UNITED UTILITIES WATER LIMITED

CREWE WwTW

FACTUAL REPORT ON
GROUND INVESTIGATION

Contract: 42187

Date: June 2018

Ian Farmer Associates (1998) Limited
14-15 Rufford Court, Hardwick Grange, Woolston, Warrington, WA1 4RF
Tel: 01925 855 440
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FACTUAL REPORT ON

GROUND INVESTIGATION

Contract name:

CREWE WwTW

Prepared for

UNITED UTILITIES WATER LIMITED
Haweswater House,
Lingley Mere Business Park
Lingley Green Avenue,
Great Sankey
Warrington
WA5 3LP

Contract No: 42187

Date: June 2018

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Issue & Revision Record			
Contract Number:		**42187**	
Contract Name:		**Crewe WwTW**	
Client:		**United Utilities Water Limited**	
Engineer:		**United Utilities Water Limited**	
Report Title:		**Factual Report on Ground Investigation**	
Version	**Issue Date**	**Report / revision details**	**Distribution**
V1	04/04/2018	Draft report on ground investigation for comment & approval. Monitoring ongoing. Geotechnical soil testing and water analysis is on going	PDF copy to United Utilities Water Limited
V2	12/04/2018	Draft report on ground investigation for comment & approval. Gas and groundwater monitoring is ongoing.	PDF copy to United Utilities Water Limited
V3	21/05/2018	Complete report	PDF copy to United Utilities Water Limited
V4	18/06/2018	Final report	PDF copy to United Utilities Water Limited

CONTENTS

1.0 INTRODUCTION

1.1 On the instructions of LiMA acting on behalf of United Utilities Water Limited. (UU), a ground investigation was undertaken to determine ground, groundwater and ground contamination conditions at the site, and to provide factual information to assist the Engineer in the geotechnical and geo-environmental appraisal of the site.

1.2 This factual report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.

1.3 The comments given in this report and the opinions expressed herein are based on the information received, the conditions encountered during site works, and on the results of tests made in the field and laboratory. However, there may be conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report.

1.4 Observations on groundwater conditions were made at the time the site work was carried out. It should be noted that groundwater conditions may vary owing to seasonal or other effects.

2.0 THE SITE

2.1 Location and Description

2.1.1 The site is situated approximately 0.8km north of Worleston and approximately 4.5km to the northwest of the town centre of Crewe.

2.1.2 The site may be located by Grid reference SJ 664 572.

2.1.3 A site location plan is included in Appendix 1, Figure A1.1.

2.1.4 Access to the site is down a single-track concrete roadway off the B5074 (Church Minshull Road).

2.1.5 The site is currently used as a waste water treatment works for Crewe and the surrounding area.

2.1.6 The site sloped gently downwards towards the river and contained many cut and fill features in relation to its construction. The site was a mix of concrete, tarmacadam and grass verges.

2.1.1 There was a main office building at the north end of the site, brick built, single storey with a flat roof. There were eleven settling ponds and agitator tanks on the eastern half of the site. The west half of the site had many gas storage tanks and process buildings.

2.1.2 The site was bounded to the east by the River Weaver, which flowed north to south. The rest of the site was bounded by agricultural ground used for crops and grazing.

2.2 Geology

2.2.1 The geology beneath the site is indicated on British Geological Survey Sheets 109, “Chester”, Solid Edition, 1: 50,000 scale, 1986 and Drift Edition, 1: 63,360 scale published 1965.

2.2.2 The natural drift strata beneath the majority of the site is recorded as Boulder Clay. The Boulder Clay flanks a strip of Fluvio-Glacial gravel that extends from north to south beneath the eastern part of the site. Alluvium is recorded beneath the eastern boundary of the site, adjacent to the River Weaver.

2.2.3 The bedrock beneath the site is recorded as Middle Mudstone from the Mercia Mudstone Group of Triassic age.

2.2.4 Made ground may be anticipated due to development of the waste water treatment works.

3.0 SITE WORK

3.1 General

3.1.1 The site work was carried out between 23rd February to 14th March 2018.

3.1.2 The site works were carried out on the basis of the practices set out in BS 5930:2015 (ref.7.1), BS EN ISO 14688-1:2002+A1:2013 (ref. 7.2), BS EN ISO 14689-1:2003 (ref.7.3) and BS 10175:2011+A1:2013 (ref. 7.4).

3.1.3 The scope of the site works was determined by LiMA.

3.2 Underground Services

3.2.1 Each exploratory hole location was surveyed using a Cable Avoidance Tool (CAT) prior to any physical excavation.

3.2.2 A trial pit was hand excavated to 1.20m at each borehole location to ensure that there were no underground services at shallow depth. The trial pit was periodically surveyed using a CAT during excavation and at a depth of 1.20m.

3.2.3 No underground services were encountered within the exploratory hole locations.

3.3 Exploratory Holes

3.3.1 Seventeen boreholes, designated BH01, BH02, BH04, BH05 (A to K), BH10, BH12 and BH13 were sunk using cable percussion boring methods.

3.3.2 BH05A to BH05J were terminated at 0.30m due to concrete obstructions.

3.3.3 Two boreholes, designated BH03 and BH06 were sunk using cable percussion boring and rotary coring methods.

3.3.4 Rotary coring was carried out incorporating a semi-rigid plastic liner to obtain core at a nominal diameter of 92mm. A photographic record of rock core is given in Appendix 5.

3.3.5 Four trial pits, designated TP01, TP05, TP08 and TP09 were excavated by hand. A photographic record of trial pits is given in Appendix 5.

3.3.6 Five trial pits, designated TP02, TP03, TP04, TP06 and TP07 were excavated by 13 tonne tracked excavator.

3.3.7 The locations of the exploratory holes are indicated on Figure A1.2.

3.3.8 The depths of exploratory holes, depths of samples, detailed descriptions of strata encountered, and groundwater observations are presented on the exploratory hole records in Appendix 2.

3.3.9 Representative undisturbed and disturbed samples were taken at changes of strata and at regular intervals to identify strata and provide samples for testing.

3.3.10 Driven open tube samples were obtained in fine soils. Tubes were steel (UTW).

3.3.11 Samples were despatched to the offices of Ian Farmer Associates at Warrington for storage.

3.3.12 Samples for environmental analysis were taken in appropriate containers and stored in cold boxes for daily collection. Collected samples were transferred to temperature-controlled laboratory storage to await testing.

3.3.13 Environmental samples were scanned for volatile organic content (VOC) using a hand held PID unit. The PID readings obtained are presented on the borehole records.

3.4 In-Situ Testing

3.4.1 Standard penetration tests, (ref.7.5) were carried out in the boreholes. Uncorrected SPT 'N' values are presented on the borehole records.

3.4.2 The SPT hammer calibration certificate is provided in Appendix 2.

3.4.3 One rising head permeability was undertaken within BH04. Results are presented in Appendix 2.

3.4.4 In-situ Cone Penetration Test (CPT) was undertaken by Lankelma. The CPT data is reported in Appendix 2.

3.5 Locating and Survey

3.5.1 The locations of exploratory holes were indicated on drawings supplied by United Utilities.

3.5.2 The ground levels and co-ordinates reported on the records were determined by survey to OS Datum using GPS methods.

3.6 Instrumentation

3.6.1 Monitoring instrumentation was installed in BH01, BH03, BH04, BH05 and BH10.

3.6.2 Standpipe monitoring wells were of 50mm diameter UPVC with a slotted response zone sealed in a gravel filter.

3.6.3 The standpipes were protected at surface by lockable flush stopcock covers set in concrete.

3.6.4 The depths of the instrumentation were instructed by LiMA.

3.7 Monitoring

3.7.1 During the site works water levels of installed boreholes were recorded.

3.7.2 After completion of site works a programme of monitoring was undertaken comprising of 6 visits at fortnightly intervals.

3.7.3 One return visit on 28th March 2018 to collect water samples. And additional waters were collected on 19th April 2018.

3.7.4 The results of the monitoring are presented in Appendix 6.

4.0 GEOTECHNICAL LABORATORY TESTS

4.1.1 Geotechnical testing schedules were supplied by LiMA.

4.1.2 The majority of geotechnical testing was undertaken by Ian Farmer Associates at their Washington Laboratory. A number of tests were undertaken by Envirolab at Hyde.

4.1.3 Soil samples for testing were prepared in accordance with BS1377: Part One: 1990 (ref.7.6) and representative sub-samples were taken for testing. The following tests were carried out;

Soil

- 14 No. Moisture contents
- 15 No. Atterberg Limits (Liquid and Plastic Limit)
- 8 No. Particle size distribution (sieve analysis) with pipette analysis to determine silt / clay content
- 11 No Undrained shear strength
- 24 No. BRE SD1 Suite C (Envirolab)

Rock

- 13No. Point load test
- 3 No. Uniaxial Compression Strength test

4.1.4 The results of the soil tests are presented in Appendix 3, Test Reports 42187, 42187A and 42187B.

4.1.5 The results of the rock tests are presented in Appendix 3, Test Report 42187R.

4.1.6 The results of the BRE SD1 Suite C tests are presented in Appendix 3 in test reports 18-02249-1, 18-02254-1 & 18-02257-1.

5.0 CHEMICAL ANALYSIS

5.1.1 Schedules of chemical analysis were supplied by LiMA.

5.1.2 The chemical analyses were carried out on fifteen samples of soil and seven samples of water. The nature of the analyses is detailed below:

Soil testing suite

- CLEA Metals
- pH
- Moisture content
- Total Organic Carbon
- total petroleum hydrocarbons (TPH-CWG)
- Speciated polyaromatic hydrocarbons (PAH)
- Topsoil according to BS 3882
- UU Suite H – Leachability Test

Groundwater testing suite

- Suite S: TPHCWG (C5 - C44)
- Suite Y: Inorganic Standards
- Suite Z: Organic Standards

5.1.3 The results of the chemical analysis are presented in Appendix 4 in Test Report 18-01785-1

5.1.4 The results of the water analysis are presented in Appendix 4 in Test Report 18-02399-1 and 18-02976-1

6.0 GROUND CONDITIONS

6.1 Introduction

6.1.1 The summaries presented in this section of the report are only based on the information obtained during this investigation and presented in the Appendices.

6.2 Strata Summary

6.2.1 The strata encountered during the investigation may be summarised as follows:

Strata Encountered	Depth Encountered (m bgl)		Strata Thickness (m)
	From	To	
Topsoil	0.00	0.10 to 0.3	Nil to 0.30
Made Ground	0.00 to 0.30	0.80 to 4.70	Nil to 4.70
Drift (Clay with sand layers)	0.30 to 4.70	3.70 to 10.10	Nil to 8.70
Bedrock (Mudstone / Siltstone / Sandstone)	3.70 to 10.10	Up to 22.00	Base not proved

6.2.2 Detailed descriptions of strata including secondary and tertiary constituents are presented on the borehole records in Appendix 2.

6.3 Groundwater

6.3.1 Groundwater was struck in BH03 at a depth of 13.30m no rise after 20 minutes. Seepage was encountered at 3.00m within TP06.

6.3.2 Post site works monitoring visit recorded the following water levels:

Exploratory Hole	Visit 1 21/03/18	Visit 2 28/03/18	Visit 3 4/04/18	Visit 4 19/04/18	Visit 5 03/05/18	Visit 6 18/05/18
BH01	1.37	1.31	1.09	1.55	1.59	Destroyed
BH03	5.17	5.55	4.97	Destroyed	Destroyed	Destroyed
BH04	3.14	2.85	3.05	3.39	Destroyed	Destroyed
BH05	2.21	1.83	1.35	1.20	1.65	1.76

6.3.3 BH10 was destroyed post site works.

7.0 REFERENCES

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

7.2 British Standards Institution: BS EN ISO 14688-1:2002+A1:2013. 'Geotechnical investigation and testing – Identification and Classification of Soil – Part 1 Identification and description.' BSI 2013.

7.3 British Standards Institution: BS EN ISO 14689-1:2003. 'Geotechnical investigation and testing – Identification and Classification of Rock – Part 1 Identification and description.' BSI 2003. Incorporating Corrigendum No. 1 February 2007.

7.4 British Standards Institute: BS 10175:2011+A1:2013 'Code of practice for the investigation of potentially contaminated sites', BSI 2013.

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

7.6 British Standard 1377:1990, Part 1-9, 'Methods of Test for Soils for Civil Engineering Purposes'.

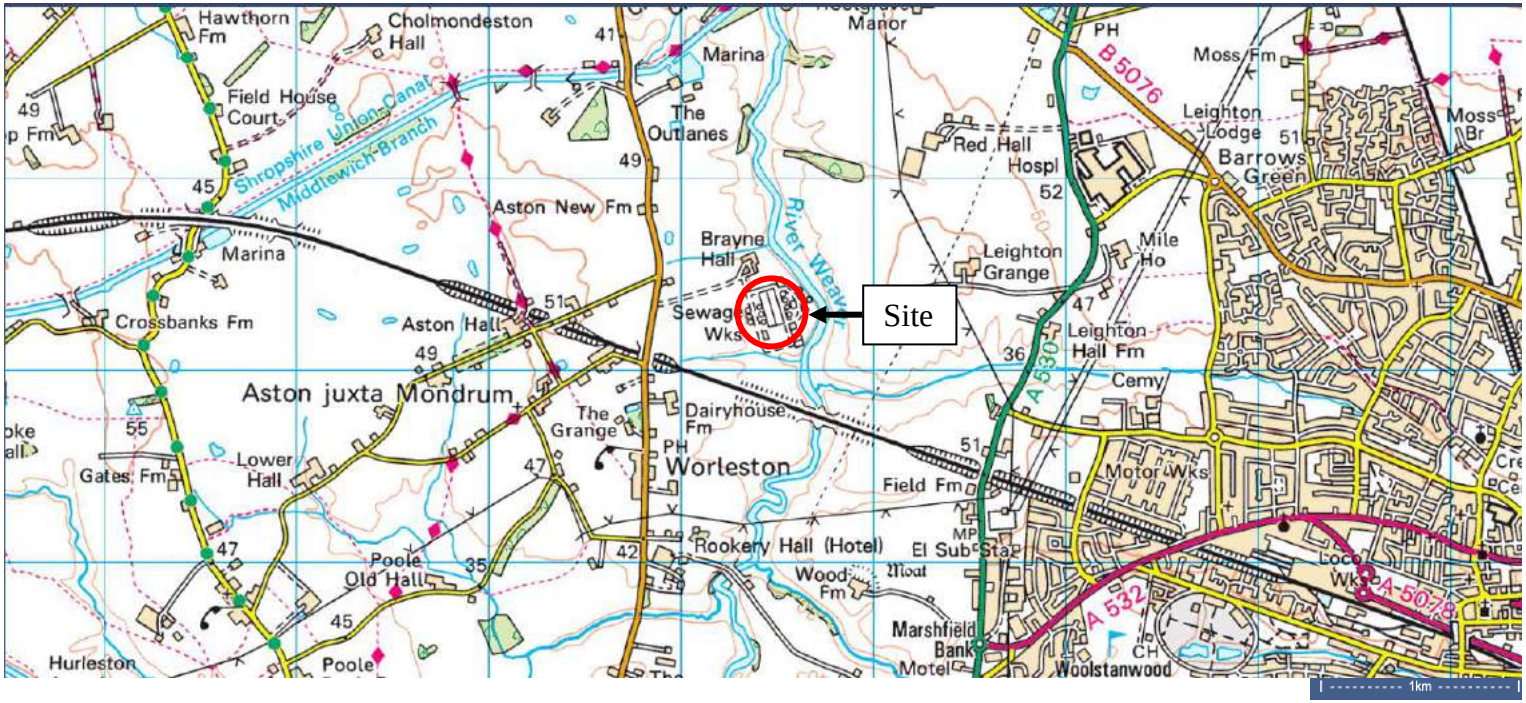
For and on behalf of Ian Farmer Associates (1998) Limited

