have been carried out in accordance with the recommendations of the British Standards BS 5930+A2 (2010)⁽¹⁾, BS 1377 (1990)⁽²⁾ and BS10175 (2001)⁽³⁾.

Soil and rock descriptions follow the recommendations of BS 5930+A2. Where descriptions or classifications are based on other documents (e.g. BS 8004 (1986) or CIRIA Project Report 11 (1993)), this is stated in the report text.

2. Site methods

Unless specifically stated otherwise, the following methods are used for exploratory holes.

- Holes described as cable percussive are bored using a light cable percussive rig. Standard penetration tests are carried out where appropriate, as shown in the logs. Disturbed and undisturbed samples are taken from the exploratory holes at the depths on the records.
- Window sampling generally uses the windowless sampling method, using a tracked Geotool.
- Dynamic probes are usually heavy dynamic probes, using the same tracked Geotool used for window sampling.

3. Definitions and abbreviations

The following terms are used in the exploratory hole logs

Samples

ES	Environmental sample
U	Undisturbed 102mm dia. sample
TW	Thin Walled undisturbed 102mm dia. sample
B	Bulk sample
D	Small disturbed sample
W	Water sample
CBR	California Bearing Ratio test or CBR value obtained from Mexiprobe test

In situ tests

S	Standard penetration test (SPT)
N	SPT N value (blows/300mm)
PID	Photo-ionisation detector – used to detect the presence of VOCs.
PP	Hand penetrometer – shear strength
HV	Hand shear vane – shear strength
VOC	Volatile organic compounds (ppm)

Core recovery and rock quality

TCR	Total core recovery (%)
SCR	Solid core recovery (%)
RQD	Rock quality designation (%)
FI	Fracture index
NR	No recovery
NI	Not intact

Rotary drilling sizes

Index letter	Nominal diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

Water strikes

▽	Level of water strike
▼	Water level rose to this level (see Remarks at foot of log for details)

Depth means depth below existing ground level unless otherwise specified. Values specified in soil descriptions given in the exploratory hole logs are depths unless otherwise specified.



Abbreviations

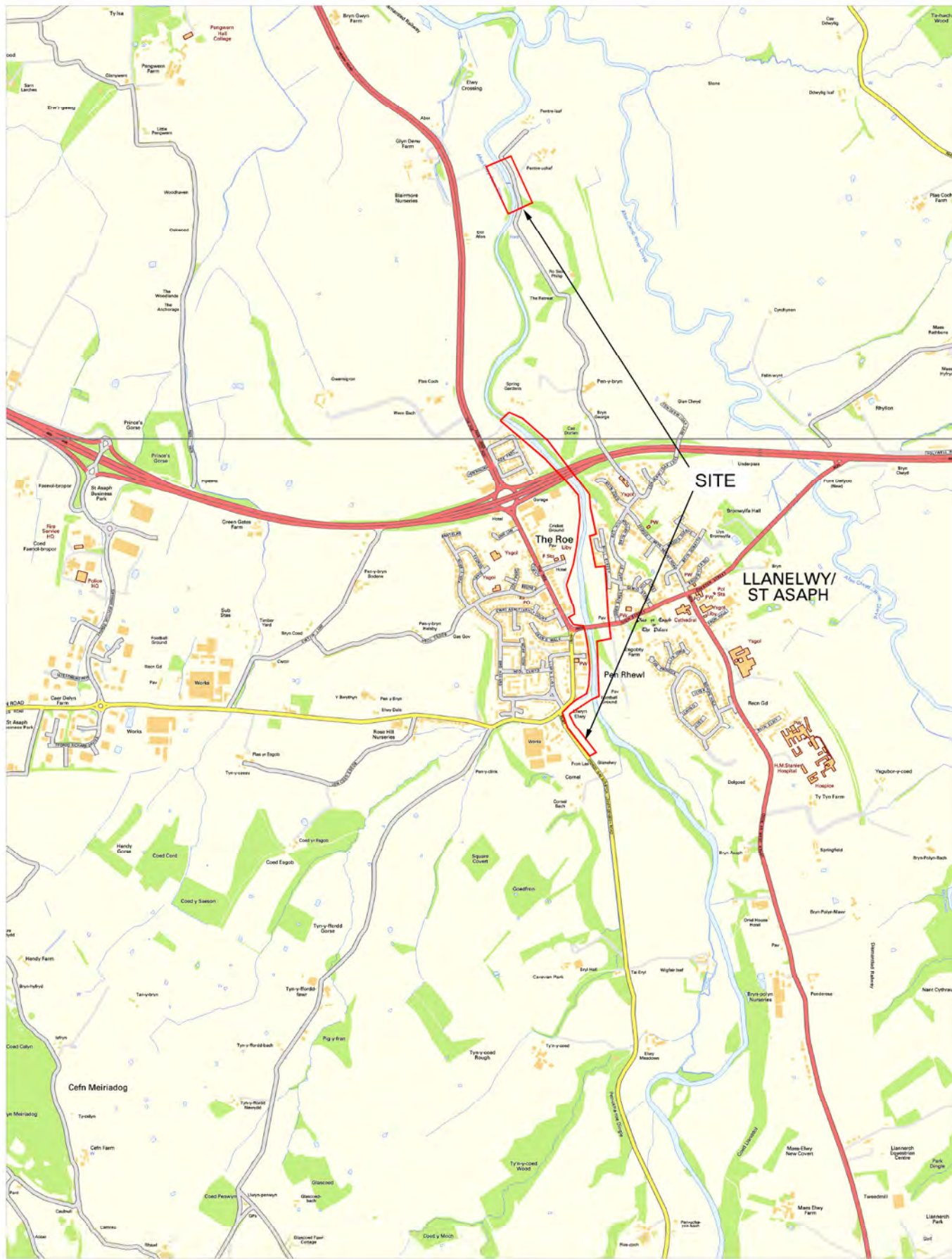
BGS	British Geological Survey
bgl	below ground level
NRW	Natural Resources Wales
LOD	Limit of detection
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
TPH	Total Petroleum Hydrocarbon
PAH	Polycyclic aromatic hydrocarbon
PRO	Petroleum Range Organics
DRO	Diesel Range Organics
VPH	Volatile Petroleum Hydrocarbons
EPH	Extractable Petroleum Hydrocarbons
ppm	parts per million
VOC	Volatile Organic Carbon
SVOC	Semi-volatile organic compounds
SOM	Soil Organic Matter
FOC	Fraction Organic Carbon



Figures



Figure 1 – Site Location Plan



Contains Ordnance Survey data © Crown copyright and database right 2014

REV	DESCRIPTION	BY	CHK	APP	DATE
-----	-------------	----	-----	-----	------

5th FLOOR, LONGCROSS COURT
47 NEWPORT ROAD
CARDIFF
CF24 0AD



Client:
NATURAL ENGLAND WALES

Project:
ST ASAPH FRM

Drawing Title:
SITE LOCATION PLAN

TEL: +44 (0)29 2032 0769
FAX: +44 (0)29 2045 5321
e-mail: cardiff@wyg.com

Scale @ A4 NTS	Drawn PP	Date 18.05.16	Checked LK	Date 18.05.16	Approved CBP	Date 18.05.16
Project No. A089434-1	Office CDF	Type GEO	Drawing No. 1	Revision 00		



Figure 2 – Site Investigation Layout Plan

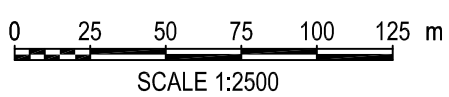
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WYG 2016 SITE INVESTIGATION LOCATIONS:

- TRIAL PITS
- HAND PITS
- ▼ WINDOWLESS SAMPLES
- BOREHOLES
- ⊕ DYNAMIC PROBE LOCATIONS

WYG 2014 SITE INVESTIGATION LOCATIONS:

- TRIAL PITS
- ⊕ HAND PITS
- ▼ WINDOWLESS SAMPLES
- BOREHOLES



REV	DESCRIPTION			BY	CHK	APP	DATE
	Scale @ A3 1:2500	Drawn Date PP 18.05.16	Checked Date LK 18.05.16	Approved Date CBP 18.05.16			
	Project No. A089434-1	Office Type CDFGEO	Drawing No. 2	Revision 00			



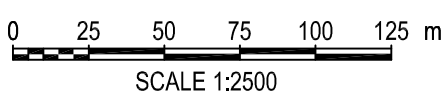
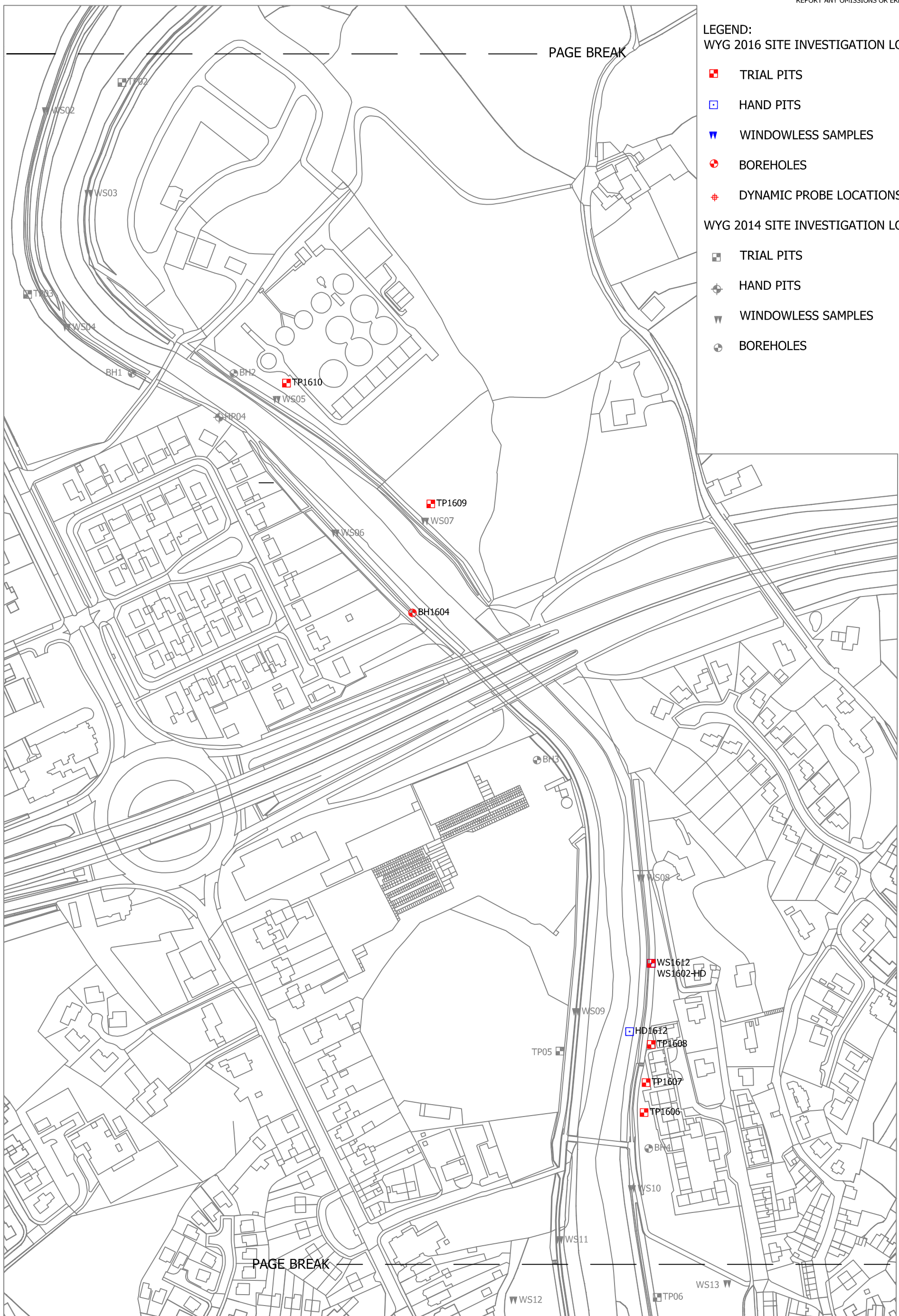
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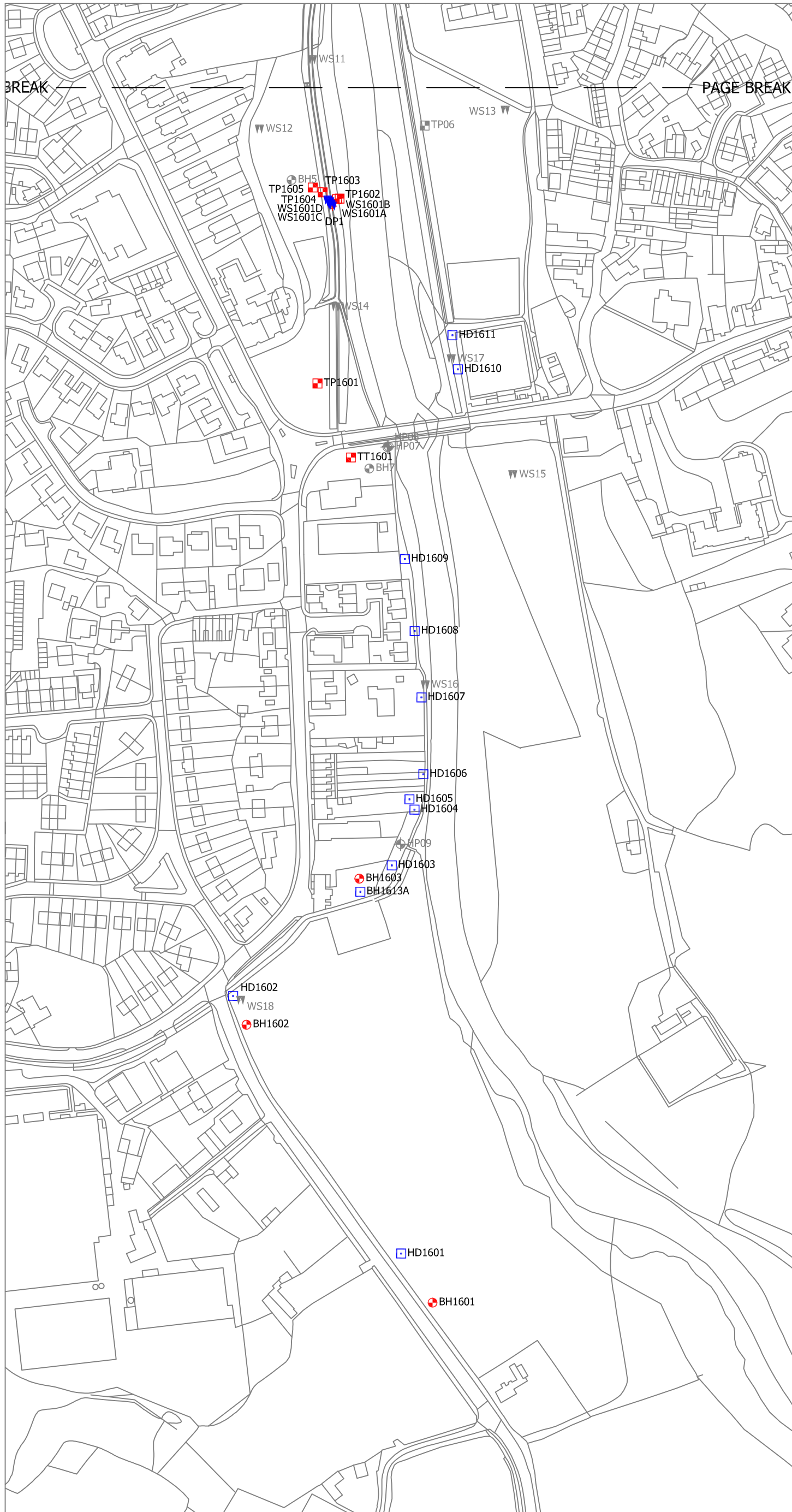
- TRIAL PITS
- HAND PITS
- ▼ WINDOWLESS SAMPLES
- BOREHOLES
- + DYNAMIC PROBE LOCATIONS

WYG 2014 SITE INVESTIGATION LOCATIONS:

- TRIAL PITS
- ⊕ HAND PITS
- ▼ WINDOWLESS SAMPLES
- BOREHOLES



REV	DESCRIPTION	BY	CHK	APP	DATE
Scale @ A3	Drawn Date	Checked Date	Approved Date		
1:2500	PP 18.05.16	LK 18.05.16	CBP 18.05.16		
Project No.	Office	Type	Drawing No.	Revsion	
A089434-1	CDFGEO		2	00	



LEGEND:

WYG 2016 SITE INVESTIGATION LOCATIONS:

- TRIAL PITS
- HAND PITS
- ▼ WINDOWLESS SAMPLES
- BOREHOLES
- + DYNAMIC PROBE LOCATIONS

WYG 2014 SITE INVESTIGATION LOCATIONS:

- TRIAL PITS
- HAND PITS
- ▼ WINDOWLESS SAMPLES
- BOREHOLES

0 25 50 75 100 125 m

SCALE 1:2500

5th FLOOR, LONGCROSS COURT
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Client:
NATURAL ENGLAND WALES

Project:
ST ASAPH FRMS

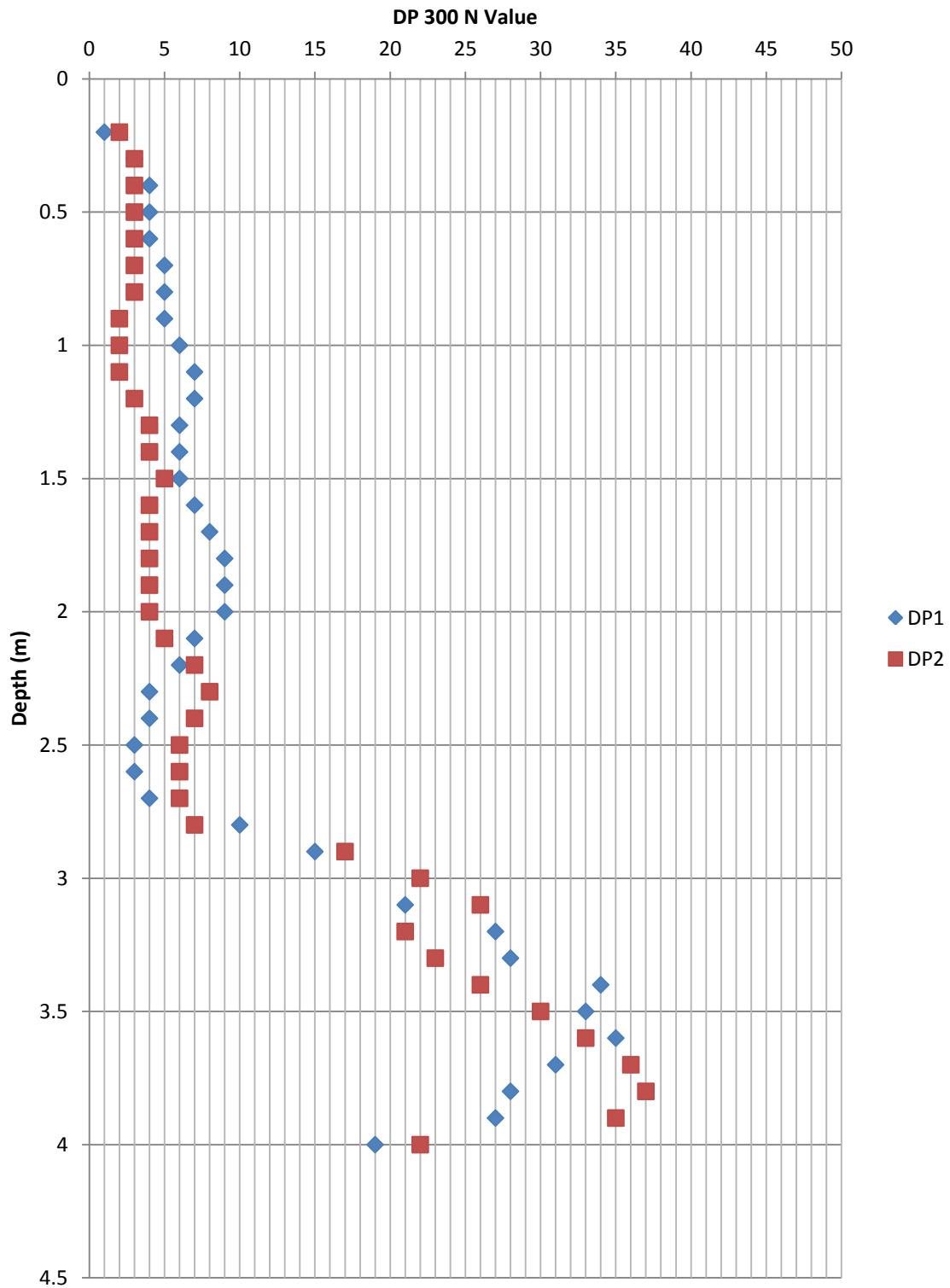
Drawing Title:
**SITE INVESTIGATION
LAYOUT PLAN
SHEET 3 OF 3**

REV	DESCRIPTION	BY	CHK	APP	DATE
Scale @ A3 1:2500	Drawn Date PP 18.05.16	Checked Date LK 18.05.16	Approved Date CBP 18.05.16		
Project No. A089434-1	Office Type CDFGEO	Drawing No. 2	Revision 00		



Figure 3 – SPT N values vs. Depth

DP 300 N Values vs Depth Plot



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Longcross Court, Newport Rd, Cardiff, CF24 0AD

Tel: 02920 892200

Fax: 02920 455321



Environmental Consultancy

Project

**St Asaph FRMS
Additional GI**

Client

NRW

Drawing Title

**DP300 vs
DEPTH**

Drawing No.

FIGURE 3



Appendices



Appendix A – Report Conditions



APPENDIX A - REPORT CONDITIONS GROUND INVESTIGATION

This report is produced solely for the benefit of Natural Resources Wales and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categorical assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYG. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.



Appendix B – Exploratory Hole Logs



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303540.40 Northing: 373713.20
 Level: 16.57mAOD Depth: 7.50m
 Logger: JB Type: CP
 Inclination: 90°

Status
PRELIM

Borehole Number
BH1601

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				Scale:		
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth (m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	1:50
0.00	1.20	Inspection Pit Cable Percussion	Hand Excavated Dando 2000	C Jobson C Jobson	1.20	150	6.00	150	21/03	17:00	7.50	6.00	None	LK	
1.20	7.50				7.50	150								Approved By:	21/03/2016
														Start Date:	21/03/2016
														Finish Date:	21/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Soft brown silty sandy very gravelly CLAY with occasional subrounded sandstone cobbles. Gravel of fine to coarse subangular to subrounded sandstone. (TOPSOIL).		0.00				0.00 - 0.70	D1 B2	
Light brown grey clayey sandy fine to coarse subrounded to rounded sandstone GRAVEL. (FLUVIO GLACIAL DEPOSITS).		0.70	15.87			0.70 - 1.20	D3 B4	
		1.20 - 1.65				1.20 - 1.70	D5 B6	SPT(S) 1.20m, N=22 (4,5,5,6,5,6)
		1.70					D7	
		2.00 - 2.45				2.00 - 2.50	D8 B9	SPT(S) 2.00m, N=22 (3,5,6,5,5,6)
Stiff light brown sandy very gravelly CLAY with occasional sand lenses. Gravel of fine to coarse subrounded to rounded sandstone. (GLACIAL TILL).		3.40	13.17			2.50	D10	
		3.00 - 3.50				2.70	EW10	
		3.50				3.00 - 3.50	B12	SPT(S) 3.00m, N=11 (1,2,3,3,3)
		4.00 - 4.45				4.50	D15 B16	Ublows=150 Recovery=78%
		4.50 - 5.00				5.00 - 5.45	D17 B18	SPT(S) 5.00m, N=22 (3,4,4,5,6,7)
From 5.00 to 5.50m bgl clay becoming soft.					5.50	D19		
From 6.50 to 7.00m bgl clay becoming firm.					6.00 - 6.45	U20	Ublows=150 Recovery=100%	
					6.50 - 7.00	D21 B22		
					7.00 - 7.45	D23	SPT(S) 7.00m, N=28 (4,6,7,6,7,8)	
EOH at 7.50m - Achieved target depth.		7.50	9.07					

Observations / Remarks	Chiselling			Water Added		Hammer Information	
	From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
	1. No visual or olfactory evidence of contamination encountered. 2. Upon completion borehole backfilled with arisings and bentonite.						JB.14
	Groundwater					Project Number	
	Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	
	2.70	-	3	20	2.60	A089434-1	



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303427.73 Northing: 373881.48
 Level: 15.14mAOD Depth: 7.50m
 Logger: LK Type: CP
 Inclination: 90°

Status
PRELIM

Borehole Number
BH1602
 Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	1:50
0.00	1.20	Inspection Pit Cable Percussion	Hand Excavated Dando 2000	C Jobson C Jobson	1.20	150	1.20	150	15/03	17:00	1.20	-	None	LK	
1.20	7.50				7.50	150	6.00	150	16/03	17:00	7.50	6.00	None	Approved By:	15/03/2016
														Start Date:	15/03/2016
														Finish Date:	16/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
TOPSOIL: Dark brown slightly sandy slightly gravelly clayey organic SILT with occasional cobbles.		0.30	14.84			0.00 0.00 - 0.30	D1 B2	
Brown clayey sandy fine SILT. (ALLUVIUM).		0.60	14.54			0.30 0.30 - 0.60	D3 B4	
Brown slightly clayey silty sandy GRAVEL with low to moderate cobble content. Gravel is fine to coarse rounded sandstone and mudstone. Sand is fine to coarse grained. (FLUVIO GLACIAL DEPOSITS).		2.90	12.24			0.60 0.60 - 1.70	D5 B6	
Firm to stiff red brown grey slightly sandy slightly gravelly CLAY. Gravel is fine to rounded sandstone and mudstone. (GLACIAL TILL).		5.50	9.64			1.20 - 1.65 1.20 - 1.70	D7 B8	SPT(S) 1.20m, N=20 (6,6/5,4,5,6)
Firm to stiff brown grey CLAY. (GLACIAL DEPOSITS).		7.50	7.64			1.70 1.70	D9 EW10	
EOH at 7.50m - Achieved target depth.						2.00 - 2.45 2.00 - 2.50	D11 B12	SPT(S) 2.00m, N=14 (4,3/3,3,3,5)
						2.50	D13	
						2.90 3.00 - 3.45	D14 U15	Ublows=120 Recovery=78%
						3.50 3.50 - 4.00	D16 B17	HV 5.45m, (p)=120 kPa (r)=n/a kPa
						4.00 - 4.45 4.00 - 4.50	D18 B19	SPT(S) 4.00m, N=22 (2,2/4,5,6,7)
						4.50	D20	
						5.00 - 5.45	U21	Ublows=90 Recovery=100% HV 5.00m, (p)=120 kPa (r)=n/a kPa
						5.50 5.50 - 6.00	D22 B23	HV 5.45m, (p)=120 kPa (r)=n/a kPa
						6.00 - 6.45 6.00 - 6.50	D24 B25	SPT(S) 6.00m, N=30 (3,4/5,7,9,9)
						6.50	D26	
						7.00 - 7.45	U27	Ublows=88 Recovery=89% HV 7.00m, (p)=120 kPa (r)=n/a kPa
						7.50	D28	HV 7.45m, (p)=108 kPa (r)=n/a kPa

Observations / Remarks	Chiselling			Water Added		Hammer Information	
	From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
	1. No visual or olfactory evidence of contamination encountered. 2. Upon completion borehole backfilled with arisings and bentonite.						JB.14
	Groundwater					Project Number	
	Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	
	1.70	-	3	20	1.60	A089434-1	



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303496.06 Northing: 373969.94
 Level: 14.69mAOD Depth: 8.50m
 Logger: LK Type: CP
 Inclination: 90°

Status
PRELIM

Borehole Number
BH1603

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	1:50
0.00	1.20	Inspection Pit	Hand Excavated	C Jobson	1.20	-	4.50	150	14/03	17:00	5.00	4.50	None	LK	
1.20	8.50	Cable Percussion	Dando 2000	C Jobson	8.50	150	7.50	150	15/03	00:00	8.50	7.50	0.6	Approved By:	
														Start Date:	14/03/2016
														Finish Date:	14/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown slightly clayey organic SILT with many roots and rootlets (TOPSOIL). MADE GROUND: Brown clayey silty gravelly SAND. Gravel is fine to coarse subangular to subrounded brick, glass and sandstone.		0.10	14.59			0.00 0.00 - 0.40 0.10 - 0.40	D1 B2 ES1	
Grey brown clayey silty sandy GRAVEL. Gravel is fine to coarse rounded sandstone and siltstone. (ALLUVIUM).		0.40	14.29			0.40 0.40 - 0.60 0.60	D3 B4 D5 B6	
Grey brown silty sandy GRAVEL with low to moderate cobble content. Gravel is fine to coarse rounded sandstone and siltstone. (FLUVIO GLACIAL DEPOSITS). <i>At 0.70 to 3.10m bgl increasing cobble content with depth.</i>		0.70	13.99			1.20 - 1.65 1.20 - 1.70	D7 B8	SPT(S) 1.20m, N=12 (4,3/3,3,3,3)
Stiff red brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium rounded sandstone and siltstone. (GLACIAL TILL).		3.10	11.59			1.70 1.80	D9 EW10	
						2.00 - 2.15 2.00 - 2.50	D11 B12	SPT(S) 2.00m, N=43 (8,8/7,16,11,9)
						2.50	B13	
						3.00 - 3.45 3.00 - 3.50 3.10	D14 B16 D15	SPT(S) 3.00m, N=24 (2,2/4,6,6,8)
						3.50	D17	
						4.00 - 4.45	U18	Ublows=150 Recovery=78% HV 4.00m, (p)=n/a kPa (r)=n/a kPa Too stiff, unable to do HV.
						4.50 4.50 - 5.00	D19 B20	HV 4.45m, (p)=n/a kPa (r)=n/a kPa Too stiff, unable to do HV.
						5.00 - 5.45 5.00 - 5.50	D21 B22	SPT(S) 5.00m, N=32 (4,5/6,8,8,10)
						5.50	D23	
						6.00 - 6.45	U24	Ublows=108 Recovery=100% HV 6.00m, (p)=n/a kPa (r)=n/a kPa Too stiff, unable to do HV.
						6.50 6.50 - 7.00	D25 B26	HV 6.45m, (p)=n/a kPa (r)=n/a kPa Sample twists within lines, unable to take reading.
Stiff brown grey thinly laminated CLAY with occasional fine sand laminae. (GLACIAL DEPOSITS).		6.80	7.89			7.00 - 7.45 7.00 - 7.50	D27 B28	SPT(S) 7.00m, N=29 (3,5/6,6,8,9)
						7.50	D29	
						8.00 - 8.50	B31	
EOH at 8.50m - Achieved target depth.		8.50	6.19					

Observations / Remarks	Chiselling			Water Added		Hammer Information	
	From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
	1. No visual or olfactory evidence of contamination encountered. 2. Hand vane measurement attempted in U100 samples at 4.00m, 4.45m and 6.00m bgl. Samples were too stiff to take readings. 3. Upon completion borehole backfilled with arisings and bentonite.	2.70	3.00	60			JB.14
	Groundwater						Project Number
	Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	A089434-1
	1.80	-	3	20	1.74		
	8.00	-	-	20	0.60		



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303365.30 Northing: 374902.61
 Level: 14.96m AOD Depth: 11.00m
 Logger: LK Type: CP
 Inclination: 90°

Status
PRELIM

Borehole Number
BH1604
 Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale:	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	
0.00	1.20	Inspection Pit Cable Percussion	Hand Excavated Dando 2000	C Jobson C Jobson	1.20	150	8.00	150						LK	
1.20	11.00				11.00	150	10.50	150						Approved By:	
														Start Date:	18/03/2016
														Finish Date:	18/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing			
						Depth (m)	Ref	Tests / Results	
Dark brown clayey gravelly organic SAND with many roots and rootlets (TOPSOIL). MADE GROUND: Stiff red brown sandy gravelly CLAY with large subangular sandstone cobbles. Gravel is fine to coarse subangular to rounded sandstone and mudstone. Sand is fine to medium. (REWORKED GLACIAL TILL).		0.10	14.86			0.00	D1		
						0.00 - 0.10	B2		
						0.10	D3		
						0.10 - 0.50	B4		
						0.50	D5		
						0.50 - 1.20	B6		
						1.20 - 1.65	D7	SPT(S) 1.20m, N=18 (3,1/4,4,4,6)	
						1.20 - 1.70	B8		
						1.70	D9		
						2.00 - 2.50	B12	SPT(S) 2.00m, 50 (11,13/50 for 114mm)	
		2.20	12.76			2.20	D11		
						2.50	D13		
						3.00 - 3.45	D14	SPT(S) 3.00m, N=36 (6,6/9,9,7,11)	
						3.00 - 3.50	B15		
						3.50	D16		
						4.00 - 4.45	D17	SPT(S) 4.00m, N=32 (6,7/7,8,8,9)	
						4.00 - 4.50	B18		
						4.20	EW19		
						4.50	D20		
						5.00 - 5.45	D21	SPT(S) 5.00m, N=16 (6,10/7,3,3,3)	
						5.00 - 5.50	B22		
		5.20	9.76			5.50	D23		
						6.00 - 6.50	B25	SPT(S) 6.00m, N=24 (4,2/3,5,8,8)	
						6.50	D26		
		6.40	8.56			7.00 - 7.45	U27	Ublows=150 Recovery=89% HV 7.00m, (p)=n/a kPa (r)=n/a kPa Too disturbed.	
						7.50	D28	HV 7.45m, (p)=n/a kPa (r)=n/a kPa Very stiff, not possible.	
						7.50 - 8.00	B29		
						8.00 - 8.45	D30	SPT(S) 8.00m, 0 (25 for 147mm/0 for 0mm)	
						8.00 - 8.50	B31		
						8.50	D32		
						9.00 - 9.45	D33	SPT(S) 9.00m, 50 (10,12/50 for 232mm)	
						9.00 - 9.50	B34		
						9.50	D35		
						10.00 - 10.45	D36	SPT(S) 10.00m, 50 (25 for 123mm/50 for 129mm)	
						10.00 - 10.50	B37		

Observations / Remarks	Chiselling			Water Added		Hammer Information		
	From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %	
	1. No visual or olfactory evidence of contamination encountered. 2. Hand vane measurement attempted in U100 samples at 7.00m bgl. Samples were too stiff to take readings. 3. Upon completion borehole backfilled with arisings and bentonite.	1.90	2.20	230			JB.14	78
	3.50	4.00	60					
	7.80	8.00	30					
	Groundwater					Project Number		
	Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks		
	4.20	-	-	20	4.05			
							A089434-1	



Project: FRM
Location: St Asaph
Client: Natural Resources Wales

Location Details

Easting: 303365.30 Northing: 374902.61
 Level: 14.96mAOD Depth: 11.00m
 Logger: LK Type: CP
 Inclination: 90°

Status

PRELIM

Borehole Number

BH1604

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By: LK
0.00	1.20	Inspection Pit	Hand Excavated	C Jobson	1.20	-	8.00	150						Approved By:
1.20	11.00	Cable Percussion	Dando 2000	C Jobson	11.00	150	10.50	150						Start Date: 18/03/2016
														Finish Date: 18/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
EOH at 11.00m - Achieved target depth.	[Pattern]	11.00	3.96			10.50	D38	
						11.00 - 11.45	D39	SPT(S) 11.00m, 50 (25 for 128mm/50 for 181mm)
								11
								12
								13
								14
								15
								16
								17
								18
								19
								20

Observations / Remarks	Chiselling			Water Added		Hammer Information	
	From (m)	To (m)	Time (mins)	From (m)	To (m)	Serial No.	Energy Ratio %
	1. No visual or olfactory evidence of contamination encountered. 2. Hand vane measurement attempted in U100 samples at 7.00m bgl. Samples were too stiff to take readings. 3. Upon completion borehole backfilled with arisings and bentonite.	10.00	10.50	60			JB.14
	Groundwater				Project Number		
	Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	
						A089434-1	

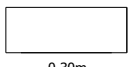


Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303496.69 Northing: 373962.00
 Level: 14.96mAOD Depth: 1.50m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
BH1613A
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10	
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK	Approved By:
 0.30m x 0.20m	Shoring: None Stability: Stable Plant: Hand Excavated					Start Date: 16/03/2016	Finish Date: 16/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Grass cover over brown very silty sandy CLAY with roots and rootlets. (TOPSOIL).								
MADE GROUND: Dark brown black clayey silty sandy fine to coarse subrounded to subangular brick, sandstone, coke, pottery fragments and glass GRAVEL with occasional angular brick cobbles.		0.08	14.88			0.08 - 0.75	B1	
						0.40	ES1	
MADE GROUND: Firm light brown, mottled orange silty sandy very gravelly CLAY. Gravel of fine to coarse subangular to subrounded brick and sandstone. <i>From 0.75 to 1.45m bgl becoming less gravelly with depth.</i>		0.75	14.21			0.75 - 1.45	B2	
						0.90	ES2	
Grey light brown clayey very silty SAND (ALLUVIUM).		1.45	13.51					
EOH at 1.50m - Exploratory hole abandoned		1.50	13.46					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 45

BH1603A - Spoil



Plate 46

BH1603A - Pit

WYG Environment
 5th Floor, Longcross Court
 47 Newport Road
 Cardiff
 CF24 0AD



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 Environmental Consultancy
 Ground Technologies & Investigation

Project :-
St Asaph
Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303521.44 Northing: 373743.18
 Level: 15.51mAOD Depth: 1.25m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1601
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Unstable from 1.00m to 1.25m bgl Plant: Hand Excavated	1.20	1.20	20		Approved By:
						Start Date: 15/03/2016
						Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Short grass over dark brown very clayey silty sandy fine to medium subangular to rounded sandstone GRAVEL with occasional subrounded sandstone cobbles.						0.00 - 0.35 0.00 - 0.35	B1 D1	
Light brown very clayey silty sandy fine to medium subrounded to rounded sandstone GRAVEL with occasional subrounded sandstone cobbles. <i>From 0.35 to 1.00m bgl clay is brown/mottled orange.</i>		0.35	15.16			0.35 - 1.00 0.35 - 1.00	B2 D2	
Light brown and grey clayey silty very sandy fine to medium subrounded to rounded sandstone and river deposit GRAVEL with occasional subrounded river deposit cobbles. (FLUVIO-GLACIAL DEPOSITS). <i>From 1.00 to 1.25m bgl pit walls collapsing.</i>		1.00	14.51			1.00 - 1.25 1.00 - 1.25	B3 D3	1
EOH at 1.25m - Exploratory hole abandoned due to poor stability		1.25	14.26					2

Observations / Remarks

- No visual or olfactory evidence of contamination encountered.
- Upon completion borehole backfilled with arisings.