H L Hadwin
BSc (Hons), MSc, FGS
Engineering Geologist

J A Latimer
BSc (Hons) FGS
Director

APPENDIX 1

DRAWINGS



N

PROJECT: Crewe WwTW
FIGURE No. A1.1. **SCALE: As Indicated**
TITLE: Site Location Plan
IAN FARMER ASSOCIATES Geotechnical & Environmental Specialists

366300E
366450E
366600E
366750E
357450N
357300N
357150N

CPT10
32.29
BH01
33.92
TP08
32.85
TP09
35.63
CPT08
32.09
TP07
32.31
CPT07
31.09
BH06
30.95
BH04
30.96
TP05
30.38
TP06
31.60
CPT09
31.57
BH02
31.97
BH12
34.61
BH10
34.64
BH13
34.44
TP04
31.49
CPT04
31.23
CPT06
32.76
CPT02
32.71
BH03
32.79
TP02
32.81
TP03
34.74
CPT03
34.70
TP01
34.73
BH05
34.67

Key: heights refer to code

TP (Trial Pit)

BH (Borehole)

Cone Penetration Test
CPT

IAN FARMER ASSOCIATES
Geotechnical & Environmental Specialists

Site Surveying Services - A.M.I.C.E.S
Suite 7
Grindleton Business Centre
Grindleton, BB7 4DH
Tel: 01200 439320
Fax07092376308
www.sitesurvey.co.uk
Land/ Engineering Surveyors

Setting Out & Control Surveys
Topographic/ Volumetric Surveys
GPS Specialists using also
GPS Post Process to tie any site to OS without trig point or BM
Construction Line Registered
TSA member

construction line

THE SURVEY ASSOCIATION

Client: Ian Farmer Associates
PROJECT: 42187

FIGURE No.A1.2
TITLE: Exploratory Hole Location Plan

Additional Comments:
To osbn15/osgm15 sss spec (old suvery to osbn92/osgm02)
all work to sss spec, some by gps
contact us for details

Drawing Number: sss-7057 — Revision: A

Drawn By: MK — Checked By: HW

Date: 15/03/2018 — Scale 1:1500, A3

APPENDIX 2

SITE WORK

APPENDIX 2

GENERAL NOTES ON SITE WORKS

A2.1 SITE WORK

A2.1.1 Rotary Drilling

For exploration within rock rotary drilling methods are employed, where the drill bit is rotated on the bottom of the borehole. This method is occasionally used for drilling within soils. The drilling fluid is transferred from the surface though hollow drilling rods to the bit cooling and lubricating. Drilling fluids commonly comprise clean water, air, foam, mud or polymers which aid the transportation of drill cuttings to the surface and maximise core recovery.

There are two basic types of rotary drilling:

- Open hole where the drill bit cuts all the material within the diameter of the borehole. This technique is sometimes used in soils and weak rocks as a rapid and economical means of making holes for taking soil samples, carrying out insitu soil tests, installing instruments and probing for voids such as mine workings or solution cavities. The only samples recovered are the poor quality drill cuttings.

- Core drilling where an annular bit fixed to the bottom of the core barrel cuts a core, which is recovered within the innermost tube of the core barrel. Coring is normally carried out by triple tube core barrels. At the end of the core run the core barrel assembly is brought to the surface. The core is prevented from dropping out of the barrel by a core catcher made of spring steel. The non-rotating inner barrel contains a removable sample tube or liner. At the end of each coring run the liner is extracted from the barrel and stored in a core box, where it can be photographed, described and tested.

A2.1.2 Cable Percussion Boring

For routine soil exploration a cable percussion rig is generally employed for boring through soils and weak rocks. It consists of a powered winch and tripod frame, with running wheels that are permanently attached so that the rig may be towed behind a suitable vehicle. The rig is towed into position and set up using its own winching system.

The locations of services are checked to make sure the borehole is not situated unacceptably near any services. Regardless of the proximity of services, a CAT scan is undertaken at the borehole location and a trial hole dug to 1.20m by hand.

Boreholes are advanced in soil by the percussive action of the cable tool. The force of the cylindrical tool as it is dropped a short distance cuts a plug of cohesive soil that is removed by the tool.

In non-cohesive soils, the borehole is advanced by a ‘shell’, otherwise known as a ‘bailer’ or ‘sand pump’, which incorporates a clack valve. Material is transferred into the shell and retained by the clack valve. The water level in a borehole is maintained above that in the surrounding granular soil to allow for temporary reductions in the head of water as the shell is withdrawn from the borehole. Water should flow from the borehole into the surrounding soil at all times to prevent ‘piping’ and loosening the soil at the base of the hole. The casing is always advanced with the borehole in granular soil so that material is drawn from the base rather than the borehole sides.

Obstructions to boring are overcome by fitting a serrated chiselling ring to the base of the percussion tool. For large obstructions, a heavy chisel with a hardened cutting edge may have to be used.

Disturbed samples are taken in polythene bags, jars or tubs that are sealed against air or water loss.

Undisturbed samples are generally taken in cohesive materials at changes in strata and at one metre intervals to 5 metres then at 1.5 metre intervals to the full depths of the borehole. The general purpose open-tube sampler is suitable for firm to stiff clays, but is often used to retrieve disturbed samples of weak rocks, soft or hard clay and also clayey sand or silts. This has been adopted for routine use, and usually consists of a 100mm internal diameter tube (U100), which is capable of taking soil samples up to 450mm in length. The undisturbed samples are sealed at each end using micro-crystalline wax to prevent drying.

Standard penetration tests are generally carried out in non-cohesive soils but also in stiff clays and soft rocks at frequencies similar to that of undisturbed sampling.

A2.1.3 Trial Pits

Shallow trial pits are generally dug by mechanical excavator, however, in difficult access locations or adjacent to structures, such pits may be hand dug. Pits are best used where the ground will stand unsupported and generally, the maximum depth of machine dug pits is 4m to 5m. Where personnel are required to enter pits, it is essential that side support is provided. Entry by personnel into unsupported pits deeper than 1.2m is not allowed for health and safety reasons.

Trial pits allow the in-situ condition of the ground to be examined both laterally and vertically and also allow discontinuities to be recorded. The field record should give the orientation of the pit with details of which face was logged, assessment of stability of sides of pit and groundwater as well as the strata encountered. Photographs of the pit should also be taken.

In-situ testing, such as hand penetrometer, hand vane, Macintosh probe, or similar, can be undertaken in the sides or base of pits while both disturbed and undisturbed samples recovered.

It is generally advisable to backfill the pits as soon as possible, open pits should not be left unattended.

A2.2 IN-SITU TESTS

A2.2.1 Standard Penetration Test

The Standard Penetration Test is carried out in accordance with the proposals recommended in ref 7.5.

The standard penetration test, **SPT**, covers the determination of the resistance of soils to the penetration of a split barrel sampler. A 50mm diameter split barrel sampler is driven 450mm into the soil using a 65kg hammer with a 760mm drop. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows to achieve the standard penetration of 300mm is reported as the 'N' value.

The test is generally carried out in fine soils, however, it may also be carried out in coarse granular soils, weak rocks and glacial tills using the same procedure as for the SPT but with a 50mm diameter, 60° apex solid cone replacing the split spoon sampler, **CPT.**

When attempting the standard penetration test in very dense material or weathered rocks it may be necessary to terminate the test before completion to prevent damage to the equipment. In these circumstances it is important to distinguish how the blow count relates to the penetration of the sampler. This may be achieved in the following manner:

- Where the seating drive has been completed, the test drive is terminated if 50 blows are reached before the full penetration of 300mm is achieved. The penetration for 50 blows is recorded and an approximate N value obtained by linear extrapolation of the number of blows for the partial test drive.

- If the seating drive of 150mm is not achieved within the first 25 blows, the penetration after 25 blows is recorded and the test drive then commenced.

- For tests in soft rocks, the test drive should be terminated after 100 blows where the penetration of 300mm has not been achieved.

The N-value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels as follows:

Term	SPT N-Value : Blows/300mm Penetration
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

A2.3 SAMPLES

U(S/0.45) represents undisturbed 100mm diameter sample with (S/0.45) being the steel tubes and the length of the test sample within the tube.

U NR| indicates undisturbed sample not recovered

B represents large bulk disturbed samples

D represents small disturbed sample

ES represents environmental sample

W represents water sample

▽ respresents water strike

▼ represents level to which water rose

A2.4 DESCRIPTION OF SOILS

A2.4.1 General

The procedures and principles given in BS EN ISO 14688-1:2002+A1:2013 (ref. 7.2) and BS 5930:2015 (ref. 7.1) have been used in the soil descriptions contained within this report.

A2.5 GEOLOGICAL LOGGING

A2.5.1 General

The procedures and principles given in BS EN ISO 14689-1:2003 (ref 7.3) and BS 5930:2015 (ref.7.1) have been used in the rock descriptions contained within this report.

Open hole drilling (OH) was achieved with a tricone rock bit.

A core run is the length of rock drilled from the base of the hole each time the core barrel is run into the hole.

A2.5.2 Fracture State

Various criteria may be used for quantitative description of the Fracture State of rock cores. The standard terms are as follows.

TCR (%)	ratio of core recovered (solid and non intact) to length of core run.
SCR (%)	ratio of solid core recovered to length of core run.
RQD (%)	ratio of solid core pieces longer than 100mm to length of core run.
Fracture Index	a count of the number or spacing of fractures over an arbitrary length of core of similar intensity of fracturing. Commonly reported as either Fracture Index (FI, number of fractures per metre) or as Fracture Spacing (I_f mm).
NR	indicates no core recovery.
NI	indicates intensely fractured rock which is not of sufficient quality to allow an assessment of fracture spacing to be made.

SPT Hammer Calibration Certificates

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:200

ARCHWAY ENGINEERING
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX59JP

SPT Hammer Ref:	PNA2
Test Date:	02/12/2016
Report Date:	02/12/2016
File Name:	PNA2.spt
Test Operator:	SH

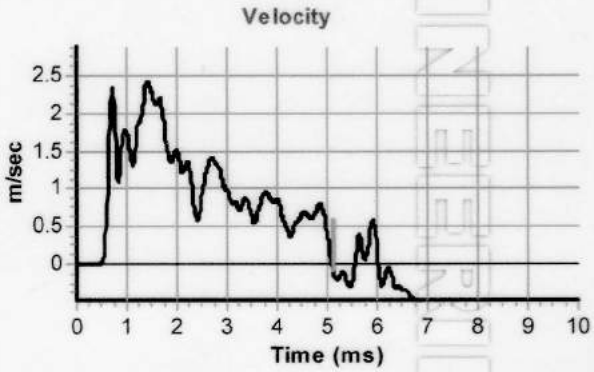
Instrumented Rod Data

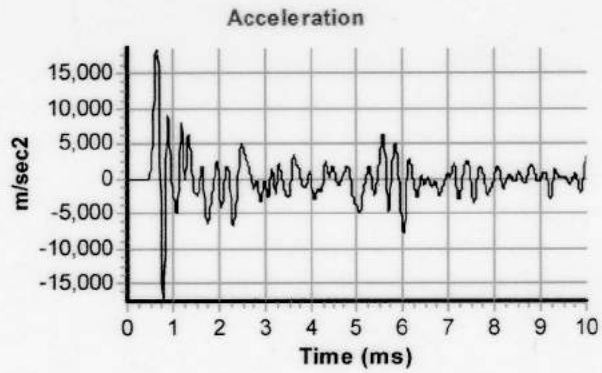
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.1
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	7080
Accelerometer No.2:	7079

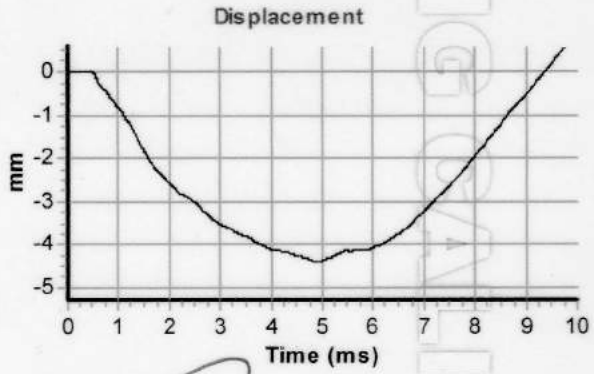
SPT Hammer Information

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

Comments / Location
CALIBRATION







Calculations

Area of Rod A (mm2):	918
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	252

Energy Ratio E_r (%): **53**

Signed: S. HOWARTH
Title: FITTER

The recommended calibration interval is 12 months

Borehole Records

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH01**
Dates: 01/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Cable Percussion Borehole Log	Location: 366538.14E 357401.14N	Ground level: 33.92mOD / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.20 - 1.20	B1		33.72	0.20	MADE GROUND: Grass over, dark brown, slightly gravelly, slightly clayey, fine to coarse SAND with occasional roots and rootlets (Topsoil).			
					MADE GROUND: Firm, stiff in places, gravelly, sandy CLAY with medium cobble content. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone , quartzite, brick and concrete.			
1.20		SPT(S) N=17 (0,1/2,3,5,7)		(2.10)				
1.20 - 1.65	B2							
1.20 - 1.65	D3							
2.00		SPT(S) N=11 (1,2/2,3,3,3)						
2.00 - 2.45	B4							
2.00 - 2.45	D5		31.62	2.30	Stiff, reddish brown, sandy, gravelly CLAY with rare sand pockets. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.			
2.70	D6							
3.00 - 3.45	D7				*At 3.00m: high strength.*			
3.00 - 3.45	U8	54 blows. 90% recovery						
				(2.70)				
4.00		SPT(S) N=32 (1,2/4,7,9,12)						
4.00 - 4.45	B9							
4.00 - 4.45	D10							
5.00		SPT(S) N=40 (2,4/9,10,10,11)	28.92	5.00	Weathered reddish brown MUDSTONE recovered as stiff, locally firm, reddish brown mottled grey, slightly sandy, slightly gravelly clay.			
5.00 - 5.45	B12							
5.00 - 5.45	D11							
				(2.37)				
6.50		SPT(S) N=49 (7,9/9,9,15,16)						
6.50 - 6.95	B13							
6.50 - 6.95	D14							
7.00		SPT(S) 50 (7,9/50 for 225mm)						
7.00 - 7.37	D15		26.55	7.37	End of Borehole at 7.37m			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
7.37	150

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
01/03	15:00	7.37	6.00	Dry

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
6.00	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	PLAIN	
1.00	7.00	SLOTTED	

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH02**	
Dates: 28/02/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location: 366578.20E 357263.49N	Ground level: 31.97mOD	Logged by: DO	Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.20 - 1.00	B1		31.77	0.20	MADE GROUND: Grass over, dark brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is angular to subrounded, fine and medium including sandstone, mudstone and quartzite (Topsoil).			
					MADE GROUND: Soft, brown, gravelly, sandy CLAY with low cobble content. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, brick and concrete. Cobbles are angular to subrounded including sandstone and brick.			
1.20		SPT(S) N=2 (1,1/0,1,0,1)			*Below 1.20m: very soft.*			
1.20 - 1.65	B2							
2.00		SPT(S) N=3 (0,0/1,1,0,1)		(3.50)				
2.00 - 2.45	B3							
2.00 - 2.45	D4							
3.00 - 3.45	D6				*At 3.00m: low strength.*			
3.00 - 3.45	U5	9 blows. 100% recovery						
3.70	D7		28.27	3.70	Weathered, reddish brown, locally mottled light grey MUDSTONE recovered as stiff locally firm, slightly sandy, slightly gravelly clay.			
4.00		SPT(S) N=37 (6,5/7,7,9,14)						
4.00 - 4.45	D8							
4.40 - 4.45	B9			(1.69)				
5.00		SPT(S) N=50 (5,8/12,13,16,9)						
5.00 - 5.45	D10							
			26.58	5.39	End of Borehole at 5.39m			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
5.39	150

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
28/02	16:00	5.39	5.00	Dry

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
4.50	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES	Plant used:	Project: Crewe WwTW	Location ID: **BH03**
	Dates: 02/03/2018 - 09/03/2018	Client: United Utilities Water Limited	Sheet 1 of 3
Cable Percussion Borehole Log	Location: 366663.91E 357197.33N	Ground level: 32.79mOD / Logged by: DO/RS / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.20 - 1.00	B1		32.49	(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, fine to coarse SAND with occasional roots and rare rootlets (Topsoil).			
					MADE GROUND: Firm, brown, sandy, gravelly CLAY with medium cobble content. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, brick and concrete. Cobbles are subrounded including quartzite, sandstone and rare brick.			
1.20		SPT(S) N=20 (1,3/4,5,5,6)			*Below 1.20m: stif*			
1.20 - 1.65	B2							
1.20 - 1.65	D3			(2.40)				
2.00		SPT(S) N=16 (1,1/2,3,5,6)						
2.00 - 2.45	B4							
2.00 - 2.45	D5							
2.70	D6		30.09	2.70	Medium dense, brown, gravelly, fine and medium SAND with rare pockets of clay. Gravel is subangular to subrounded, fine to coarse including sandstone.			
3.00		SPT(S) N=21 (3,6/6,6,4,5)						
3.00 - 3.45	B7			(0.90)				
3.00 - 3.45	D8							
			29.19	3.60	Firm, brown, very sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine including sandstone and quartzite.			
				(0.40)				
4.00 - 4.45	D10		28.79	4.00	Firm in places, brown, slightly sandy, slightly gravelly, silty CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.			
4.00 - 4.45	U9	42 blows. 90% recovery			*At 4.00m: high strength.*			
				(1.80)				
5.00		SPT(S) N=8 (2 for 78mm/1,2,2,3)						
5.00 - 5.45	B11							
5.00 - 5.45	D12							
5.80	D13		26.99	5.80	Weathered reddish brown MUDSTONE recovered as stiff, slightly sandy, slightly gravelly clay.			
6.50 - 6.95	U14	74 blows. 90% recovery			*At 6.50m: medium strength.*			
6.95	D15			(2.20)				
8.00		SPT(S) 50 (25 for 148mm/50 for 160mm)	24.79	8.00	Extremely to very weak mottled grey, medium to thinly interbedded reddish brown SILTSTONE and greenish grey MUDSTONE. discontinuities are: 0-20 degrees, extremely to very closely spaced, planar and undulating, smooth , dull partly infilled <10mm of firm grey CLAY.			
8.00 - 8.31	B16							
8.00 - 8.31	D17			(1.50)				
8.11 - 8.49	C19							
8.50		SPT(S) 50 (25 for 135mm/50 for 152mm)						
8.50 - 8.79	D18	9.08m - C20						
8.00 - 9.50	43	28						
	0				*Between 19.30m and 19.63m: band of greenish grey, extremely to very weak MUDSTONE with frequent veins <5mm, 0-20 degrees of gypsum. Partly recovered as non intact.*			
		NI	23.29	9.50				
		AZCL		(0.50)	Assumed zone of core loss.			
	TCR/SCR/RQD	FI	Samples & Tests		Continued next sheet			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
8.79	150
22.00	94

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
05/03	08:00	4.50	4.00	Dry
02/03	16:30	4.50	4.00	Dry
08/03	08:00	8.00	8.00	5.20
05/03	10:30	8.79	8.00	Dry

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
8.00	121
8.50	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
13.30	8.00		20	13.30	

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	PLAIN	
1.00	10.00	SLOTTED	

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES	Plant used:	Project: Crewe WwTW	Location ID: **BH03**
	Dates: 02/03/2018 - 09/03/2018	Client: United Utilities Water Limited	Sheet 2 of 3
Rotary Borehole Log	Location: 366663.91E 357197.33N	Ground level: 32.79mOD / Logged by: DO/RS / Vertical scale: 1:50	Project ID: 42187

Coring, Samples & In Situ Testing				Strata Details					Groundwater	
Depth	TCR/SCR/RQD	FI	Samples & Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
9.50 - 11.00	67 33 0	NI 31 NI 25 NI 14 NI 10	10.54m - C21	22.79		Extremely to very weak, reddish brown SILTSTONE with rare very thin bands of extremely to very weak greenish grey MUDSTONE. Discontinuities are 0-20 degrees, planar and undulating, rough, dull, closed, clean, very close to close. *Areas non-intact are recovered as gravel*		11		
11.00 - 12.50	73 24 0	AZCL NI 13 NI 23 NI 16 NI	11.78m - C22		(2.50)			12		
12.50 - 14.00	94 88 60	AZCL 10 2	12.59m - C24 13.61m - C23	20.29	12.50	Weak to very weak, reddish brown SILTSTONE with closely to very closely spaced frequent veins of gypsum, 0-20 degrees, <5mm thick and frequent reduction spots (<40mm). Discontinuities are 0-20 degrees, undulating and planar, rough, closed, with <5mm infill of gypsum, very close to medium spaced.		13	▼	
14.00 - 15.50	100 94 39	7 13 4	15.23m - C25					14 15		
15.50 - 17.00	100 83 47	10 3 40+ 10	16.02m - C26		(9.50)	*Between 17.00m and 17.94m: assumed zone of core loss.*		16 17		
17.00 - 18.50	37 37 0	AZCL 17	18.32m - C27			*Below 17.94m: Discontinuities are 1) 0-30 degrees, undulating and planar, rough, closed with <5mm infill of gypsum, very close to medium spaced. 2) 75-10 degrees, planar, rough, closed with infill <5mm of gypsum, spacing not acertainable.* *At 18.32m: extremely weak.*		18		
18.50 - 20.00	95 60 17	21 NI 10 32 NI AZCL 8	19.30m - C28			*Between 19.56m and 19.63m: assumed zone of core loss.*		19 20		
						Continued next sheet				

Flush Details				Borehole Diameter	
Top (m)	Base (m)	Flush Type	Flush Return %	Depth (m)	Dia (mm)
				8.79	150
				22.00	94

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
05/03	08:00	4.50	4.00	Dry
02/03	16:30	4.50	4.00	Dry
08/03	08:00	8.00	8.00	5.20
05/03	10:30	8.79	8.00	Dry

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
8.00	121
8.50	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
13.30	8.00		20	13.30	

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	PLAIN	
1.00	10.00	SLOTTED	

Checked by:	HH	IFA RC v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH03**
Dates: 02/03/2018 - 09/03/2018	Client: United Utilities Water Limited		Sheet 3 of 3
Rotary Borehole Log	Location: 366663.91E 357197.33N	Ground level: 32.79mOD	Logged by: DO/RS	Vertical scale: 1:50	Project ID: 42187

Coring, Samples & In Situ Testing				Strata Details					Groundwater	
Depth	TCR/SCR/RQD	FI	Samples & Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
20.00 - 21.50	0 0 0	AZCL				Weak to very weak, reddish brown SILTSTONE with closely to very closely spaced frequent veins of gypsum, 0-20 degrees, <5mm thick and frequent reduction spots (<40mm). Discontinuities are 0-20 degrees, undulating and planar, rough, closed, with <5mm infill of gypsum, very close to medium spaced. *Between 20.00m to 21.78m: assumed zone of core loss.*		21		
21.50 - 22.00	44 44 0	18	21.78m - C29	10.79	22.00	End of Borehole at 22.00m		22		
								23		
								24		
								25		
								26		
								27		
								28		
								29		
								30		

Flush Details			
Top (m)	Base (m)	Flush Type	Flush Return %

Borehole Diameter	
Depth (m)	Dia (mm)

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
08/03	16:00	20.00	8.00	17.50
09/03	08:00	20.00	8.00	16.80
09/03	16:30	22.00	8.00	17.30

Remarks:

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA RC v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH04**	
Dates: 23/02/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location: 366696.85E 357284.44N	Ground level: 30.96mOD	Logged by: DO	Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Grass over MADE GROUND. Slightly clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse including sandstone, brick and concrete.			
0.30 - 1.00	B1		30.66	0.30	MADE GROUND: Brown, gravelly very sandy CLAY. Gravel is angular to subrounded fine to coarse including siltstone, sandstone and rare brick.			
				(0.90)				
1.20		SPT(S) N=10 (2,2/2,2,3,3)	29.76	1.20	MADE GROUND: Firm stiff in places organic, dark grey, slightly gravelly very sandy CLAY. Gravel is angular to subrounded fine to coarse including siltstone, quartzite and rare brick.			
1.20 - 1.65	B2							
1.20 - 1.65	D3							
2.00		SPT(S) N=19 (3,3/3,5,5,6)						
2.00 - 2.45	B4							
2.00 - 2.45	D5							
3.00		SPT(S) N=12 (2,3/3,3,3,3)		(3.50)				
3.00 - 3.45	B6							
3.00 - 3.45	D7							
4.00		SPT(S) N=13 (2,2/3,3,3,4)						
4.00 - 4.45	B8							
4.00 - 4.45	D9							
4.70	D10		26.26	4.70	Firm, bluish grey mottled orange, very sandy CLAY with frequent pockets of fine and medium sand. *At 5.00m: soft.*			
5.00		SPT(S) N=11 (2,2/2,3,3,3)						
5.00 - 5.45	B11							
5.00 - 5.45	D12			(1.20)				
5.00 - 5.45	U13	10 blows. No recovery						
5.90	D14		25.06	5.90	Medium dense, brown, sandy, angular to subangular, fine to coarse GRAVEL including sandstone.			
6.50		SPT(S) N=18 (2,2/4,4,5,5)						
6.50 - 6.95	B15							
6.50 - 6.95	D16							
				(2.40)				
8.00		SPT(S) 50 (12,12/50 for 193mm)			*Below 8.00m: very dense.*			
8.00 - 8.30	D17		22.66	8.30	End of Borehole at 8.30m			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
8.30	150

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
23/02	08:00	8.30	8.00	6.90

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
8.00	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	PLAIN	
1.00	8.00	SLOTTED	

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH05A**
Dates: 14/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Cable Percussion Borehole Log	Location:	Ground level: / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.				
					End of Borehole at 0.30m				
							1		
							2		
							3		
							4		
							5		
							6		
							7		
							8		
							9		
							10		

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m.
Relocated BH05B.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05B**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.			
					End of Borehole at 0.30m			

1 2 3 4 5 6 7 8 9 10

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05C.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05C**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.			
					End of Borehole at 0.30m			

1 2 3 4 5 6 7 8 9 10

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05D.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05D**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.			
					End of Borehole at 0.30m			

1 2 3 4 5 6 7 8 9 10

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05E.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05E**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.				
					End of Borehole at 0.30m				

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05F.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05F**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.			
					End of Borehole at 0.30m			

1 2 3 4 5 6 7 8 9 10

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05G.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05G**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.				
					End of Borehole at 0.30m				

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05H.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05H**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.				
					End of Borehole at 0.30m				

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05I.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH05I**	
Dates: 14/03/2018	Client: United Utilities Water Limited	Sheet 1 of 1	
Cable Percussion Borehole Log	Location:	Ground level:	Logged by: DO / Vertical scale: 1:50 / Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.			
					End of Borehole at 0.30m			

1 2 3 4 5 6 7 8 9 10

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05J.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH05J**
Dates: 14/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Cable Percussion Borehole Log	Location:	Ground level: / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
				(0.30) 0.30	MADE GROUND: Grass over, dark brown, clayey, gravelly, fine to coarse SAND with medium cobble content. Gravel and cobbles are angular to subrounded including sandstone, mudstone and brick.				
					End of Borehole at 0.30m				
							1		
							2		
							3		
							4		
							5		
							6		
							7		
							8		
							9		
							10		

Chiselling				Borehole Diameter		Boring Progress				
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 0.30m. Relocated BH05K.

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH05K**
Dates: 14/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Cable Percussion Borehole Log	Location: 366579.05E 357105.44N	Ground level: 34.67mOD / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Grass over, dark brown, clayey, slightly gravelly, fine to coarse SAND with occasional roots and rootlets.			
0.40 - 1.00	B1		34.37	0.30	MADE GROUND: Stiff brown, gravelly, sandy CLAY with high cobble content. Gravel and cobbles are angular to subrounded including sandstone, siltstone and concrete.			
1.20		SPT(S) N=6 (1,2/2,2,1,1)			*At 1.00m: surface water (perched).*			
1.20 - 1.65	B2			(2.00)				
1.20 - 1.65	D3							
2.00		SPT(S) N=9 (1,2/2,2,2,3)						
2.00 - 2.45	B4							
2.00 - 2.45	D5		32.37	2.30	Stiff, brown, sandy, slightly gravelly CLAY with frequent sand lenes. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.			
3.00 - 3.45	D7				*At 3.00m: medium strength.*			
3.00 - 3.45	U6	36 blows. 100% recovery						
4.00		SPT(S) N=15 (1,2/3,3,4,5)		(3.50)	*At 4.00m: very sandy.*			
4.00 - 4.45	B8							
4.00 - 4.45	D9							
5.00		SPT(S) N=26 (2,4/5,5,7,9)						
5.00 - 5.45	B10							
5.00 - 5.45	D11							
5.80	D12		28.87	5.80	Weathered grey mottled brown MUDSTONE. Recovered as slightly sandy clay.			
6.00		SPT(S) 50 (5,5/50 for 83mm)		(0.43)				
6.00 - 6.23	D13		28.44	6.23	End of Borehole at 6.23m			

Chiselling

From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter

Depth (m)	Dia (mm)
6.23	150

Casing Diameter

Depth (m)	Dia (mm)
4.50	150

Boring Progress

Date	Time	Depth (m)	Cased (m)	Water (m)
14/03	15:00	1.65	1.20	0.80
14/03	08:00	1.65	1.20	Dry
15/03	15:00	6.23	4.50	Dry