Project Number
A089434-1



Plate 19

HD1601 - Spoil



Plate 20

HD1601 - Pit

WYG Environment
 5th Floor, Longcross Court
 47 Newport Road
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 Environmental Consultancy
 Ground Technologies & Investigation

Project :-
St Asaph
Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303419.63 Northing: 373898.89
 Level: 15.83mAOD Depth: 1.40m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1602
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Long grass cover over brown very silty sandy CLAY with roots and rootlets. (TOPSOIL).		0.10	15.73			0.10 - 0.35	B1	
MADE GROUND: Reddish, brown very clayey sandy gravelly SILT. Gravel is fine to coarse angular to subangular sandstone, coke and brick.						0.35 - 0.85	B2	
						0.60	ES1	
Light brown and grey very clayey silty gravelly SAND. Gravel of fine to coarse subrounded to rounded sandstone. (FLUVIO-GLACIAL DEPOSITS).		0.85	14.98			0.85 - 1.10	B3	
Grey mottled brown clayey silty very sandy fine to medium subrounded to rounded sandstone and river deposit GRAVEL. (FLUVIO-GLACIAL DEPOSITS).		1.10	14.73			1.10 - 1.40	B4	
EOH at 1.40m - Exploratory hole abandoned due to refusal		1.40	14.43					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 21

HD1602 - Spoil



Plate 22

HD1602 - Pit

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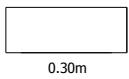

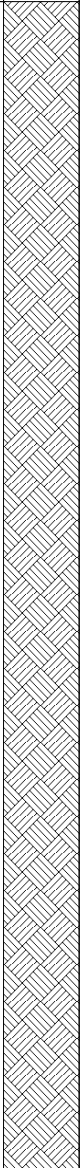
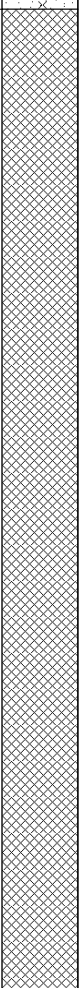
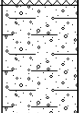

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Project :-
 St Asaph
 Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016

	Project: FRM Location: St Asaph Client: Natural Resources Wales		Location Details Easting: 303515.71 Northing: 373977.97 Level: 16.10mAOD Depth: 1.55m Logger: JB Type: IP				Status PRELIM		Pit Number HD1603 Sheet 1 of 1		
	Hole Information Pit Dimensions:  Orientation: ° Shoring: None Stability: Stable Plant: Hand Excavated			Groundwater Strike (m) Rose To (m) After (mins) Remarks				Scale: 1:10 Checked By: LK Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016			
Strata Description			Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing Depth (m) Ref Tests / Results			
Grass cover over brown very silty sandy CLAY with roots and rootlets and subrounded sandstone boulder. (TOPSOIL).				0.10	16.00			0.10 - 0.70	B1		
MADE GROUND: Stiff reddish brown silty sandy very gravelly CLAY. Gravel of fine to coarse subrounded to subangular sandstone.								0.30	ES1		
								0.70 - 1.40	B2		
Grey very clayey silty sandy fine to coarse subrounded to angular sandstone GRAVEL. (FLUVIO GLACIAL DEPOSITS).				1.40	14.70			1.40 - 1.55	B3		
EOH at 1.55m - Exploratory hole abandoned				1.55	14.55						
Observations / Remarks 1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Only scraped the top of the gravel layer. 4. Upon completion exploratory hole backfilled with arisings.										Project Number A089434-1	

1

2



Plate 23

HD1603 - Spoil



Plate 24

HD1603 - Pit

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Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303529.47 Northing: 374011.74
 Level: 15.91mAOD Depth: 1.55m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1604
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10 Checked By: LK Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	
	Shoring: None Stability: Stable Plant: Hand Excavated					

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Grass cover over brown very silty sandy CLAY with roots and rootlets. (TOPSOIL).								
MADE GROUND: Stiff reddish brown silty sandy very gravelly CLAY. Gravel of fine to coarse subrounded to subangular sandstone and brick.		0.08	15.83			0.10 - 1.00	B1	
						0.50	ES1	
						1.00 - 1.50	B2	
EOH at 1.55m - Exploratory hole abandoned		1.55	14.36					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 25

HD1604 - Spoil



Plate 26

HD1604 - Pit

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Project No.: A089434-1

Date :16th May 2016


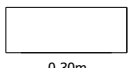

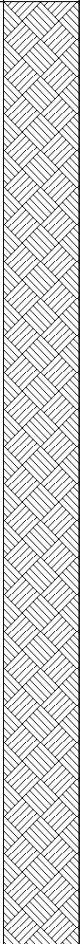
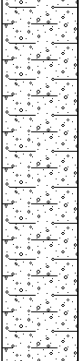
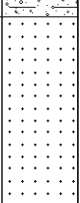
	Project: FRM Location: St Asaph Client: Natural Resources Wales		Location Details Easting: 303526.42 Northing: 374017.97 Level: 15.01mAOD Depth: 1.25m Logger: JB Type: IP				Status PRELIM		Pit Number HD1605 Sheet 1 of 1	
	Hole Information Pit Dimensions:  Orientation: ° Shoring: None Stability: Unstable from 1.00m bgl Plant: Hand Excavated			Groundwater Strike (m) Rose To (m) After (mins) Remarks				Scale: 1:10 Checked By: LK Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016		
Strata Description			Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing Depth (m) Ref Tests / Results		
Black very clayey gravelly SILT. Gravel of fine to coarse subrounded river deposit. <i>From 0.00 to 0.05m bgl quite earthy material.</i>				0.50	14.51			0.00 - 0.50	B1	
Light brown greyish very clayey silty sandy fine to coarse rounded to subrounded sandstone GRAVEL with rare subrounded sandstone cobbles. (FLUVIO GLACIAL DEPOSITS).				1.00	14.01			0.50 - 1.20	B2	
Light brown grey sandy gravelly SANDSTONE COBBLES. Gravel is fine to coarse rounded sandstone. <i>From 1.00m bgl pit walls collapsing.</i> <i>From 1.00m bgl becoming damper.</i> <i>From 1.00m bgl large cobbles at base of hole, very hard to dig.</i>				1.25	13.76					
EOH at 1.25m - Exploratory hole abandoned due to refusal										
Observations / Remarks 1. Groundwater not observed. From 1.00m bgl arisings are damp. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion exploratory hole backfilled with arisings.								Project Number A089434-1		



Plate 27

HD1605 - Spoil



Plate 28

HD1605 - Pit

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Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303534.87 Northing: 374033.17
 Level: 14.55mAOD Depth: 1.55m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1606
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
MADE GROUND: Stiff reddish brown silty sandy very gravelly CLAY. Gravel of fine to coarse subrounded to subangular sandstone, brick, glass and coke.						0.00 - 0.68	B1	
						0.50	ES1	
MADE GROUND: Brown very clayey silty gravelly SAND. Gravel of fine to coarse subrounded to subangular pottery fragments, coke, sandstone and mudstone.		0.68	13.87			0.68 - 1.55	B2	
<i>At 1.40m bgl lead plate discovered.</i>								
EOH at 1.55m - Exploratory hole abandoned		1.55	13.00					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 29

HD1606 - Spoil



Plate 30

HD1606 - Pit

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Date :16th May 2016

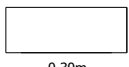


Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303533.70 Northing: 374079.68
 Level: 15.33mAOD Depth: 1.50m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1607
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Lawn turf cover over brown very silty sandy CLAY with roots and rootlets. (TOPSOIL).		0.10	15.23			0.10 - 0.40	B1	
MADE GROUND: Dark brown very clayey sandy gravelly SILT. Gravel of fine to coarse angular to subangular brick and slate with rare brick cobbles.		0.40	14.93			0.30	ES1	
MADE GROUND: Stiff reddish brown silty sandy very gravelly CLAY. Gravel of fine to coarse subrounded to subangular sandstone, brick and slate tile.		1.50	13.83			0.40 - 1.55	B2	
EOH at 1.50m - Exploratory hole abandoned								

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 31 HD1607 - Spoil



Plate 32 HD1607 - Pit

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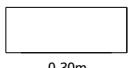

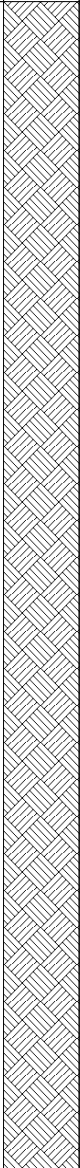
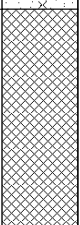
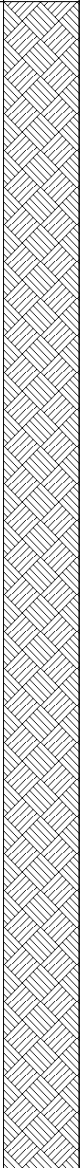
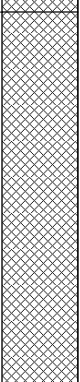
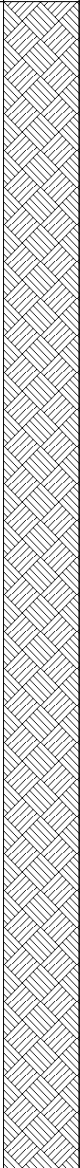
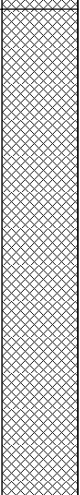
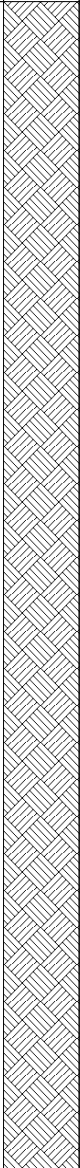
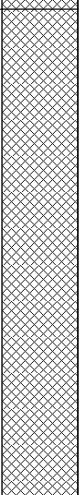
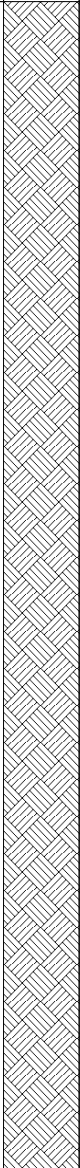
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	Hole Information Pit Dimensions:  Orientation: ° Shoring: None Stability: Stable Plant: Hand Excavated			Groundwater Strike (m) Rose To (m) After (mins) Remarks				Scale: 1:10 Checked By: LK Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016		
Strata Description			Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
Grass cover over brown very silty sandy CLAY with roots and rootlets. (TOPSOIL).				0.10	15.13			0.10 - 0.40	B1	
MADE GROUND: Stiff reddish, brown silty sandy very gravelly CLAY. Gravel of fine to coarse subrounded to subangular sandstone, brick and river deposits. (BUND).				0.40	14.83			0.40 - 0.90	B2	
MADE GROUND: Black greyish silty very sandy fine to coarse angular to subangular brick, ash, coke and slate tile GRAVEL with frequent angular brick cobbles.				0.90	14.33			0.60	ES1	
MADE GROUND: Stiff brown mottled orange silty sandy very gravelly CLAY. Gravel of fine to coarse angular to subrounded brick, glass, tile fragments, coke and slate tile.								0.90 - 1.55	B3	
At 1.35m bgl tin paint can be discovered.								1.20	ES2	
EOH at 1.55m - Exploratory hole abandoned				1.55	13.68					
Observations / Remarks 1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion exploratory hole backfilled with arisings.										Project Number A089434-1



Plate 33

HD1608 - Spoil



Plate 34

HD1608 - Pit

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Date :16th May 2016

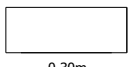


Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303523.63 Northing: 374163.44
 Level: 15.18mAOD Depth: 1.45m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1609
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Shrub and wood chipping cover over brown very silty sandy CLAY with roots and rootlets. (TOPSOIL).								
MADE GROUND: Stiff reddish brown silty sandy very gravelly CLAY. Gravel of fine to coarse subangular to subrounded sandstone, and brick.		0.20	14.98			0.20 - 0.50	B1	
MADE GROUND: Black dark grey clayey silty sandy fine to coarse subangular to subrounded sandstone, slate tile, pottery fragments, coke and river deposit GRAVEL with rare subrounded sandstone and brick cobbles.		0.50	14.68			0.50 - 1.45	B2	
EOH at 1.45m - Exploratory hole abandoned		1.45	13.73					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
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Plate 35

HD1609 - Spoil



Plate 36

HD1609 - Pit

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Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303555.78 Northing: 374278.37
 Level: 14.42mAOD Depth: 1.10m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1610
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By:
						Start Date: 15/03/2016
						Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing	
						Depth (m)	Ref
MADE GROUND: Firm reddish brown silty sandy very gravelly CLAY. Gravel of fine to coarse subangular to subrounded sandstone.						0.00 - 0.70 0.00 - 0.70	B1 D1
MADE GROUND: Black grey slightly clayey sandy gravelly SILT. Gravel of fine to coarse angular to subangular brick, ash and coke. <i>From 0.70 to 0.75m bgl limestone boulder or slab.</i>		0.70	13.72				
MADE GROUND: Dark brown reddish very clayey sandy gravelly SILT. Gravel of fine to coarse angular to subrounded brick, pottery fragments, flint and sandstone.		0.80	13.62			0.80 - 1.10 0.80 - 1.10	B2 D2
EOH at 1.10m - Exploratory hole abandoned due to refusal		1.10	13.32				

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
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Plate 37

HD1610 - Spoil



Plate 38

HD1610 - Pit

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Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303552.45 Northing: 374299.00
 Level: 14.41mAOD Depth: 1.50m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1611
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By: Start Date: 15/03/2016 Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
MADE GROUND: Brown very clayey sandy gravelly SILT. Gravel of fine to coarse subrounded to rounded sandstone.						0.00 - 0.70 0.70 - 0.80	B1 D1	
MADE GROUND: Dark brown very clayey silty gravelly SAND with occasional angular brick cobbles. Gravel of fine to coarse angular to subrounded sandstone and brick.		0.70	13.71			0.70 - 0.80 0.70 - 0.80	B2 D2	
MADE GROUND: Dark brown reddish very clayey sandy gravelly SILT. Gravel of fine to coarse angular to subrounded brick, pottery fragments, flint and sandstone. <i>From 0.85 to 0.90m bgl band of clay.</i>		0.80	13.61			0.80 - 1.50 0.80 - 1.50	B3 D3	
						1.00	ES1	1
EOH at 1.50m - Exploratory hole abandoned		1.50	12.91					2

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1

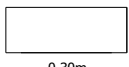


Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303516.42 Northing: 374611.08
 Level: 12.14mAOD Depth: 1.50m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1612
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None	1.50	1.50	20		Approved By:
	Stability: Stable					Start Date: 15/03/2016
	Plant: Hand Excavated					Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Grass and twigs over very silty CLAY with roots and rootlets.						0.00 - 0.03 0.00 - 0.60	B1 D1	
MADE GROUND: Brown very clayey sandy slightly gravelly SILT with roots and rootlets. Gravel of fine to coarse subangular to subrounded sandstone.		0.10	12.04					
MADE GROUND: Brown very clayey sandy slightly gravelly SILT with rare subrounded sandstone cobbles. Gravel of fine to coarse subrounded to subangular sandstone, brick, quartz and pottery fragments. <i>From 0.60 to 1.30m bgl frequent wood chippings and roots.</i>		0.60	11.54			0.60 - 1.30 0.60 - 1.30	B2 D2	
Very soft grey, brown sandy very silty gravelly CLAY. Gravel of fine to medium rounded to subrounded sandstone. (ALLUVIUM). <i>From 1.30 to 1.50 bgl free wood chipping and roots.</i>		1.30	10.84			1.30 1.30 - 1.50	B3 D3	
EOH at 1.50m - Exploratory hole abandoned		1.50	10.64	▼				

Observations / Remarks

- No visual or olfactory evidence of contamination encountered.
- Upon completion borehole backfilled with arisings.

Project Number
A089434-1



Plate 39

HD1612 - Spoil



Plate 40

HD1612 - Pit

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Project :-
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 Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303212.43 Northing: 376029.86
 Level: 8.12mAOD Depth: 1.30m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
HD1613
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable Plant: Hand Excavated					Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown very clayey sandy SILT with rare rounded sandstone cobbles. <i>From 0.38 to 0.40m bgl lens of reish clay.</i>		0.40	7.72			0.00 - 0.35	B1	
Brown very clayey sandy gravelly SILT with occasional subrounded sandstone cobbles. Gravel of fine to coarse subrounded to rounded sandstone.		0.40	7.72			0.40 - 1.10	B2	
Grey brown clayey silty very sandy fine to coarse rounded to subrounded sandstone GRAVEL with occasional subrounded sandstone cobbles. (FLUVIO-GLACIAL DEPOSITS). <i>From 1.15 to 1.30m bgl very cobbley at the base of hole, too hard to go further.</i>		1.15	6.97			1.15 - 1.30	B3	
EOH at 1.30m - Exploratory hole abandoned due to difficult digging / refusal		1.30	6.82					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 41

HD1613 - Spoil



Plate 42

HD1613 - Pit

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Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016



Plate 46

TP1601 - Spoil



Plate 47

TP1601 - Pit

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Project No.: A089434-1

Date : 17th May 2016

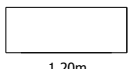








Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303484.14 Northing: 374381.77
 Level: 13.85mAOD Depth: 1.20m
 Logger: LK Type: TP

Status
PRELIM

Pit Number
TP1602
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Unstable from 0.60 to 1.20m bgl. Plant: 3t Tracked Excavator					

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown slightly clayey organic SILT with many roots and rootlets (TOPSOIL). MADE GROUND: Brown sandy GRAVEL with occasional brick and glass fragments. Gravel is fine to coarse rounded sandstone and mudstone. (REWORKED FLUVIO GLACIAL DEPOSITS).		0.06	13.79					
Brown sandy GRAVEL. Gravel is fine to coarse rounded sandstone and mudstone. (POSSIBLE FLUVIO GLACIAL DEPOSITS).		0.60	13.25					
Brown very sandy gravelly rounded COBBLES. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).		1.00	12.85					1
EOH at 1.20m - Achieved target depth.		1.20	12.65					2
								3
								4
								5

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 48

TP1602 - Spoil



Plate 49

TP1602 - Pit

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Project No.: A089434-1

Date : 17th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303482.57 Northing: 374381.54
 Level: 13.89mAOD Depth: 2.10m
 Logger: LK Type: TP

Status
PRELIM

Pit Number
TP1603
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable. Plant: 3t Tracked Excavator					Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
MADE GROUND: Brown slightly clayey organic SILT with many roots and rootlets (TOPSOIL). MADE GROUND: Firm brown CLAY with rare subangular fine to coarse gravel of mudstone.		0.10	13.79					
MADE GROUND: Stiff red brown sandy slightly gravelly CLAY. Gravel is coarse subangular sandstone. (REWORKED GLACIAL TILL).		0.55	13.34					
Brown slightly clayey slightly silty sandy GRAVEL with moderate rounded to high cobble content. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).		0.90	12.99			1.20 - 1.50	B1	
EOH at 2.10m - Achieved target depth.		2.10	11.79					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 50

TP1603 - Spoil



Plate 51

TP1603 - Pit

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Date : 17th May 2016



Plate 52

TP1604 - Spoil



Plate 53

TP1604 - Pit

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Date : 17th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303467.87 Northing: 374388.48
 Level: 13.26mAOD Depth: 1.40m
 Logger: LK Type: TP

Status
PRELIM

Pit Number
TP1605
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Unstable from 0.70 to 1.40m bgl. Plant: 3t Tracked Excavator					

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). MADE GROUND: Dark brown black gravelly silty SAND. Gravel is medium to coarse angular to subrounded glass, coal and mudstone.		0.15	13.11			0.30 - 0.40	B1	
Brown grey slightly clayey slightly silty sandy GRAVEL with moderate cobble content. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).		0.70	12.56			1.10 - 1.20	B2	
						1.20 - 1.30	B3	
EOH at 1.40m - Achieved target depth.		1.40	11.86					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 54

TP1605 - Spoil



Plate 55

TP1605 - Pit

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Date : 17th May 2016


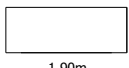

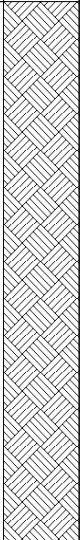
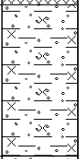
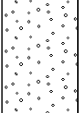
	Project: FRM Location: St Asaph Client: Natural Resources Wales	Location Details Easting: 303526.50 Northing: 374554.70 Level: 13.38mAOD Depth: 1.80m Logger: LK Type: TP				Status PRELIM	Pit Number TP1606 Sheet 1 of 1		
	Hole Information Pit Dimensions:  Orientation: ° Shoring: None Stability: Stable. Plant: 3t Tracked Excavator	Groundwater Strike (m) Rose To (m) After (mins) Remarks				Scale: 1:25 Checked By: LK Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016			
Strata Description		Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing Depth (m) Ref Tests / Results		
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). MADE GROUND: Brown slightly gravelly clayey SILT. Gravel is fine to coarse subangular to subrounded brick glass, stone, pottery. (SUBSOIL). MADE GROUND: Light brown mottled black sandy GRAVEL with moderate cobble content of entire bricks and demolition rubble with pockets (up to 20-30cm) of sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone, sandstone, brick, pottery, glass and metal fragments.			0.10 0.30	13.28 13.08			0.30 - 0.80 0.90 - 1.00	B1 B2	
Soft to firm brown slightly gravelly silty very sandy CLAY. Gravel is fine to coarse rounded sandstone. (ALLUVIUM).			0.90	12.48					1
Brown sandy GRAVEL with moderate cobble content. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).			1.40	11.98					
EOH at 1.80m - Achieved target depth.			1.80	11.58					2
									3
									4
									5
Observations / Remarks 1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion exploratory hole backfilled with arisings.							Project Number A089434-1		



Plate 56

TP1606 - Spoil



Plate 57

TP1606 - Pit

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Project No.: A089434-1

Date : 17th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303527.91 Northing: 374575.56
 Level: 12.82mAOD Depth: 1.55m
 Logger: LK Type: TP

Status
PRELIM

Pit Number
TP1607
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Unstable from 0.90 to 1.55m bgl. Plant: 3t Tracked Excavator					Approved By:
						Finish Date: 16/03/2015

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). MADE GROUND: Grey brown clayey silty sandy GRAVEL. Gravel is fine to coarse angular to rounded brick, sandstone and mudstone.		0.15	12.67			0.40 - 0.70	B1	
Stiff dark brown CLAY with black inclusions. (ALLUVIUM). Brown silty sandy GRAVEL of fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).		0.70 0.75	12.12 12.07			0.75 - 0.85 0.90 - 1.20	B2 B3	
Grey slightly sandy GRAVEL with moderate cobble content. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).		1.20	11.62			1.30 - 1.55	B4	
EOH at 1.55m - Achieved target depth.		1.55	11.27					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 58

TP1607 - Spoil



Plate 59

TP1607 - Pit

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Client: Natural Resources Wales

Project No.: A089434-1

Date : 17th May 2016


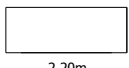


	Project: FRM Location: St Asaph Client: Natural Resources Wales		Location Details Easting: 303531.53 Northing: 374602.09 Level: 12.79mAOD Depth: 1.60m Logger: LK Type: TP				Status PRELIM		Pit Number TP1608 Sheet 1 of 1	
	Hole Information Pit Dimensions:  Orientation: ° Shoring: None Stability: Stable. Plant: 3t Tracked Excavator			Groundwater Strike (m) Rose To (m) After (mins) Remarks				Scale: 1:25 Checked By: LK Approved By: Start Date: 16/03/2016 Finish Date: 16/03/2016		
Strata Description			Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). MADE GROUND: Brown clayey silty sandy GRAVEL with moderate cobble content of brick and metal fragments. Gravel is fine to coarse subangular to subrounded glass, pottery, sandstone and mudstone.				0.15	12.64			0.20 - 0.30	B2	HV 1.00m, (p)=76 kPa (r)=n/a kPa
<i>At 0.65m bgl drain, no outlet on other side of pit, possibl rubbish?</i> MADE GROUND: Orange brown sandy GRAVEL with low cobble content. Gravel is fine to medium subangular.								0.30 - 0.50	B3	
MADE GROUND: Grey brown mottled black slightly gravelly very sandy CLAY with low cobble content. Gravel is fine to medium subangular.			0.70	12.09			0.60 - 0.70	B3		
MADE GROUND: Grey brown mottled black slightly gravelly very sandy CLAY with low cobble content. Gravel is fine to medium subangular.			0.90	11.89			0.95 - 1.10	B4		
Brown slightly gravelly very sandy SILT. Gravel is fine to medium rounded sandstone. (ALLUVIUM). <i>At 1.25 to 1.40m bgl pea gravel, likely surrounding service, pit extended to east (sewer).</i>			1.10	11.69			1.10 - 1.45	B5		
Grey sandy GRAVEL with low cobble content. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS). EOH at 1.60m - Achieved target depth.			1.45	11.34						
			1.60	11.19						
Observations / Remarks 1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Pea gravel encountered at western side of pit between 1.25m and 1.40m bgl. Suspected to surround service (sewer). Pit extended to east to avoid service. 4. Upon completion exploratory hole backfilled with arisings.									Project Number A089434-1	



Plate 60

TP1608 - Spoil 1

Plate 61

TP1608 - Spoil 2

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Project No.: A089434-1

Date : 17th May 2016



Plate 62

TP1608 - Pit northern side



Plate 63

TP1608 - Pit southern side

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Plate 64

TP1608 - Pit eastern side



Plate 65

TP1608 - Pit western side

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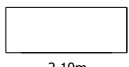


Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303378.05 Northing: 374978.50
 Level: 11.42mAOD Depth: 0.80m
 Logger: LK Type: TP

Status
PRELIM

Pit Number
TP1609
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable. Plant: 3t Tracked Excavator					Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). Brown grey silty sandy GRAVEL. Gravel is fine to coarse rounded sandstone and mudstone. (ALLUVIUM).		0.10	11.32			0.30 - 0.40	B1	
Soft brown grey slightly gravelly very silty CLAY. (ALLUVIUM).		0.40	11.02					
Brown grey sandy GRAVEL with moderate cobble content. Gravel is fine to coarse rounded sandstone and mudstone. (FLUVIO GLACIAL DEPOSITS).		0.50	10.92			0.60 - 0.70	B2	
EOH at 0.80m - Achieved target depth.		0.80	10.62					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 66

TP1609 - Spoil



Plate 67

TP1609 - Pit

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Project No.: A089434-1

Date : 17th May 2016

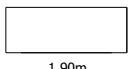



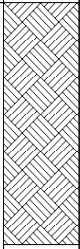
Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303277.60 Northing: 375062.61
 Level: Depth: 0.80m
 Logger: LK Type: TP

Status
PRELIM

Pit Number
TP1610
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Stable. Plant: 3t Tracked Excavator					Approved By: Start Date: 17/03/2016 Finish Date: 17/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). Brown grey silty sandy GRAVEL. Gravel is fine to coarse rounded sandstone and mudstone. (ALLUVIUM).		0.10				0.40	B1	HV 0.25m, (p)=91 kPa (r)=n/a kPa
		0.60				0.70 - 0.80	B2	
EOH at 0.80m - Achieved target depth.		0.80						

Observations / Remarks 1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion exploratory hole backfilled with arisings.	Project Number
	A089434-1



Plate 68

TP1610 - Spoil



Plate 69

TP1610 - Pit

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Project :-
St Asaph
Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 17th May 2016


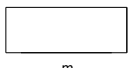
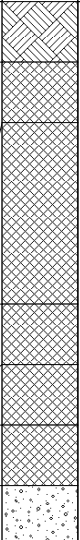
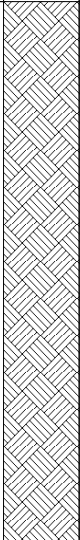
	Project: FRM Location: St Asaph Client: Natural Resources Wales	Location Details Easting: 303497.00 Northing: 374225.00 Level: Depth: 1.80m Logger: JB Type: TP				Status PRELIM	Pit Number TT1601 Sheet 1 of 1		
	Hole Information Pit Dimensions:  m Orientation: ° Shoring: None Stability: Stable. Plant: 8t Tracked Excavator		Groundwater Strike (m) Rose To (m) After (mins) Remarks				Scale: 1:25 Checked By: LK Approved By: Start Date: 21/03/2016 Finish Date: 21/03/2016		
Strata Description		Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing Depth (m) Ref Tests / Results		
TOPSOIL: Grass cover over soft brown very silty sandy CLAY with rare fine to coarse subangular sandstone gravel.			0.20				0.20 - 0.40	B1	
MADE GROUND: Grey, white, light brown clayey silty very sandy fine to coarse subrounded to angular brick, sandstone, pottery and river deposit GRAVEL with occasional subrounded to subangular sandstone cobbles and boulders. <i>At 0.20m bgl possible drainage channel, black in colour and angled towards already open historic trial pit (see photos).</i>			0.40				0.40 - 1.00	B2	
MADE GROUND: Stiff red, light brown very gravelly CLAY. Gravel of fine to coarse subrounded to angular glass, brick, river deposits and pottery.			1.00				1.00 - 1.20	B3	
MADE GROUND: Firm dark brown, black very silty gravelly CLAY. Gravel of fine to coarse subrounded to angular glass, brick, river deposits and pottery. (mid 19thC fill).			1.20				1.20 - 1.40	B4	
MADE GROUND: Stiff red, light brown very gravelly CLAY. Gravel of fine to coarse subrounded to angular glass, brick, river deposits and pottery.			1.40				1.40 - 1.60	B5	
MADE GROUND: Brown, grey very clayey silty sandy rounded to subangular fine to coarse river deposit, coke and brick GRAVEL.			1.60				1.60 - 1.80	B6	
Grey, light brown very sandy subrounded to subrounded sandstone and river deposit GRAVEL. (FLUVIO GLACIAL DEPOSITS).			1.80						
EOH at 1.80m - Achieved target depth.									
Observations / Remarks 1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Drainage channel encountered at 0.20m bgl (see sketch). 4. Upon completion exploratory hole backfilled with arisings. 5. Trial trench undertaken for archaeological purposes and supervised by Clwyd Powys Archaeological Trust.							Project Number A089434-1		



Plate 72

TT1601 - Spoil 1



Plate 73

TT1601 - Spoil 2

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Project :-
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Client: Natural Resources Wales

Project No.: A089434-1

Date : 17th May 2016



Plate 74

TT1601 - Spoil 3



Plate 75

TT1601 - Pit western side

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Client: Natural Resources Wales

Project No.: A089434-1

Date : 17th May 2016



Plate 76

TT1601 - Pit eastern side



Plate 77

TT1601 - Pit northern side

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Project :-
St Asaph
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Client: Natural Resources Wales

Project No.: A089434-1

Date : 17th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303479.70 Northing: 374377.16
 Level: 15.16mAOD Depth: 4.00m
 Logger: LK Type: WS
 Inclination: 90°

Status
PRELIM

Borehole Number
WS1601A

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater					Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: LK
0.00	4.00	Window Sampler	Tracked Rig	J.Bibby											Approved By:
															Start Date: 15/03/2016
															Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
TOPSOIL: Soft to firm brown silty CLAY with many roots and rootlets. MADE GROUND: Firm brown CLAY with rare subangular fine to coarse gravel of mudstone.		0.15	15.01			0.15 - 0.67	B1	
						0.30 - 0.40	D1	
MADE GROUND: Firm brown mottled black sandy gravelly SILT. Gravel is fine to coarse subangular to subrounded brick, coal and mudstone.		0.67	14.49			0.67 - 0.90	ES1	
MADE GROUND: Stiff red brown sandy slightly gravelly CLAY. Gravel is coarse subangular sandstone.		0.90	14.26			0.90 - 1.96	B2	
MADE GROUND: Dark brown black gravelly silty SAND. Gravel is medium to coarse angular to subrounded glass, coal and mudstone.		1.96	13.20			1.96 - 2.80	ES2	
Brown grey sandy GRAVEL. Gravel is fine to coarse subangular to rounded sandstone. (FLUVIO GLACIAL DEPOSITS).		2.80	12.36			2.80 - 4.00	B3	
EOH at 4.00m - Achieved target depth.		4.00	11.16					

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion window sample backfilled with bentonite.	0.00	1.00	90	100			
	1.00	2.00	72	100			
	2.00	3.00	72	40			
	3.00	4.00	60	70			
							Project Number
							A089434-1



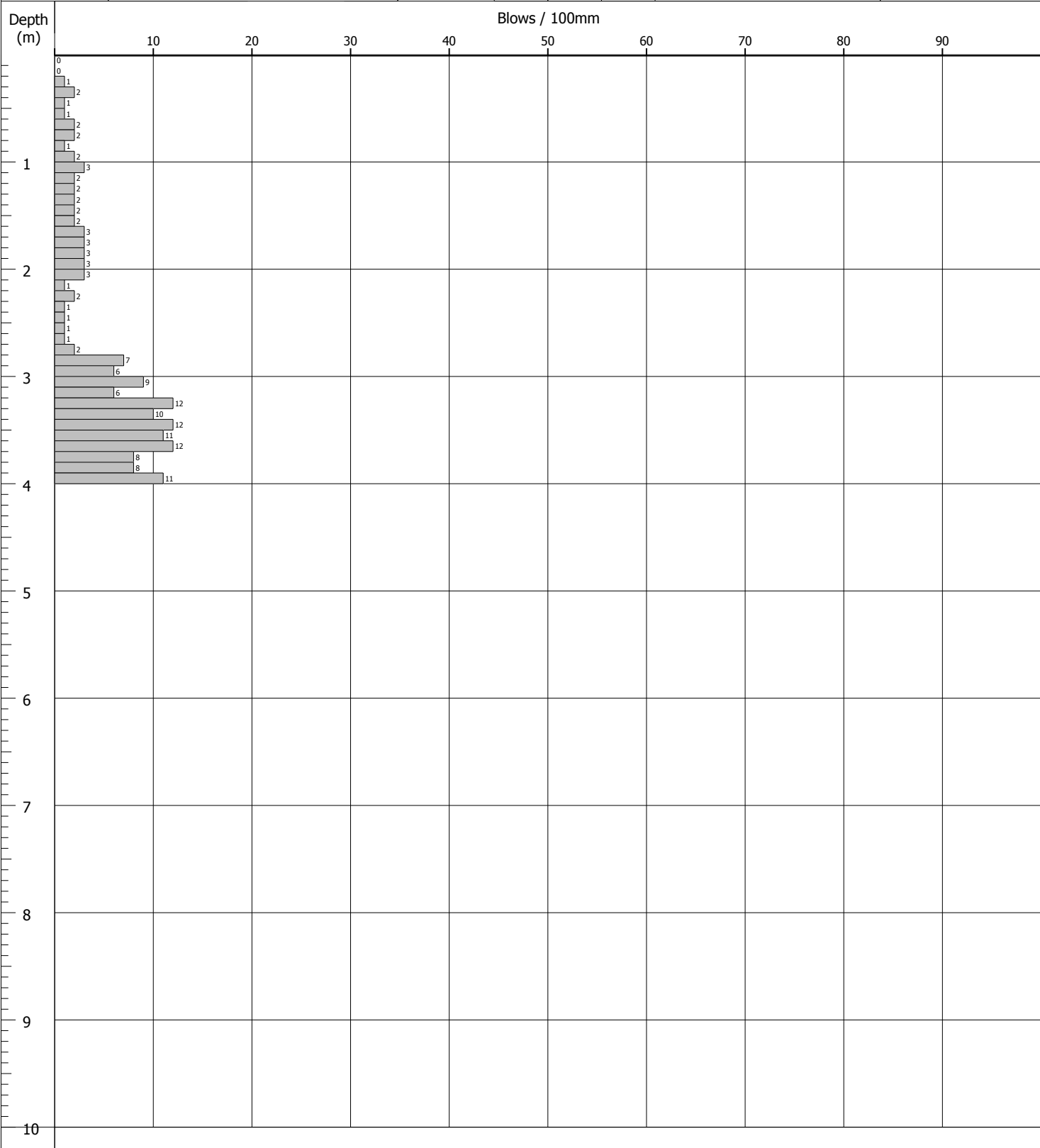
Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303479.70 Northing: 374377.16
 Level: 15.16mAOD Depth: 4.00m
 Logger: LK Type: DP

Status
PRELIM

Probe Number
DP1
 Sheet 1 of 1

	Hole Information			Groundwater				Scale: 1:50
	Probe Information		Termination	Strike (m)	Rises to (m)	Time (min)	Remarks	Checked By: LK
	Fall Height: 750mm	Cone Base Diameter: 50mm	Achieved target depth.					Approved By:
	Hammer Weight: 64.00kg	Rod Diameter: 35mm						Start Date: 15/03/2016
	Probe Type: DPSH-B							Finish Date: 15/03/2016



Observations / Remarks	Hammer Information	
	Hammer Serial No.	Energy Ratio %
	Project Number A089434-1	



Plate 1 WS1601A undisturbed



Plate 2 WS1601A disturbed

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Project :-
St Asaph
Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303478.97 Northing: 374378.32
 Level: 15.16mAOD Depth: 3.40m
 Logger: LK Type: WS
 Inclination: 90°

Status
PRELIM

Borehole Number
WS1601B

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater					Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: LK
0.00	3.40	Window Sampler	Tracked Rig	J.Bibby											Approved By:
															Start Date: 15/03/2016
															Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Tarmacadam.		0.02	15.14					
Tarmacadam.		0.07	15.09					
MADE GROUND: Grey sandy GRAVEL fine to medium angular. (SUBBASE).		0.27	14.89			0.27 - 0.70	B1	HV 0.40m, (p)=62 kPa (r)=n/a kPa Core broke. HV 0.50m, (p)=44 kPa (r)=n/a kPa (only 2/3 in soil gravel), core.
MADE GROUND: Firm brown CLAY with rare subangular fine to coarse gravel of mudstone.						0.34 - 2.00	B2	
MADE GROUND: Firm brown mottled black sandy gravelly SILT. Gravel is fine to coarse subangular to subrounded brick, coal and mudstone.		0.70	14.46			0.70 - 0.94	B1	
MADE GROUND: Stiff red brown sandy slightly gravelly CLAY. Gravel is coarse subangular sandstone.		0.94	14.22					
NO RECOVERY.		2.00	13.16					
MADE GROUND: Dark brown black gravelly silty SAND. Gravel is medium to coarse angular to subrounded glass, coal and mudstone.		2.40	12.76			2.40 - 3.40	B2	
Brown grey sandy GRAVEL. Gravel is fine to coarse subangular to rounded sandstone. (FLUVIO GLACIAL DEPOSITS).		3.00	12.16			3.00 - 3.40	B3	
EOH at 3.40m - Achieved target depth.		3.40	11.76					

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion window sample backfilled with bentonite.	0.00	1.00	80	100			
	1.00	2.00	80	90			
	2.00	3.00	76	60			
	3.00	3.40	62	100			
						Project Number	
						A089434-1	



Plate 3 WS1601B undisturbed



Plate 4 WS1601B disturbed

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Project :-
St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303478.13 Northing: 374379.77
 Level: 15.18m AOD Depth: 3.20m
 Logger: LK Type: WS
 Inclination: 90°

Status
PRELIM

Borehole Number
WS1601C

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater				Scale:		
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By:
0.00	3.20	Window Sampler	Tracked Rig	J.Bibby					2.70	-	-	2.95	20		LK
														Approved By:	15/03/2016
														Finish Date:	15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Tarmacadam.		0.05	15.13			0.15 - 1.00	B1	
MADE GROUND: Grey sandy GRAVEL fine to medium angular. (SUBBASE). MADE GROUND: Firm brown CLAY with rare subangular fine to coarse gravel of mudstone.		0.15	15.03					HV 0.60m, (p)=74 kPa (r)=n/a kPa Sample broke. HV 0.80m, (p)=52 kPa (r)=n/a kPa Sample broke.
MADE GROUND: Stiff red brown sandy slightly gravelly CLAY. Gravel is coarse subangular sandstone.		1.00	14.18			1.00 - 2.00	B2	HV 1.50m, (p)=54 kPa (r)=n/a kPa Sample broke, 1/3 of vane in.
MADE GROUND: Grey brown gravelly silty SAND with fragments of china.		2.05	13.13					
MADE GROUND: Dark brown black gravelly silty SAND. Gravel is medium to coarse angular to subrounded glass, coal and mudstone. <i>Between 2.70 and 2.95m bgl sample is wet.</i>		2.55	12.63			2.50 - 2.55 2.55 - 3.00	ES1 B2	
Brown sandy GRAVEL. Gravel is fine to coarse subangular to rounded sandstone. (FLUVIO GLACIAL DEPOSITS). EOH at 3.20m - Achieved target depth.		3.00	12.18			3.00 - 3.20	B3	
		3.20	11.98					

Observations / Remarks	Sampling Runs				Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Serial No.	Energy Ratio %
1. Arisings are wet between 2.70m and 2.95m bgl. 2. No visual or olfactory evidence of contamination encountered. 3. Hand vane measurements attempted at 0.60m, 0.80m and 1.50m bgl. However, sample broken by test. 4. Upon completion window sample backfilled with bentonite.	0.00	1.00	80	70		
	1.00	2.00	76	100		
	2.00	3.00	62	60		
	3.00	3.20	60	100		
	Project Number					
	A089434-1					



Plate 5

WS1601C

BLANK

Plate 6

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St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303476.99 Northing: 374380.86
 Level: 15.13m AOD Depth: 4.00m
 Logger: LK Type: WS
 Inclination: 90°

Status
PRELIM

Borehole Number
WS1601D

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing			Groundwater				Scale:	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	1:50
0.00	4.00	Window Sampler	Tracked Rig	J.Bibby					2.70	-	-	2.90	20		Checked By: LK
															Approved By:
															Start Date: 15/03/2016
															Finish Date: 15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
NO RECOVERY.								
Wood		0.15	14.98					
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL). MADE GROUND: Firm brown CLAY with rare subangular fine to coarse gravel of mudstone.		0.30	14.83			0.35 - 1.60	B1	HV 0.50m, (p)=88 kPa (r)=n/a kPa Sample core broke.
		0.35	14.78					
		1.60	13.53					
MADE GROUND: Stiff red brown sandy slightly gravelly CLAY. Gravel is coarse subangular sandstone.		1.70	13.43					
MADE GROUND: Soft grey brown very silty CLAY.		1.90	13.23					
MADE GROUND: Stiff red brown sandy slightly gravelly CLAY. Gravel is coarse subangular sandstone.		2.00	13.13					
NO RECOVERY.								
MADE GROUND: Grey brown gravelly SAND with tile fragments.		2.50	12.63			2.55 - 2.90	B2	
Black MADE GROUND as before. From 2.70 to 2.90m bgl sample is wet.		2.55	12.58					
MADE GROUND: Soft brown grey gravelly CLAY with glass fragments.		2.90	12.23			3.00 - 4.00	B3	
Brown grey sandy GRAVEL. Gravel is fine to coarse subangular to rounded sandstone. FLUVIO GLACIAL DEPOSITS).		3.00	12.13					
		4.00	11.13					
EOH at 4.00m - Achieved target depth.								