Water Strikes

Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations

Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	PLAIN	
1.00	5.00	SLOTTED	

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH06**
Dates: 07/03/2018	Client: United Utilities Water Limited		Sheet 1 of 2
Cable Percussion Borehole Log	Location: 366690.46E 357305.59N	Ground level: 30.95mOD / Logged by: DO/BR / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.20 - 1.00	B1		30.75	0.20	MADE GROUND: Brown, clayey, slightly gravelly, fine to coarse SAND with occasional rootlets. Gravel is angular to subrounded, fine and medium including sandstone, mudstone, concrete and rare brick (Topsoil).			
					MADE GROUND: Firm, brown, gravelly, sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, concrete and brick.			
1.20		SPT(S) N=12 (3,3/3,3,3,3)		(1.80)				
1.20 - 1.65	B2							
1.20 - 1.65	D5							
2.00		SPT(S) N=2 (1,0/0,1,0,1)	28.95	2.00				
2.00 - 2.45	B3			(0.30)	MADE GROUND: Very loose, greenish grey, fine and medium SAND.			
2.00 - 2.45	D4		28.65	2.30				
					Firm, brown, gravelly, sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and rare brick.			
3.00		SPT(S) N=10 (1,2/2,2,3,3)						
3.00 - 3.45	B6			(1.85)				
3.00 - 3.45	D7							
4.00		SPT(S) N=6 (1,1/1,1,2,2)						
4.00 - 4.45	B8		26.80	4.15				
4.00 - 4.45	D9				Firm, dark brown, very sandy CLAY with some pockets of sand.			
				(1.10)				
5.00		SPT(S) N=3 (0,0/0,1,1,1)						
5.00 - 5.45	B10							
5.00 - 5.45	D11		25.70	5.25				
					Very loose, brown, coarse SAND.			
6.50		SPT(S) N=9 (1,1/2,3,2,2)		(2.65)	*Below 6.50m: loose*			
6.50 - 6.95	B12							
6.50 - 6.95	D13							
			23.05	7.90				
8.00		SPT(S) 50 (5,5/50 for 281mm)	22.95	8.00				
8.00 - 8.43	D14	8.00m - SPT(S) 50 (5,5/50 for 281mm)			Weathered, red brown, MUDSTONE recovered as firm, locally stiff, grey, slightly sandy, slightly gravelly clay.			
100	39	8.00m - D14			Extremely weak to very weak, red brown greenish grey, thinly interbedded MUDSTONE and SILTSTONE. Discontinuities are 1) 0-20 degrees, very closely spaced, undulating rough, with clay infill. 2) 50-70 degrees, very closely spaced, undulating striated with clay infill.			
8.00 - 9.00	69	8.30m - C15		(1.00)				
	0							
		NI						
			21.95	9.00	Assumed zone of core loss.			
	27							
9.00 - 10.50	0	AZCL		(1.10)				
	0							
	TCR/SCR/RQD	FI	Samples & Tests		Continued next sheet			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
8.43	150
15.00	94

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
26/02	08:00	5.45	5.00	Damp
27/02	08:00	5.45	5.50	4.10
07/03	08:00	8.43	8.00	6.50
27/02	15:00	8.43	8.00	6.50

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
8.00	150
8.00	121

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW	Location ID: **BH06**	
Dates: 07/03/2018	Client: United Utilities Water Limited	Sheet 2 of 2	
Rotary Borehole Log	Location: 366690.46E 357305.59N	Ground level: 30.95mOD	Logged by: DO/BR	Vertical scale: 1:50	Project ID: 42187

Coring, Samples & In Situ Testing				Strata Details					Groundwater	
Depth	TCR/SCR/ RQD	FI	Samples & Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
				20.85	10.10	Assumed zone of core loss.				
		NI			(0.40)	Extremely weak, red brown, greenish grey mottled, very thinly to thinly interbedded MUDSTONE and weak SILTSTONE.				
				20.45	10.50	Discontinuities are 2-10 degrees, very closely spaced, undulating rough with clay infill. 2) 50-70 degrees, very closely spaced, undulating striated with clay infill.				
		AZCL			(0.70)	Assumed zone of core loss.				
10.50 - 12.00	53 19 0		11.20m - C16	19.75	11.20			11		
		NI			(0.52)	Very weak, reddish brown, locally mottled greenish grey MUDSTONE interbedded with weak greenish grey SILTSTONE.				
		38	11.72m - C17	19.23	11.72					
		24				Very weak, reddish brown, mottled greenish grey SILTSTONE with very closely spaced spaced gypsum veins <8mm thick. Discontinuities are 1) 2-20 degrees, very closely to closely, planar, striated, tight, infilled with gypsum. 2) 30-45 degrees, closely spaced, undulating striated infilled with gypsum.		12		
12.00 - 13.50	100 97 0	NI 20	13.15m - C18		(1.78)			13		
				17.45	13.50	Very weak, reddish brown, mottled greenish MUDSTONE with closely to closely spaced gypsum veins up to 6mm thick and occasional reduction spots up to 8mm diameter. Discontinuities are 1) 2-20 degrees, very closely to closely spaced, undulating to planar striated and gypsum infilled. 2) 30-50 degrees, closely spaced, undulating to planar, striated and infilled with clay and gypsum veins.				
13.50 - 15.00	88 10 0	NI			(1.32)	*Between 13.50m and 14.55m: non intact recovered as subangular to subrounded, fine to coarse gravel.*		14		
		25	14.58m - C19			*At 14.58m: extremely weak.*				
		NI 40 AZCL		16.13	14.82	*Between 14.70m and 14.78m: non intact recovered as subangular and subrounded, fine to coarse gravel.*				
				15.95	15.00	Assumed zone of core loss.		15		
						End of Borehole at 15.00m				
								16		
								17		
								18		
								19		
								20		

Flush Details			
Top (m)	Base (m)	Flush Type	Flush Return %

Borehole Diameter	
Depth (m)	Dia (mm)
8.43	150
15.00	94

Casing Diameter	
Depth (m)	Dia (mm)
8.00	150
8.00	121

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
26/02	08:00	5.45	5.00	Damp
27/02	08:00	5.45	5.50	4.10
07/03	08:00	8.43	8.00	6.50
27/02	15:00	8.43	8.00	6.50

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Checked by:	HH	IFA RC v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH10**
Dates: 07/03/2018 - 08/03/2018	Client: United Utilities Water Limited		Sheet 1 of 2
Cable Percussion Borehole Log	Location: 366437.96E 357254.19N	Ground level: 34.64mOD / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
			34.47	0.17	MADE GROUND: Concrete slab.			
0.30	ES1		34.34	0.30	MADE GROUND: Light grey, slightly sandy, angular to subrounded, fine to coarse GRAVEL including limestone and occasional granite.			
0.50	ES2				MADE GROUND: Firm, stiff in places, reddish brown, sandy, slightly gravelly, sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, quartzite and rare concrete and limestone.			
0.70 - 1.00	B3			(1.20)				
1.00	ES4							
1.20		SPT(S) N=3 (0,1/0,1,1,1)						
			33.14	1.50	Stiff, firm in places, reddish brown, gravelly, slightly sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.			
2.00	ES6				*At 2.00m: low strength.*			
2.00 - 2.45	D7							
2.00 - 2.45	U5	13 blows. 100% recovery						
2.50	ES8							
3.00		SPT(S) N=12 (1,1/2,2,3,5)						
3.00 - 3.45	B9							
3.00 - 3.45	D10							
3.50	D11							
4.00 - 4.45	D13				*At 4.00m: medium strength.*			
4.00 - 4.45	U12	98 blows. 60% recovery						
4.70		SPT(S) 50 (9,12/50 for 194mm)			*At 4.70m: low cobble content. Cobble is subangular to subrounded including siltstone.*			
4.70 - 5.00	B14				*Below 5.00m: very gravelly.*			
4.70 - 5.10	D15							
				(8.60)				
6.50		SPT(S) N=35 (5,5/6,8,9,12)			*At 6.50m: very sandy.*			
6.50 - 6.95	B17							
6.50 - 6.95	D16							
8.00		SPT(S) N=111 (5,6/8,9,90,4)						
8.00 - 8.45	D18							
9.50		SPT(S) N=38 (4,4/5,8,10,15)						
9.50 - 9.95	B19							
9.50 - 9.95	D20							
10.00	D21				Continued next sheet			

Chiselling

From (m)	To (m)	Time (mins)	Remarks
4.70	4.80	60	

Borehole Diameter

Depth (m)	Dia (mm)
12.58	150

Casing Diameter

Depth (m)	Dia (mm)
6.00	150

Boring Progress

Date	Time	Depth (m)	Cased (m)	Water (m)
07/03	16:30	5.00	4.70	Dry
08/03	08:00	5.00	4.70	Dry
08/03	16:30	12.50	6.00	Dry

Water Strikes

Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Monitoring Installations

Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	PLAIN	
1.00	10.00	SLOTTED	

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH10**
Dates: 07/03/2018 - 08/03/2018	Client: United Utilities Water Limited		Sheet 2 of 2
Cable Percussion Borehole Log	Location: 366437.96E 357254.19N	Ground level: 34.64mOD / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
			24.54	10.10	Stiff, firm in places, reddish brown, gravelly, slightly sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.				
					Weathered, reddish brown MUDSTONE recovered as stiff, slightly sandy, slightly gravelly clay. *Below 10.50m: mottling grey.*				
11.00		SPT(S) 54 (9,11/54 for 231mm)					11		
11.00 - 11.40	B22			(2.48)					
11.00 - 11.40	D23						12		
12.50		SPT(S) 50 (25 for 49mm/50 for 34mm)	22.06	12.58	*At 12.50m: end of Trial Pit .*				
12.50 - 12.60	D24				End of Borehole at 12.58m		13		
							14		
							15		
							16		
							17		
							18		
							19		
							20		

Chiselling				Borehole Diameter		Boring Progress					Remarks:
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)	
											SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH12**
Dates: 12/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Cable Percussion Borehole Log	Location: 366430.98E 357269.54N	Ground level: 34.61mOD / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Concrete.			
0.30 - 1.00	B1		34.31	0.30	MADE GROUND: Firm, reddish brown, sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse including sandstone, mudstone, quartzite, rare limestone and concrete.			
				(0.90)				
1.20		SPT(S) N=2 (0,1/0,0,1,1)	33.41	1.20	Firm, reddish brown, slightly sandy, slightly gravelly , silty CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, siltstone and quartzite.			
1.20 - 1.65	B3							
1.20 - 1.65	D2							
2.00		SPT(S) N=3 (1,0/1,1,0,1)						
2.00 - 2.45	B4							
2.00 - 2.45	D5							
3.00 - 3.45	D7				*At 3.00m: high strength.*			
3.00 - 3.45	U6	53 blows. 90% recovery		(4.25)				
4.00		SPT(S) N=14 (1,2/3,3,4,4)						
4.00 - 4.45	B8							
4.00 - 4.45	D9							
5.00 - 5.45	U10	68 blows. 60% recovery			*At 5.00m: high strength.*			
5.45	D11		29.16	5.45	End of Borehole at 5.45m			

1 2 3 4 5 6 7 8 9 10

Chiselling

From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter

Depth (m)	Dia (mm)
5.45	150

Boring Progress

Date	Time	Depth (m)	Cased (m)	Water (m)
12/03	16:00	5.45	1.50	Dry

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter

Depth (m)	Dia (mm)
1.50	150

Water Strikes

Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations

Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project: Crewe WwTW		Location ID: **BH13**
Dates: 09/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Cable Percussion Borehole Log	Location: 366439.18E 357245.27N	Ground level: 34.44mOD / Logged by: DO / Vertical scale: 1:50	Project ID: 42187

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
			34.24	0.20	MADE GROUND: Concrete.			
0.30	ES1		34.14	0.30	MADE GROUND: Light grey, sandy, angular to subangular, fine to coarse GRAVEL including limestone and occasional granite.			
0.50	ES2			(0.70)	MADE GROUND: Firm stiff in places, reddish brown, gravelly, slightly sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, quartzite and rare concrete.			
1.00	ES3		33.44	1.00				
1.20		SPT(S) N=2 (1,0/0,0,1,1)			Firm, reddish brown, gravelly, slightly sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.			
1.20 - 1.65	B6							
2.00	ES4				*At 2.00m: low strength.*			
2.00 - 2.45	U7	15 blows. 100% recovery						
2.50	ES5							
3.00		SPT(S) N=11 (1,1/1,2,3,5)						
3.00 - 3.45	B9			(4.45)				
3.00 - 3.45	D8							
4.00 - 4.45	D11				*At 4.00m: high strength.*			
4.00 - 4.45	U10	53 blows. 100% recovery						
5.00		SPT(S) N=30 (6,4/6,5,9,10)			*Below 5.00m: stiff*			
5.00 - 5.45	D12							
			28.99	5.45	End of Borehole at 5.45m			

1 2 3 4 5 6 7 8 9 10

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
5.45	150

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
09/03	15:00	5.45	3.00	Dry

Remarks:
No groundwater encountered. Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: N/R, Energy Ratio: N/R

Casing Diameter	
Depth (m)	Dia (mm)
3.00	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	HH	IFA CP v01.01
Log status:	FINAL	

Trial Pit Records

IAN FARMER ASSOCIATES

Plant used: Hand excavated	Project: Crewe WwTW		Location ID: **TP01**
Dates: 28/02/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366573.34E 357119.34N	Ground level: 34.73mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Grass over, dark brown, clayey, slightly gravelly, fine and medium SAND with frequent roots and rootlets. Gravel is angular to subrounded including sandstone and rare concrete (Topsoil).				
0.25 0.25	ES1	PID=0.0ppm	34.43	0.30	MADE GROUND: Light grey, slightly sandy angular to subrounded fine to coarse GRAVEL including limestone and rare concrete.				
0.50 0.50 0.50	D4 ES2	PID=0.0ppm	34.20	0.53	MADE GROUND: Firm locally stiff, brown, gravelly slightly sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and rare concrete.				
				(0.67)					
1.00 1.00 1.00	D5 ES3	PID=0.0ppm	33.53	1.20	End of Trial Pit at 1.20m		1		
							2		
							3		
							4		
							5		

Termination:

Stability:
Trial pit remained stable.

Remarks:

Dimensions (Length m x Width m):
0.60 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH
Status:	FINAL

IFA TP v01.01

IAN FARMER ASSOCIATES

Plant used: 13t Tracked excavator	Project: Crewe WwTW		Location ID: **TP02**
Dates: 02/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366651.81E 357194.47N	Ground level: 32.81mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Grass over, dark brown, clayey, fine and medium SAND with frequent roots and rootlets.				
0.25 0.25	ES1	PID=0.1ppm	32.51	0.30					
0.50 0.50 0.50	D3 ES2	PID=0.9ppm			Stiff firm in places, brown mottled black, sandy, gravelly CLAY with medium cobble content. Gravel is angular to subrounded, fine to coarse including sandstone and mudstone.				
1.00 1.00 1.00	D5 ES4	PID=0.5ppm					1		
				(2.70)					
2.00 2.00 2.00	D7 ES6	PID=0.3ppm					2		
					Between 2.80m and 3.00m: with frequent pockets of fine and medium sand.				
3.00 3.00 3.00	D9 ES8	PID=0.0ppm	29.81	3.00	End of Trial Pit at 3.00m		3		
							4		
							5		

Termination:

Stability:

Remarks:
No groundwater encountered.

Dimensions (Length m x Width m):
3.00 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH
Status:	FINAL

IFA TP v01.01

IAN FARMER ASSOCIATES

Plant used: 13t Tracked excavator	Project: Crewe WwTW		Location ID: **TP03**
Dates: 06/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366541.14E 357192.60N	Ground level: 34.74mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Dark brown, clayey, slightly gravelly, fine to coarse SAND with occasional roots and rootlets. Gravel is angular to subrounded, fine and medium including sandstone, quartzite and rare brick.				
0.25	ES1		34.44	0.30					
0.25		PID=0.0ppm			MADE GROUND: Light brown and grey mottled, slightly gravelly, fine and medium SAND. Gravel is angular to subrounded fine to coarse including sandstone, quartzite and rare brick.				
0.30 - 0.60	B5								
0.50	ES2			(0.50)					
0.50		PID=0.0ppm			*Between 0.60 and 0.70m: mottling orange.*				
			33.94	0.80					
					MADE GROUND: Firm, stiff in places, brown, slightly gravelly, slightly sandy CLAY with low cobble content. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and rare brick. Cobble is subrounded including quartzite.				
1.00	D6		33.74	1.00			1		
1.00	ES3				Stiff, brown and grey mottled, gravelly, slightly sandy CLAY with rare fibrous peat pockets. Gravel is angular to subrounded, fine and coarse including sandstone, mudstone and quartzite.				
1.00		PID=0.0ppm							
				(0.80)					
			32.94	1.80					
					Stiff, reddish brown, slightly sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.				
2.00	D7						2		
2.00	ES4								
2.00		PID=0.0ppm							
				(1.20)					
3.00	D8		31.74	3.00			3		
					End of Trial Pit at 3.00m				
							4		
							5		

Termination:

Stability:
Trial pit remained stable during excavation.