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
	1. Arisings are wet between 2.70m and 2.95m bgl. 2. No visual or olfactory evidence of contamination. 3. Upon completion window sample backfilled with bentonite.	0.00	1.00	85	80		
	1.00	2.00	72	90			
	2.00	3.00	72	50			
	3.00	4.00	60	60			
	Project Number						
	A089434-1						



Plate 7

WS1601D



Plate 8

WS1601 disturbed

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Project :-
St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303531.51 Northing: 374658.58
 Level: 12.84mAOD Depth: 1.10m
 Logger: JB Type: IP

Status
PRELIM

Pit Number
WS1602-HD
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By:
	Shoring: None					Approved By:
	Stability: Unstable from 1.00m bgl					Start Date: 15/03/2016
	Plant: Hand Excavated					Finish Date:

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Light brown clayey silty very gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded sandstone and occasional subrounded sandstone cobbles. (FLUVIO-GLACIAL DEPOSITS).		0.40	12.44			0.00 - 0.40	B1	
						0.40 - 1.10	D2	
Light brown silty very sandy fine to coarse subrounded to rounded sandstone GRAVEL with occasional subrounded sandstone cobbles. (FLUVIO-GLACIAL DEPOSITS).								
EOH at 1.10m - Exploratory hole abandoned due to poor stability		1.10	11.74					

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 43

WS1602-HD - Spoil



Plate 44

WS1602-HD - Pit

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Project :-
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 Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date :16th May 2016

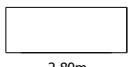


Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303531.53 Northing: 374658.58
 Level: 12.84mAOD Depth: 1.10m
 Logger: JB Type: TP

Status
PRELIM

Pit Number
WS1602-TP
 Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions 	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: LK
	Shoring: None Stability: Unstable from 1.00m bgl. Plant: 3t Tracked Excavator					

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown clayey sandy gravelly organic SILT with many roots and rootlets. Gravel is fine to coarse rounded sandstone and mudstone. (TOPSOIL).								
Brown grey gravelly SILT. Gravel is fine to medium rounded sandstone. (ALLUVIUM).		0.30	12.54			0.30 - 0.40	B1	
Grey brown silty sandy GRAVEL. Gravel is fine to coarse rounded sandstone. (FLUVIO GLACIAL DEPOSITS).		0.40	12.44			0.40 - 1.10	B2	
<i>At 1.00m bgl pit walls collapsing.</i>								
EOH at 1.10m - Achieved target depth.		1.10	11.74			1.00 - 1.10	B3	

Observations / Remarks

- Groundwater not observed.
- No visual or olfactory evidence of contamination encountered.
- Upon completion exploratory hole backfilled with arisings.

Project Number
A089434-1



Plate 70

WS1602-TP - Spoil



Plate 71

WS1602-TP - Pit

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Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 17th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details

Easting: 303240.51 Northing: 375962.20
 Level: 10.29m AOD Depth: 4.40m
 Logger: LK Type: WS
 Inclination: 90°

Status

PRELIM

Borehole Number

WS1603

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing			Groundwater				Scale: 1:50		
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By:	
0.00	4.40	Window Sampler	Tracked Rig	J.Bibby					4.00 3.40	-	-	4.00 3.40	20 20	Arisings are wet Arisings are wet	LK	
															Approved By:	18/03/2016
															Finish Date:	18/03/2016

Strata Description					Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing			
										Depth (m)	Ref	Tests / Results	
Soft to firm dark brown silty sandy organic CLAY with many roots and rootlets. (TOPSOIL). MADE GROUND: Firm brown sandy fine to medium slightly gravelly CLAY with occasional roots and plant remains. Gravel is fine to medium subangular to rounded coal, mudstone and sandstone.						0.10	10.19			0.10 - 0.63	B1	HV 0.30m, (p)=44 kPa (r)=n/a kPa Core broke apart.	
MADE GROUND: Brown silty very gravelly SAND fine to medium. Gravel is fine to medium angular to subrounded mudstone.						0.63 0.70	9.66 9.59						
MADE GROUND: Firm yellowish brown mottled grey sandy slightly gravelly CLAY. Gravel is medium rounded mudstone. NO RECOVERY.						1.00	9.29						1
Brown slightly gravelly slightly clayey organic SILT. (POSSIBLE RELICT TOPSOIL).						1.40	8.89						
MADE GROUND: Grey clayey sandy GRAVEL. Gravel is fine to medium angular to subrounded mudstone and coal. <i>At 1.70m bgl concrete cobble and mudstone cobble.</i>						1.70	8.59						
Firm red brown slightly sandy slightly gravelly CLAY with bands of medium sand. Gravel is fine to medium rounded mudstone and sandstone. (GLACIAL TILL). <i>At 2.80 to 2.90m bgl SAND.</i> <i>At 3.40 to 3.50m bgl SAND and sample is wet.</i>						1.95	8.34			2.00 - 3.30	B2	HV 2.20m, (p)=68 kPa (r)=n/a kPa Core broke apart. HV 2.50m, (p)=68 kPa (r)=n/a kPa Core broke apart. HV 3.00m, (p)=100 kPa (r)=n/a kPa	
Soft grey CLAY with plant relicts. (GLACIAL DEPOSITS)/ Soft brown grey very sandy gravelly CLAY. Gravel is fine to medium rounded mudstone and sandstone. (GLACIAL DEPOSITS). <i>From 4.00 to 4.40m bgl sample is wet.</i> <i>At 4.25 to 4.30m bgl sand band.</i>						3.90 4.00	6.39 6.29			4.00 - 4.40	B3	4	
EOH at 4.40m - Achieved target depth.						4.40	5.89						5
													6
													7
													8
													9
													10

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
	1. Arisings are wet between 3.40m and 3.50m and between 4.00m and 4.40m bgl. 2. No visual or olfactory evidence of contamination encountered. 3. Hand vane measurements attempted at 0.30m, 2.20m and 2.50m bgl. However, sample broken by test. 4. Upon completion window sample backfilled with bentonite.	0.00	1.00	82	100		
	1.00	2.00	45	60			
	2.00	3.00	62	100			
	3.00	4.00	55	70			
	4.00	4.40	55	100			
							Project Number
							A089434-1



Plate 9

WS1603



Plate 10

WS1603 disturbed

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 Environmental Consultancy
 Ground Technologies & Investigation

Project :-
St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303240.50 Northing: 375962.20
 Level: 10.30m AOD Depth: 5.00m
 Logger: LK Type: WS
 Inclination: 90°

Status
PRELIM

Borehole Number
WS1604

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater					Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth (m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By:
0.00	5.00	Window Sampler	Tracked Rig	J.Bibby					4.00	-	-	4.00	20		LK
															Approved By:
															Start Date: 18/03/2016
															Finish Date: 18/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
TOPSOIL: Firm dark brown slightly sandy gravelly CLAY with many roots and rootlets. MADE GROUND: Soft to firm brown sandy gravelly CLAY. Gravel is fine to coarse subangular to rounded coal, mudstone and sandstone.		0.05	10.25			0.05 - 0.65	B1	
MADE GROUND: Firm to stiff red brown very sandy fine CLAY with occasional gravel up to 1.7m bgl. Gravel is fine to medium rounded sandstone and mudstone.		0.65	9.65			0.65 - 1.70	B2	HV 0.70m, (p)=118 kPa (r)=n/a kPa
						1.70 - 3.70	B3	
Slightly lightly red brown slightly clayey medium grained SAND. (PROBABLEE GLACIAL DEPOSITS). <i>Between 4.00 - 4.60m bgl sample is wet.</i>		3.70	6.60			3.70 - 4.65	B4	HV 3.50m, (p)=120 kPa (r)=n/a kPa Core broke apart.
Stiff brown sandy gravelly CLAY. Gravel is fine to coarse rounded mudstone and sandstone. (PROBABLE GLACIAL TILL).		4.65	5.65			4.65 - 5.00	B5	
EOH at 5.00m - Achieved target depth.		5.00	5.30					

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
1. Arisings are wet between 4.00m and 4.60m bgl. 2. No visual or olfactory evidence of contamination encountered. 3. Hand vane measurements attempted at 0.70m and 3.50m bgl. However, sample broken by test. 4. Upon completion window sample backfilled with bentonite.	0.00	1.00	80	100			
	1.00	2.00	72	80			
	2.00	3.00	65	85			
	3.00	4.00	53	100			
	4.00	5.00	53	100			
						Project Number	
						A089434-1	



Plate 11

WS1604



Plate 12

WS1604 disturbed

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Project :-
St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303227.65 Northing: 376038.25
 Level: 7.84mAOD Depth: 2.00m
 Logger: JB Type: WS
 Inclination: °

Status
PRELIM

Borehole Number
WS1605

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater					Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: LK
0.00	2.00	Window Sampler	Tracked Rig	J.Bibby											Approved By:
															Start Date: 17/03/2016
															Finish Date: 17/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Dark brown very clayey sandy SILT (TOPSOIL). MADE GROUND: Firm red silty very gravelly SAND. Gravel of fine to coarse subrounded to subangular sub base material.		0.05	7.79			0.12 - 0.45	B1	
MADE GROUND: Light brown silty very sandy fine to coarse rounded to subangular sandstone GRAVEL.		0.12	7.72					
MADE GROUND: Firm brown silty sandy gravelly CLAY. Gravel of fine to coarse subrounded to subrounded sandstone. <i>From 0.45 to 1.48m bgl black staining in clay from roots.</i>		0.45	7.39			0.45 - 1.48	B2	
MADE GROUND: Light brown, grey very clayey silty sandy fine to coarse rounded to subangular sandstone GRAVEL.		1.48	6.36			1.48 - 2.00	B3	
<i>At 1.95m bgl becoming very sandy.</i> EOH at 2.00m - Exploratory hole achieved target depth		2.00	5.84					

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
	1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion window sample backfilled with bentonite.	0.00	1.00	85	100		
	1.00	2.00	72	70			
Project Number							A089434-1



Plate 13

WS1605

BLANK

Plate 14

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 Ground Technologies & Investigation

Project :-
 St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303217.77 Northing: 376035.89
 Level: 9.88m AOD Depth: 4.00m
 Logger: JB Type: WS
 Inclination: °

Status
PRELIM

Borehole Number
WS1606
 Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing			Groundwater					Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth (m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By:	1:50
0.00	4.00	Window Sampler	Tracked Rig	J.Bibby											LK	
															Approved By:	
															Start Date:	15/03/2016
															Finish Date:	15/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Brown very clayey SILT (TOPSOIL).								
MADE GROUND: Firm light brown reddish mottled grey silty sandy slightly gravelly CLAY. Gravel of fine to coarse subangular to subrounded sandstone and quartz. (BUND). <i>From 0.18 to 2.30m bgl becoming redder in colour and more silty with depth.</i>		0.18	9.70			0.20 - 2.00	B1	HV 0.40m, (p)=66 kPa (r)=n/a kPa HV 0.80m, (p)=88 kPa (r)=n/a kPa HV 1.20m, (p)=72 kPa (r)=n/a kPa HV 1.60m, (p)=58 kPa (r)=n/a kPa
MADE GROUND: Black dark brown clayey silty sandy fine to coarse angular limestone GRAVEL.		2.30	7.58					
MADE GROUND: Firm light brown reddish mottled grey very silty sandy slightly gravelly CLAY. Gravel of fine to coarse subrounded to subangular sandstone and river deposit. <i>From 2.50 to 3.00m bgl orange water staining in clay.</i>		2.50	7.38			2.50 - 3.00	B2	
Light brown grey reddish very clayey silty sandy fine to coarse subangular to subrounded GRAVEL. (FLUVIO-GLACIAL DEPOSITS).		3.00	6.88			3.00 - 4.00	B3	
EOH at 4.00m - Exploratory hole achieved target depth		4.00	5.88					

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Hand vane measurements attempted at 0.40m, 0.80m, 1.20m and 1.60m bgl. However, sample broken by test. 4. Upon completion window sample backfilled with bentonite.	0.00	1.00	90	100			
	1.00	2.00	76	90			
	2.00	3.00	76	95			
	3.00	4.00	62	80			
						Project Number	
						A089434-1	



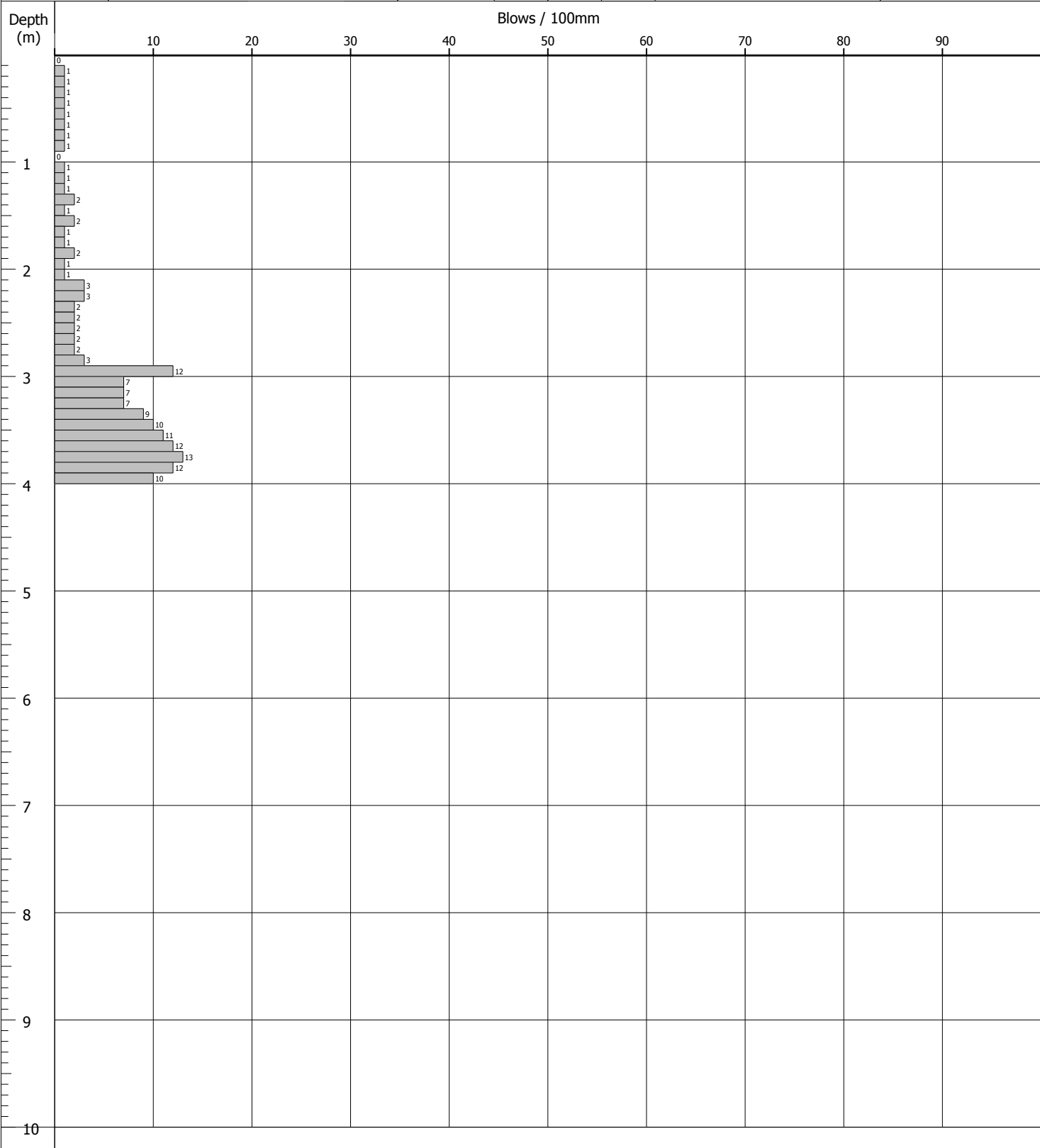
Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303217.77 Northing: 376035.89
 Level: Depth: 4.00m
 Logger: LK Type: DP

Status
PRELIM

Probe Number
DP2
 Sheet 1 of 1

	Hole Information			Groundwater				Scale: 1:50
	Probe Information		Termination	Strike (m)	Rises to (m)	Time (min)	Remarks	Checked By: LK
	Fall Height: 750mm	Cone Base Diameter: 50mm	Achieved target depth.					Approved By:
	Hammer Weight: 64.00kg	Rod Diameter: 35mm						Start Date: 15/03/2016
	Probe Type: DPSH-B							Finish Date: 15/03/2016



Observations / Remarks	Hammer Information	
	Hammer Serial No.	Energy Ratio %
	Project Number A089434-1	



Plate 15

WS1606



Plate 16

WS1606 detail disturbed

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Project :-
St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Project: **FRM**
 Location: **St Asaph**
 Client: **Natural Resources Wales**

Location Details
 Easting: 303220.71 Northing: 376054.41
 Level: 7.79mAOD Depth: 2.00m
 Logger: LK Type: WS
 Inclination: 90°

Status
PRELIM

Borehole Number
WS1607

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing			Groundwater				Scale: 1:50	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: LK
0.00	2.00	Window Sampler	Tracked Rig	J.Bibby											Approved By:
															Start Date: 18/03/2016
															Finish Date: 18/03/2016

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Dark brown sandy gravelly organic SILT. Gravel is fine subangular to rounded sandstone and mudstone with many roots and rootlets. (TOPSOIL).		0.15	7.64					
MADE GROUND: Orange very sandy GRAVEL. Gravel is fine angular.		0.24	7.55			0.24 - 0.65	B1	
MADE GROUND: Black dark brown clayey very gravelly fine to coarse grained SAND with occasional cobble. Gravel is fine to coarse fine to coarse angular to subrounded coal, brick, conglomerate, sandstone and mudstone.		0.65	7.14			0.24 - 0.65	ES1	
Soft to firm brown slightly gravelly CLAY. Gravel is fine to medium rounded sandstone and mudstone.		1.00	6.79			0.65 - 1.00	B2	
Greenish grey clayey sandy fine to coarse GRAVEL. Gravel is fine to coarse subangular to rounded mudstone and sandstone.		2.00	5.79			1.00 - 2.00	B3	
EOH at 2.00m - Achieved target depth.		2.00	5.79					

Observations / Remarks	Sampling Runs					Hammer Information	
	From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
	1. Groundwater not observed. 2. No visual or olfactory evidence of contamination encountered. 3. Upon completion window sample backfilled with bentonite.	0.00	1.00	90	100		
	1.00	2.00	76	75			
Project Number							A089434-1

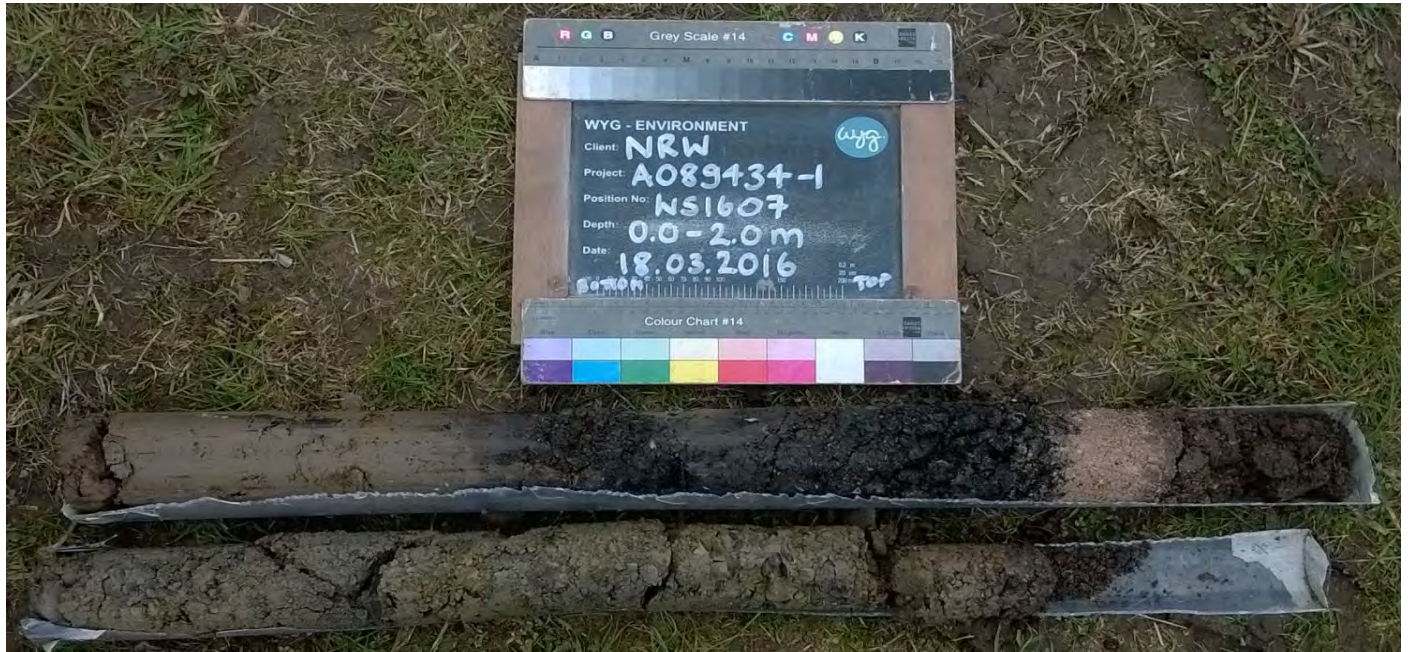


Plate 17

WS1607



Plate 18

WS1607 disturbed

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Project :-
St Asaph Additional Ground Investigation

Client: Natural Resources Wales

Project No.: A089434-1

Date : 9th May 2016



Appendix C – Geotechnical Laboratory Testing Results



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 30365

Client's Reference: **A089434-1 PO: C16/154**

Report Date: **18-04-2016**

Client **WYG Group**
Arndale Court
Headingley
Leeds
LS6 2UJ

Contract Title: **St Asaph**
For the attention of: **Luzia Kathriner**

Date Received: **22-03-2016**
Date Commenced: **22-03-2016**
Date Completed: **18-04-2016**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	6
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	6
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	24
Determination of Permeability in a triaxial cell BS1377 Part 6 : 1990 Clause 6 - * UKAS	1
Extra Over Item (4 Days Over)	6
CD 100mm Consolidated drained Triaxial compression test on a single 100 mm diameter specimens Multistage loading with the measurement of volume change and pore water pressure including saturation and consolidation, test duration FOUR days. BS1377 : Part 8 : Clause 7 : 1990 - @ Non Accredited Test	5
Extra over items for test duration in excess of four days.	6
Disposal of Samples on Project	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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

Approved Signatories:

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

**Test Report: Method of the Determination of the plastic limit and plasticity index
BS 1377 : Part 2 : 1990 Method 5**

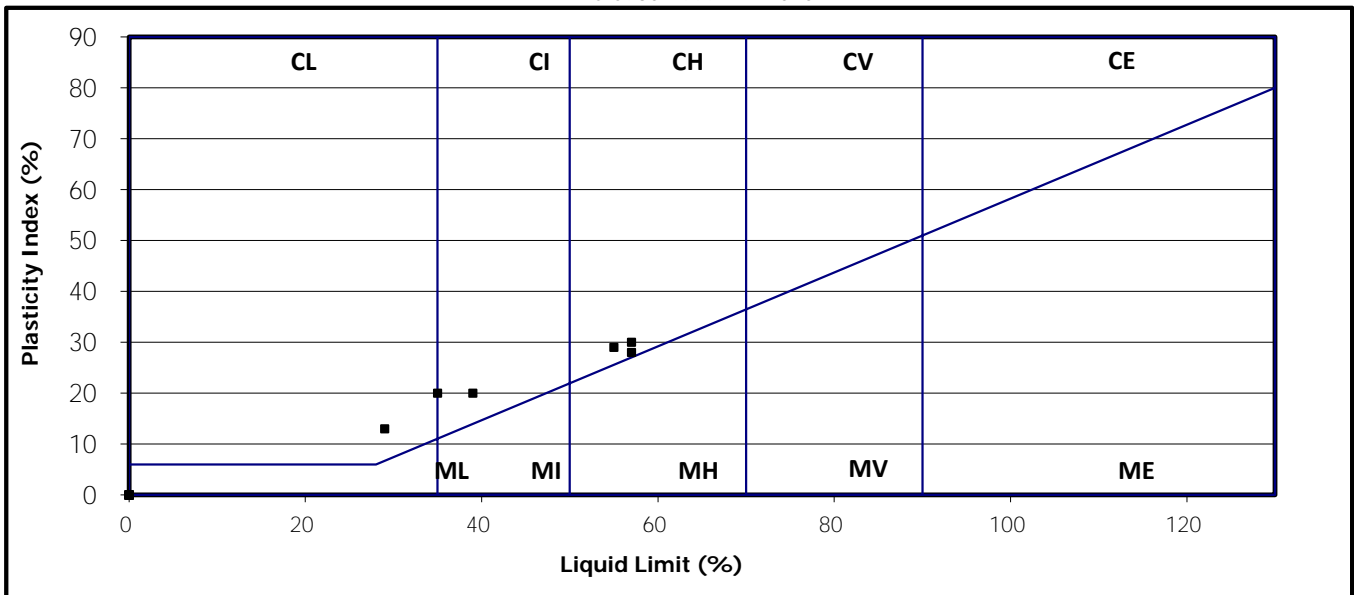
Client ref: A089434-1
Location: St Asaph
Contract Number: 36365-300316

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
WS1601A/1	B	0.15 - 0.67	28	57	29	28	100	CH High Plasticity
WS1601A/2	B	0.90 - 1.96	11	29	16	13	85	CL Low Plasticity
WS1601B/1	B	0.27 - 0.70	29	57	27	30	100	CH High Plasticity
WS1601B/1	B	0.70 - 0.94	16	35	15	20	97	CL/I Low/Inter. Plasticity
WS1601C/2	B	1.00 - 2.00	16	39	19	20	91	CI Intermediate Plasticity
WS1601D/1	B	0.35 - 1.60	24	55	26	29	100	CH High Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

BS 5930:1999+A2:2010



For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)
 Date: **18.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

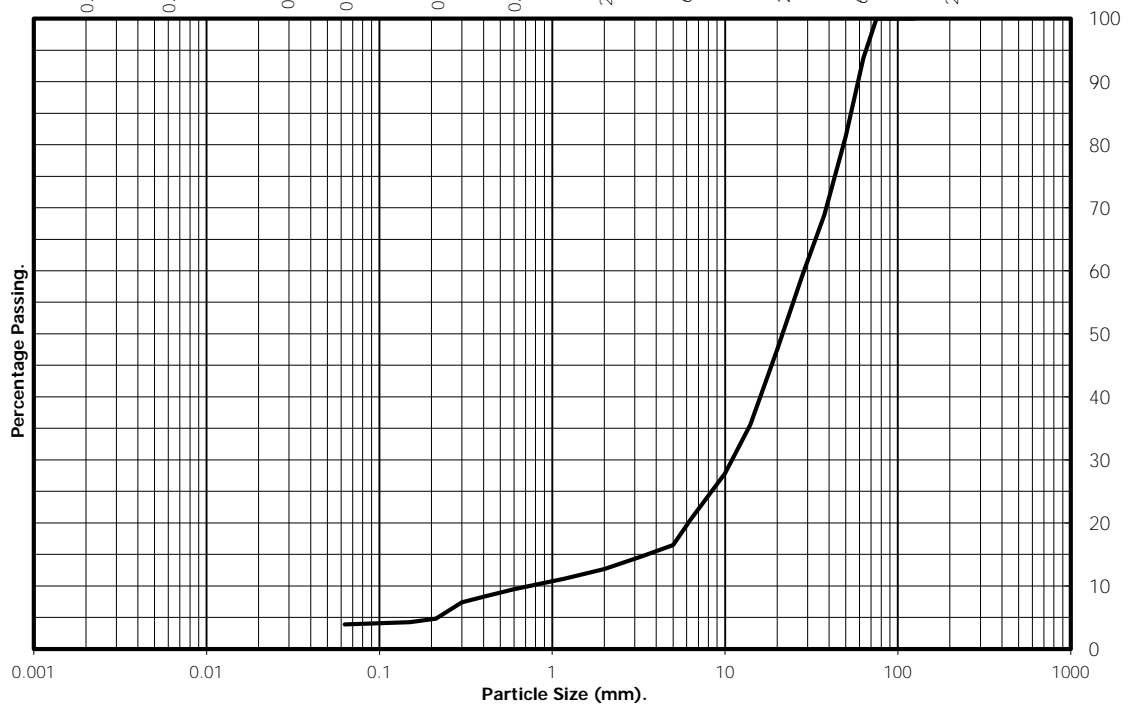
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1601**

Sample Number: **1**
 Depth from (m): **0.34**
 Depth to (m): **0.40**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL with few cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	94
50	81
37.5	69
28	59
20	48
14	36
10	28
6.3	20
5.0	16
3.35	15
2.00	13
1.18	11
0.60	9
0.425	8
0.300	7
0.212	5
0.150	4
0.063	4



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	4	9	81	6	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1601**

Sample Number: **2**
 Depth from (m): **1.00**
 Depth to (m): **1.10**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	83
63	68
50	57
37.5	54
28	50
20	42
14	34
10	29
6.3	24
5.0	21
3.35	20
2.00	17
1.18	15
0.60	11
0.425	7
0.300	5
0.212	3
0.150	2
0.063	2



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	2	15	51	32	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

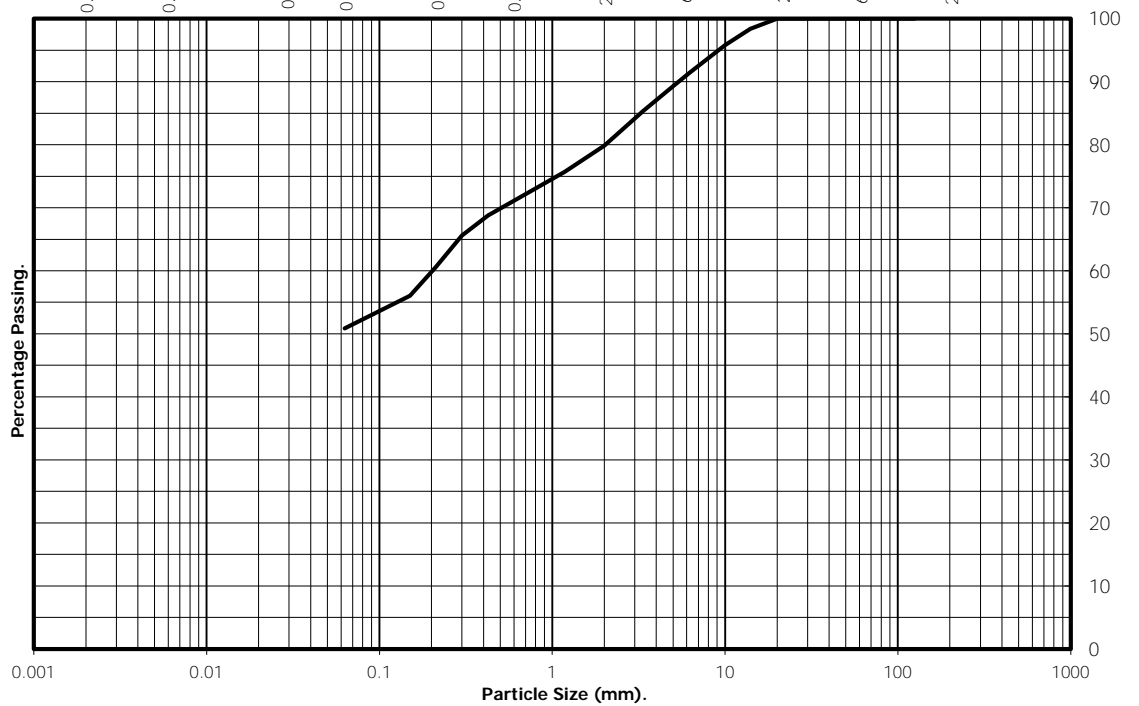
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1601**

Sample Number: **3**
 Depth from (m): **1.10**
 Depth to (m): **1.20**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown gravelly sandy fine to medium silty CLAY.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	98
10	96
6.3	92
5.0	89
3.35	85
2.00	80
1.18	76
0.60	71
0.425	69
0.300	66
0.212	61
0.150	56
0.063	51



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	51	29	20	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

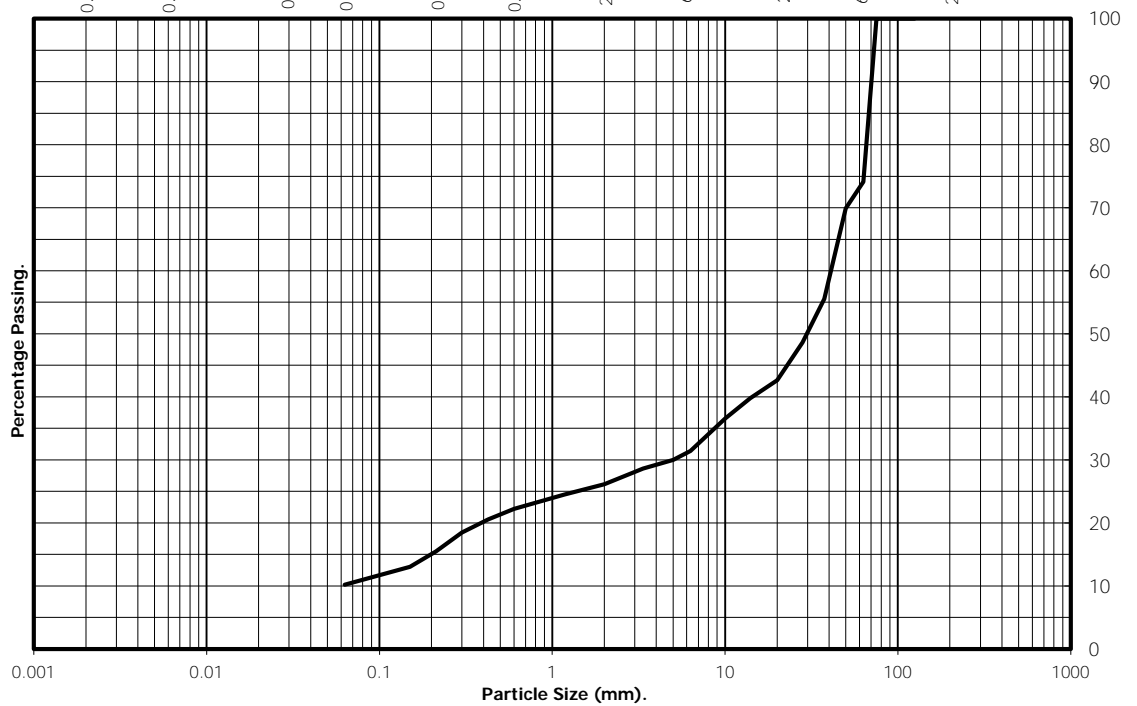
Client ref: **A089434-1**
Contract Number: **30365-300316**
Hole Number: **TP1603**

Sample Number: **1**
Depth from (m): **1.20**
Depth to (m): **1.30**
Sample Type: **B**

Location: **St Asaph**
Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	74
50	70
37.5	56
28	49
20	43
14	40
10	37
6.3	31
5.0	30
3.35	29
2.00	26
1.18	25
0.60	22
0.425	21
0.300	18
0.212	15
0.150	13
0.063	10



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	16	48	26	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1604**

Sample Number: **1**
 Depth from (m): **0.50**
 Depth to (m): **0.70**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	90
28	82
20	74
14	71
10	66
6.3	58
5.0	56
3.35	53
2.00	48
1.18	44
0.60	38
0.425	35
0.300	32
0.212	26
0.150	24
0.063	22



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	22	26	52	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **15.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

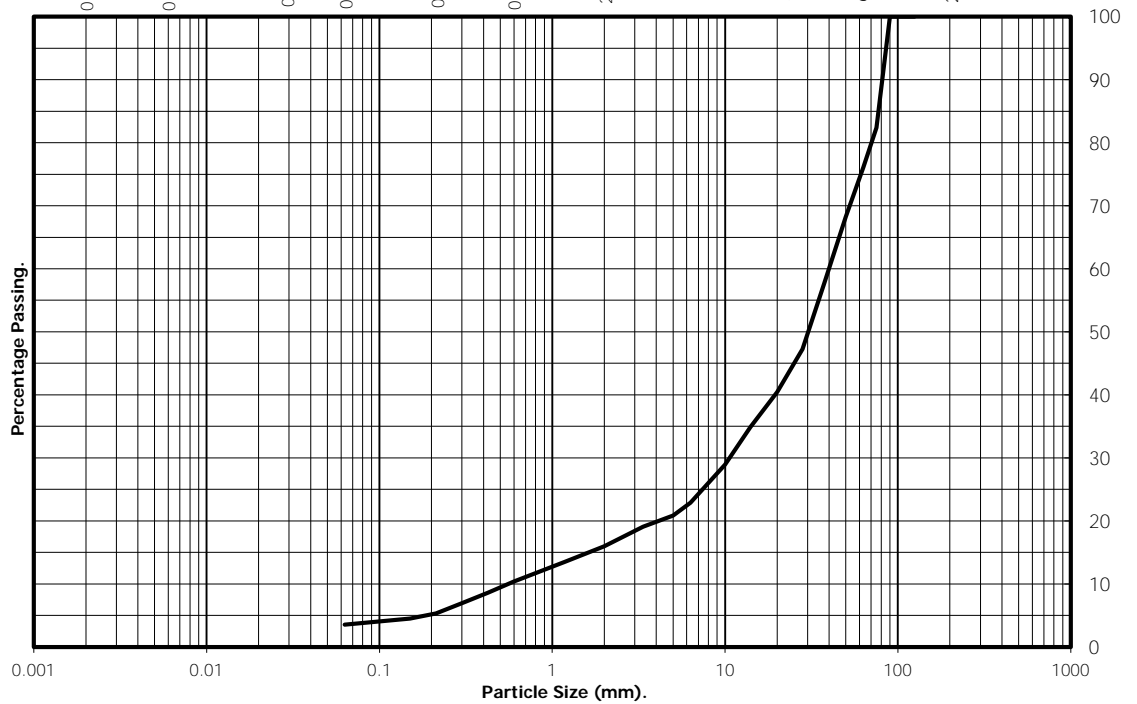
Client ref: **A089434-1**
Contract Number: **30365-300316**
Hole Number: **TP1605**