Remarks:
No groundwater encountered.

Dimensions (Length m x Width m):
3.00 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH
Status:	FINAL

IFA TP v01.01

IAN FARMER ASSOCIATES

Plant used: 13t Tracked excavator	Project: Crewe WwTW		Location ID: **TP04**
Dates: 06/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366689.88E 357236.38N	Ground level: 31.49mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Grass over brown, clayey, fine and medium SAND with occasional roots and rootlets.				
0.25 0.25	ES1	PID=0.0ppm	31.19	0.30					
0.50 0.50 0.50	D3 ES2	PID=0.5ppm		(0.50)	MADE GROUND: Stiff, firm in places, sandy, gravelly CLAY with medium cobble content. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, brick and wood. Cobbles are subangular including brick and concrete.				
			30.69	0.80					
1.00 1.00 1.00	D5 ES4	PID=0.2ppm			Firm, soft in places, grey mottled black, sandy, slightly gravelly CLAY with occasional fragments of wood. Gravel is angular to subrounded, fine and medium including sandstone and quartzite.		1		
				(1.80)					
2.00 2.00 2.00	D7 ES6	PID=0.1ppm					2		
2.60 - 3.00	B8		28.89	2.60	Grey, speckled black, slightly clayey, fine and medium SAND.				
				(0.40)					
3.00 3.00 3.00	D10 ES9	PID=0.0ppm	28.49	3.00	End of Trial Pit at 3.00m		3		
							4		
							5		

Termination:

Stability:
Trial pit remained stable.

Remarks:
No groundwater encountered.

Dimensions (Length m x Width m):

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH
Status:	FINAL

IFA TP v01.01

IAN FARMER ASSOCIATES

Plant used: Hand excavated	Project: Crewe WwTW		Location ID: **TP05**
Dates: 28/02/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366728.33E 357285.37N	Ground level: 30.38mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				(0.30)	MADE GROUND: Grass over, firm, brown, slightly sandy, slightly gravelly CLAY with frequent roots and rootlets. Gravel is angular to rounded fine to coarse including sandstone, mudstone and quartzite (topsoil).				
0.25 0.25	ES1	PID=0.0ppm	30.08	0.30	Stiff, reddish brown, sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.				
0.50 0.50 0.50	D4 ES2	PID=0.0ppm		(0.90)					
1.00 1.00 1.00	D5 ES3	PID=0.0ppm	29.18	1.20	End of Trial Pit at 1.20m		1 2 3 4 5		

Termination:

Stability:
Trial pit remained stable.

Remarks:

Dimensions (Length m x Width m):
0.60 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH
Status:	FINAL

IFA TP v01.01

IAN FARMER ASSOCIATES

Plant used: 13ton tracked excavator	Project: Crewe WwTW		Location ID: **TP06**
Dates: 06/03/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366611.86E 357271.24N	Ground level: 31.60mOD	Logged by: DO	Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
			31.50	0.10	MADE GROUND: Light grey, slightly sandy, angular to subrounded, fine to coarse GRAVEL including granite, sandstone and brick. *At 0.10m: a piece of membrane.*				
0.25	ES1								
0.25		PID=0.0ppm			MADE GROUND: Stiff, firm in places, reddish brown speckled black, sandy, gravelly CLAY with occasional fragments of decayed timber.				
0.50	D4				*Between 0.50 and 1.20m: with high cobble content and low boulder content. Cobble is subangular including brick and wood. Boulder is subangular ?*				
0.50	ES2								
0.50		PID=0.0ppm		(1.10)	*Between 0.80 and 1.00m: mottling black.*				
1.00	D5				*Between 1.00 and 1.20m: becoming soft in places.*		1		
1.00	ES3								
1.00		PID=0.3ppm							
			30.40	1.20	Stiff ,reddish brown, sandy, gravelly CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.				
					Between 1.80 and 2.80m: occasional pockets of fine and medium sand.				
2.00	D7						2		
2.00	ES6								
2.00		PID=0.0ppm		(1.80)					
3.00	D8		28.60	3.00	End of Trial Pit at 3.00m		3	▼	
							4		
							5		

Termination:

Stability:
Trial pit remained stable during excavation.

Remarks:

Dimensions (Length m x Width m):
3.00 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks
3.00	0	3.00	At 3.00m: seepage.

Checked by:	HH	IFA TP v01.01
Status:	FINAL	

IAN FARMER ASSOCIATES

Plant used: 8 Tonne Tracked Excavator	Project: Crewe WwTW		Location ID: **TP07**
Dates: 27/02/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366598.01E 357302.73N	Ground level: 32.31mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				(0.32)	MADE GROUND: Grass over, dark brown, clayey slightly gravelly, fine SAND. Gravel is angular to subrounded, fine and medium including sandstone, quartzite and rare brick (Topsoil).				
0.25		PID=0.0ppm							
0.30	ES1		31.99	0.32					
				(0.38)	MADE GROUND: Firm, reddish brown, slightly gravelly, slightly sandy CLAY with low cobble content and frequent sand pockets. Gravel is angular to subrounded, fine to coarse including sandstone and mudstone. Cobble is subangular including quartzite and brick.				
0.50	D2								
0.50		PID=0.0ppm							
0.60	ES3		31.61	0.70					
				(0.60)	Stiff, reddish brown, sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and quartzite.		1		
1.00	D4								
1.00		PID=0.0ppm							
1.20	ES5								
1.20		PID=0.0ppm	31.01	1.30					
				(0.40)	Reddish brown, coarse SAND.				
1.50	D7								
1.50	ES6								
			30.61	1.70	*At 1.70m: end of trial pit due to services.*				
					End of Trial Pit at 1.70m		2		
							3		
							4		
							5		

Termination:

Stability:
Trial pit remained stable.

Remarks:

Dimensions (Length m x Width m):
5.00 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH
Status:	FINAL

IFA TP v01.01

IAN FARMER ASSOCIATES

Plant used: Hand excavated	Project: Crewe WwTW		Location ID: **TP08**
Dates: 23/02/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366549.74E 357337.98N	Ground level: 32.85mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
					MADE GROUND: Dark brown, clayey, gravelly, fine and medium SAND with frequent rootlets.				
0.25	D2		32.58	0.27					
0.25	ES1				MADE GROUND: Firm, brown mottled dark brown, gravelly, slightly sandy CLAY with frequent pockets of sand. Gravel is angular to subrounded, fine to coarse including sandstone, siltstone, quartzite and rare brick and cement.				
0.25		PID=0.0ppm							
0.50	D4								
0.50	ES3								
0.50		PID=0.0ppm		(0.73)					
1.00	D6		31.85	1.00			1		
1.00	ES5				Reddish brown, gravelly, fine to coarse SAND. Gravel is angular to subrounded fine to coarse, including quartzite and siltstone.				
1.00 - 1.20	B8								
1.00		PID=0.0ppm	31.65	1.20					
1.20	ES7				End of Trial Pit at 1.20m				
1.20		PID=0.0ppm							
							2		
							3		
							4		
							5		

Termination:
Trial pit terminated at 1.20m due to encountering electric cable.

Stability:
Trial pit remained stable.

Remarks:

Dimensions (Length m x Width m):
4.00 x 0.60

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH	IFA TP v01.01
Status:	FINAL	

IAN FARMER ASSOCIATES

Plant used: Hand excavated	Project: Crewe WwTW		Location ID: **TP09**
Dates: 28/02/2018	Client: United Utilities Water Limited		Sheet 1 of 1
Trial Pit Log	Location: 366408.71E 357316.78N	Ground level: 35.63mOD / Logged by: DO / Vertical scale: 1:25	Contract ID: 42187

Samples & In Situ Testing			Strata Details						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
0.25	ES1			(0.35)	MADE GROUND: Grass over, firm brown, gravelly, sandy CLAY with frequent roots and rootlets. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone and rare concrete.				
0.25		PID=0.0ppm	35.28	0.35					
0.50	D4				Stiff, reddish brown, gravelly, sandy CLAY. Gravel is angular to subrounded, fine to coarse including sandstone, mudstone, quartzite and rare wood. (possibly re-worked).				
0.50	ES2								
0.50		PID=0.0ppm		(0.85)					
1.00	D5						1		
1.00	ES3								
1.00		PID=0.0ppm	34.43	1.20					
					End of Trial Pit at 1.20m		2		
							3		
							4		
							5		

Termination:

Stability:
Trial pit remained dry and stable during excavation.

Remarks:
No groundwater encountered.

Dimensions (Length m x Width m):
0.30 x 0.30

Water Strikes

Strike (m)	Time (mins)	Rose to (m)	Remarks

Checked by:	HH	IFA TP v01.01
Status:	FINAL	

Rising Head Test records

IAN FARMER ASSOCIATES

VARIABLE HEAD PERMEABILITY TEST

42187 Variable Head (Rising head) Permeability Test BH04

SITE Crewe WwTW

CONTRACT 42187 BH04 DEPTH: mBGL 8.00

INITIAL CONDITIONS

Base of Response Zone	8.00	mBGL	Operator		MH/DO
Top of Reponse Zone	8.00	mBGL	Date		23/02/2018
Diameter of casing	150.00	mm	Time		
Height of casing	0.00	mAGL	Weather		
Elevation of Borehole		mAOD	Calculated		
Groundwater Level	6.90	mBGL	0.00	m	

TEST CALCULATION

Intake Factor, F

F= 0.41 (i)

Borehole Case b

BS 5930: 1999 Figure 6

Permeability, K

$$K = \frac{A}{F * (t2 - t1)} .Ln(H1/H2) \quad (ii)$$

L= 0.00 m
D= 0.150 m
L/D= 0

t1= 300 s
t2= 1200 s
H1= 0.89 m
H2= 0.85 m

A= 0.01768 m^2
F= 0.4125 From (i)
T= s
K= 1.9844E-06 m/s From (ii)

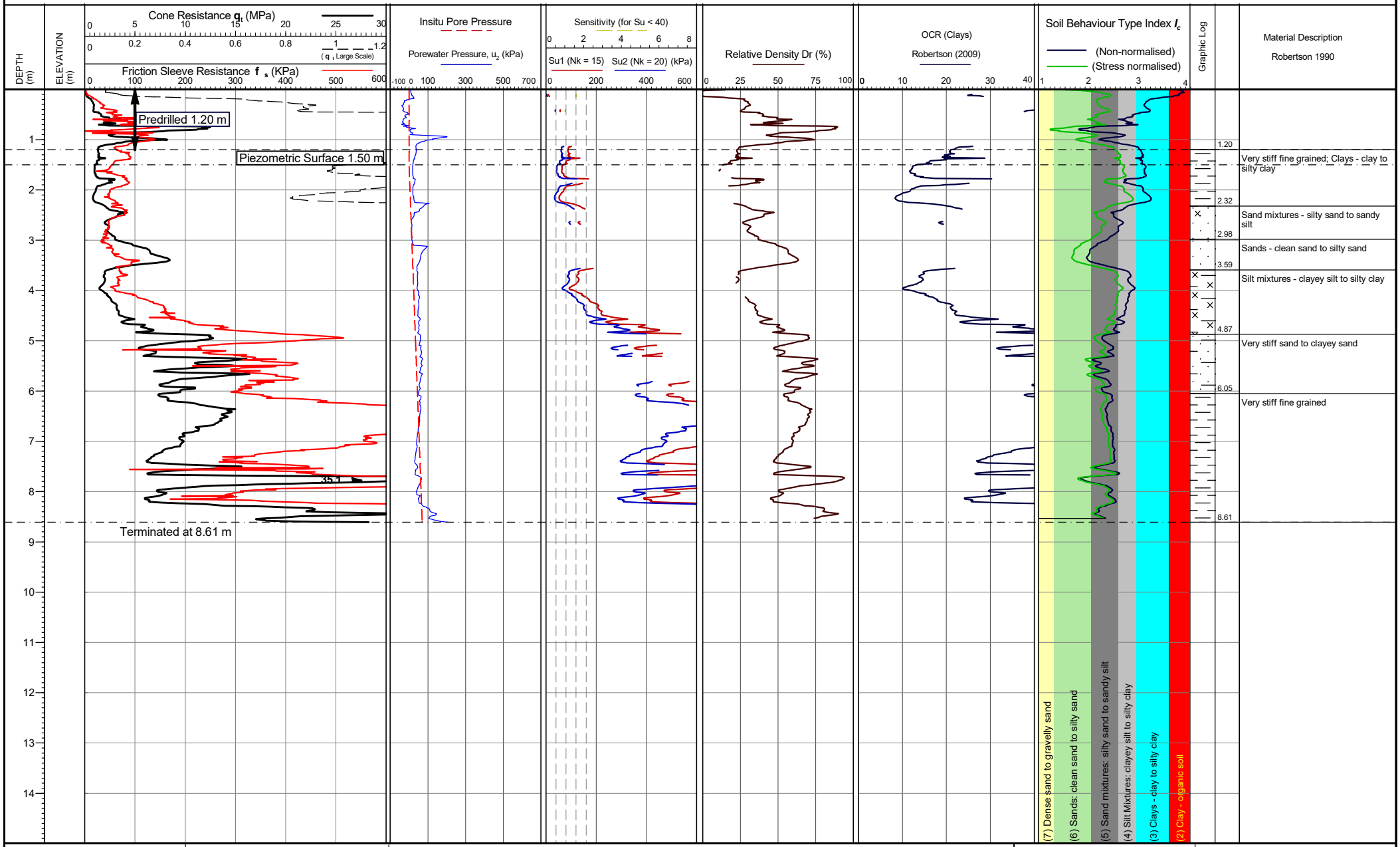
Remarks

Elapsed (minutes)	Total seconds	Water Depth (m)	Head (metres)	H/Ho
0.0	0	8.000	-1.100	1.000
0.5	30	7.980	-1.080	0.982
1.0	60	7.960	-1.060	0.964
2.0	120	7.930	-1.030	0.936
3.0	180	7.910	-1.010	0.918
4.0	240	7.890	-0.990	0.900
5.0	300	7.880	-0.980	0.891
6.0	360	7.880	-0.980	0.891
7.0	420	7.880	-0.980	0.891
8.0	480	7.870	-0.970	0.882
9.0	540	7.870	-0.970	0.882
10.0	600	7.870	-0.970	0.882
15.0	900	7.850	-0.950	0.864
20.0	1200	7.840	-0.940	0.855
25.0	1500	7.840	-0.940	0.855
30.0	1800	7.840	-0.940	0.855
40.0	2400	7.840	-0.940	0.855
50.0	3000	7.840	-0.940	0.855
60.0	3600	7.840	-0.940	0.855

CPT report by Lankelma

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 10:27:04

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Total reaction force

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

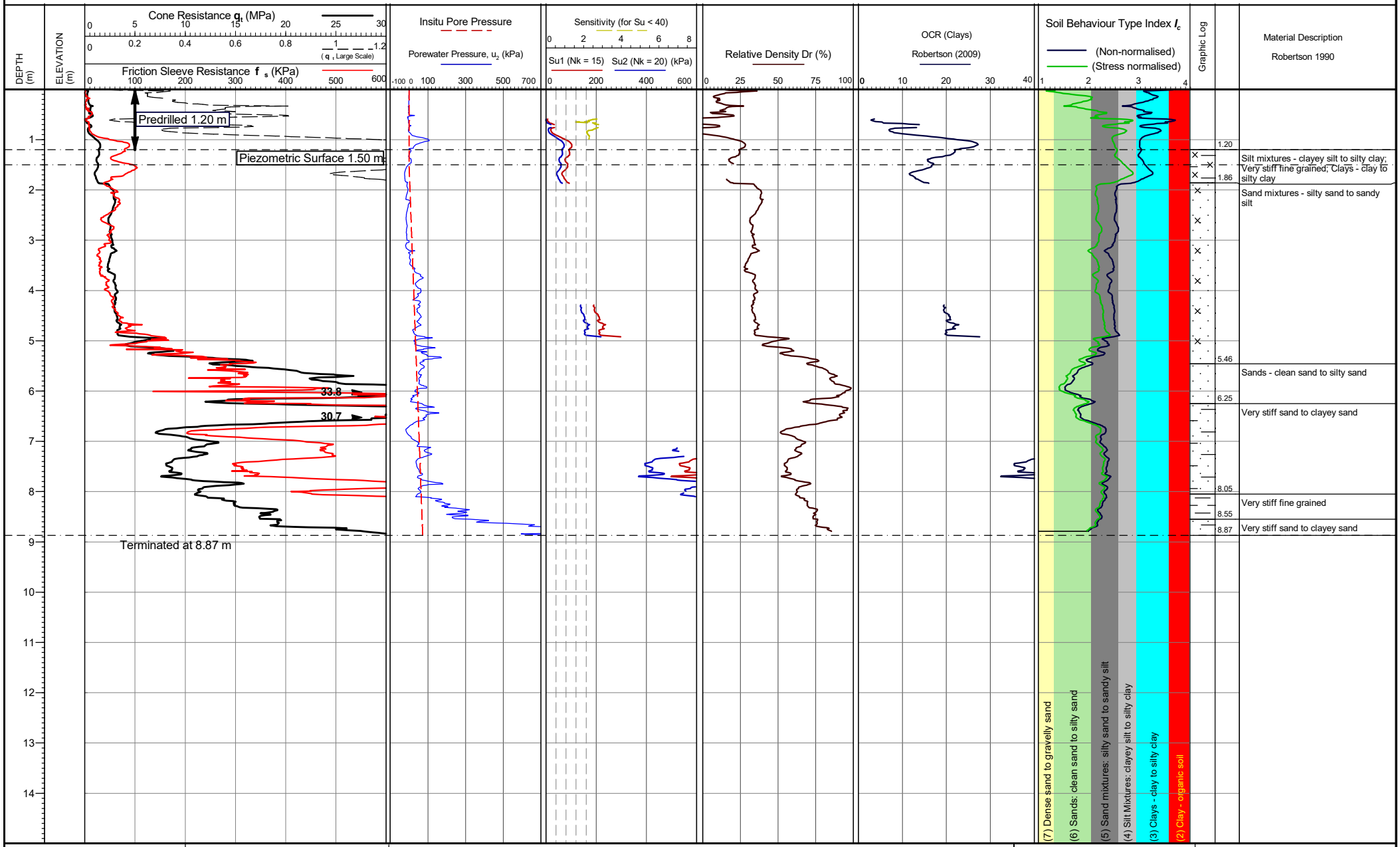
See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT02

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 09:09:29

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Tip load

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

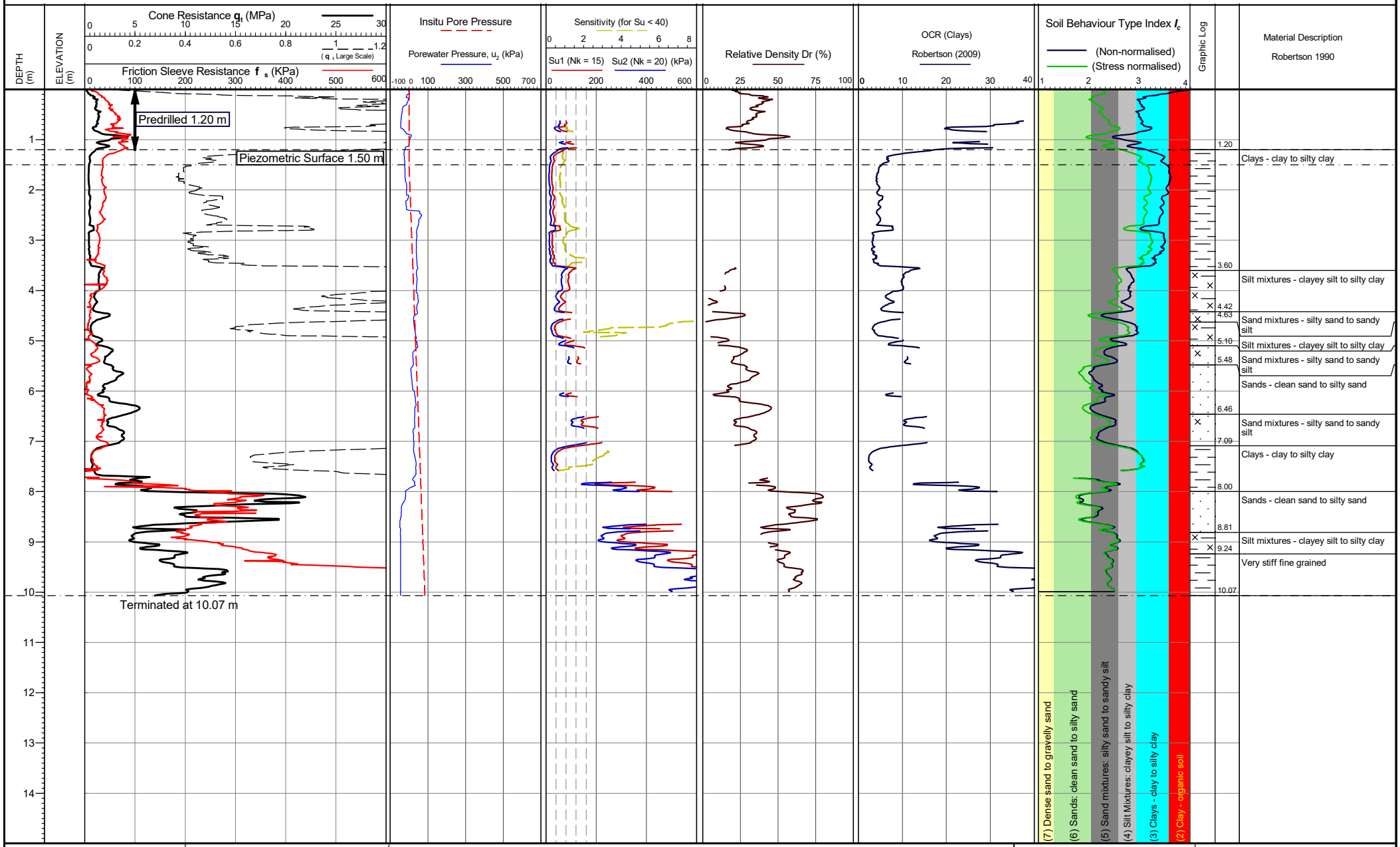
Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT03

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 11:07:07

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

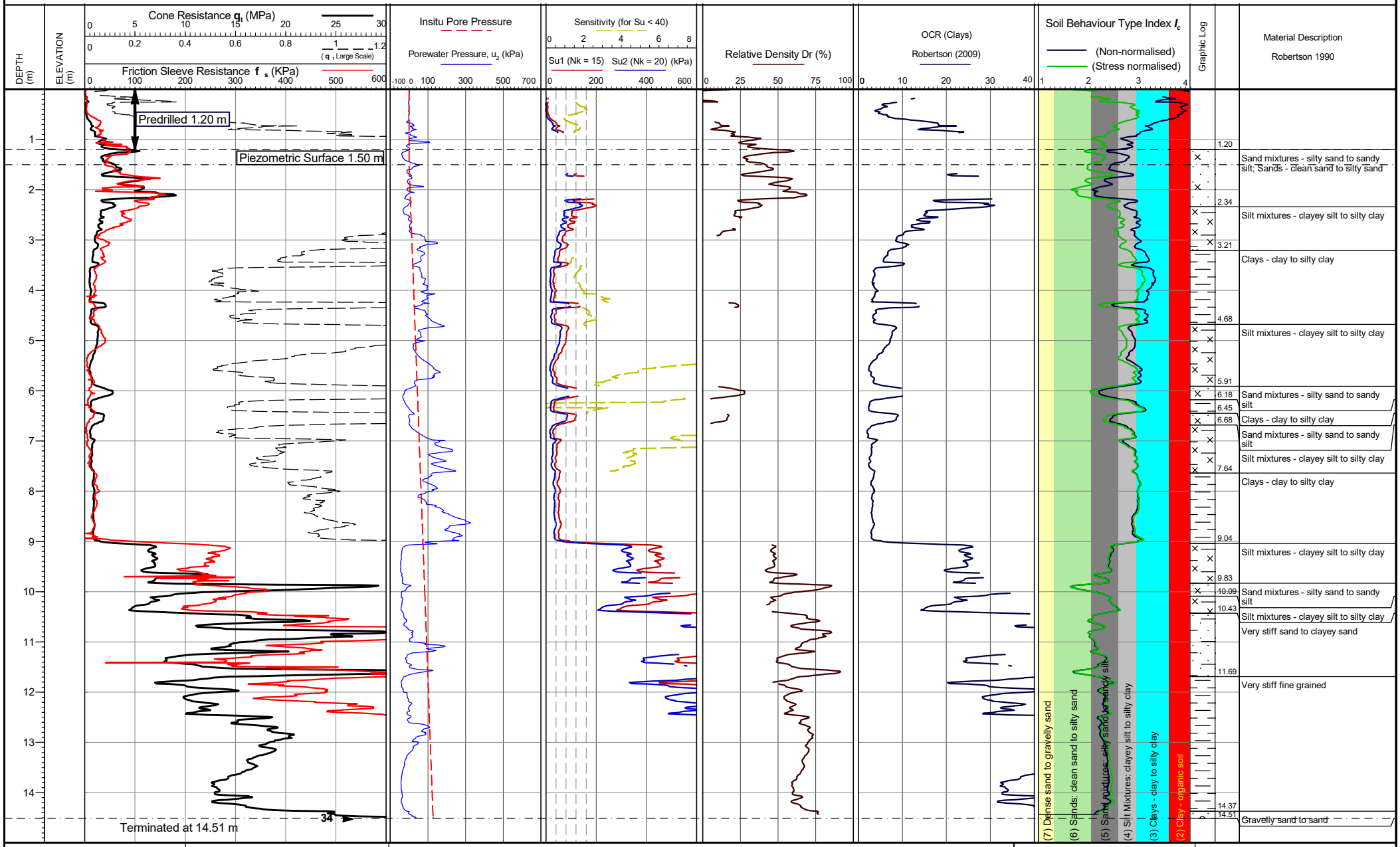
Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT04

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 11:36:15

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Target depth

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

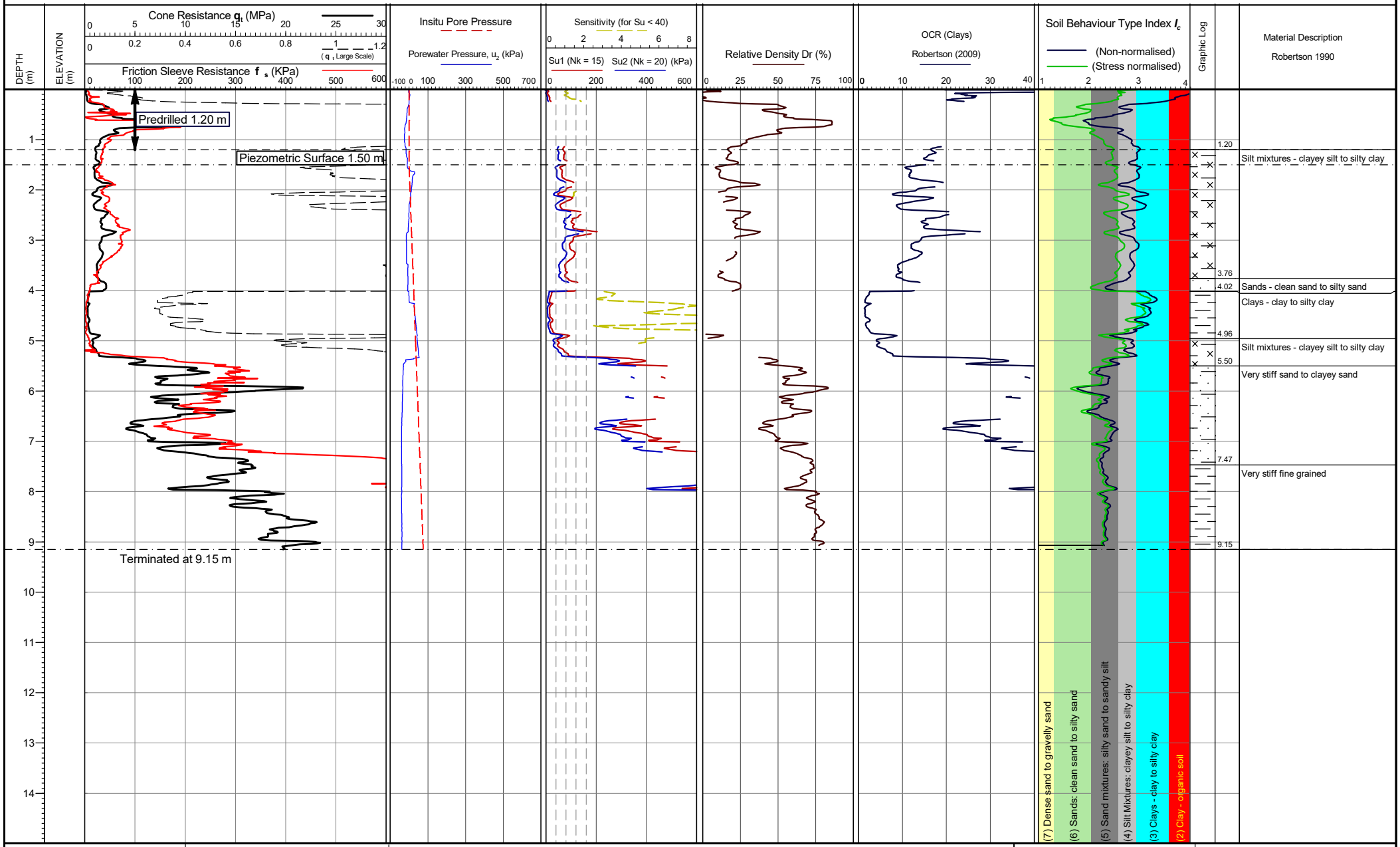
See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT06