Sample Number: **2**
Depth from (m): **1.10**
Depth to (m): **1.20**
Sample Type: **B**

Location: **St Asaph**
Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	82
63	76
50	68
37.5	58
28	47
20	40
14	35
10	29
6.3	23
5.0	21
3.35	19
2.00	16
1.18	13
0.60	10
0.425	9
0.300	7
0.212	5
0.150	4
0.063	4



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	4	12	60	24	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

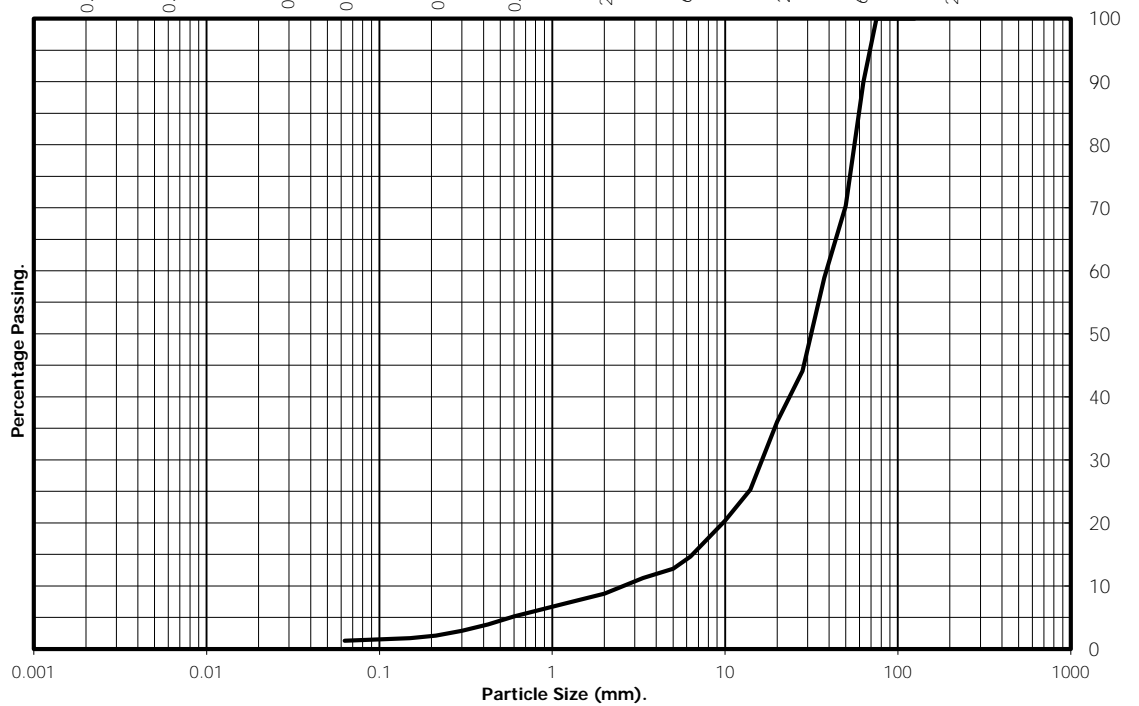
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1605**

Sample Number: **3**
 Depth from (m): **1.20**
 Depth to (m): **1.30**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	90
50	70
37.5	59
28	44
20	36
14	25
10	20
6.3	15
5.0	13
3.35	11
2.00	9
1.18	7
0.60	5
0.425	4
0.300	3
0.212	2
0.150	2
0.063	1



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	1	8	81	10	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

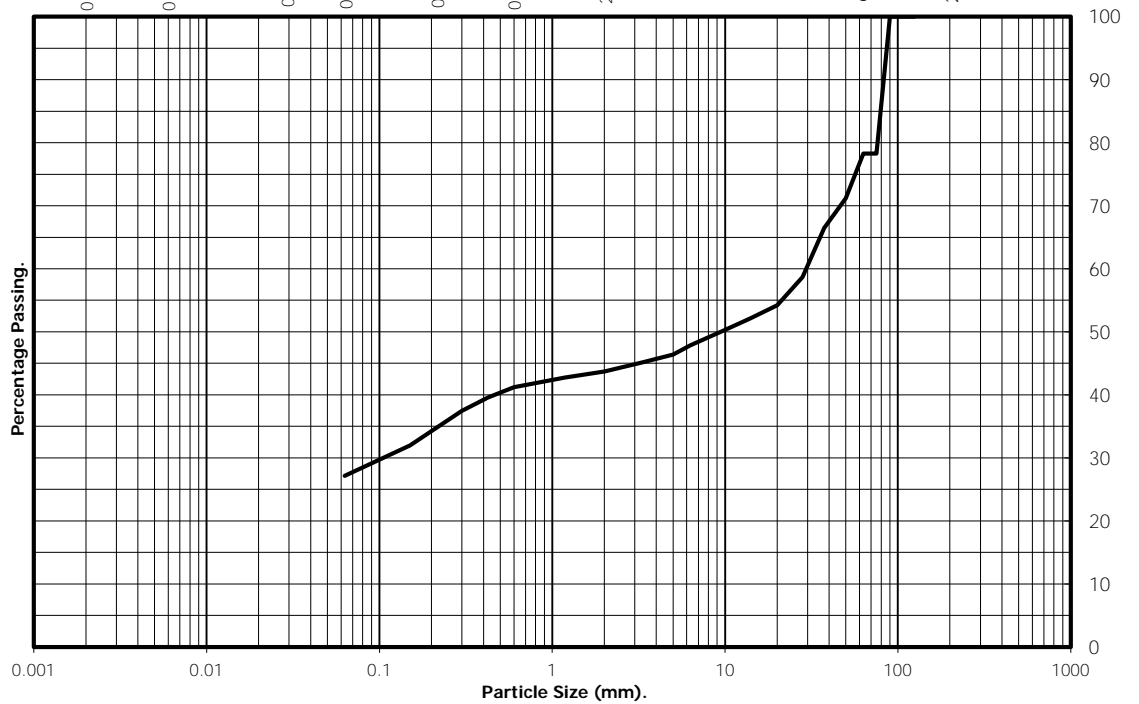
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1606**

Sample Number: **1**
 Depth from (m): **0.30**
 Depth to (m): **0.80**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy silty clayey fine to coarse GRAVEL with many cobbles.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	78
63	78
50	71
37.5	66
28	59
20	54
14	52
10	50
6.3	48
5.0	46
3.35	45
2.00	44
1.18	43
0.60	41
0.425	40
0.300	37
0.212	35
0.150	32
0.063	27



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	27	17	34	22	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

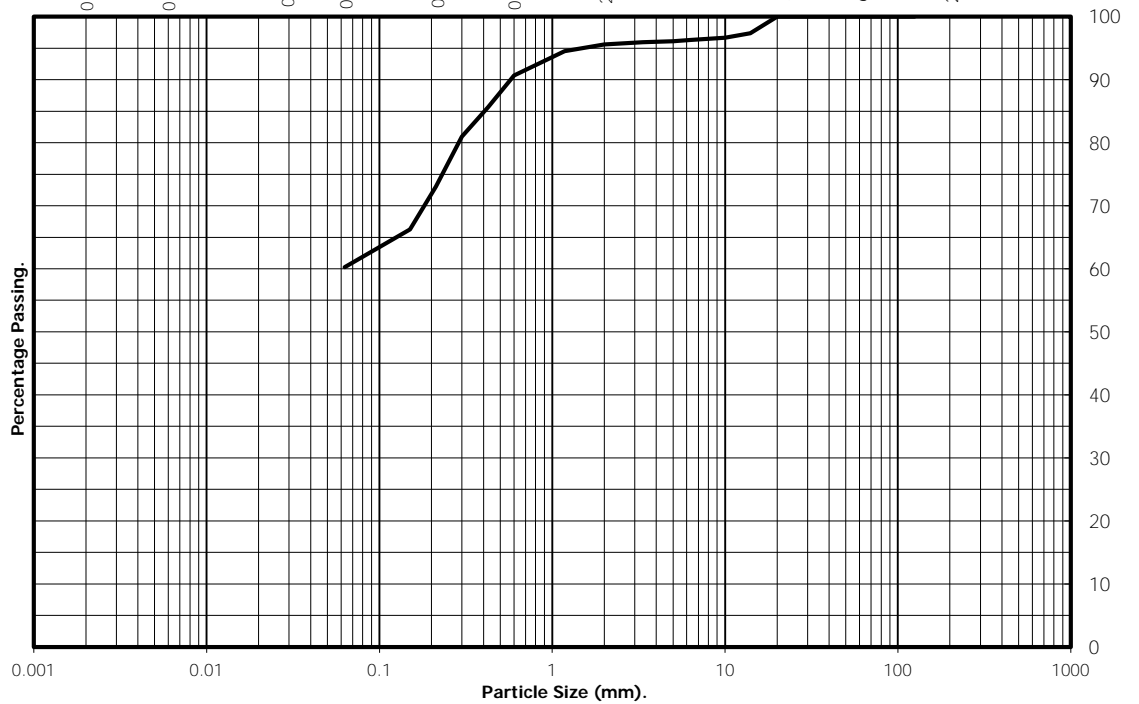
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1606**

Sample Number: **2**
 Depth from (m): **0.90**
 Depth to (m): **1.00**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown gravelly sandy fine to medium silty CLAY.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	97
10	97
6.3	96
5.0	96
3.35	96
2.00	96
1.18	95
0.60	91
0.425	86
0.300	81
0.212	73
0.150	66
0.063	60



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	60	36	4	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

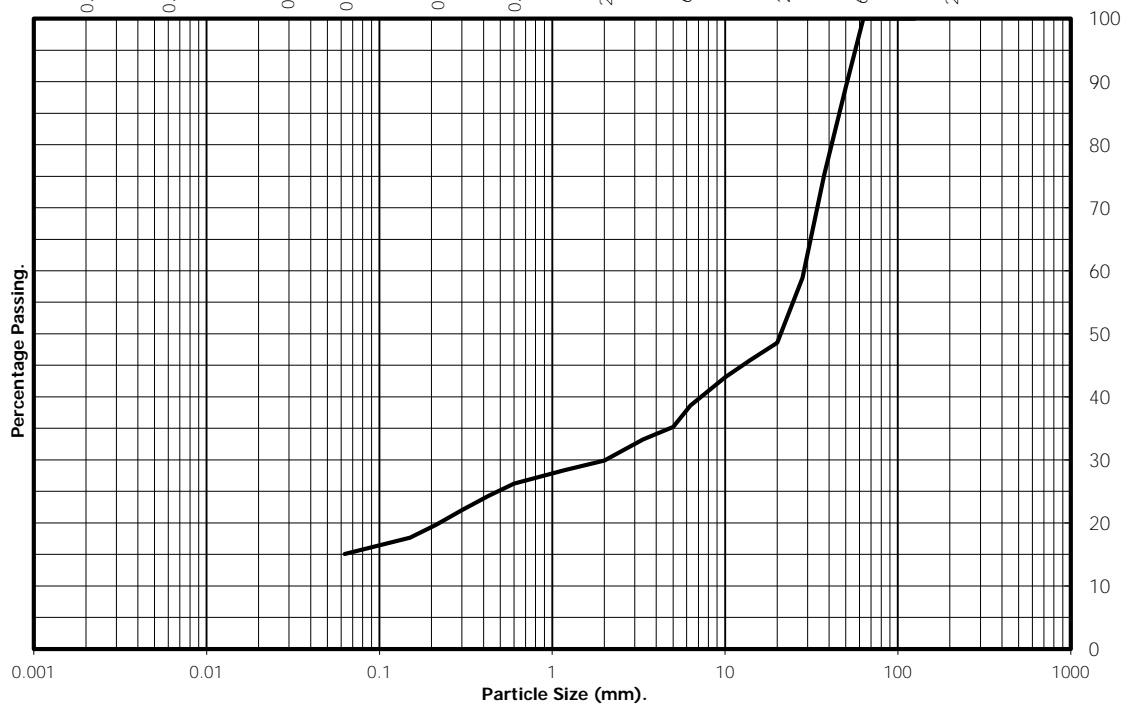
Client ref: **A089434-1**
Contract Number: **30365-300316**
Hole Number: **TP1607**

Sample Number: **1**
Depth from (m): **0.40**
Depth to (m): **0.70**
Sample Type: **B**

Location: **St Asaph**
Description: **Brown silty clayey sandy fine to coarse GRAVEL.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	89
37.5	75
28	59
20	49
14	46
10	43
6.3	39
5.0	35
3.35	33
2.00	30
1.18	28
0.60	26
0.425	24
0.300	22
0.212	20
0.150	18
0.063	15



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	15	15	70	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

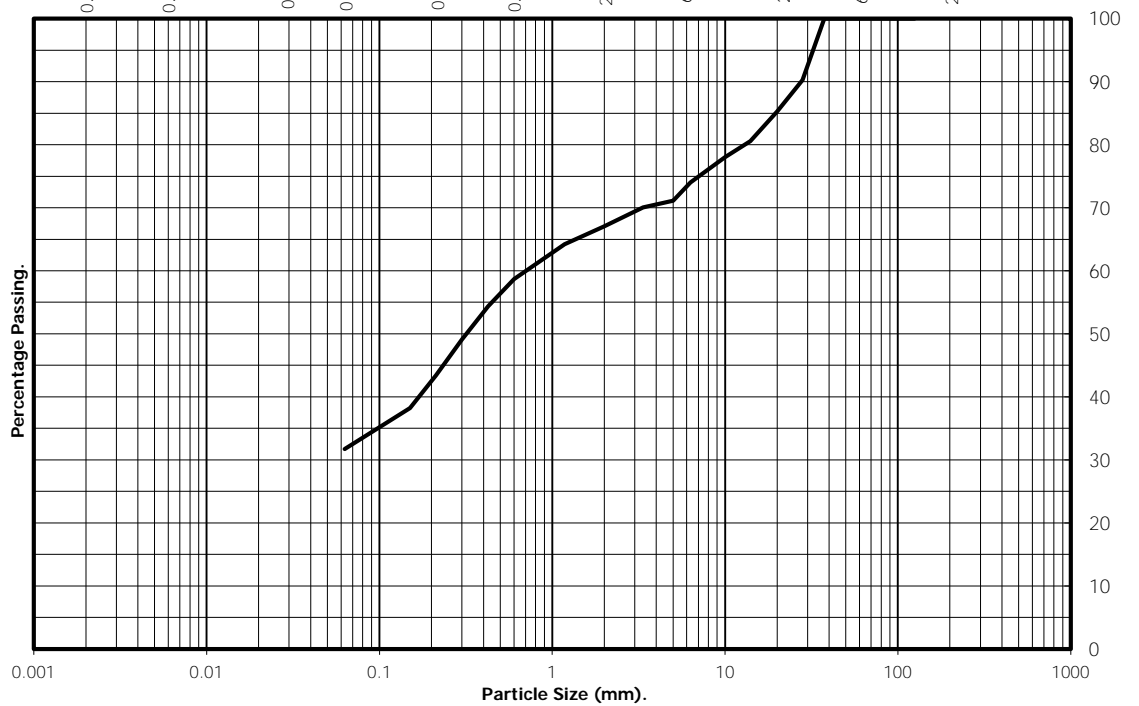
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1607**

Sample Number: **2**
 Depth from (m): **0.75**
 Depth to (m): **0.85**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey gravelly fine to medium SAND.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	90
20	85
14	81
10	78
6.3	74
5.0	71
3.35	70
2.00	67
1.18	64
0.60	59
0.425	54
0.300	49
0.212	43
0.150	38
0.063	32



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	32	35	33	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

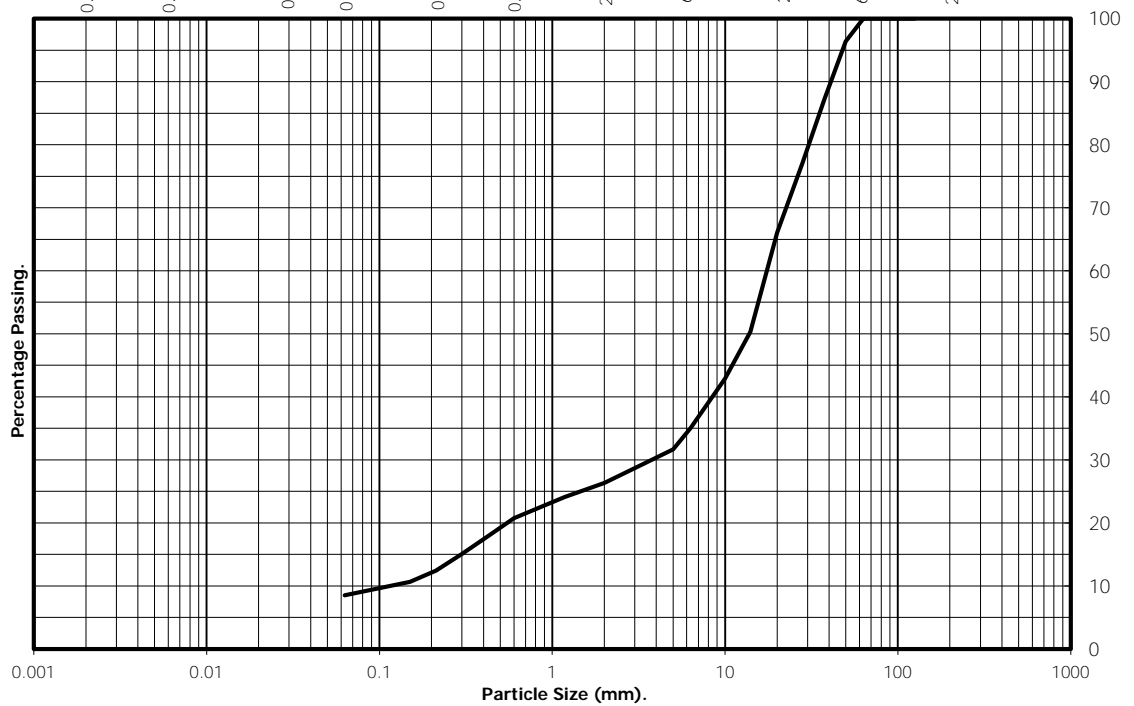
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1607**

Sample Number: **3**
 Depth from (m): **0.90**
 Depth to (m): **1.20**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	96
37.5	87
28	77
20	66
14	50
10	43
6.3	35
5.0	32
3.35	29
2.00	26
1.18	24
0.60	21
0.425	18
0.300	15
0.212	12
0.150	11
0.063	9



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	9	17	74	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

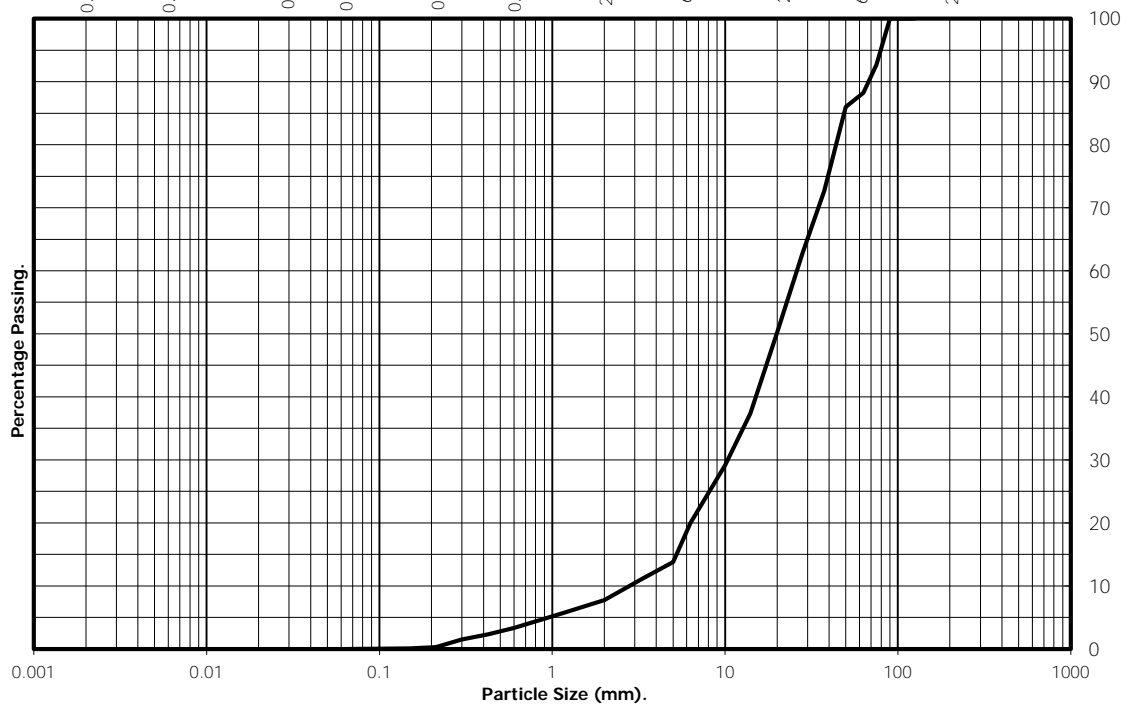
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1607**

Sample Number: **4**
 Depth from (m): **1.30**
 Depth to (m): **1.55**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	93
63	88
50	86
37.5	73
28	63
20	50
14	37
10	29
6.3	20
5.0	14
3.35	11
2.00	8
1.18	6
0.60	3
0.425	2
0.300	2
0.212	0
0.150	0
0.063	0



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	0	8	80	12	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1608**

Sample Number: **2**
 Depth from (m): **0.20**
 Depth to (m): **0.30**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	80
63	80
50	80
37.5	67
28	57
20	47
14	44
10	40
6.3	37
5.0	35
3.35	33
2.00	31
1.18	29
0.60	26
0.425	25
0.300	23
0.212	21
0.150	18
0.063	16



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	16	15	49	20	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

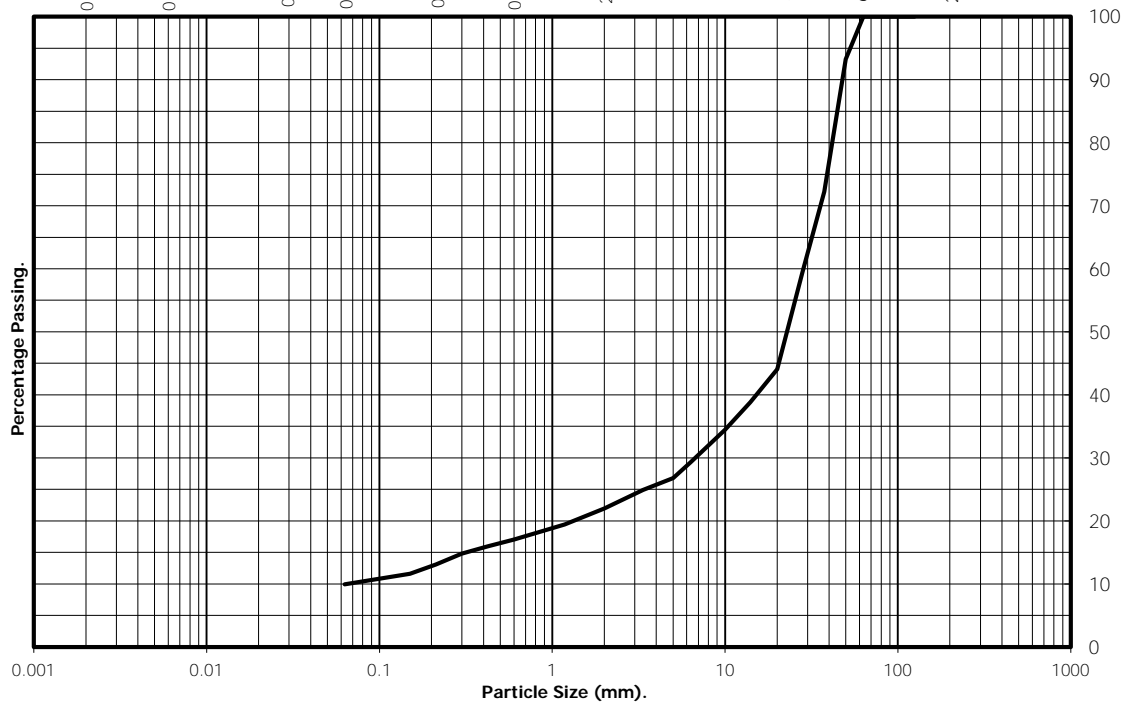
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1608**

Sample Number: **3**
 Depth from (m): **0.30**
 Depth to (m): **0.50**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	93
37.5	72
28	59
20	44
14	39
10	34
6.3	29
5.0	27
3.35	25
2.00	22
1.18	19
0.60	17
0.425	16
0.300	15
0.212	13
0.150	12
0.063	10



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	12	78	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

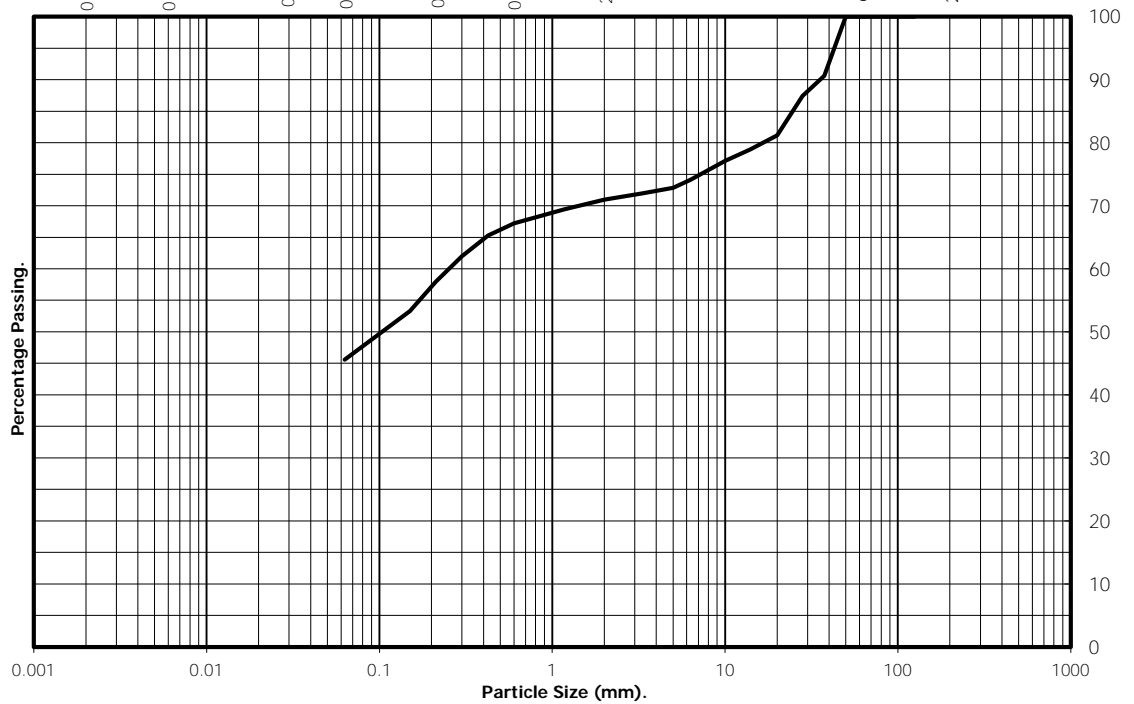
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1608**

Sample Number: **3**
 Depth from (m): **0.60**
 Depth to (m): **0.70**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy gravelly fine to medium silty CLAY.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	91
28	87
20	81
14	79
10	77
6.3	74
5.0	73
3.35	72
2.00	71
1.18	69
0.60	67
0.425	65
0.300	62
0.212	58
0.150	53
0.063	46



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	46	25	29	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

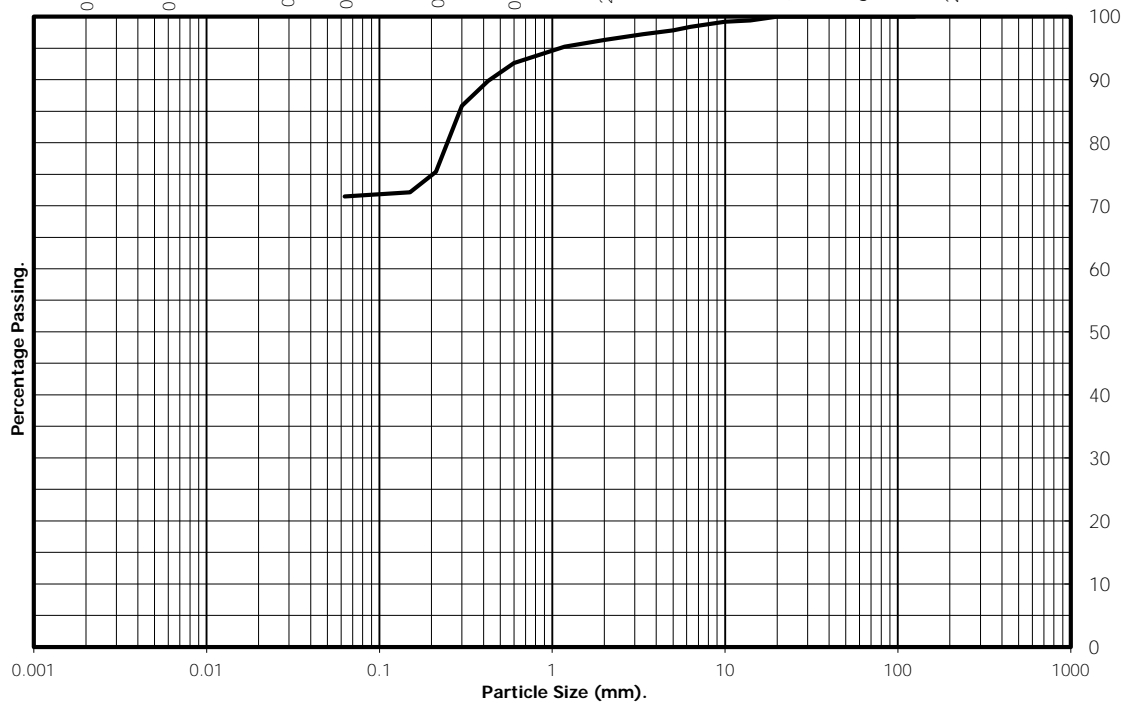
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1608**

Sample Number: **4**
 Depth from (m): **0.95**
 Depth to (m): **1.00**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown gravelly sandy fine to medium silty CLAY.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	99
10	99
6.3	98
5.0	98
3.35	97
2.00	96
1.18	95
0.60	93
0.425	90
0.300	86
0.212	75
0.150	72
0.063	71



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	71	25	4	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

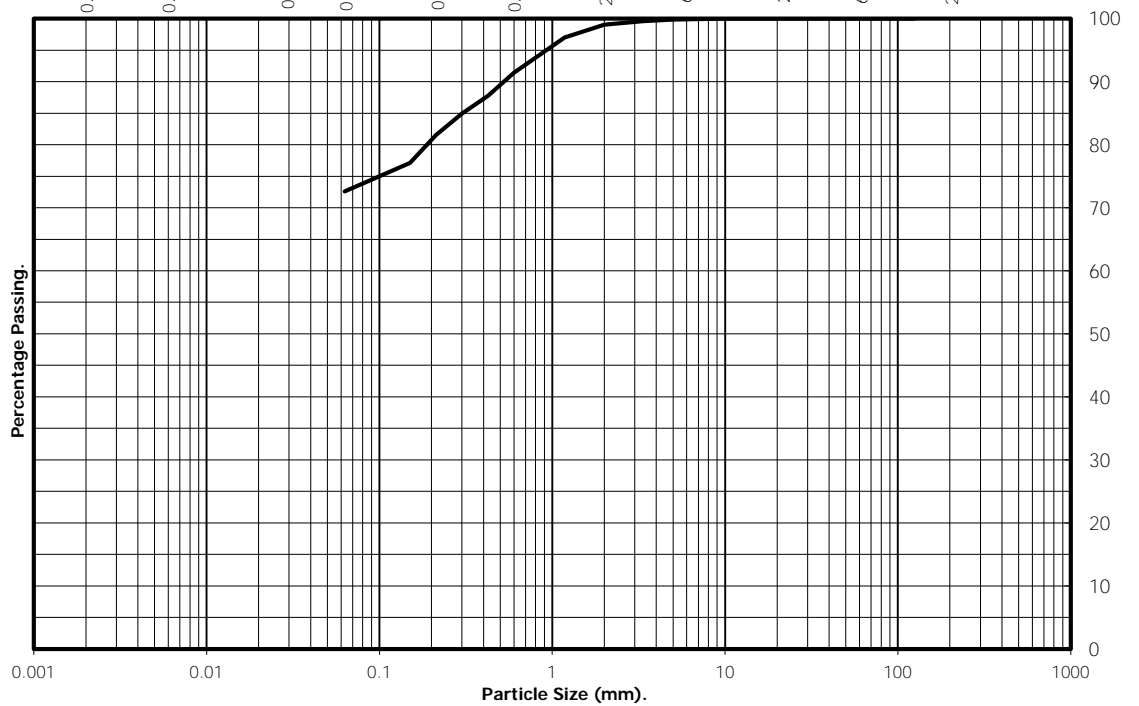
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1608**

Sample Number: **5**
 Depth from (m): **1.10**
 Depth to (m): **1.30**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown gravelly sandy fine to medium silty CLAY.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	99
1.18	97
0.60	91
0.425	88
0.300	85
0.212	82
0.150	77
0.063	73



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	73	26	1	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

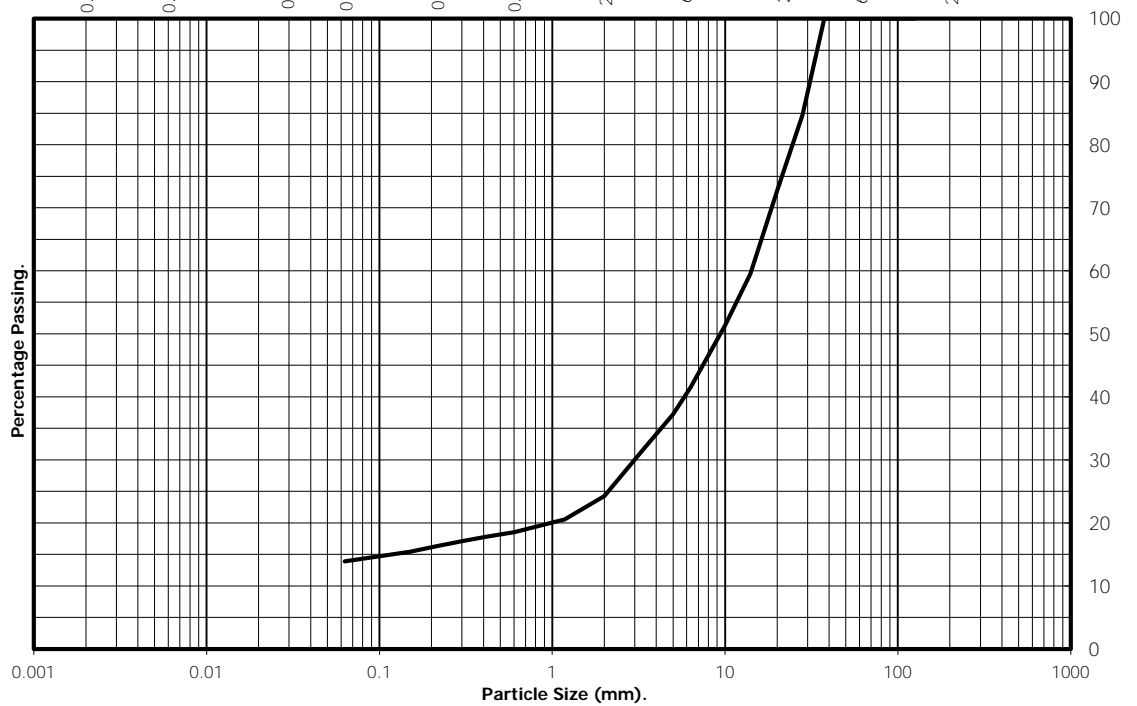
Client ref: **A089434-1**
Contract Number: **30365-300316**
Hole Number: **TP1609**

Sample Number: **1**
Depth from (m): **0.30**
Depth to (m): **0.40**
Sample Type: **B**

Location: **St Asaph**
Description: **Brown sandy silty clayey fine to coarse GRAVEL.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	85
20	73
14	60
10	51
6.3	41
5.0	37
3.35	32
2.00	24
1.18	21
0.60	19
0.425	18
0.300	17
0.212	16
0.150	15
0.063	14



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	14	10	76	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

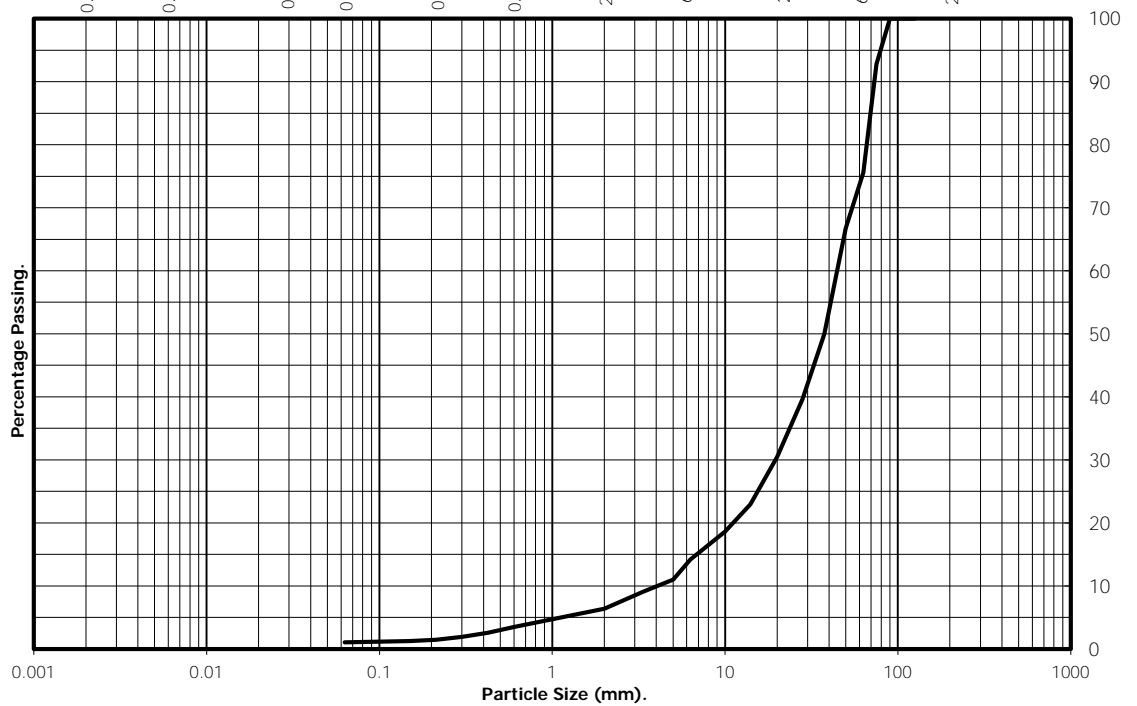
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1609**