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 12:32:59

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Total reaction force

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

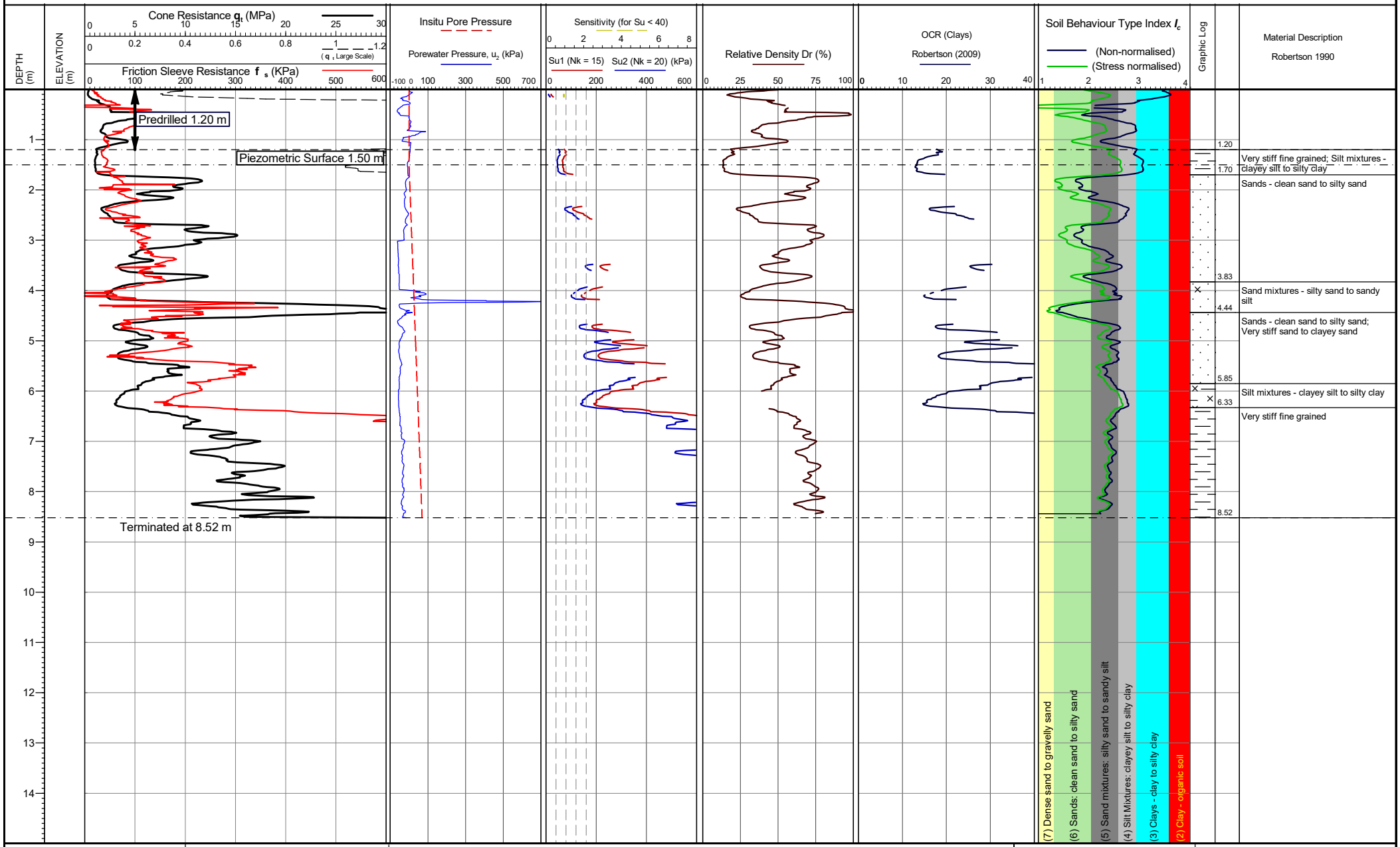
See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT07

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 13:22:25

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Total reaction force

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

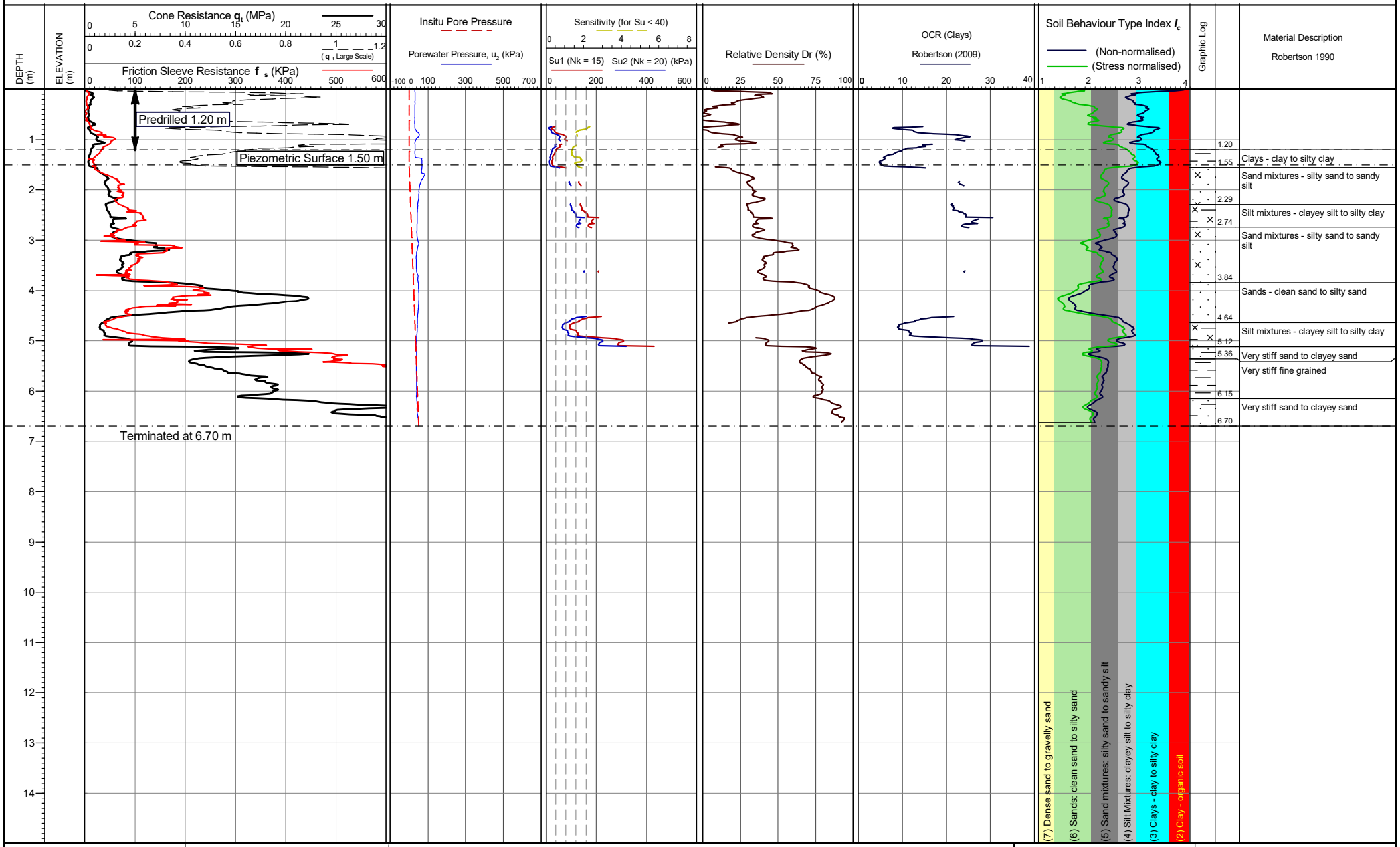
Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT08

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 09:47:21

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Sleeve load

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

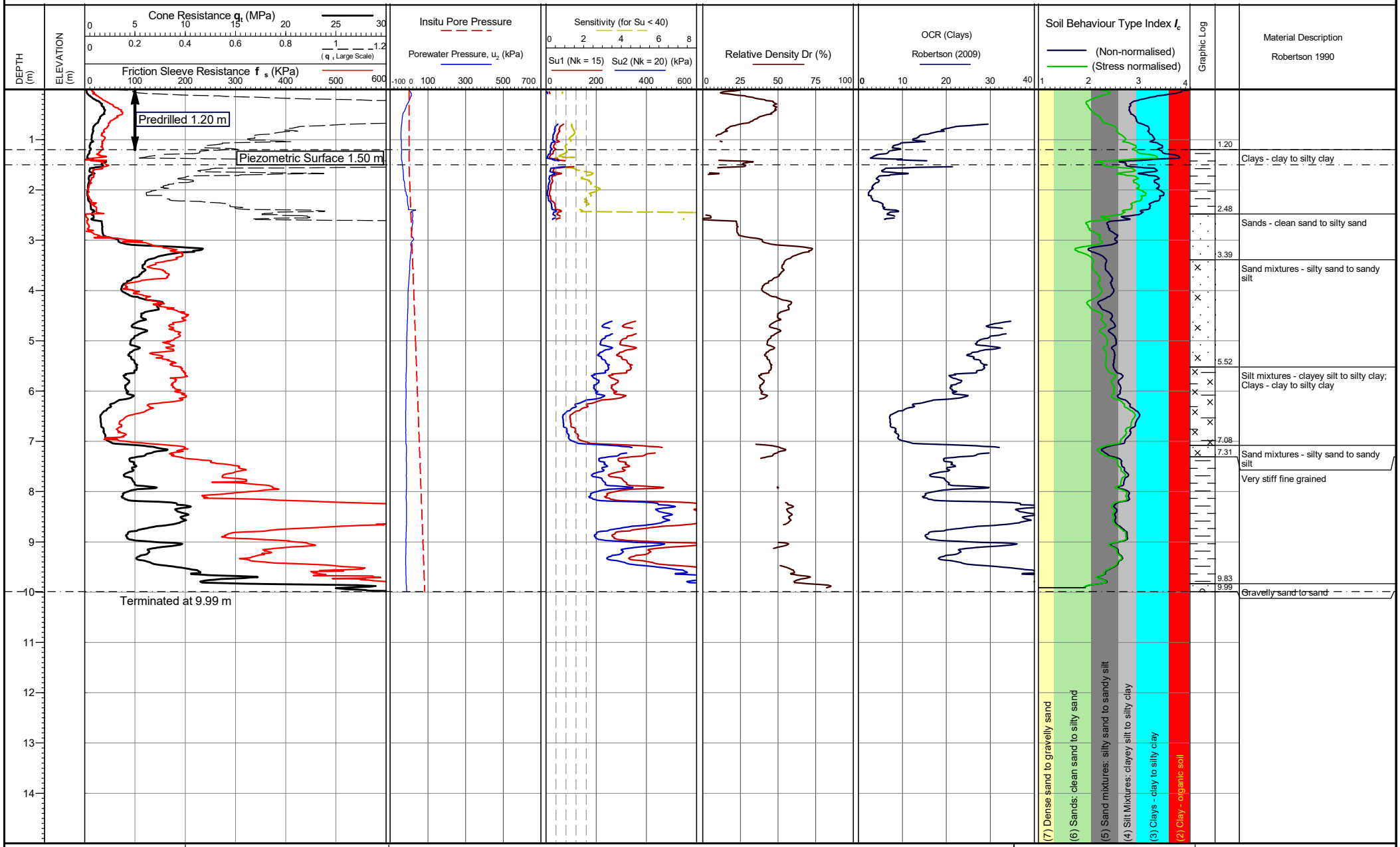
Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT09

Client: IAN FARMER ASSOCIATES **Project: CREWE WwTW**

LANKELMA



Cone area (mm2):1500
ConeID: S15-CFIP.1640
Operator: Phillip Case
Rig Used: UK15
Date of test: 01/03/2018 14:11:35

Location: Cheshire, UK

Coordinates: ,
Elevation:

Remarks: *Piezometric surface origin: Arbitrary value

Termination Remark:
Total reaction force

Dissipation Test

Both drained and undrained parameters are calculated for mixed SBTs = Ic 2.05-2.95. See report section 'Drained and Undrained Behaviour' for discussion.

See report section 'Interperative Data' for methods and discussion of parameter evaluation.

Date of plot: 16-03-18
Lankelma Project Ref: P-106864-1

Checked by:
Chris Player

TEST ID: CPT10

APPENDIX 3

LABORATORY TESTS

APPENDIX 3

GENERAL NOTES ON LABORATORY TESTS ON SOILS

A3.1 GENERAL

A3.1.1 Where applicable all tests are carried out in accordance with the relevant British Standard. The laboratory test procedures are as below:

Test Name	**Procedures BS1377:1990 Part:Clause**
Moisture Content	2:3
Liquid Limit	2:4
Plastic Limit and Plastic Index	2:5
Linear Shrinkage	2:6
Particle Size Distribution	2:9
Loss on Ignition	3:4*
Sulphate content	3:5
Chloride Content	3:7*
pH Value	3:9
Compaction Test	4:3*
Moisture condition Value	4:5
California Bearing Ratio	4:7
Consolidation	5:3
Bulk Density	7:2*
Laboratory Vane Tests	7:3*
Shear Box	7:4*
Triaxial Compression	
Total Stress Single-Stage	7:8
Total Stress Multi-Stage	7:9
Effective Stress	Note 1*
Permeability	Note 2*
Desiccation	Note 3*
In-situ density by Sand replacement	Part 9
Core Cutter	Part 9
Nuclear density	Part 9

	BS812 Part:Clause
Ten % fines (Dry and Soaked)	111
Aggregate crushing value	110
Particle density and water absorption	2
Particle size distribution	103
Moisture content – oven drying	109
Soundness	121

	BS:1881 Part:Clause
Chloride Content	124:10.2
Sulphate content	124:10.3
Curing/density and compressive strength of concrete tubes	116-111-114
Location of reinforcement	204
Carbonation	Note 4
Resistivity	Note 5
Sampling of concrete dust by drilling	Note 6
Half cell potential	Note 7

Note 1 - Manual of soils laboratory testing volume 3: 1985, section 19.2 by K.H. Head
Note 2 - Manual of soils laboratory testing volume 2: 1985, section 10.7 by K.H. Head
Note 3 - BRE Information paper IP4 issued February 1993
Note 4 - BRE Information paper IP6/81
Note 5 - In-house document number 109
Note 6 - In-house document number 112
Note 7 - ASTM C876-91
* Tests are not included in UKAS accreditation

A3.1.2 Any discussion in this report is based on the values and results obtained from the appropriate tests. Due allowance should be made, when considering any result in isolation, of the possible inaccuracy of any such individual result. Details of the accuracy of results are included in this section, where applicable.

A3.1.3 The plastic index and liquid limit have been used to classify fine soils on the basis of position on “A” Line chart. The classification prefix indicates clay (C) or silt (M). The suffix indicates plasticity described as low (L), medium (I), high (H), very high (V) or extremely high (E).

A3.1.4 The “A” line separating clay from silt is somewhat arbitrary and the soil description may therefore be at variance with the soil classification when samples plot close to the “A” line.

Results of Geotechnical Tests

Soil

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washington@ianfarmer.co.uk www.ianfarmer.co.uk

F.A.O.