Sample Number: **2**
 Depth from (m): **0.60**
 Depth to (m): **0.70**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	93
63	76
50	67
37.5	50
28	40
20	31
14	23
10	19
6.3	14
5.0	11
3.35	9
2.00	6
1.18	5
0.60	3
0.425	3
0.300	2
0.212	1
0.150	1
0.063	1



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	1	5	70	24	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

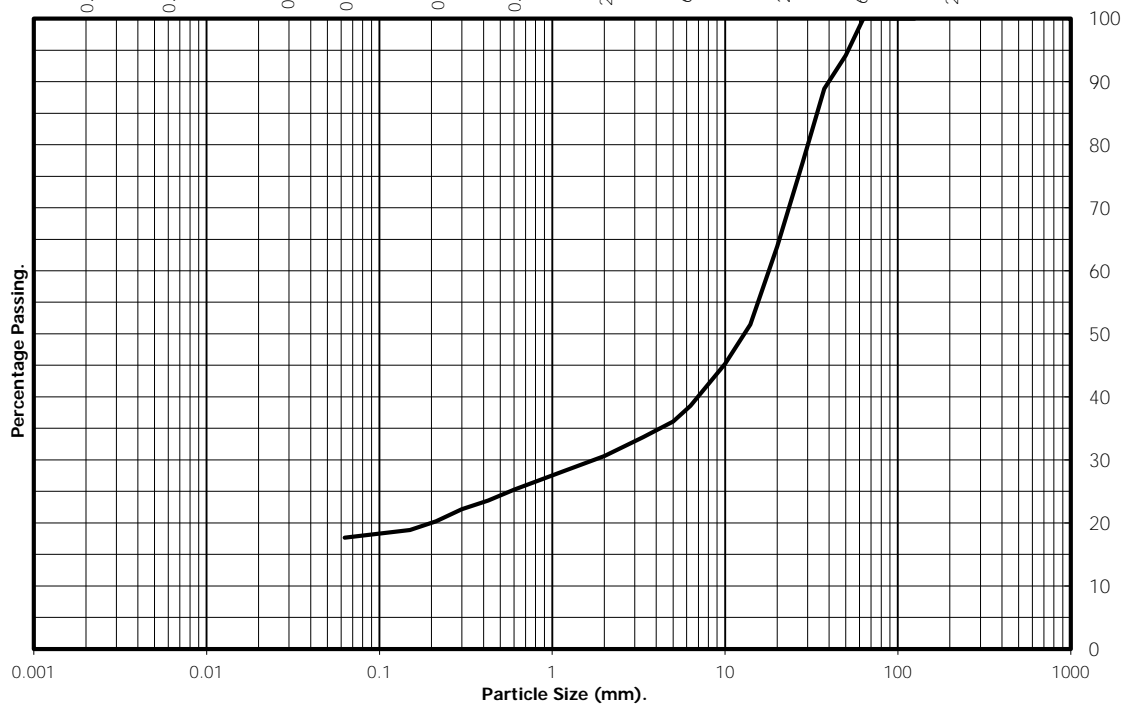
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **TP1610**

Sample Number: **1**
 Depth from (m): **0.40**
 Depth to (m):
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy silty clayey fine to coarse GRAVEL.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	94
37.5	89
28	77
20	64
14	51
10	45
6.3	39
5.0	36
3.35	34
2.00	31
1.18	28
0.60	25
0.425	24
0.300	22
0.212	20
0.150	19
0.063	18



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	18	13	69	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **15.4.16**



Test Report:

Particle Size Distribution Test BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

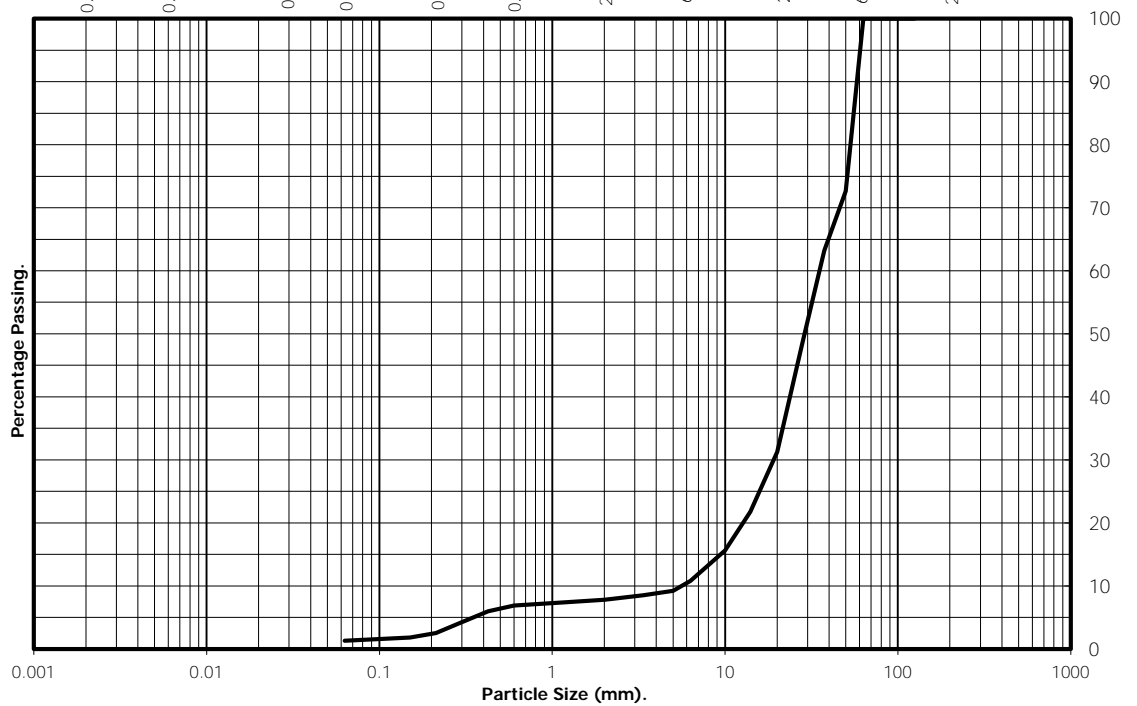
Client ref: **A089434-1**
Contract Number: **30365-300316**
Hole Number: **TP1610**

Sample Number: **2**
Depth from (m): **0.70**
Depth to (m): **0.80**
Sample Type: **B**

Location: **St Asaph**
Description: **Brown silty clayey sandy fine to coarse GRAVEL.**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	73
37.5	63
28	49
20	31
14	22
10	16
6.3	11
5.0	9
3.35	8
2.00	8
1.18	7
0.60	7
0.425	6
0.300	4
0.212	3
0.150	2
0.063	1



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	1	7	92	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)

Date: **14.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

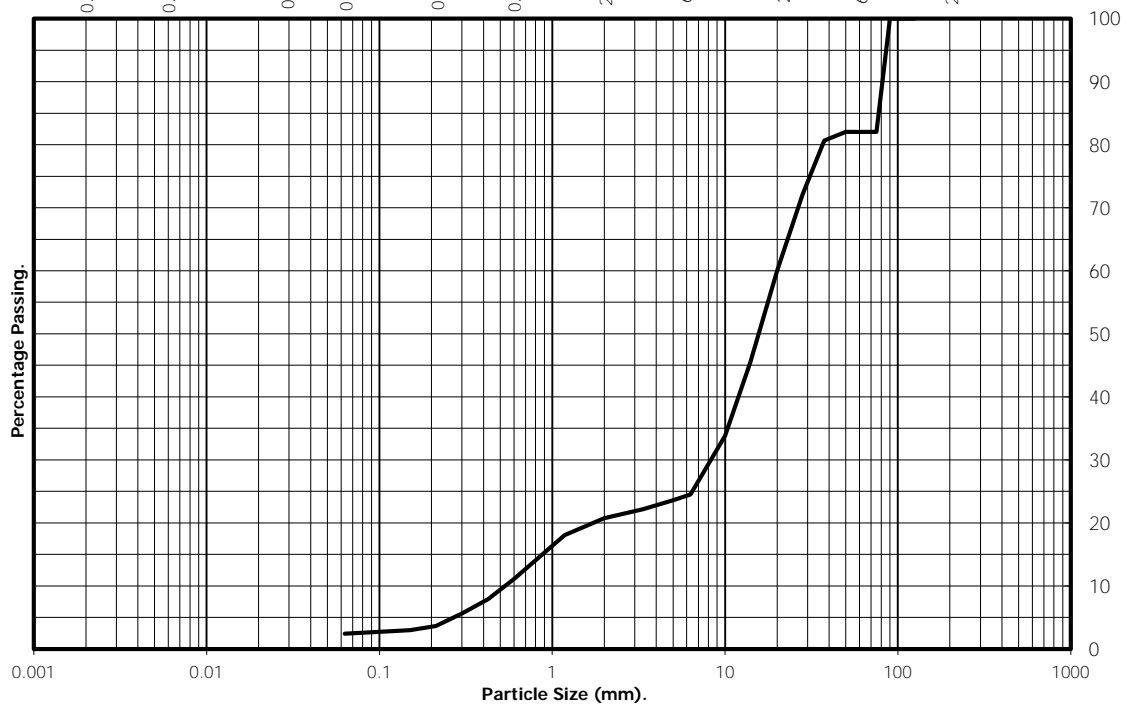
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **WS1612**

Sample Number: **2**
 Depth from (m): **0.40**
 Depth to (m): **0.50**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	82
63	82
50	82
37.5	81
28	72
20	60
14	45
10	34
6.3	25
5.0	24
3.35	22
2.00	21
1.18	18
0.60	11
0.425	8
0.300	6
0.212	4
0.150	3
0.063	2



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	2	19	61	18	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

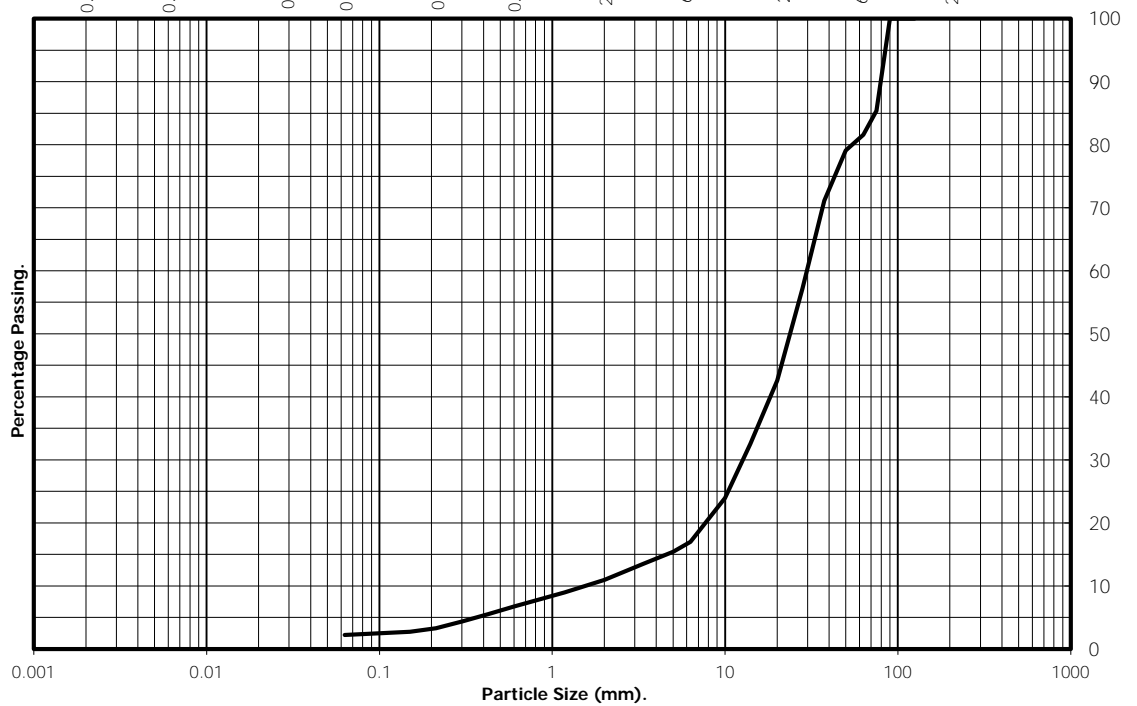
Client ref: **A089434-1**
 Contract Number: **30365-300316**
 Hole Number: **WS1612**

Sample Number: **3**
 Depth from (m): **1.00**
 Depth to (m): **1.10**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown silty clayey sandy fine to coarse GRAVEL with many cobbles.**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	85
63	82
50	79
37.5	71
28	57
20	43
14	33
10	24
6.3	17
5.0	15
3.35	13
2.00	11
1.18	9
0.60	7
0.425	6
0.300	4
0.212	3
0.150	3
0.063	2



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	2	9	71	18	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Emma Sharp (Office Manager)

Date: **15.4.16**



Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		TP1601
Sample No.		2
Depth	m	1.00
Date		15/04/2016
Disturbed / Undisturbed		Disturbed (Remoulded)

Description of Specimen

Light greyish brown fine-medium sub-rounded gravelly sl clayey silty fine-coarse SAND

Initial Specimen Conditions

Height	mm	115.50
Diameter	mm	104.80
Area	mm ²	8626.06
Volume	cm ³	996.31
Mass	g	2358.70
Dry Mass	g	2208.00
Density	Mg/m ³	2.37
Dry Density	Mg/m ³	2.22
Moisture Content	%	6.8
Voids Ratio		0.196
Specific Gravity	kN/m ³ (assumed/measured)	2.65 assumed

Final Specimen Conditions

Moisture Content	%	7.65
Density	Mg/m ³	2.42
Dry Density	Mg/m ³	2.24

Test Setup

Date started	04/04/2016
Date Finished	14/04/2016
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PPerm 1
Cell Number	CPerm 1

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Checked and Approved By

15/04/16
Date

Client Ref

A089434-1

Contract No

30365-300316



St Asaph



Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

Specimen Details

Borehole		TP1601
Sample No.		2
Depth	m	1.00
Date		15/04/2016

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	99.00
Differential Pressure	kPa	1.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	294.00
Final B Value		0.99

Consolidation

Effective Pressure	kPa	100.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	200.00
Excess Pore Pressure	kPa	94.00
Pore Pressure at End	kPa	200.00
Consolidated Volume	cm ³	983.91
Consolidated Height	mm	115.02
Consolidated Area	mm ²	8554.49
Vol. Compressibility	m ² /MN	1.4162
Consolidation Coef.	m ² /yr.	0.1324
Final Voids Ratio		0.181

Permeability

Cell Pressure	kPa	300.00
Effective Cell Pressure	kPa	100.00
Back Pressure Diff.	kPa	20.00
Mean Rate of Flow	ml/min	0.01147
Average Temperature	°C	20

Vertical Permeability Kv	m/s	1.25 x 10⁻⁹
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D P Gans

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15/04/16
Date

St Asaph

Client Ref

A089434-1

Contract No

30365-300316



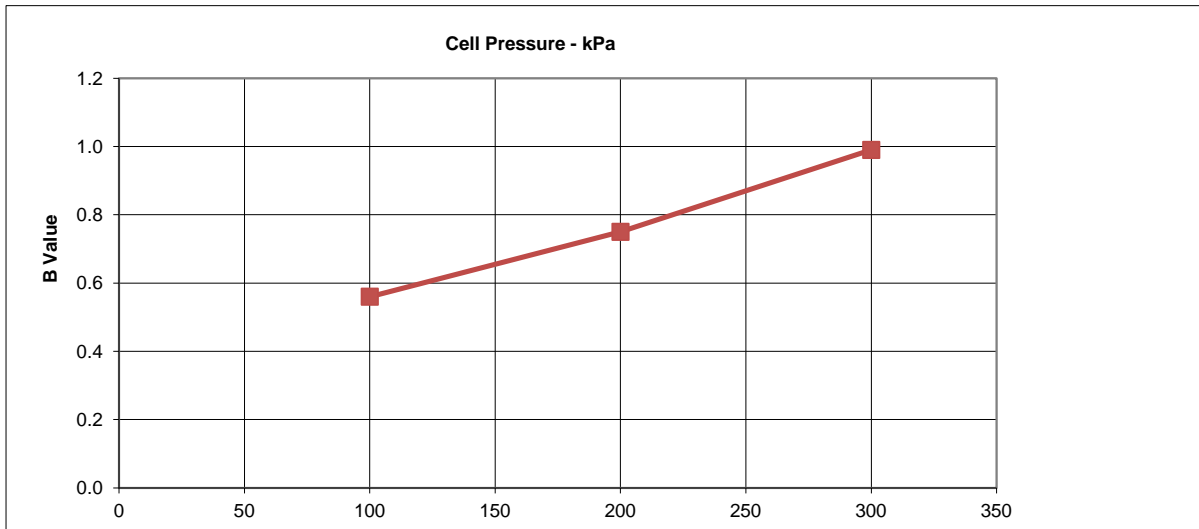
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

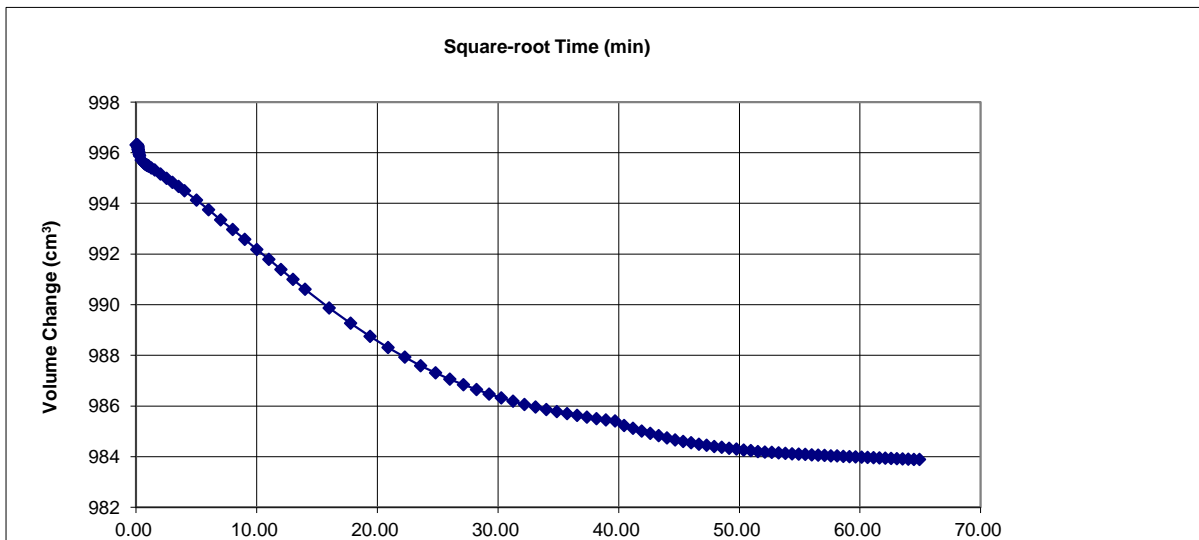
Specimen Details

Borehole		TP1601
Sample No.		2
Depth	m	1.00
Date		15/04/2016

Saturation Stage



Consolidation Stage



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15/04/16

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Client Ref

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Contract No

30365-300316



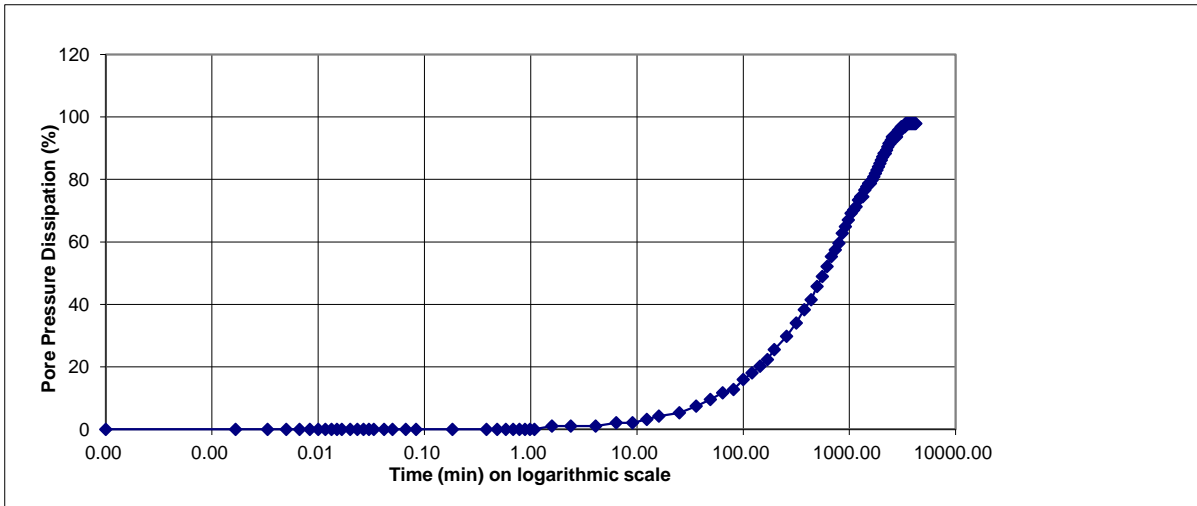
Permeability in a Triaxial Cell

BS 1377 : Part 6 : 1990 Clause 6

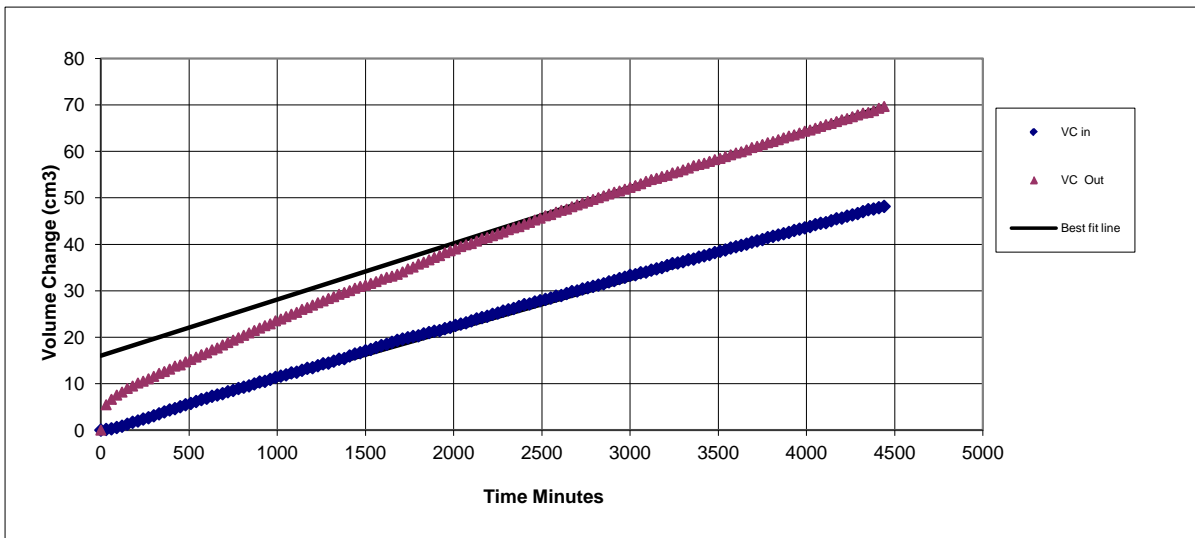
Specimen Details

Borehole		TP1601
Sample No.		2
Depth	m	1.00
Date		15/04/2016

Consolidation Stage



Permeability Stage



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Date

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GEO Site & Testing Services Limited

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Client Ref
A089434-1
Contract No

30365-300316



Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601A
Sample No.		2
Depth	m	0.90
Date		14/03/2016
Disturbed / Undisturbed		Disturbed (Remoulded)

Description of Specimen

Reddish Brown Slightly Gravelly Slightly Silty CLAY

Initial Specimen Conditions

Height	mm	205.00
Diameter	mm	104.00
Area	mm ²	8494.87
Volume	cm ³	1741.45
Mass	g	3828.70
Dry Mass	g	3378.60
Density	Mg/m ³	2.20
Dry Density	Mg/m ³	1.94
Moisture Content	%	13
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	15
Density	Mg/m ³	2.34
Dry Density	Mg/m ³	2.04

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18/04/16
Date



St Asaph

Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601A
Sample No.		2
Depth	m	0.90
Date		14/03/2016

Test Setup

Date started		09/04/2016
Date Finished		13/04/2016
Top Drain Used		y
Base Drain Used		y
Side Drains Used		y
Pressure System Number		P3
Cell Number		C3

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	107.00
Differential Pressure	kPa	-7.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	302.00
Final B Value		1.07

Consolidation

Effective Pressure	kPa	30.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	270.00
Excess Pore Pressure	kPa	32.00
Pore Pressure at End	kPa	270.00
Consolidated Volume	cm ³	1656.75
Consolidated Height	mm	201.68
Consolidated Area	mm ²	1656.75
Vol. Compressibility	m ² /MN	0.18014
Consolidation Coef.	m ² /yr.	1.36330

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18/04/16
Date



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Client Ref
A089434-1

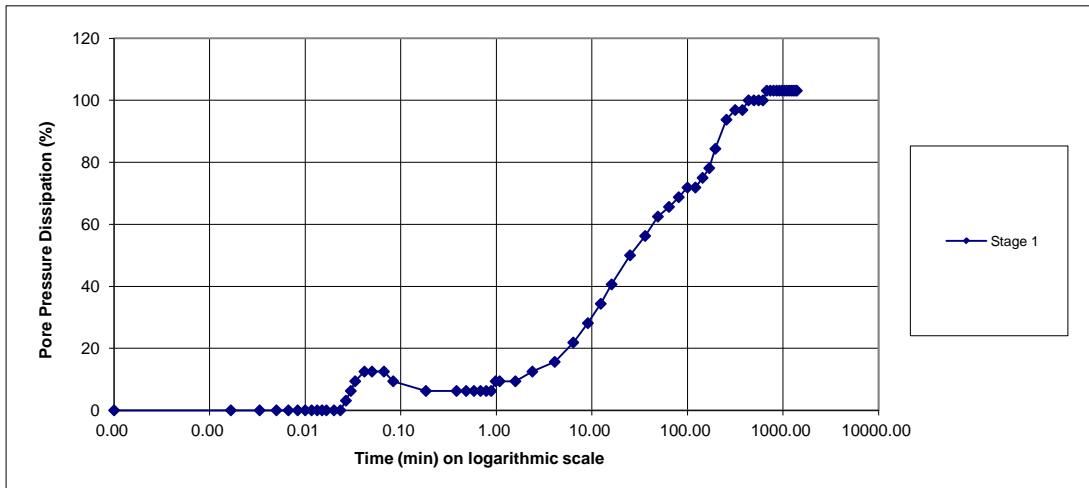
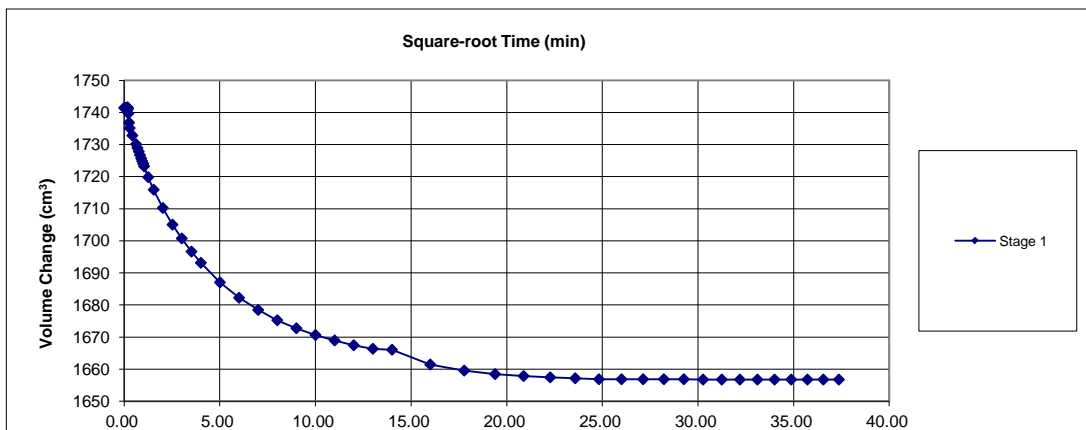
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole	WS1601A
Sample No.	2
Depth	0.90 m
Date	14/03/2016

Consolidation Stage



DP Gans

Checked and Approved By

18/04/16
Date



St Asaph

Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601A
Sample No.		2
Depth	m	0.90
Date		14/03/2016

Shearing

Initial Cell Pressure	kPa	300
Initial Pore Pressure	kPa	270
Rate of Strain	mm/min	0.0039

Max Deviator Stress

Axial Strain		5.360
Axial Stress	kPa	84.860
Cor. Deviator stress	kPa	81.812
Effective Major Stress	kPa	110.812
Effective Minor Stress	kPa	30.000
Effective Stress Ratio		3.694
s'	kPa	70.406
t'	kPa	40.406

Max Effective Principle Stress Ratio

Axial Strain		4.993
Axial Stress	kPa	82.646
Cor. Deviator stress	kPa	78.625
Effective Major Stress	kPa	108.625
Effective Minor Stress	kPa	30.000
Effective Stress Ratio		3.621
s'	kPa	69.313
t'	kPa	39.313
Shear Resistance Angle	degs	
Cohesion c'	kPa	

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18/04/16
Date

Client Ref

A089434-1

Contract No

30365-300316



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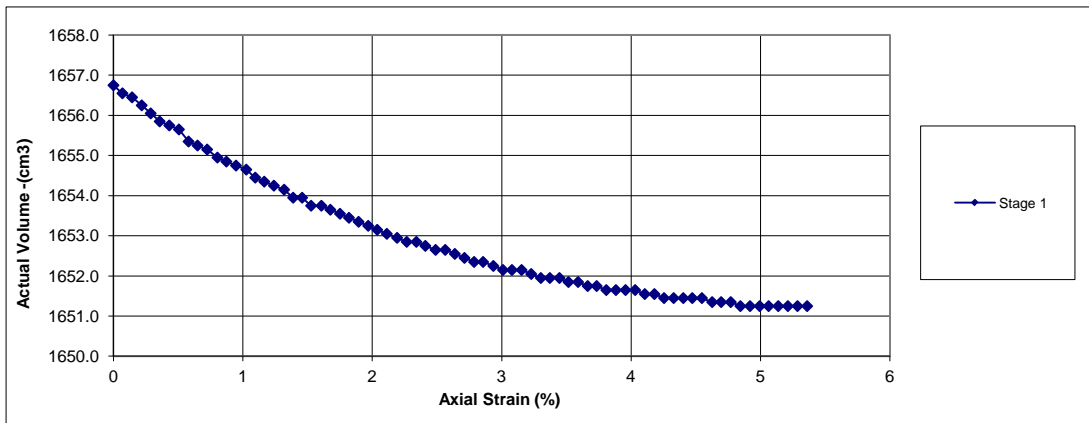
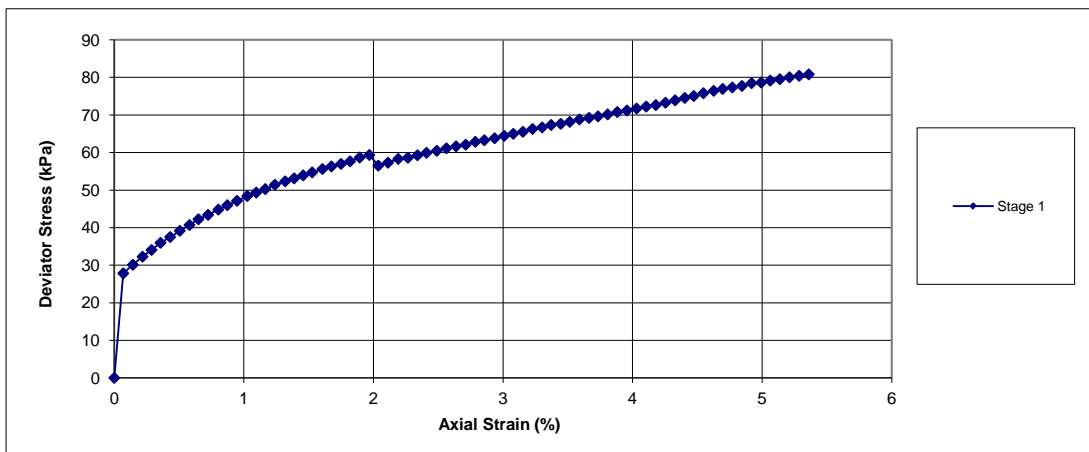
Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Stage 1

Specimen Details

Borehole		WS1601A
Sample No.		2
Depth	m	0.90
Date		14/03/2016

Shearing Stage



DP Gens

Checked and Approved By

18/04/16

Date

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GEO Site & Testing Services Limited

St Asaph

Client Ref

A089434-1

Contract No

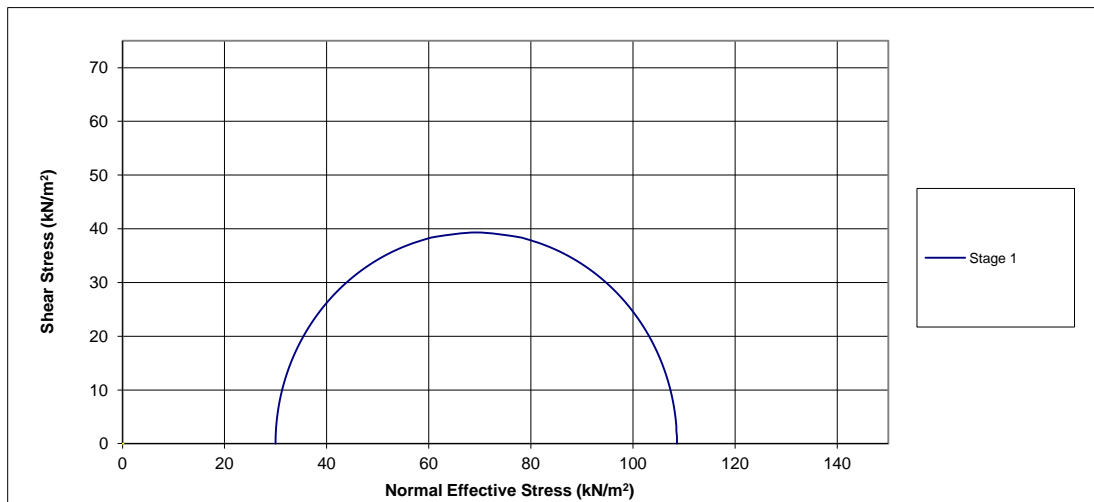
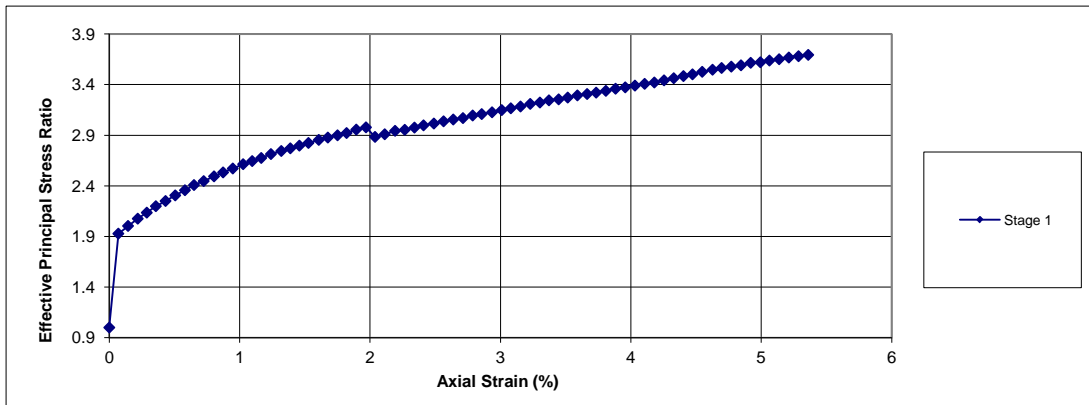
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601A
Sample No.		2
Depth	m	0.9
Date		14/03/2016

Shearing Stage



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Checked and Approved By

18/04/16
Date

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GEO Site & Testing Services Limited

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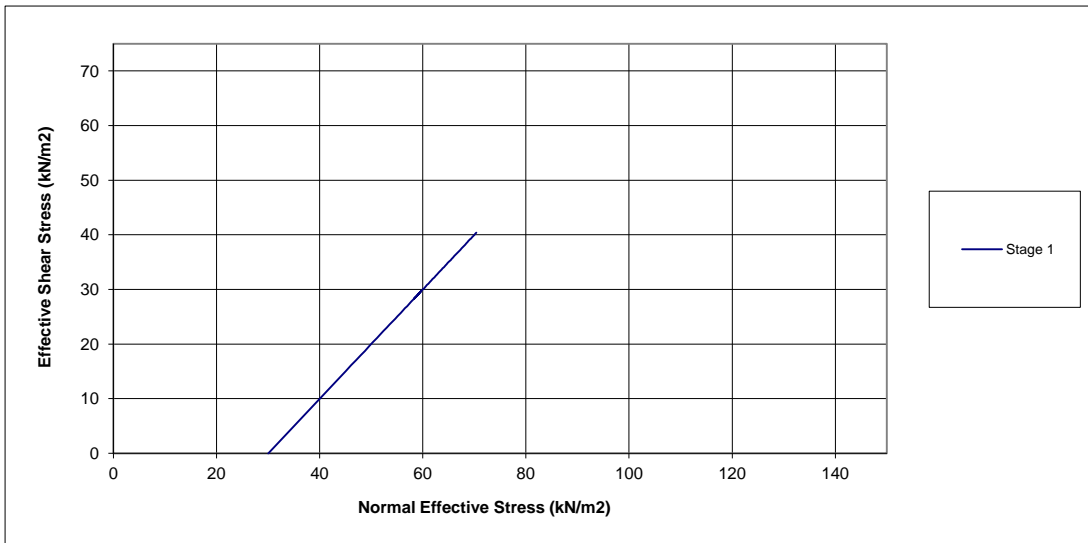
Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601A
Sample No.		2
Depth	m	0.9
Date		14/03/2016

Shearing Stage



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Geo Site & Testing Services Limited

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Client Ref

A089434-1

Contract No

30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.27
Date		14/03/2016
Disturbed / Undisturbed		Disturbed (Remoulded)

Description of Specimen

Brown Slightly Fine Gravelly Firm CLAY
--

Initial Specimen Conditions

Height	mm	205.00
Diameter	mm	103.00
Area	mm ²	8332.29
Volume	cm ³	1708.12
Mass	g	3268.60
Dry Mass	g	2566.90
Density	Mg/m ³	1.91
Dry Density	Mg/m ³	1.50
Moisture Content	%	27
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	30
Density	Mg/m ³	1.98
Dry Density	Mg/m ³	1.52

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18/04/16
Date



St Asaph

Client Ref

A089434-1

Contract No

30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.27
Date		14/03/2016

Test Setup

Date started		09/04/2016
Date Finished		13/04/2016
Top Drain Used		y
Base Drain Used		y
Side Drains Used		y
Pressure System Number		P2
Cell Number		C2

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	96.00
Differential Pressure	kPa	4.00
Final Cell Pressure	kPa	300.00
Final Pore Pressure	kPa	296.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	20.00
Cell Pressure	kPa	300.00
Back Pressure	kPa	280.00
Excess Pore Pressure	kPa	16.00
Pore Pressure at End	kPa	280.00
Consolidated Volume	cm ³	1683.32
Consolidated Height	mm	204.01
Consolidated Area	mm ²	1683.32
Vol. Compressibility	m ² /MN	0.05185
Consolidation Coef.	m ² /yr.	1.33721

DP Gans

Checked and Approved By

18/04/16
Date



St Asaph

Client Ref
A089434-1

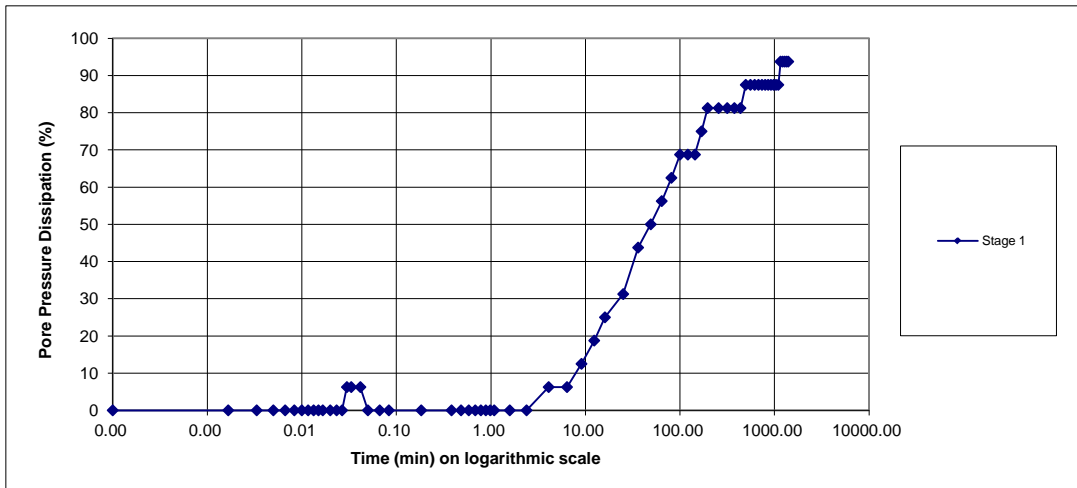
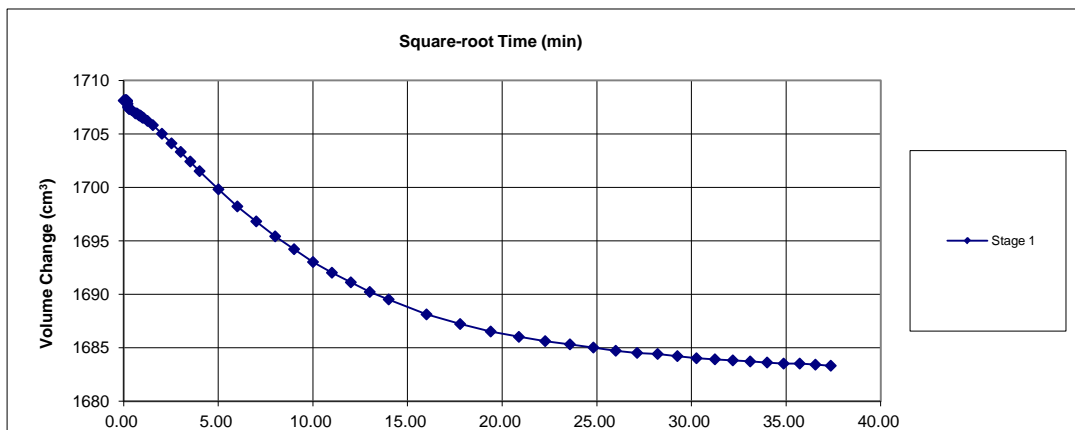
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole	WS1601B
Sample No.	1
Depth	0.27 m
Date	14/03/2016

Consolidation Stage



DP King

Checked and Approved By

18/04/16
Date

GSTL
Geo Site & Testing Services Limited

St Asaph

Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.27
Date		14/03/2016

Shearing

Initial Cell Pressure	kPa	300
Initial Pore Pressure	kPa	280
Rate of Strain	mm/min	0.0039

Max Deviator Stress

Axial Strain		8.965
Axial Stress	kPa	53.507
Cor. Deviator stress	kPa	50.181
Effective Major Stress	kPa	69.181
Effective Minor Stress	kPa	20.000
Effective Stress Ratio		3.459
s'	kPa	44.591
t'	kPa	24.591

Max Effective Principle Stress Ratio

Axial Strain		8.965
Axial Stress	kPa	53.507
Cor. Deviator stress	kPa	49.181
Effective Major Stress	kPa	69.181
Effective Minor Stress	kPa	20.000
Effective Stress Ratio		3.459
s'	kPa	44.591
t'	kPa	24.591
Shear Resistance Angle	degs	
Cohesion c'	kPa	

DP Gans

Checked and Approved By

18/04/16
Date

Client Ref

A089434-1

Contract No

30365-300316

GSTL
Geo Site & Testing Services Limited

St Asaph

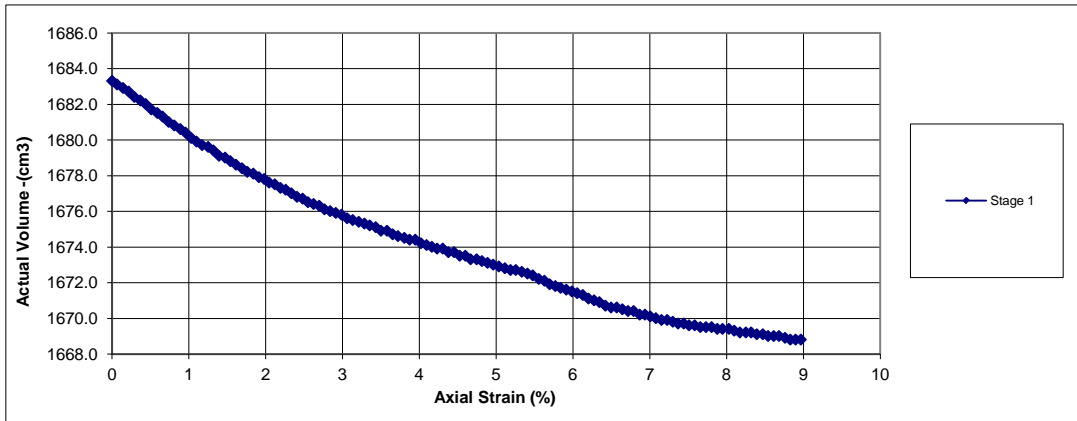
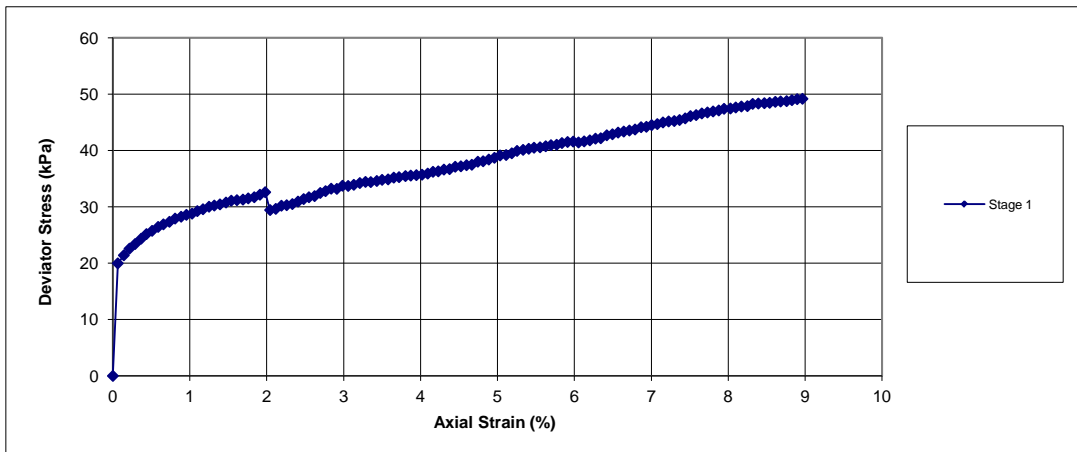
Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Stage 1

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.27
Date		14/03/2016

Shearing Stage



DP Gans

Checked and Approved By

18/04/16

Date

GSTL
Geo Site & Testing Services Limited

St Asaph

Client Ref

A089434-1

Contract No

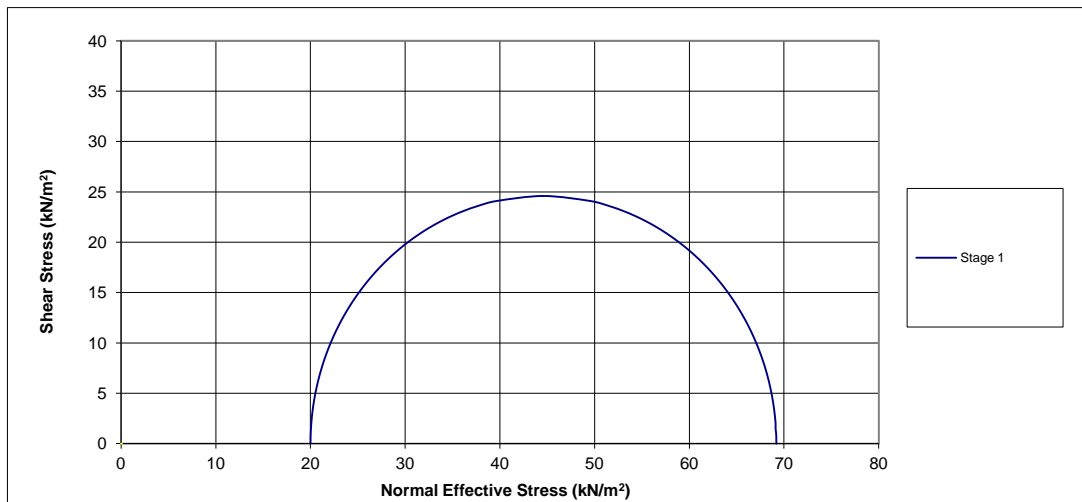
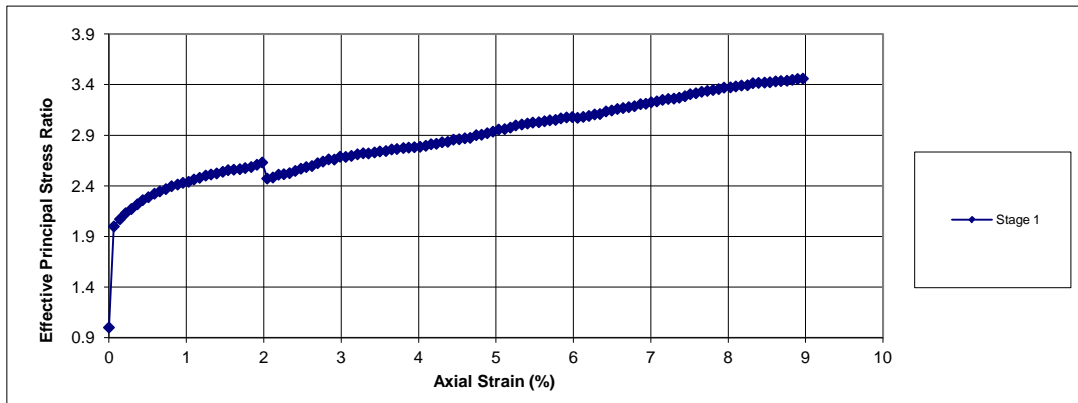
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.27
Date		14/03/2016

Shearing Stage



DP King

Checked and Approved By

18/04/16
Date



St Asaph

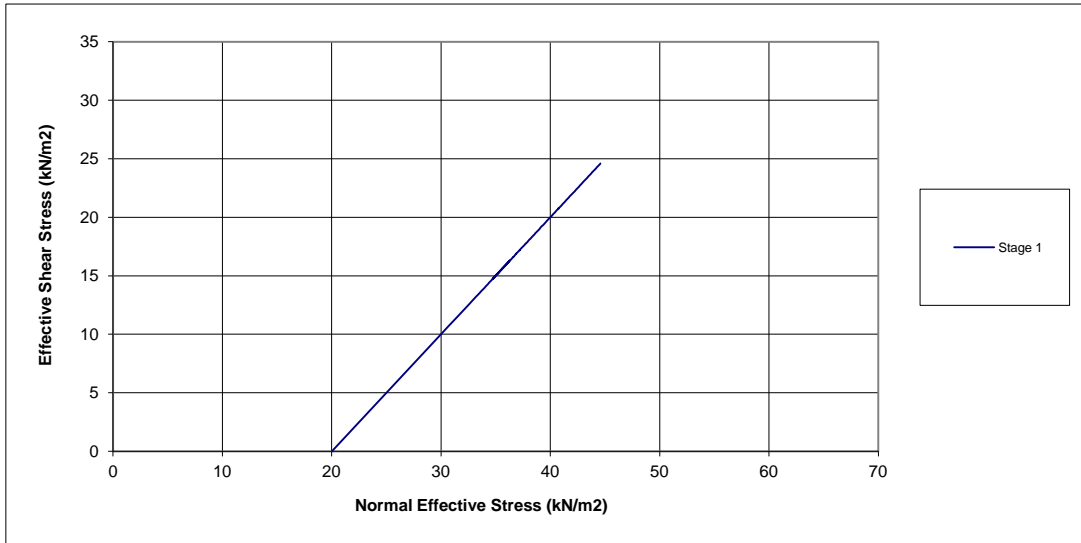
Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.27
Date		14/03/2016

Shearing Stage



DP King

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Date

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GEO Site & Testing Services Limited

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Client Ref

A089434-1

Contract No

30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016
Disturbed / Undisturbed		Disturbed (Remoulded)

Description of Specimen

Brown sandy fine-medium gravelly silty CLAY

Initial Specimen Conditions

Height	mm	202.00
Diameter	mm	104.00
Area	mm ²	8494.87
Volume	cm ³	1715.96
Mass	g	3628.80
Dry Mass	g	3089.00
Density	Mg/m ³	2.11
Dry Density	Mg/m ³	1.80
Moisture Content	%	17
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	19
Density	Mg/m ³	2.17
Dry Density	Mg/m ³	1.82

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Client Ref
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Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016

Test Setup

Date started		09/04/2016
Date Finished		13/04/2016
Top Drain Used		y
Base Drain Used		y
Side Drains Used		y
Pressure System Number		P8
Cell Number		C8

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	96.00
Differential Pressure	kPa	4.00
Final Cell Pressure	kPa	400.00
Final Pore Pressure	kPa	391.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	20.00
Cell Pressure	kPa	400.00
Back Pressure	kPa	380.00
Excess Pore Pressure	kPa	11.00
Pore Pressure at End	kPa	380.00
Consolidated Volume	cm ³	1694.26
Consolidated Height	mm	201.15
Consolidated Area	mm ²	1694.26
Vol. Compressibility	m ² /MN	0.03328
Consolidation Coef.	m ² /yr.	0.01963

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Client Ref
A089434-1

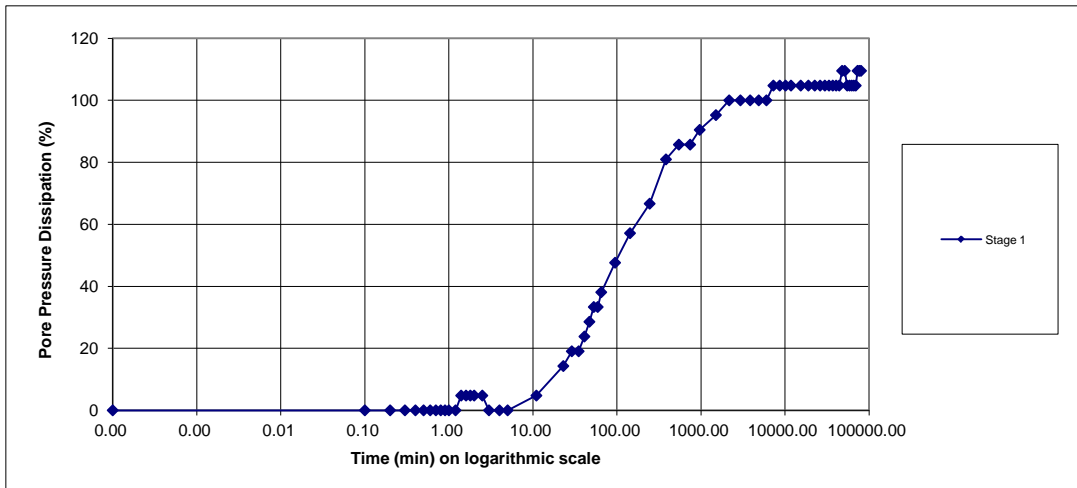
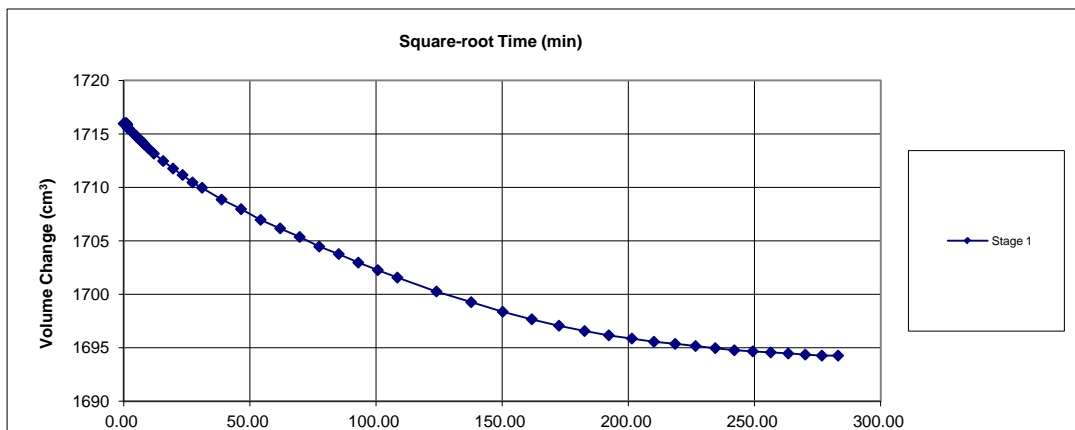
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Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016

Consolidation Stage



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18/04/16
Date

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Geo Site & Testing Services Limited

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Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016

Shearing

Initial Cell Pressure	kPa	400
Initial Pore Pressure	kPa	380
Rate of Strain	mm/min	0.0001

Max Deviator Stress

Axial Strain		5.270
Axial Stress	kPa	98.967
Cor. Deviator stress	kPa	95.926
Effective Major Stress	kPa	114.926
Effective Minor Stress	kPa	20.000
Effective Stress Ratio		5.746
s'	kPa	67.463
t'	kPa	47.463

Max Effective Principle Stress Ratio

Axial Strain		4.146
Axial Stress	kPa	96.044
Cor. Deviator stress	kPa	92.087
Effective Major Stress	kPa	112.087
Effective Minor Stress	kPa	20.000
Effective Stress Ratio		5.604
s'	kPa	66.044
t'	kPa	46.044
Shear Resistance Angle	degs	
Cohesion c'	kPa	

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Client Ref

A089434-1

Contract No

30365-300316

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St Asaph

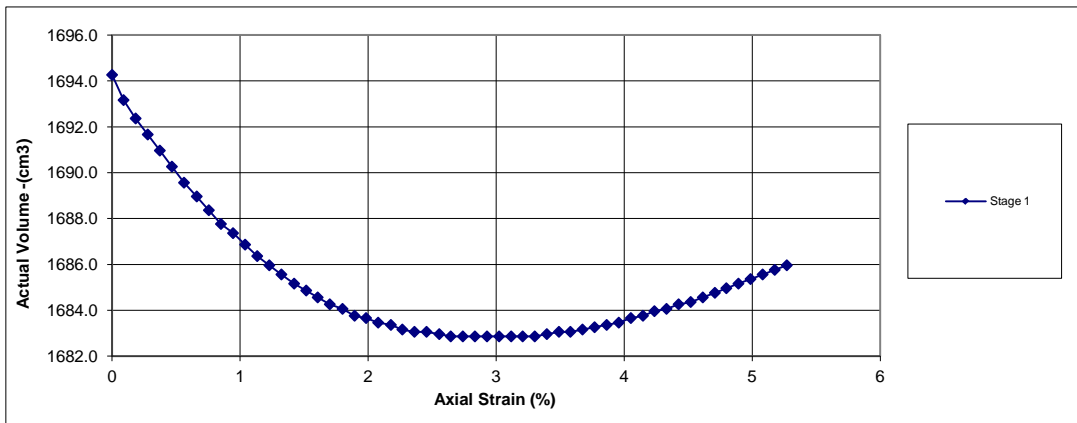
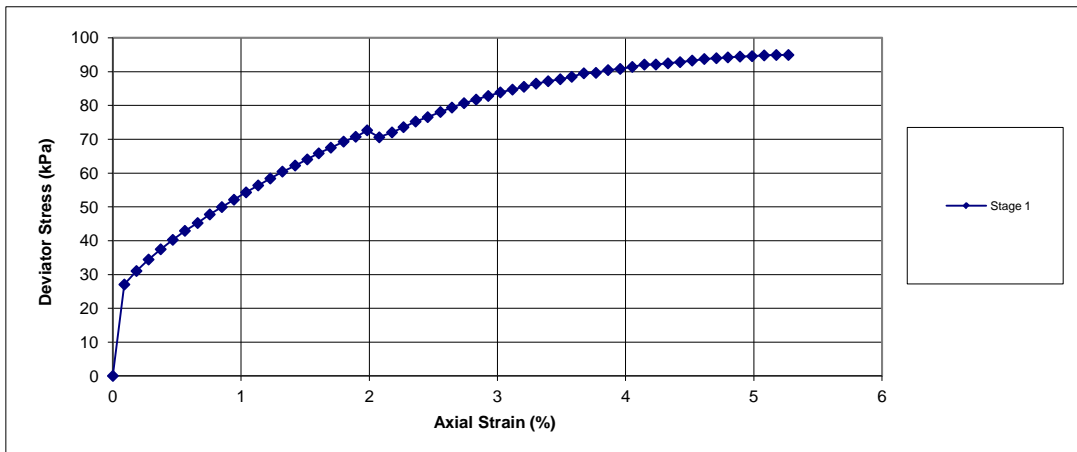
Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Stage 1

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016

Shearing Stage



D.P. Gnan

Checked and Approved By

18/04/16

Date



St Asaph

Client Ref

A089434-1

Contract No

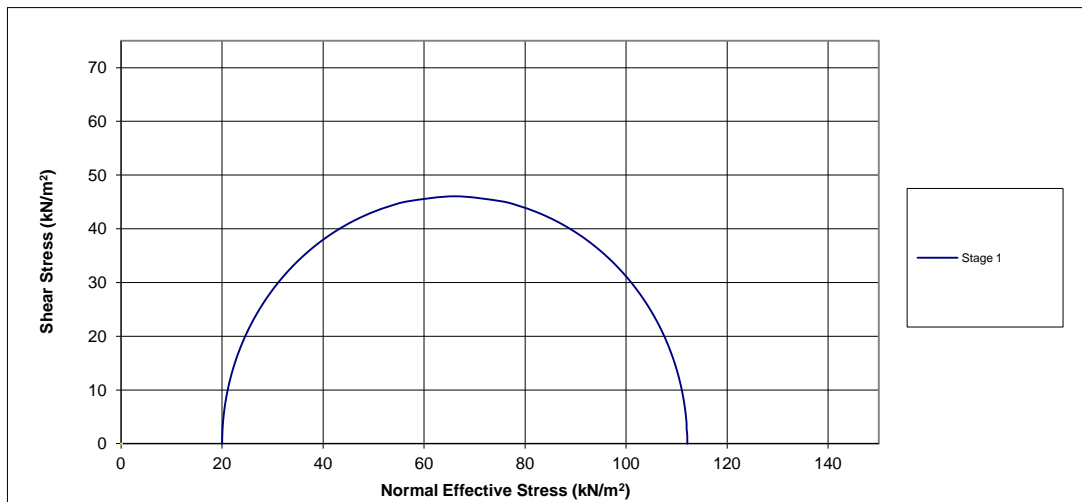
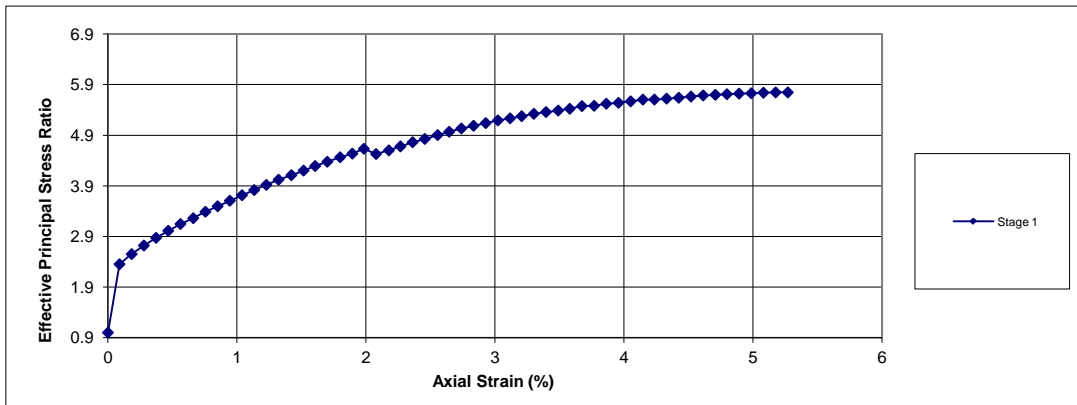
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016

Shearing Stage



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Checked and Approved By

18/04/16
Date



St Asaph

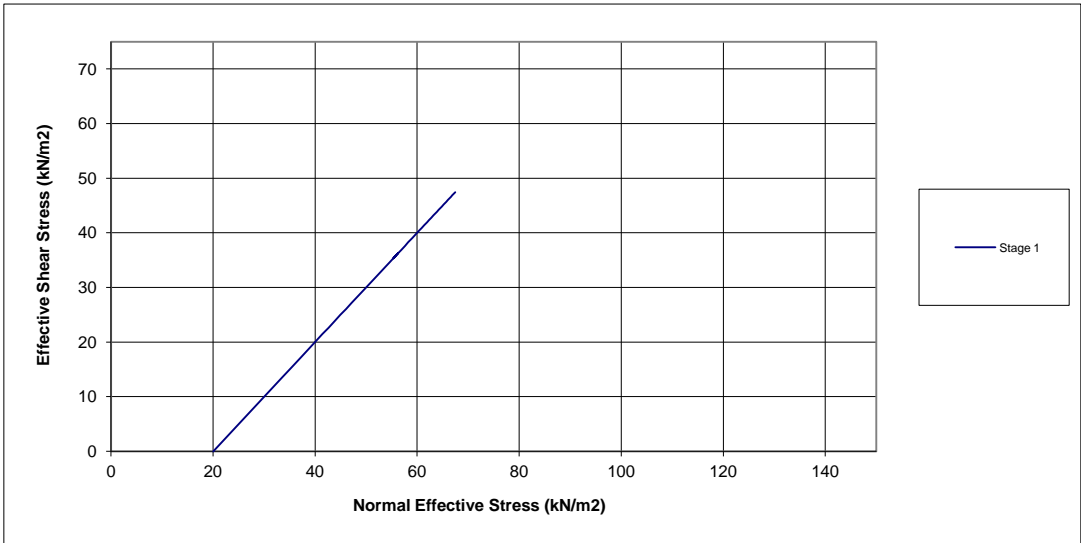
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A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601B
Sample No.		1
Depth	m	0.70
Date		14/04/2016

Shearing Stage



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18/04/16

Date

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GEO Site & Testing Services Limited

St Asaph

Client Ref

A089434-1

Contract No

30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016
Disturbed / Undisturbed		Disturbed (Remoulded)

Description of Specimen

Reddish brown sl fine gravelly silty firm CLAY
--

Initial Specimen Conditions

Height	mm	205.00
Diameter	mm	103.00
Area	mm ²	8332.29
Volume	cm ³	1708.12
Mass	g	3871.00
Dry Mass	g	3331.90
Density	Mg/m ³	2.27
Dry Density	Mg/m ³	1.95
Moisture Content	%	16
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	16
Density	Mg/m ³	2.29
Dry Density	Mg/m ³	1.98

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18/04/16
Date



St Asaph

Client Ref

A089434-1

Contract No

30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016

Test Setup

Date started		09/04/2016
Date Finished		15/04/2016
Top Drain Used		y
Base Drain Used		y
Side Drains Used		y
Pressure System Number		P4
Cell Number		C4

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	96.00
Differential Pressure	kPa	4.00
Final Cell Pressure	kPa	500.00
Final Pore Pressure	kPa	491.00
Final B Value		0.96

Consolidation

Effective Pressure	kPa	30.00
Cell Pressure	kPa	500.00
Back Pressure	kPa	470.00
Excess Pore Pressure	kPa	21.00
Pore Pressure at End	kPa	470.00
Consolidated Volume	cm ³	1685.92
Consolidated Height	mm	204.11
Consolidated Area	mm ²	1685.92
Vol. Compressibility	m ² /MN	0.02765
Consolidation Coef.	m ² /yr.	1.33721

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Client Ref
A089434-1

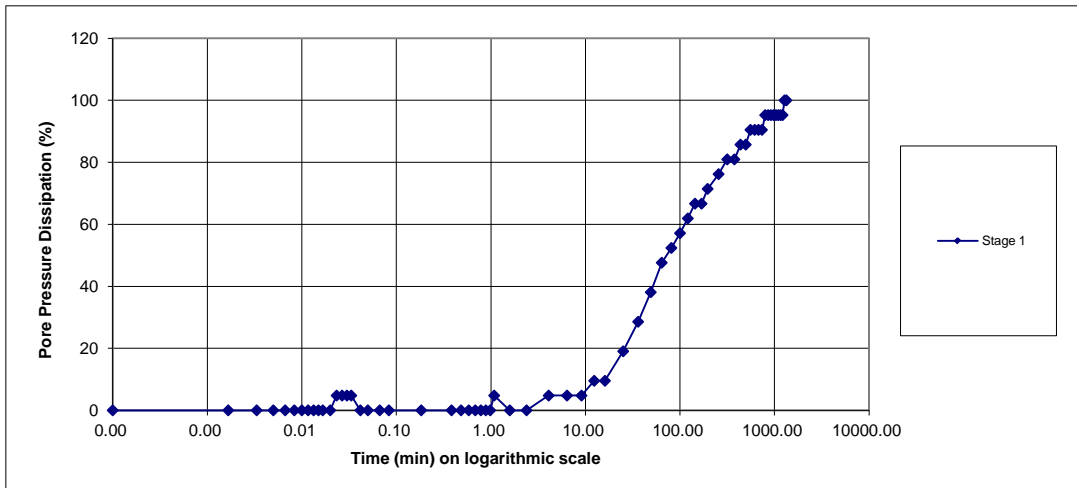
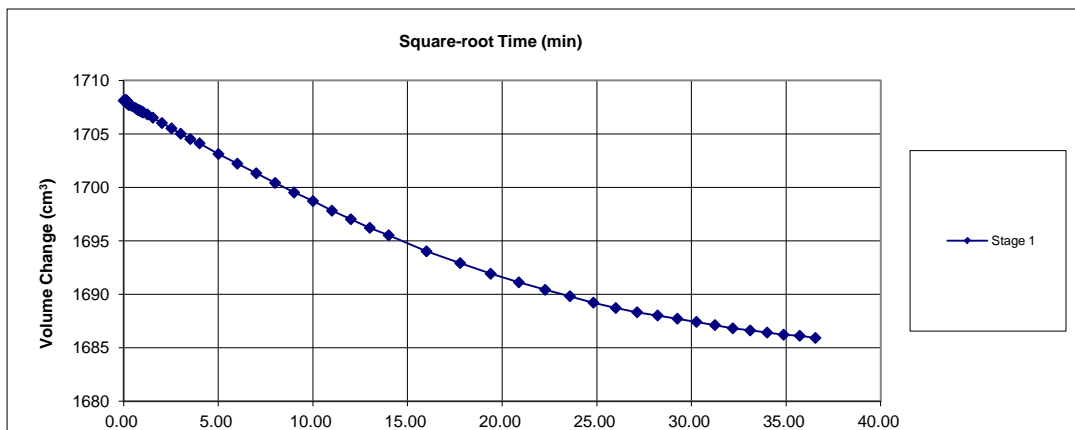
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016

Consolidation Stage



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18/04/16
Date

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Geo Site & Testing Services Limited

St Asaph

Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016

Shearing

Initial Cell Pressure	kPa	500
Initial Pore Pressure	kPa	470
Rate of Strain	mm/min	0.0039

Max Deviator Stress

Axial Strain		6.805
Axial Stress	kPa	58.105
Cor. Deviator stress	kPa	54.943
Effective Major Stress	kPa	83.943
Effective Minor Stress	kPa	30.000
Effective Stress Ratio		2.798
s'	kPa	56.971
t'	kPa	26.971

Max Effective Principle Stress Ratio

Axial Strain		5.928
Axial Stress	kPa	55.121
Cor. Deviator stress	kPa	51.025
Effective Major Stress	kPa	81.025
Effective Minor Stress	kPa	30.000
Effective Stress Ratio		2.701
s'	kPa	55.513
t'	kPa	25.513
Shear Resistance Angle	degs	
Cohesion c'	kPa	

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Date

Client Ref

A089434-1

Contract No

30365-300316

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Consolidated Drained Triaxial Compression Test

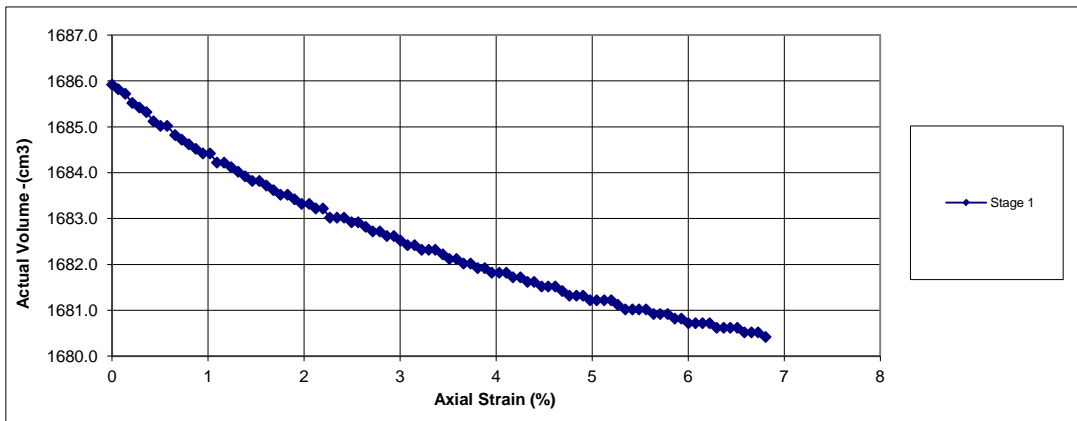
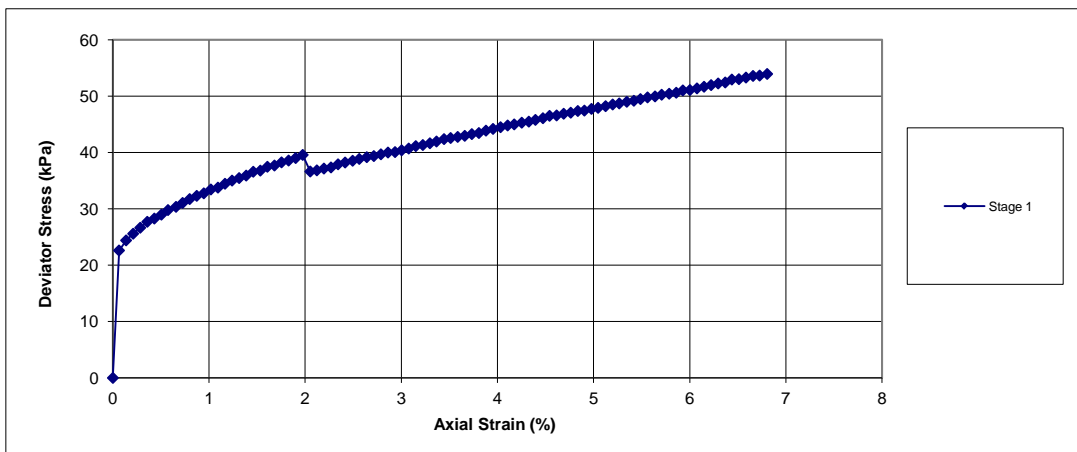
BS 1377 : Part 8 : 1990

Stage 1

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016

Shearing Stage



D.P. Gnan

Checked and Approved By

18/04/16

Date

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Geo Site & Testing Services Limited

St Asaph

Client Ref

A089434-1

Contract No

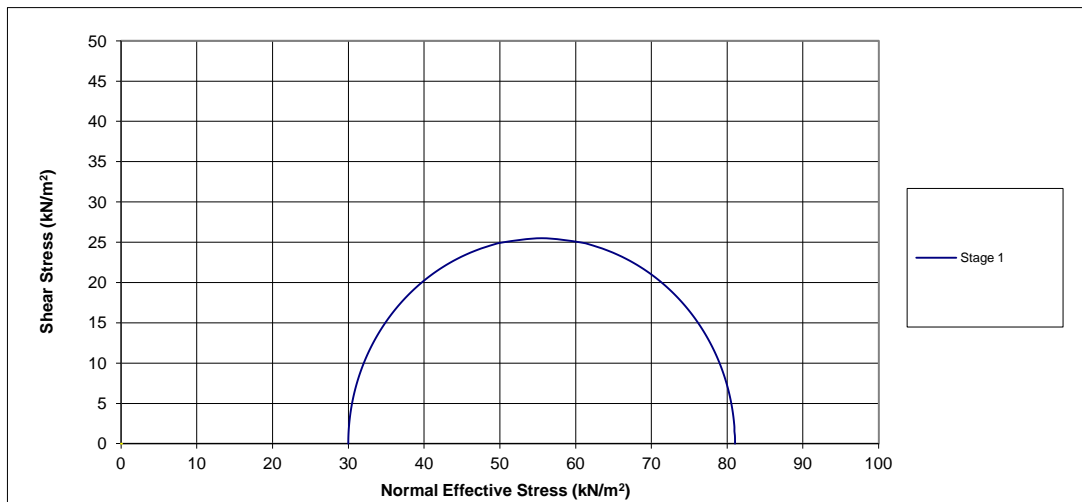
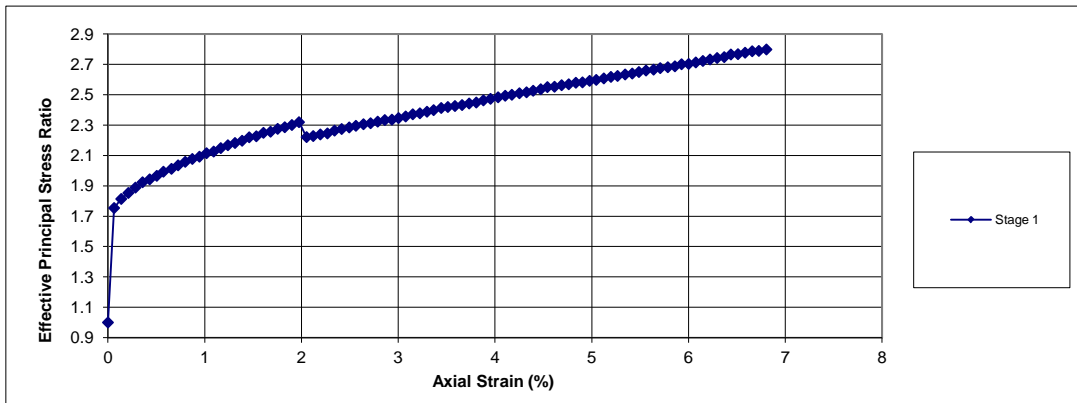
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016

Shearing Stage



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18/04/16
Date



St Asaph

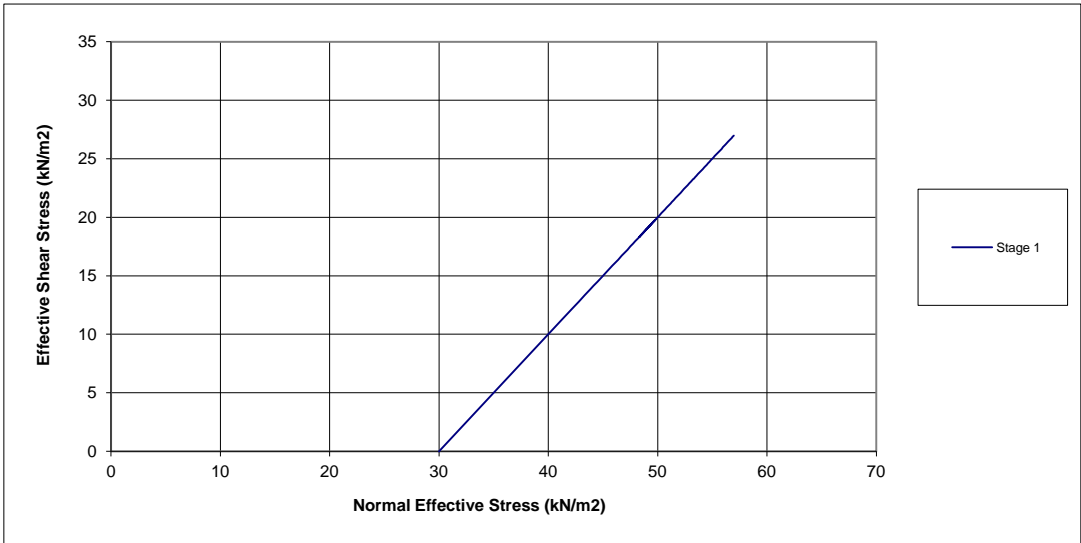
Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601C
Sample No.		2
Depth	m	1.00
Date		18/04/2016

Shearing Stage



DP Jones

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18/04/16

Date

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GEO Site & Testing Services Limited

St Asaph

Client Ref

A089434-1

Contract No

30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016
Disturbed / Undisturbed		Disturbed (Remoulded)

Description of Specimen

Greyish orange brown sl silty CLAY

Initial Specimen Conditions

Height	mm	205.00
Diameter	mm	103.00
Area	mm ²	8332.29
Volume	cm ³	1708.12
Mass	g	3390.40
Dry Mass	g	2693.50
Density	Mg/m ³	1.98
Dry Density	Mg/m ³	1.58
Moisture Content	%	26
Specific Gravity	kN/m ³	2.65
	(assumed/measured)	assumed

Final Specimen Conditions

Moisture Content	%	27
Density	Mg/m ³	2.02
Dry Density	Mg/m ³	1.59

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Checked and Approved By

18/04/16
Date

Client Ref

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Contract No

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Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016

Test Setup

Date started		09/04/2016
Date Finished		13/04/2016
Top Drain Used		y
Base Drain Used		y
Side Drains Used		y
Pressure System Number		P5
Cell Number		C5

Saturation

Cell Pressure Incr.	kPa	100.00
Back Pressure Incr.	kPa	97.00
Differential Pressure	kPa	3.00
Final Cell Pressure	kPa	400.00
Final Pore Pressure	kPa	391.00
Final B Value		0.97

Consolidation

Effective Pressure	kPa	20.00
Cell Pressure	kPa	400.00
Back Pressure	kPa	380.00
Excess Pore Pressure	kPa	11.00
Pore Pressure at End	kPa	380.00
Consolidated Volume	cm ³	1690.52
Consolidated Height	mm	204.30
Consolidated Area	mm ²	1690.52
Vol. Compressibility	m ² /MN	0.02712
Consolidation Coef.	m ² /yr.	1.33721

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18/04/16
Date



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Client Ref
A089434-1

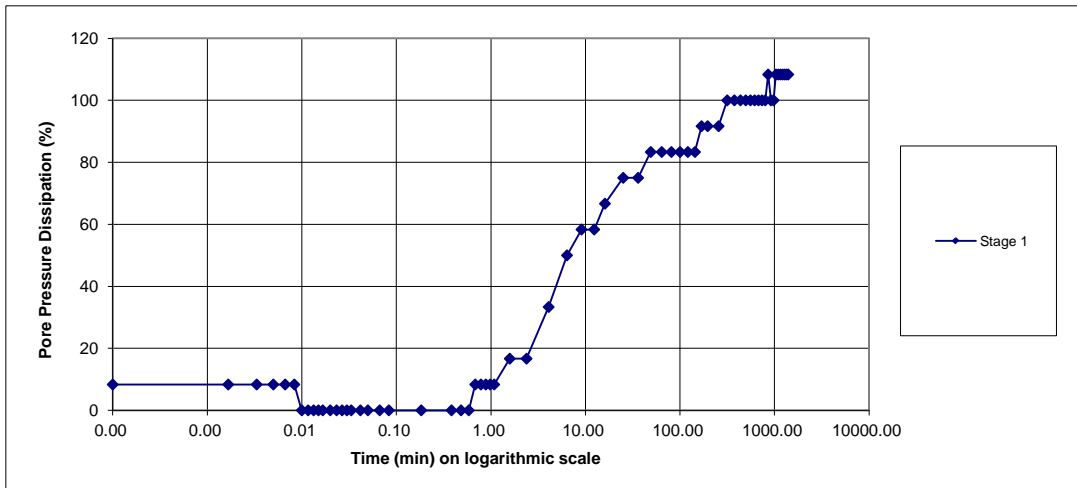
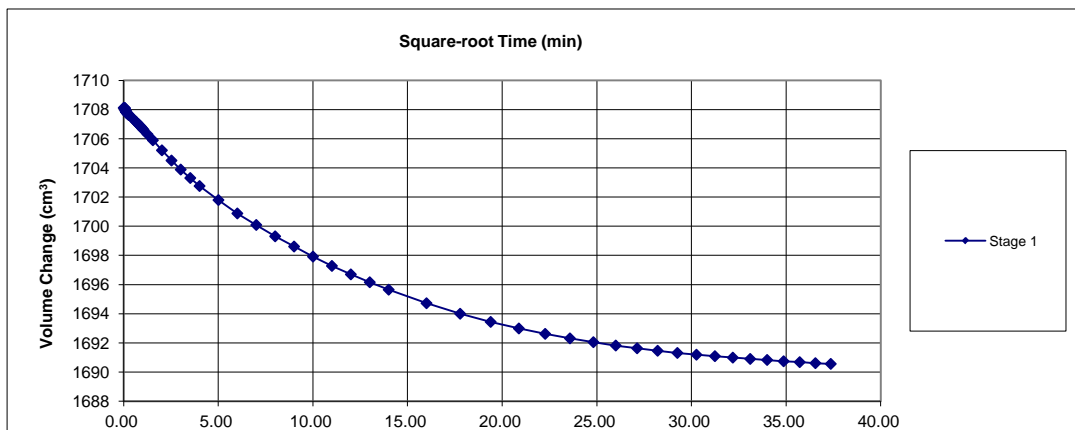
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016

Consolidation Stage



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Client Ref
A089434-1
Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016

Shearing

Initial Cell Pressure	kPa	400
Initial Pore Pressure	kPa	380
Rate of Strain	mm/min	0.0039

Max Deviator Stress

Axial Strain		10.132
Axial Stress	kPa	62.120
Cor. Deviator stress	kPa	55.524
Effective Major Stress	kPa	77.706
Effective Minor Stress	kPa	20.000
Effective Stress Ratio		3.885
s'	kPa	48.853
t'	kPa	28.853

Max Effective Principle Stress Ratio

Axial Strain		6.065
Axial Stress	kPa	50.969
Cor. Deviator stress	kPa	46.862
Effective Major Stress	kPa	66.862
Effective Minor Stress	kPa	20.000
Effective Stress Ratio		3.343
s'	kPa	43.431
t'	kPa	23.431

Shear Resistance Angle	degs	
Cohesion c'	kPa	

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Client Ref

A089434-1

Contract No

30365-300316



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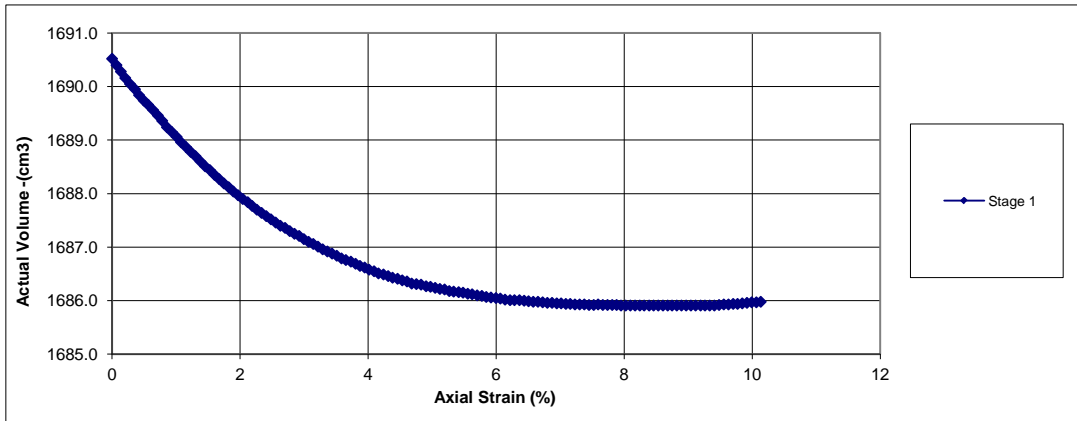
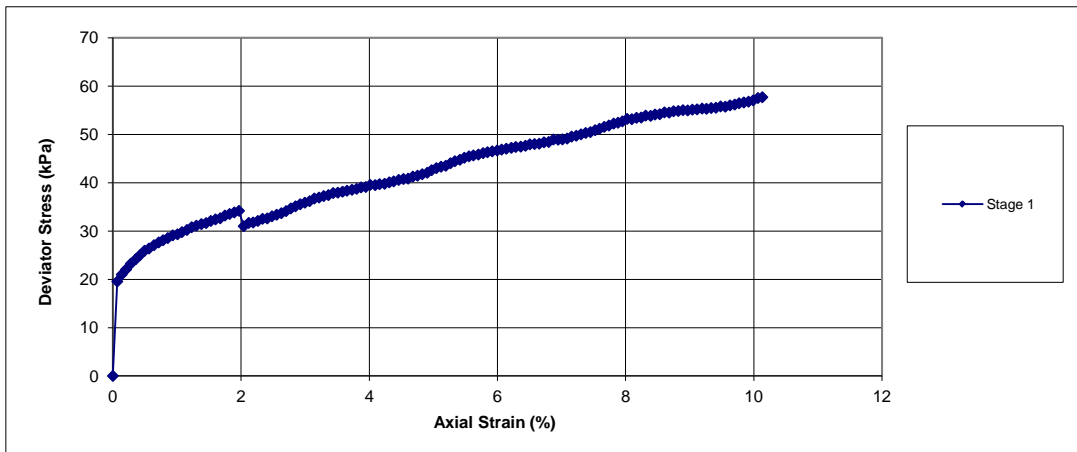
Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Stage 1

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016

Shearing Stage



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18/04/16

Date



St Asaph

Client Ref

A089434-1

Contract No

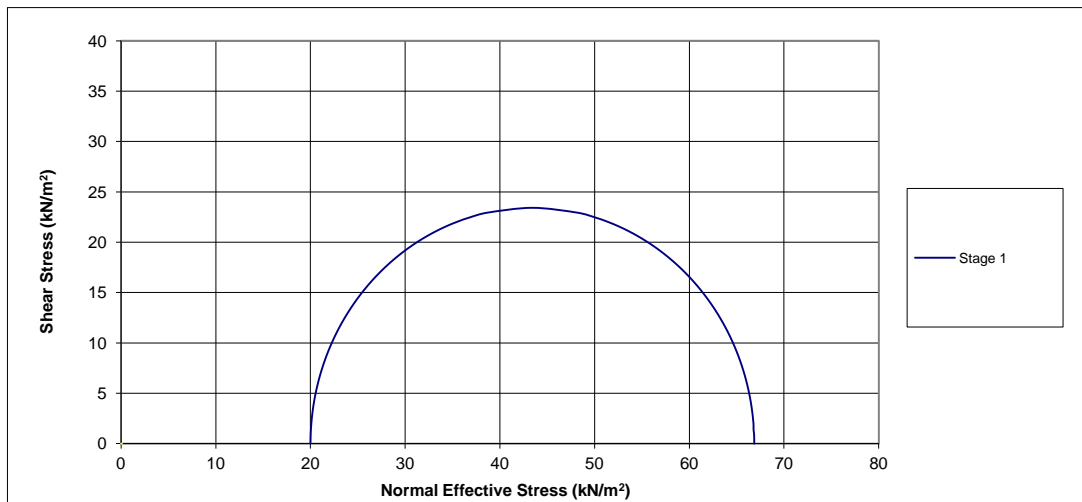
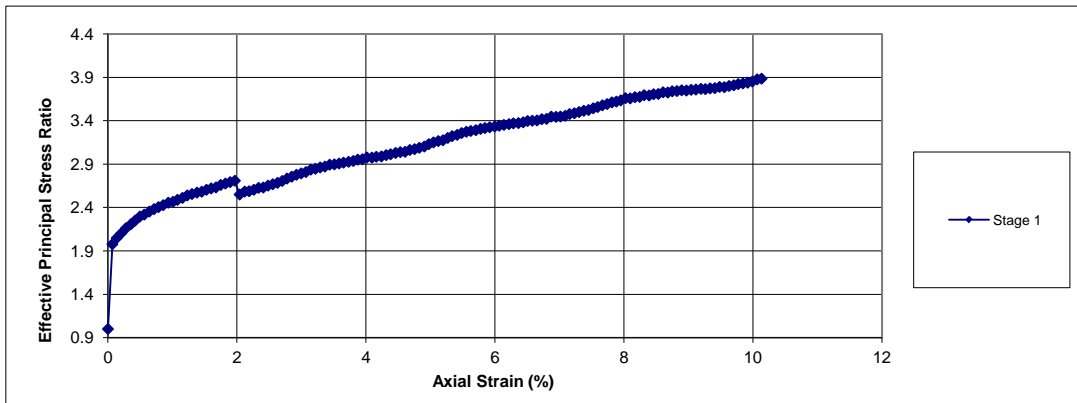
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Consolidated Drained Triaxial Compression Test BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016

Shearing Stage



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18/04/16
Date



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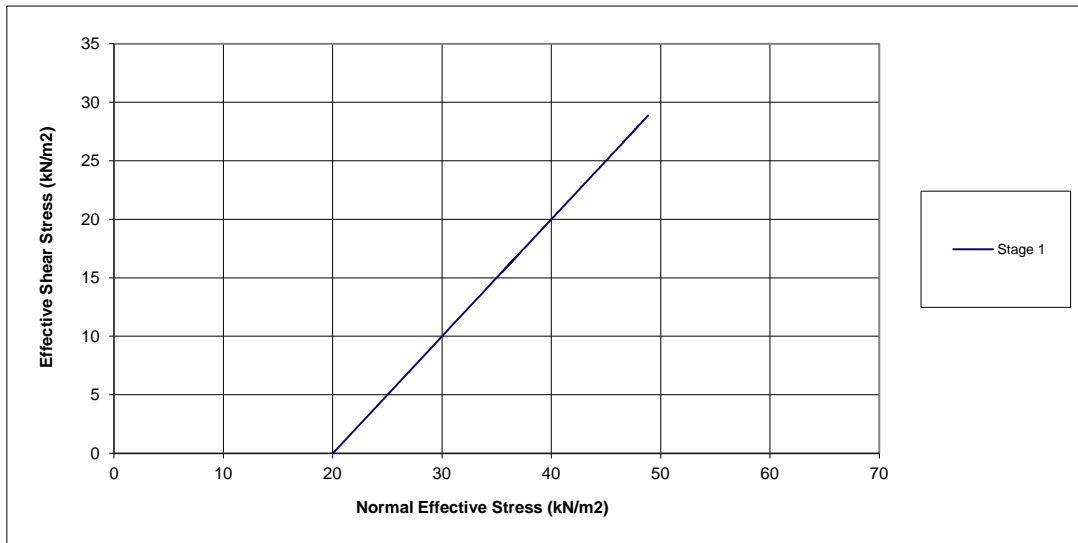
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Contract No
30365-300316

Consolidated Drained Triaxial Compression Test
BS 1377 : Part 8 : 1990

Specimen Details

Borehole		WS1601D
Sample No.		1
Depth	m	0.35
Date		14/03/2016

Shearing Stage



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18/04/16

Date

GSTL
GEO Site & Testing Services Limited

St Asaph

Client Ref

A089434-1

Contract No

30365-300316



Contract Number: 30539

Client's Reference: **A089434-1**

Report Date: **20-04-2016**

Client **WYG Group**
5th Floor
Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Contract Title: **St Asaph**
For the attention of: **Luzia Kathriner**

Date Received: **08-04-2016**
Date Commenced: **08-04-2016**
Date Completed: **20-04-2016**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	6
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	5
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	11
PSD: Sedimentation by pipette carried out with Wet Sieve 1377 : 1990 Part 2 : 9.4 - * UKAS	4
pH Value of Soil... 1377 : 1990 Part 3 : 9 - @ Non Accredited Test	3
Water Soluble Sulphate 2:1 extract 1377 : 1990 Part 3 : 5 - @ Non Accredited Test	3

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

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Approved Signatories:

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



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 30539

Test Description	Qty
Consolidated Drained Peak and Residual Shear Strength - set of 3 60 x 60mm Shear Box Specimens (5 days) 1377 : 1990 Part 7 : 4 - * UKAS	1
Disposal of Samples on Project	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

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Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager)

Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

GEO Site & Testing Services Ltd

Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 5 : 1990

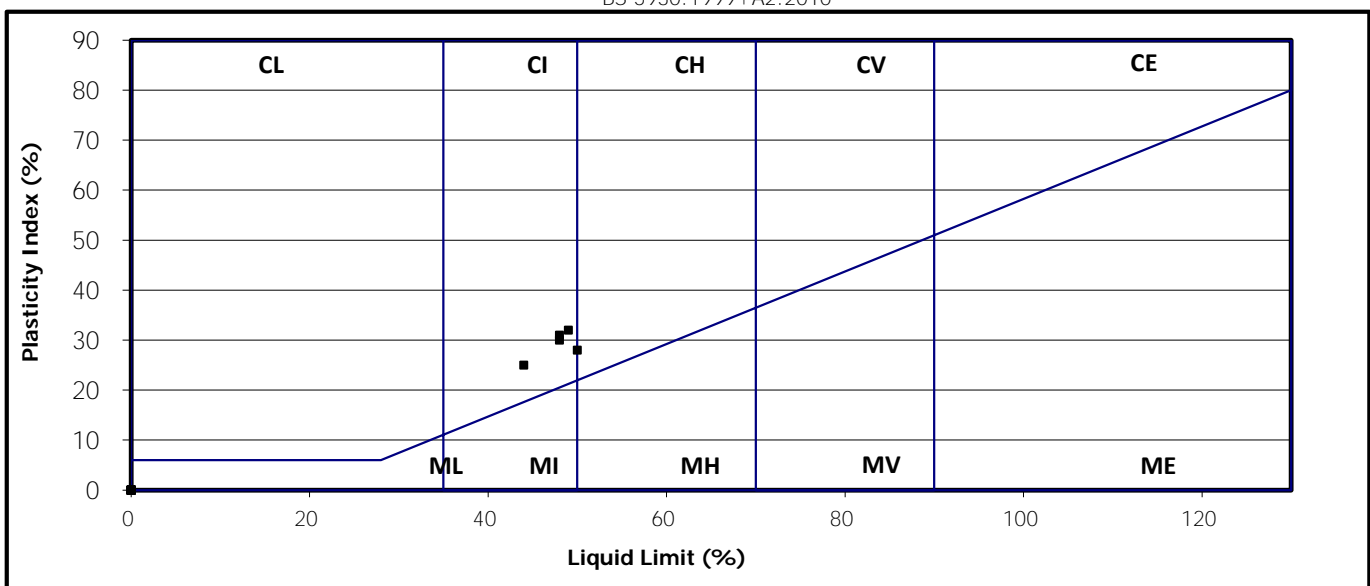
Client ref: **A089434-1**
 Location: **St Asaph**
 Contract Number: **30539-080416**

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.3	Plasticity Index % Cl. 5.4	% Passing .425mm	Remarks
BH1601/4	B	0.70 - 1.20	8.9					
BH1602/4	B	0.30 - 0.60	25	50	22	28	96	CI/H Inter/High Plasticity
BH1603/4	B	0.40 - 0.60	16	44	19	25	61	CI Intermediate Plasticity
BH1604/5	D	0.50	12	49	17	32	83	CI Intermediate Plasticity
BH1604/7	D	1.20 - 1.65	11	48	18	30	61	CI Intermediate Plasticity
BH1604/9	D	1.70	16	48	17	31	67	CI Intermediate Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

BS 5930:1999+A2:2010



For and on behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)
 Date: 15.4.16

Handwritten signature: Katam



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

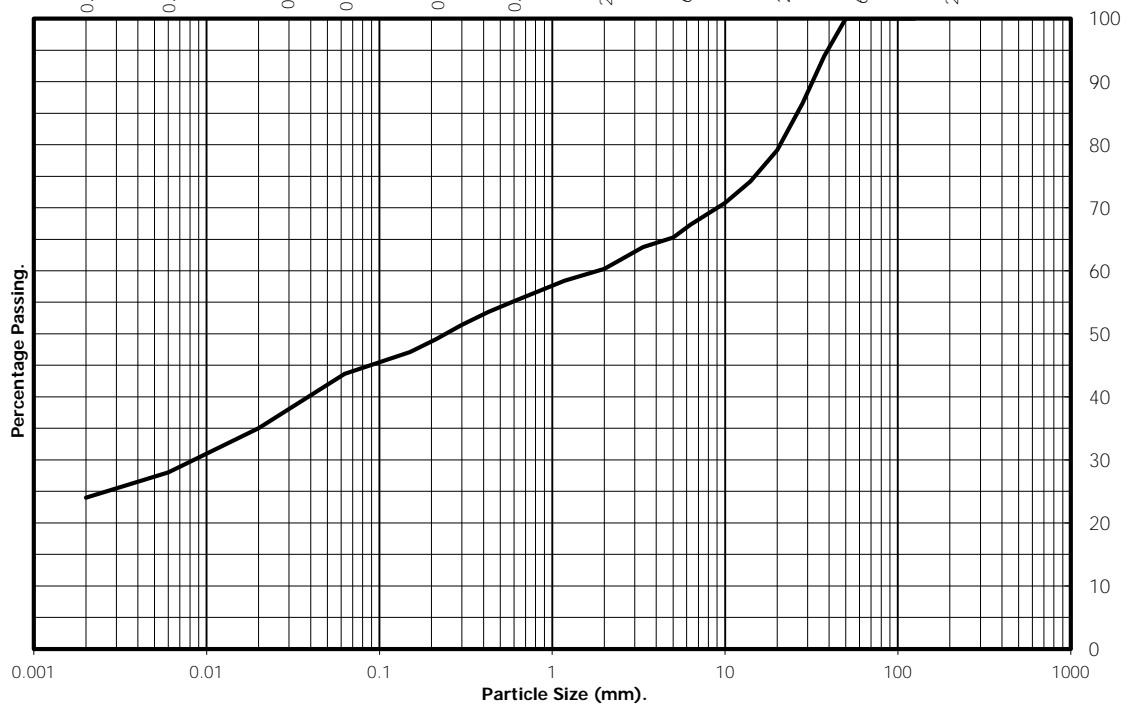
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1601**

Sample Number: **2**
 Depth from (m): **0.00**
 Depth to (m): **0.70**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy silty clayey GRAVEL (fine-coarse)**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	94
28	87
20	79
14	74
10	71
6.3	67
5.0	65
3.35	64
2.00	60
1.18	58
0.60	55
0.425	53
0.300	51
0.212	49
0.150	47
0.063	44



Particle Diameter	% Passing
0.02	35
0.006	28
0.002	24

Clay	Silt	Sand	Gravel	Cobbles	Soil Fraction
24	20	16	40	0	Total Percentage

Remarks:

Cl 9.4.8 - Sample has not been pretreated

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

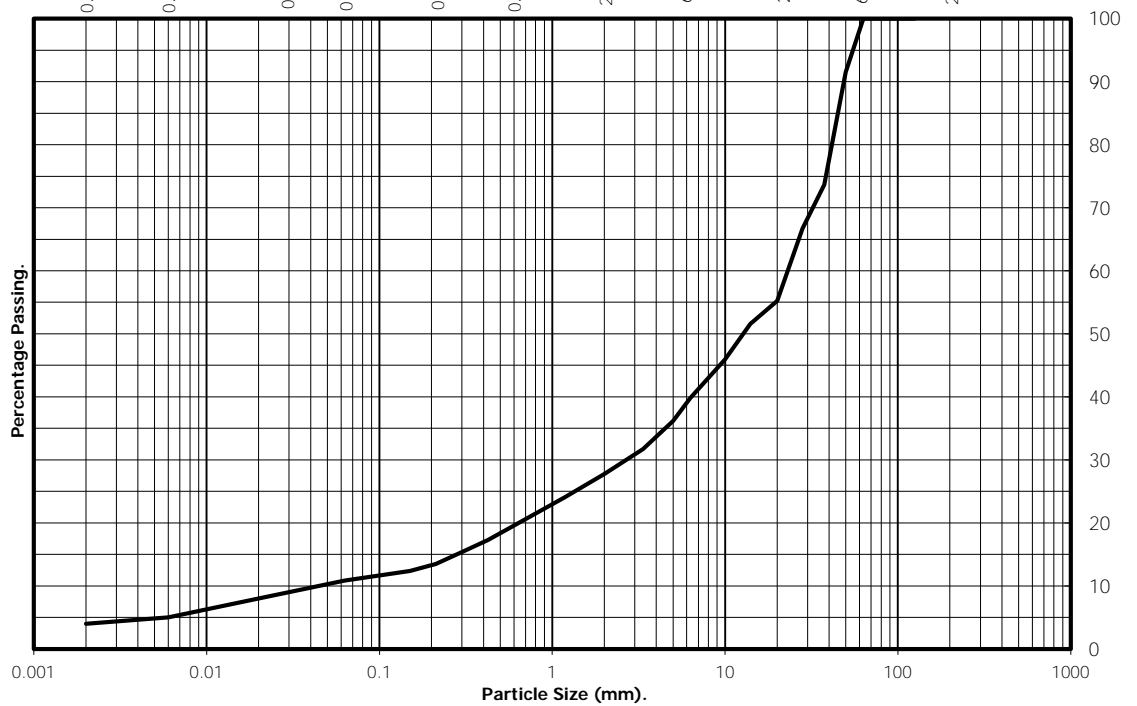
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1601**

Sample Number: **4**
 Depth from (m): **0.70**
 Depth to (m): **1.20**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown clayey silty sandy GRAVEL (fine-coarse)**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	92
37.5	74
28	67
20	55
14	52
10	46
6.3	40
5.0	36
3.35	32
2.00	28
1.18	24
0.60	20
0.425	17
0.300	15
0.212	13
0.150	12
0.063	11



Particle Diameter	% Passing
0.02	8
0.006	5
0.002	4

Clay	Silt	Sand	Gravel	Cobbles	Soil Fraction
4	7	17	72	0	Total Percentage

Remarks:

Cl 9.4.8 - Sample has not been pretreated

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

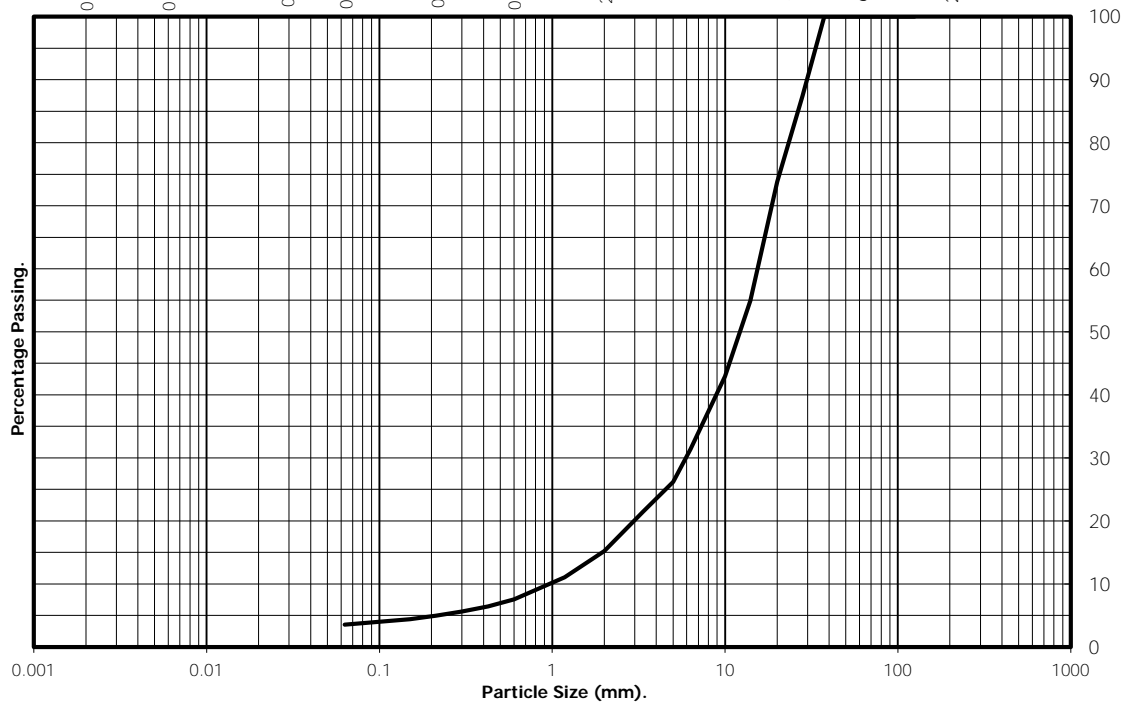
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1601**

Sample Number: **9**
 Depth from (m): **2.00**
 Depth to (m): **2.50**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown clayey silty sandy GRAVEL (fine-coarse)**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	87
20	74
14	55
10	43
6.3	31
5.0	26
3.35	21
2.00	15
1.18	11
0.60	8
0.425	6
0.300	6
0.212	5
0.150	4
0.063	4



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	4	11	85	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

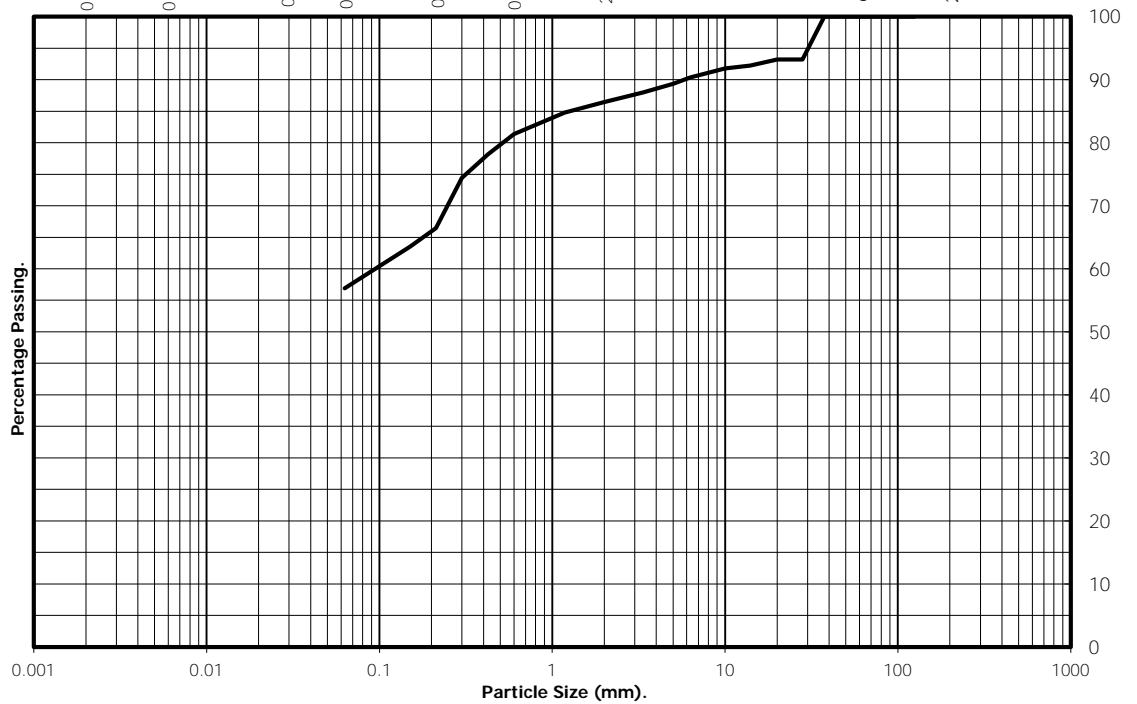
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1602**

Sample Number: **2**
 Depth from (m): **0.00**
 Depth to (m): **0.30**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown gravelly (fine-coarse) sandy silty CLAY**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	93
20	93
14	92
10	92
6.3	90
5.0	89
3.35	88
2.00	86
1.18	85
0.60	81
0.425	78
0.300	74
0.212	66
0.150	64
0.063	57



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	57	29	14	0	Total Percentage

Remarks:

- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

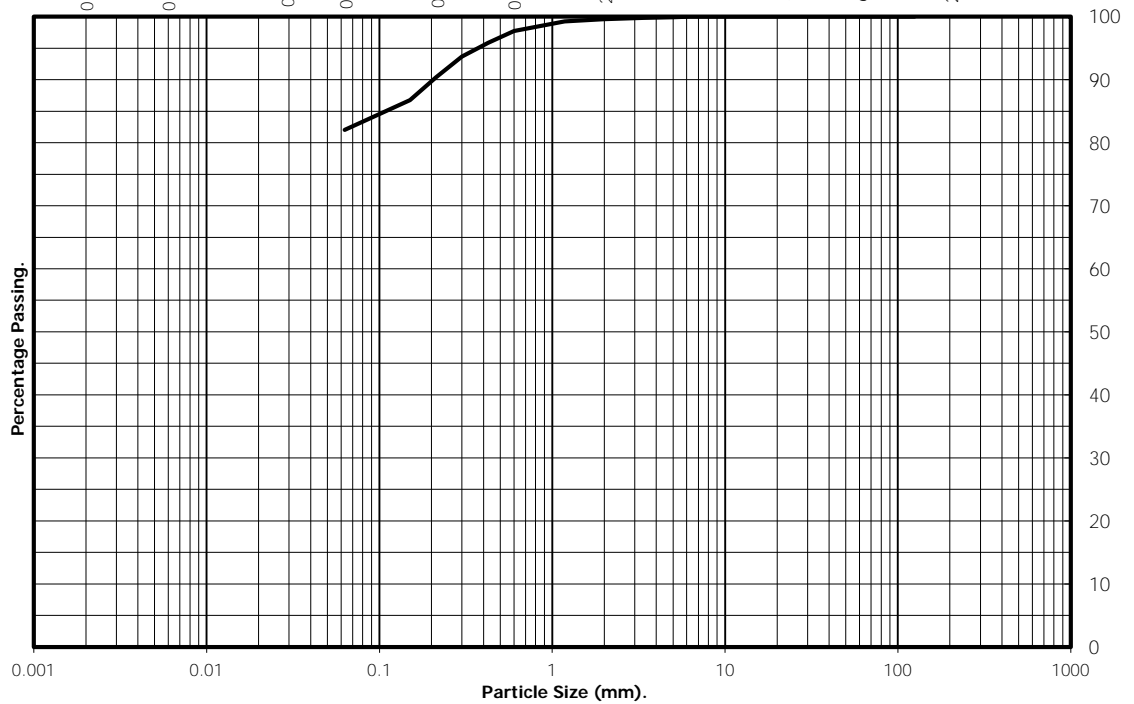
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1602**

Sample Number: **4**
 Depth from (m): **0.30**
 Depth to (m): **0.60**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy silty CLAY**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	99
0.60	98
0.425	96
0.300	94
0.212	90
0.150	87
0.063	82



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	82	18	0	0	Total Percentage

Remarks:

- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1602**

Sample Number: **6**
 Depth from (m): **0.60**
 Depth to (m): **1.20**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown clayey silty sandy GRAVEL (fine-coarse) with cobble content**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	84
50	69
37.5	62
28	57
20	53
14	49
10	47
6.3	43
5.0	42
3.35	41
2.00	40
1.18	36
0.60	31
0.425	28
0.300	26
0.212	23
0.150	20
0.063	17



Particle Diameter	% Passing
0.02	11
0.006	8
0.002	6

Clay	Silt	Sand	Gravel	Cobbles	Soil Fraction
6	11	23	44	16	Total Percentage

Remarks:

Cl 9.4.8 - Sample has not been pretreated

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1602**

Sample Number: **8**
 Depth from (m): **1.20**
 Depth to (m): **1.70**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown sandy clayey silty GRAVEL (fine-coarse) with cobble content**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	74
75	74
63	74
50	68
37.5	61
28	48
20	42
14	37
10	34
6.3	30
5.0	27
3.35	23
2.00	19
1.18	16
0.60	14
0.425	14
0.300	13
0.212	12
0.150	11
0.063	10



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	10	9	55	26	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

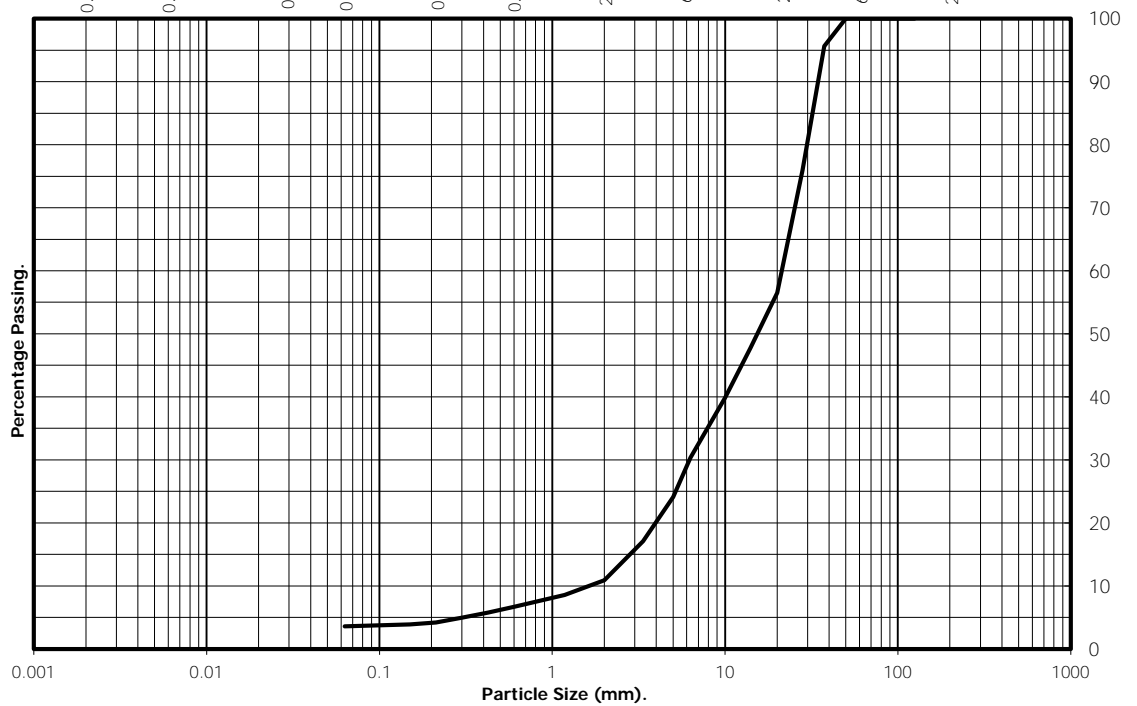
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1602**

Sample Number: **12**
 Depth from (m): **2.00**
 Depth to (m): **2.50**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown clayey silty sandy GRAVEL (fine-coarse)**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	76
20	57
14	48
10	40
6.3	30
5.0	24
3.35	17
2.00	11
1.18	9
0.60	7
0.425	6
0.300	5
0.212	4
0.150	4
0.063	4



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	4	7	89	0	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test BS 1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

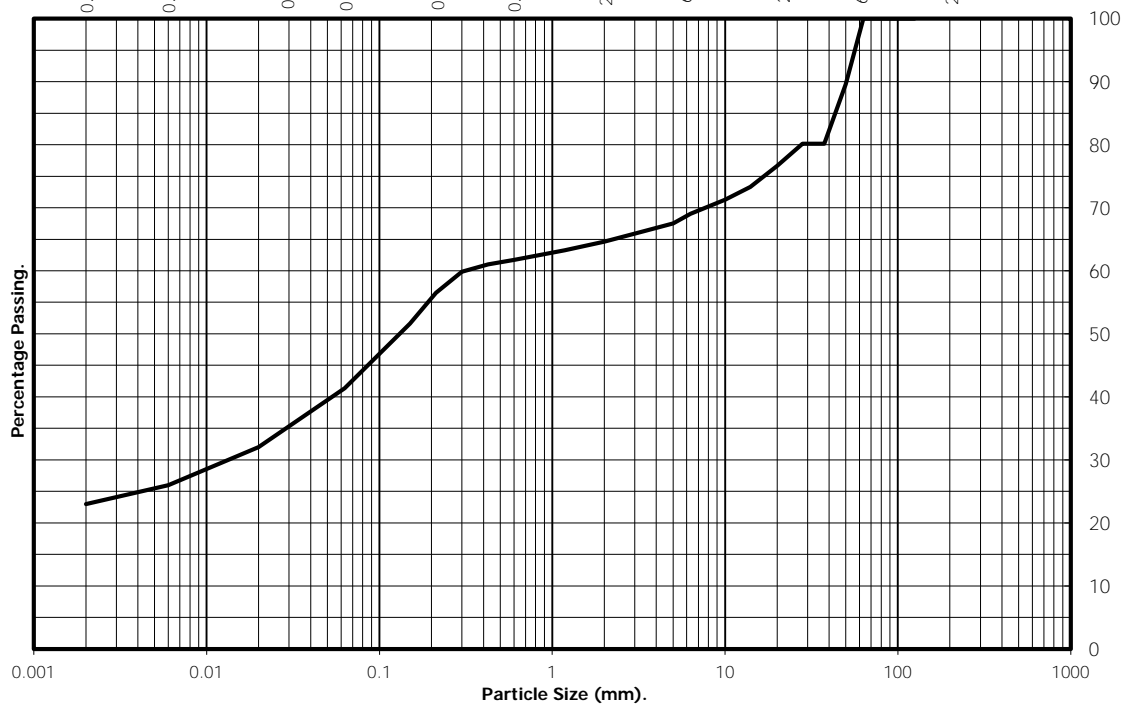
Client ref: **A089434-1**
Contract Number: **30539-080416**
Hole Number: **BH1603**

Sample Number: **4**
Depth from (m): **0.40**
Depth to (m): **0.60**
Sample Type: **B**

Location: **St Asaph**
Description: **Brown silty clayey sandy GRAVEL (fine-coarse)**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	90
37.5	80
28	80
20	77
14	73
10	71
6.3	69
5.0	68
3.35	66
2.00	65
1.18	63
0.60	62
0.425	61
0.300	60
0.212	56
0.150	52
0.063	41



Particle Diameter	% Passing
0.02	32
0.006	26
0.002	23

Clay	Silt	Sand	Gravel	Cobbles	Soil Fraction
23	18	24	35	0	Total Percentage

Remarks:

Cl 9.4.8 - Sample has not been pretreated

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

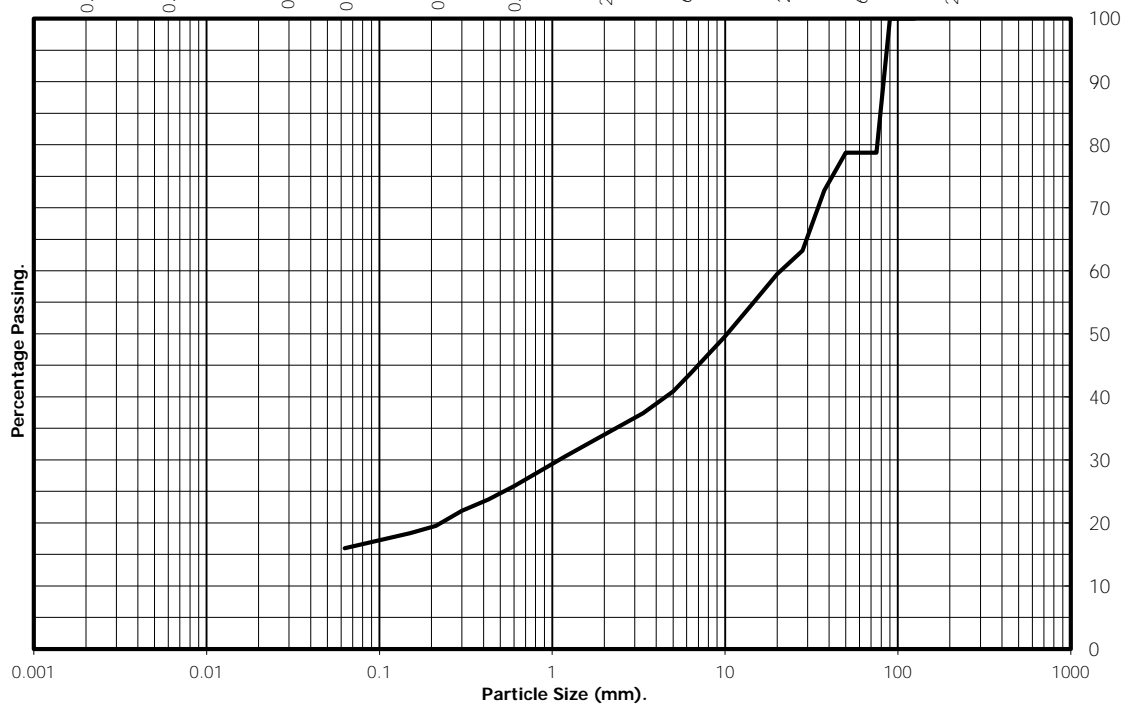
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1603**

Sample Number: **8**
 Depth from (m): **1.20**
 Depth to (m): **1.70**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown clayey silty sandy GRAVEL (fine-coarse) with cobble content**

	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
CLAY	SILT			SAND			GRAVEL			COBBLES

BS Test Sieve	% Passing
125	100
90	100
75	79
63	79
50	79
37.5	73
28	63
20	59
14	54
10	50
6.3	44
5.0	41
3.35	37
2.00	34
1.18	30
0.60	26
0.425	24
0.300	22
0.212	20
0.150	18
0.063	16



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	16	18	45	21	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report:

Particle Size Distribution Test

BS 1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

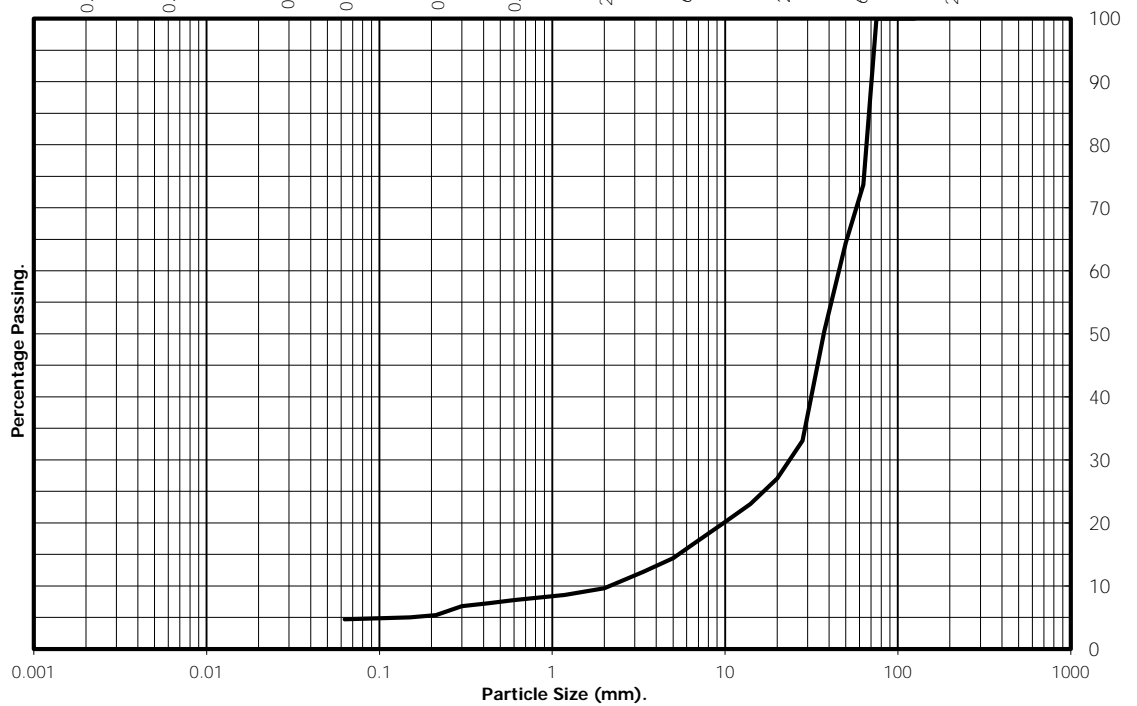
Client ref: **A089434-1**
 Contract Number: **30539-080416**
 Hole Number: **BH1603**

Sample Number: **12**
 Depth from (m): **2.00**
 Depth to (m): **2.50**
 Sample Type: **B**

Location: **St Asaph**
 Description: **Brown clayey silty sandy GRAVEL (fine-coarse) with cobble content**

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve	% Passing
125	100
90	100
75	100
63	74
50	64
37.5	50
28	33
20	27
14	23
10	20
6.3	16
5.0	14
3.35	12
2.00	10
1.18	9
0.60	8
0.425	7
0.300	7
0.212	5
0.150	5
0.063	5



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	5	5	64	26	Total Percentage

Remarks:

#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
 Jon Tatam (Office/Quality Assistant)

Tatam

Date: **15.4.16**



Test Report: CONSOLIDATED DRAINED SHEARBOX TEST.

BS1377:Part 7:4.5 :1990.

Borehole Number: BH1604 Depth from (m): 0.10
 Sample Number : Depth to (m): 2.50

Sample Type:	B
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	Submerged, Remoulded (Light Tamping) Material above 2mm removed.

Sample Description:

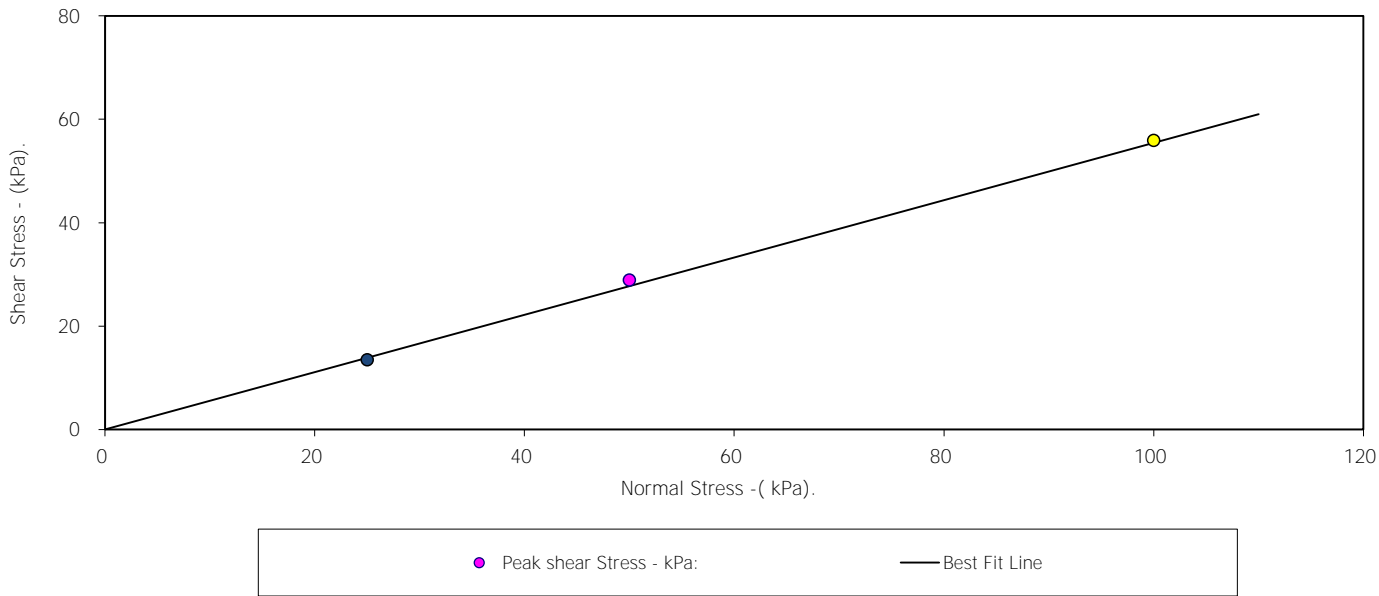
Brown sandy (fine-coarse) gravelly (fine-coarse/angular-subrounded) silty CLAY

STAGE	1	2	3
Initial Conditions			
Height - mm:	24.50	24.50	24.50
Length - mm:	59.90	59.90	59.90
Moisture Content - %:	25	25	25
Bulk Density - Mg/m3:	1.99	1.99	1.99
Dry Density - Mg/m3:	1.60	1.60	1.60
Voids Ratio:	0.6603	0.6608	0.6601
Normal Pressure- kPa	25	50	100
Consolidation			
Consolidated Height - mm:	24.35	23.08	21.81
Shear			
Rate of Strain (mm/min)	0.010	0.010	0.010
Strain at peak shear stress (mm)	10.04	9.75	9.45
Peak shear Stress - kPa:	13	29	56

PEAK

Angle of Shearing Resistance: (θ)	29.0
Effective Cohesion - kPa:	0

FAILURE CONDITIONS



D P Gans
 Checked Pages 1-4 by:

20/04/16
 Date:

D P Gans
 Approved Pages 1-4 by:

20/04/16
 Date

Contract No.:
30539-080416

St Asaph

Client Ref Number:

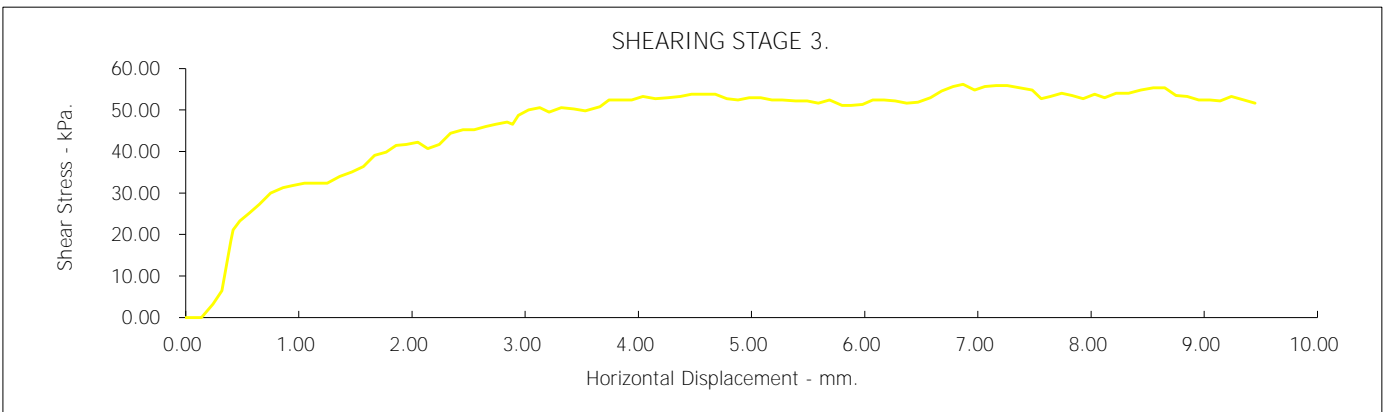
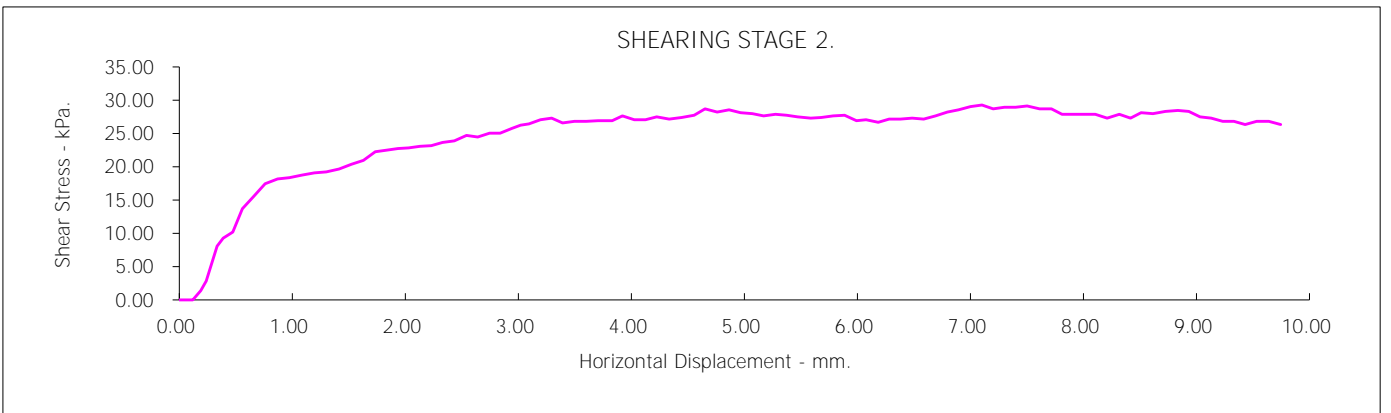
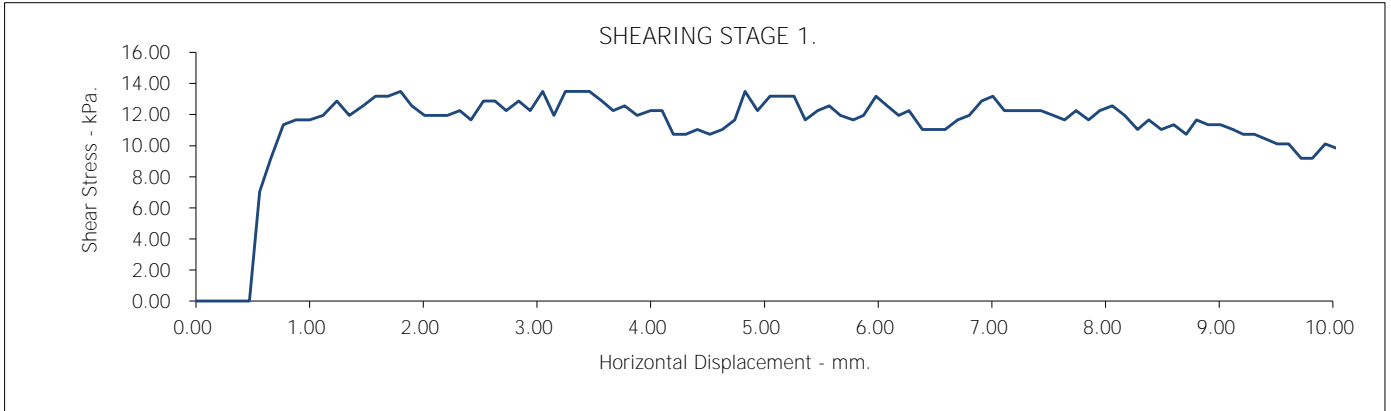
A089434-1

Test Report: CONSOLIDATED DRAINED SHEARBOX TEST.

BS1377:Part 7:4.5 :1990.

Borehole Number: BH1604
Sample Number :

Depth from (m): 0.10
Depth to (m): 2.50



St Asaph

Contract No.:
30539-080416

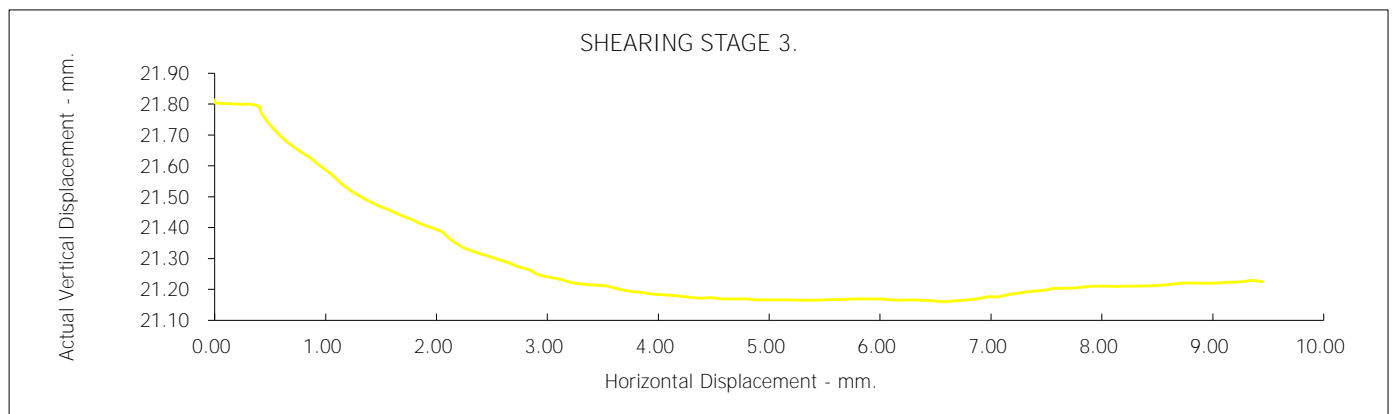
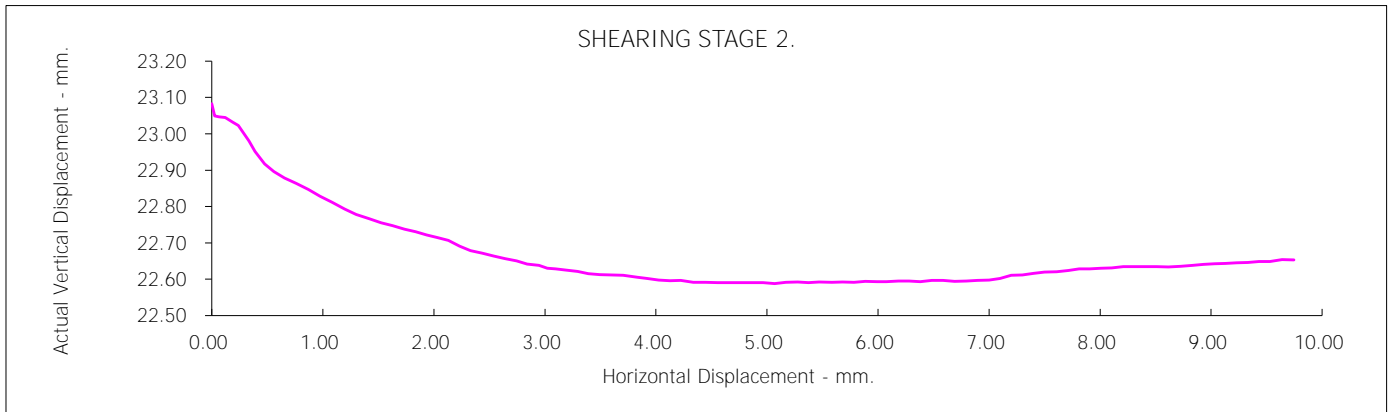
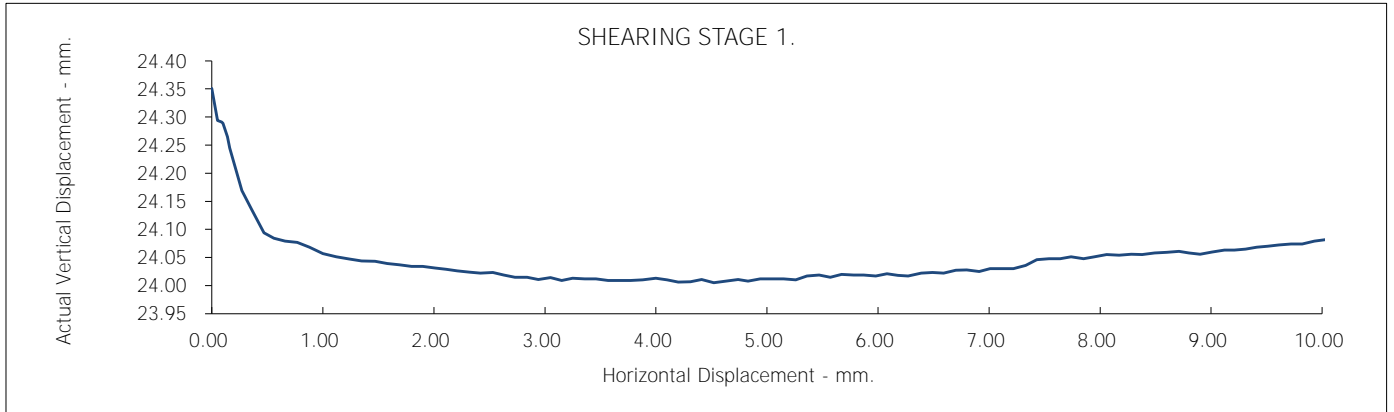
Client Ref Number:
A089434-1

Test Report: CONSOLIDATED DRAINED SHEARBOX TEST.

BS1377:Part 7:4.5 :1990.

Borehole Number: BH1604
Sample Number :

Depth from (m): 0.10
Depth to (m): 2.50



St Asaph

Contract No.:
30539-080416

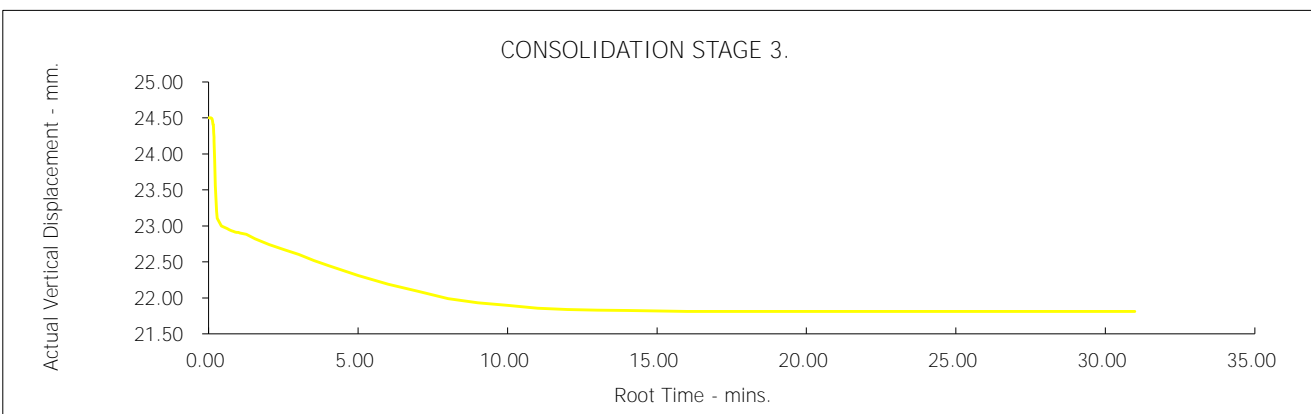
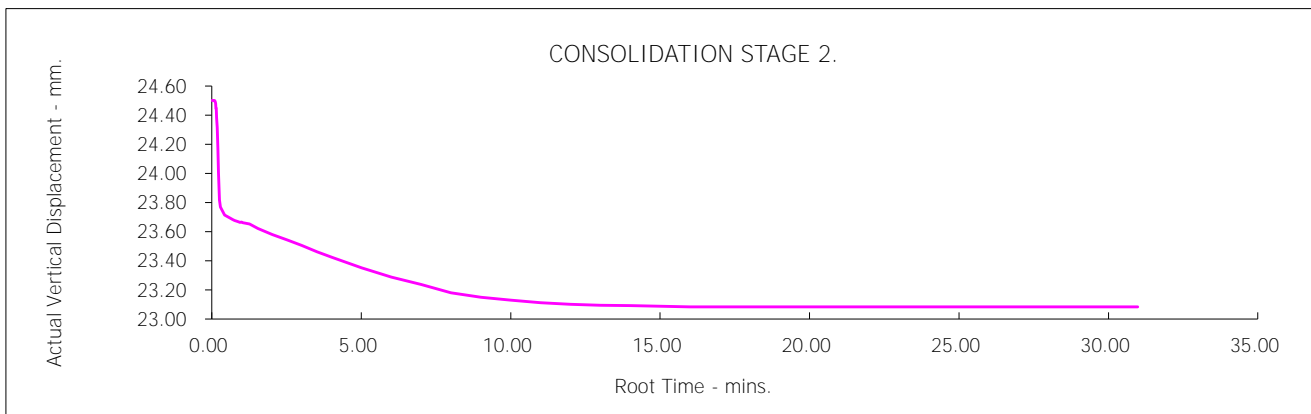
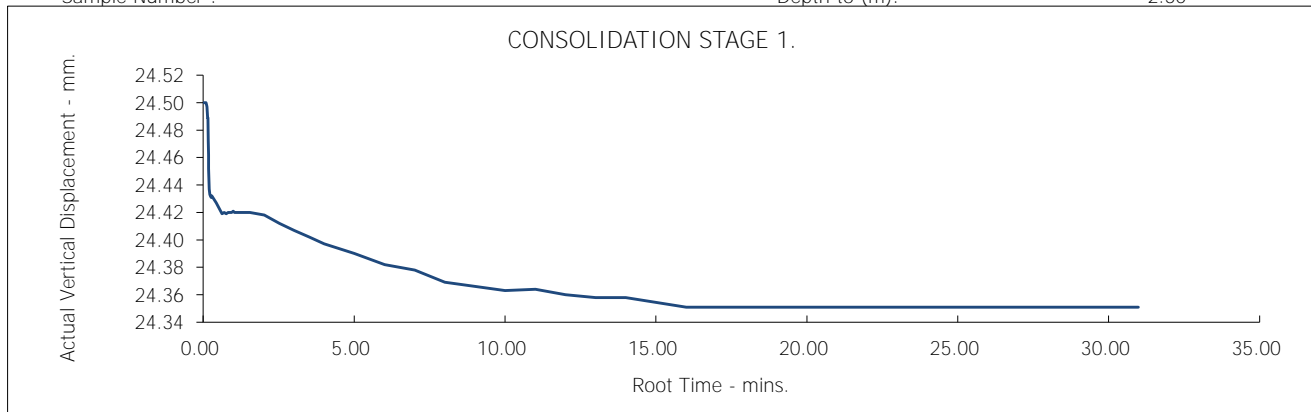
Client Ref Number:
A089434-1

Test Report: CONSOLIDATED DRAINED SHEARBOX TEST.

BS1377:Part 7:4.5 :1990.

Borehole Number: BH1604
Sample Number :

Depth from (m): 0.10
Depth to (m): 2.50



Contract No.:
30539-080416

St Asaph

Client Ref Number:
A089434-1



Appendix D – Environmental Laboratory Testing Suites



Determinand	Detection level
SUITE E1 – Soil samples general	
Arsenic	1 mg/kg
Cadmium	0.5 mg/kg
Chromium - total	10 mg/kg
Copper	10 mg/kg
Lead	10 mg/kg
Mercury	0.5 mg/kg
Nickel	10 mg/kg
Selenium	0.5 mg/kg
Zinc	10 mg/kg
Cyanide - total	5 mg/kg
pH	0.1 units
Boron (water soluble)	0.5 mg/kg
Phenols - total	1 mg/kg
Total Organic Carbon	0.1% w/w
SUITE E2 – Soil samples Asbestos	
Asbestos presence and identification	0.001% w/w
Asbestos quantification HSG248	0.001%w/w
SUITE E3 – Soil samples speciated TPH	
TPHCWG	10 mg/kg
SUITE E4 – Soil samples PAH	
USEPA 16 Polyaromatic Hydrocarbons	0.2 mg/kg
SUITE E8 – Soil samples hexavalent chromium	
Chromium - hexavalent	5 mg/kg

Determinand	Detection level
SUITE F1 – Water samples general	
pH value	0.1 pH units
Hardness	2 mg/l
Arsenic	5 µg/l
Cadmium	1 µg/l
Chromium	10 µg/l
Copper	10 µg/l
Lead	10 µg/l
Mercury	0.1 µg/l
Nickel	10 µg/l
Selenium	5 µg/l
Zinc	30 µg/l
Ammoniacal nitrogen	0.1 mg/l
Cyanide - total	30 µg /l
Phenols - total	20 µg/l
SUITE F2 – Water samples speciated TPH	
TPH CWG	50 µg/l
SUITE F3 – Water samples PAH	
16 USEPA Polyaromatic Hydrocarbons	0.05 µg/l



Jones Environmental Laboratory

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Attention : Luzia Kathriner
Date : 12th May, 2016
Your reference : A089434-1
Our reference : Test Report 16/6451 Batch 1 16/6451 Batch 2 16/6451 Batch 3
Location : St Asaph
Date samples received : 17th & 19th March, 2016 & 8th April, 2016
Status : Final report
Issue : 1

Twenty one samples were received for analysis on 17th & 19th March, 2016 & 8th April, 2016. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

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

Compiled By:

Phil Sommerton BSc
Project Manager

Client Name: WYG
Reference: A089434-1
Location: St Asaph
Contact: Luzia Kathriner

Note:

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

Opinions lie outside the scope of our UKAS accreditation.

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

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth
 Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
16/6451	1	WS1601 A	0.67-0.90	4	30/03/2016	Mass of Dry Sample	45.3 (g)
					30/03/2016	General Description (Bulk Analysis)	Soil/Stones
					30/03/2016	Asbestos Fibres	NAD
					30/03/2016	Asbestos Fibres (2)	NAD
					30/03/2016	Asbestos ACM	NAD
					30/03/2016	Asbestos ACM (2)	NAD
					30/03/2016	Asbestos Type	NAD
					30/03/2016	Asbestos Type (2)	NAD
					30/03/2016	Asbestos Level Screen	NAD
					16/6451	1	WS1601 A
30/03/2016	General Description (Bulk Analysis)	Soil/Stones/Glass					
30/03/2016	Asbestos Fibres	NAD					
30/03/2016	Asbestos Fibres (2)	NAD					
30/03/2016	Asbestos ACM	NAD					
30/03/2016	Asbestos ACM (2)	NAD					
30/03/2016	Asbestos Type	NAD					
30/03/2016	Asbestos Type (2)	NAD					
30/03/2016	Asbestos Level Screen	NAD					
16/6451	2	TP1604		33			
					30/03/2016	General Description (Bulk Analysis)	Soil/Stone
					30/03/2016	Asbestos Fibres	NAD
					30/03/2016	Asbestos Fibres (2)	NAD
					30/03/2016	Asbestos ACM	NAD
					30/03/2016	Asbestos ACM (2)	NAD
					30/03/2016	Asbestos Type	NAD
					30/03/2016	Asbestos Type (2)	NAD
					30/03/2016	Asbestos Level Screen	NAD
					16/6451	3	BH1602
14/04/2016	Asbestos Fibres	NAD					
14/04/2016	Asbestos Fibres (2)	NAD					
14/04/2016	Asbestos ACM	NAD					
14/04/2016	Asbestos ACM (2)	NAD					
14/04/2016	Asbestos Type	NAD					
14/04/2016	Asbestos Type (2)	NAD					
14/04/2016	Asbestos Level Screen	NAD					

Client Name: WYG
 Reference: A089434-1
 Location: St Asaph
 Contact: Luzia Kathriner

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
16/6451	3	TP1608	0.60-0.70	39	14/04/2016	General Description (Bulk Analysis)	soil/stones
					14/04/2016	Asbestos Fibres	NAD
					14/04/2016	Asbestos Fibres (2)	NAD
					14/04/2016	Asbestos ACM	NAD
					14/04/2016	Asbestos ACM (2)	NAD
					14/04/2016	Asbestos Type	NAD
					14/04/2016	Asbestos Type (2)	NAD
					14/04/2016	Asbestos Level Screen	NAD
16/6451	3	TP1608	1.10-1.45	41	14/04/2016	General Description (Bulk Analysis)	soil/stones
					14/04/2016	Asbestos Fibres	NAD
					14/04/2016	Asbestos Fibres (2)	NAD
					14/04/2016	Asbestos ACM	NAD
					14/04/2016	Asbestos ACM (2)	NAD
					14/04/2016	Asbestos Type	NAD
					14/04/2016	Asbestos Type (2)	NAD
					14/04/2016	Asbestos Level Screen	NAD
16/6451	3	TP1606	0.30-0.80	43	14/04/2016	General Description (Bulk Analysis)	soil/stones
					14/04/2016	Asbestos Fibres	NAD
					14/04/2016	Asbestos Fibres (2)	NAD
					14/04/2016	Asbestos ACM	NAD
					14/04/2016	Asbestos ACM (2)	NAD
					14/04/2016	Asbestos Type	NAD
					14/04/2016	Asbestos Type (2)	NAD
					14/04/2016	Asbestos Level Screen	NAD

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/6451

SOILS

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

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

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

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

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

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

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

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

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

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

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

WATERS

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

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

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

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

NOTE

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

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x2 Dilution
AB	x5 Dilution

JE Job No: 16/6451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes

JE Job No: 16/6451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID.	PM12/PM16	CWG GC-FID			AR	Yes
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID.	PM30/PM69	PM030: Eluate samples are extracted with solvent using a magnetic stirrer to create a vortex.PM069: One part soil is mixed with 10 parts water in a vial leaving no headspace. The mixture is shaken and then left to leach for 24 hours before VOC analysis.			AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM14	Analysis of waters and leachates for metals by ICP OES. Samples are filtered for dissolved metals and acidified if required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM14	Analysis of waters and leachates for metals by ICP OES. Samples are filtered for dissolved metals and acidified if required.	Yes		AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

JE Job No: 16/6451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM69	Modified BS EN 12457 method. One part soil is mixed with 10 parts water in a vial leaving no headspace. The mixture is shaken and then left to leach for 24 hours before VOC analysis.			AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen. Samples are extracted using an orbital shaker.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.			AR	
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No

JE Job No: 16/6451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes	Yes	AD	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM0	No preparation is required.	Yes		AR	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes	Yes	AR	Yes
NONE	No Method Code	PM17	Modified method EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	



Appendix E – Environmental Laboratory Testing Results