Test Report - 42187 / 1

Site:	Crewe WwTW
Job Number:	42187
Originating Client:	Laing O'Rourke
Originating Reference:	42187
Date Sampled:	01/03/2018
Date Scheduled:	16/03/2018
Date Testing Started:	24/03/2018
Date Testing Finished:	28/03/2018
Remarks:	

Authorised By:

Paul Cathcart
Laboratory Manager

Date: 04/04/2018

IAN FARMER ASSOCIATES

Laboratory Test Report | 42187 / 1

Site: Crewe WwTW **Job Number:** 42187

Client: Laing O'Rourke **Page:** 2

Determination of Water Content, Liquid Limit and Plastic Limit and Derivation of Plasticity and Liquidity Index

Borehole / Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Water Content %	Sample Passing 425 µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
					Percentage %	Water Content %						
BH01	4.00	B9	Natural	13.9	100	14.0	26	14	12	-0.01	CL	Brown slightly gravelly, sandy, organic CLAY
BH01	5.00	B12	Sieved	22.5	65	32.0	44	22	22	0.45	CI	Brown slightly gravelly, sandy, silty, slightly organic CLAY
BH02	1.20	B2	Natural	17.8	99	18.0	30	16	14	0.14	CL	Brown / Grey slightly gravelly, sandy, silty CLAY
BH02	4.40	B9	Sieved	15.2	63	21.0	35	18	17	0.19	CL/CI	Brown silty, sandy, gravelly CLAY
BH04	5.00	B11	Natural	21	100	21.0	27	15	12	0.50	CL	Grey / Brown slightly gravelly, sandy, silty CLAY

Method of Preparation: BS EN ISO 17892 : Part 1 : 2014 : Clause 5.1 Water content test preparation
BS 1377 : Part 1 : 2016 : Clause 8.4.3 Preparation of samples for plasticity tests
BS 1377 : Part 2 : 1990 : Clause 4.2 Preparation of samples for plastic limit tests

Method of Test: BS EN ISO 17892 : Part 1 : 2014 : Clause 5.2 Water content test execution
BS 1377 : Part 2 : 1990 : Clause 4.3 or 4.4 Determination of the liquid limit
BS 1377 : Part 2 : 1990 : Clause 5.3 Determination of the plastic limit and plasticity index

UKAS TESTING 1464

IAN FARMER ASSOCIATES

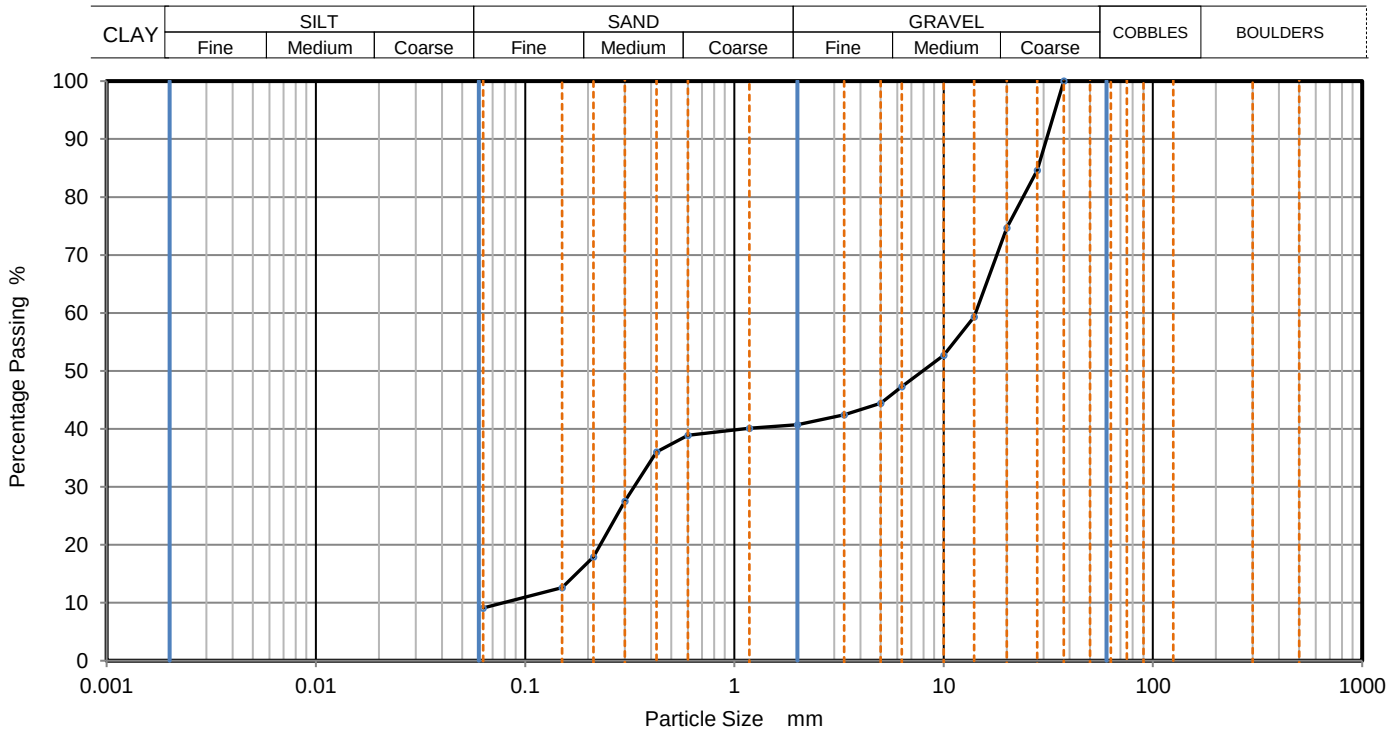
Laboratory Test Report | 42187 / 1

Site: Crewe WwTW | **Job Number:** 42187

Client: Laing O'Rourke | **Page:** 3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH04	6.50	B15	Wet Sieve	Brown slightly clayey, sandy GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
37.5	100		
28	85		
20	75		
14	59		
10	53		
6.3	47		
5	44		
3.35	42		
2	41		
1.18	40		
0.6	39		
0.425	36		
0.3	28		
0.212	18		
0.15	13		
0.063	9		

Dry Mass of sample, g: 2636

Sample Proportions	% dry mass
Very coarse	0
Gravel	59
Sand	32
Fines <0.063mm	9

Grading Analysis		
D100	mm	37.5
D60	mm	14.2
D30	mm	0.333
D10	mm	0.0793
Uniformity Coefficient		180
Curvature Coefficient		0.098

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method

UKAS TESTING 1464

IAN FARMER ASSOCIATES

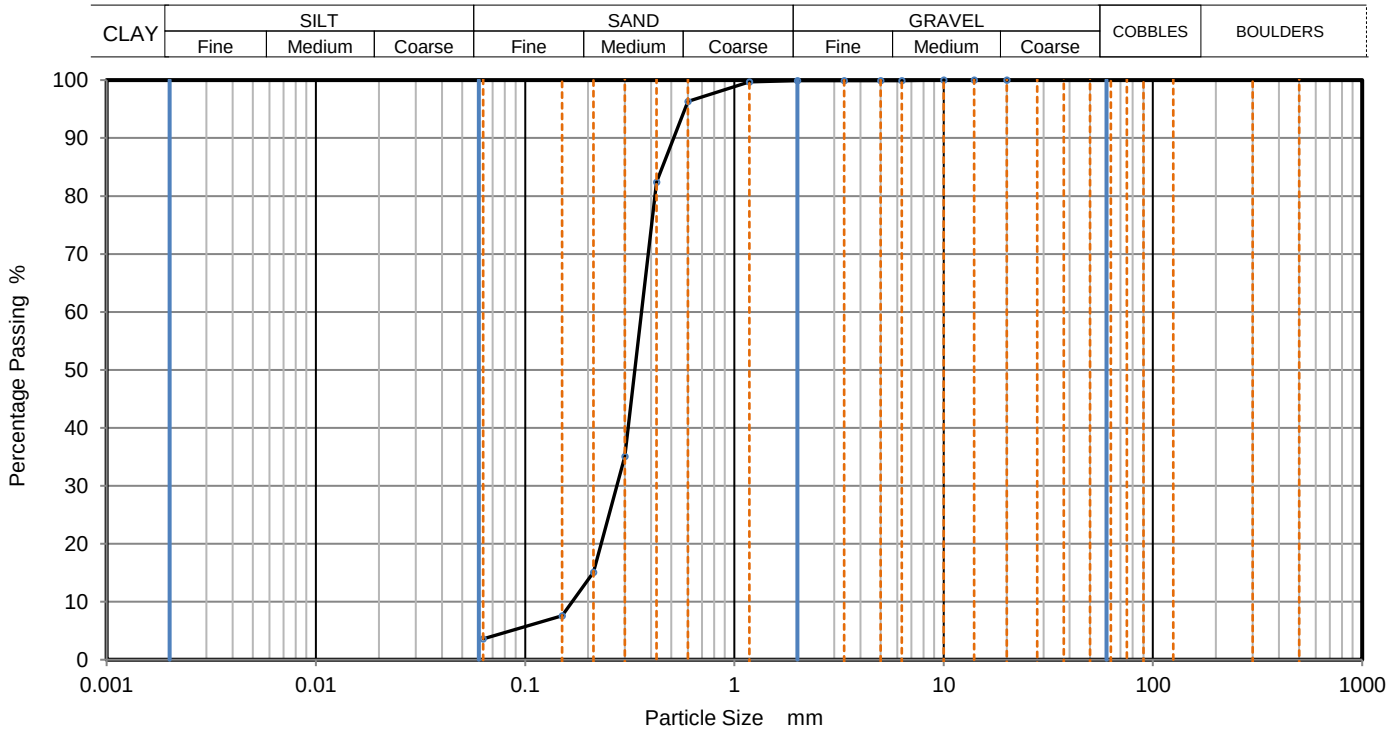
Laboratory Test Report | 42187 / 1

Site: Crewe WwTW | **Job Number:** 42187

Client: Laing O'Rourke | **Page:** 4

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH06	6.50	B12	Wet Sieve	Brown slightly silty SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	96		
0.425	82		
0.3	35		
0.212	15		
0.15	8		
0.063	4		

Dry Mass of sample, g: 759

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	96
Fines <0.063mm	4

Grading Analysis		
D100	mm	10
D60	mm	0.36
D30	mm	0.275
D10	mm	0.167
Uniformity Coefficient		2.2
Curvature Coefficient		1.3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method

UKAS TESTING 1464

IAN FARMER ASSOCIATES

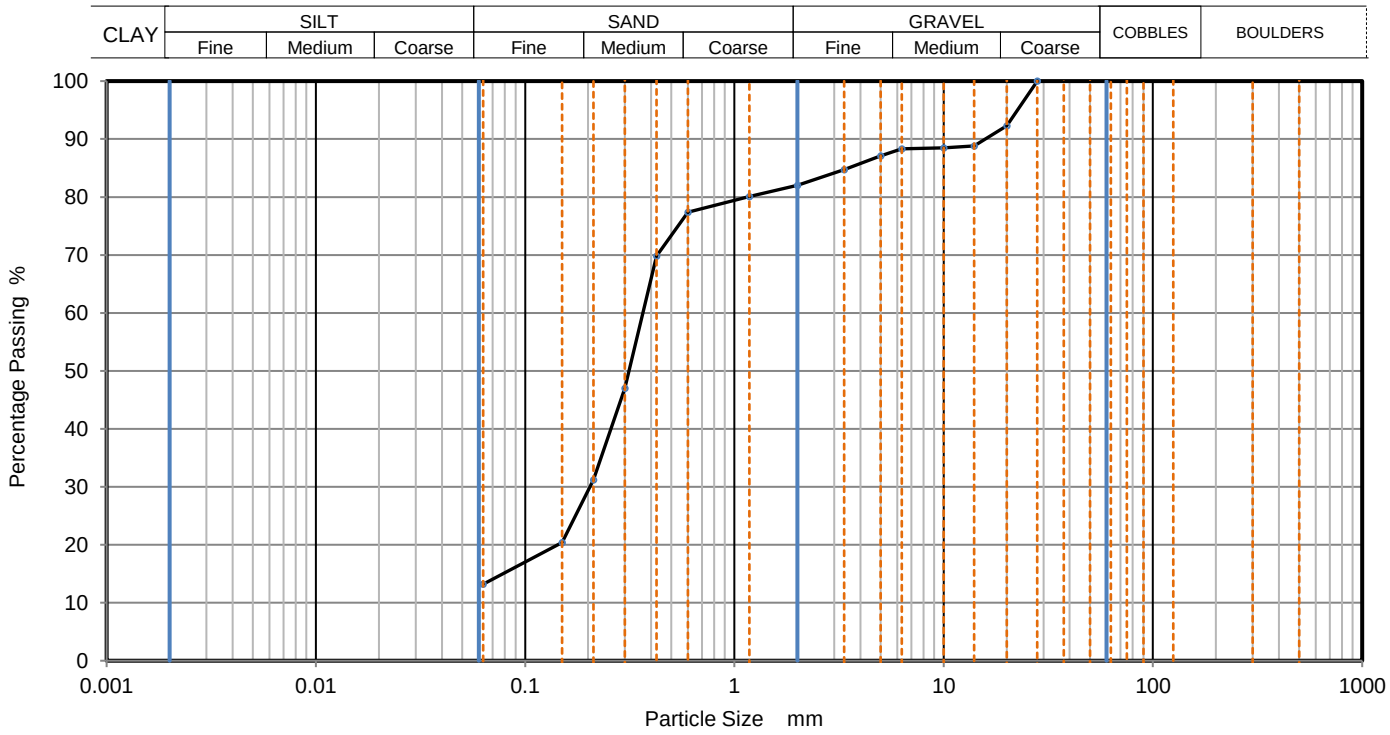
Laboratory Test Report 42187 / 1

Site: Crewe WwTW **Job Number:** 42187

Client: Laing O'Rourke **Page:** 5

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
TP08	1.00	B8	Wet Sieve	Brown / Red silty, gravelly, organic SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
28	100		
20	92		
14	89		
10	89		
6.3	88		
5	87		
3.35	85		
2	82		
1.18	80		
0.6	77		
0.425	70		
0.3	47		
0.212	31		
0.15	20		
0.063	13		

Dry Mass of sample, g: 1633

Sample Proportions	% dry mass
Very coarse	0
Gravel	18
Sand	69
Fines <0.063mm	13

Grading Analysis		
D100	mm	28
D60	mm	0.366
D30	mm	0.204
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method

UKAS TESTING 1464

IAN FARMER ASSOCIATES	Laboratory Test Report	42187 / 1

Site: Crewe WwTW **Job Number:** 42187

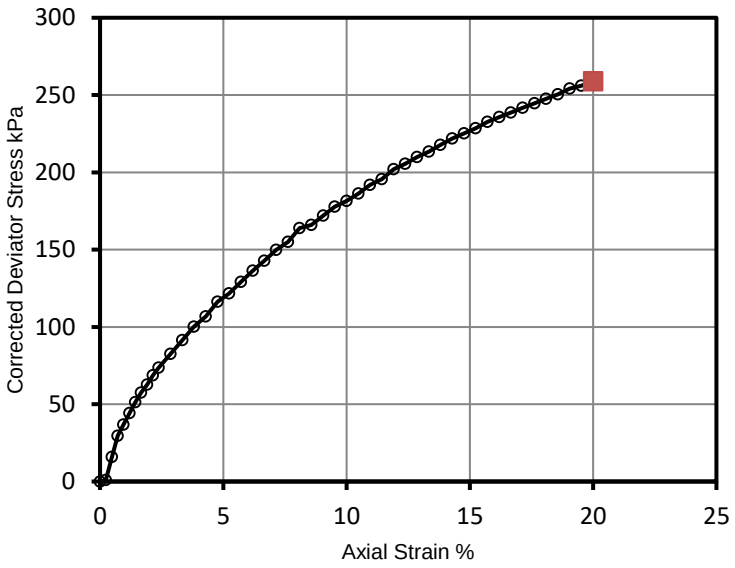
Client: Laing O'Rourke **Page:** 6

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

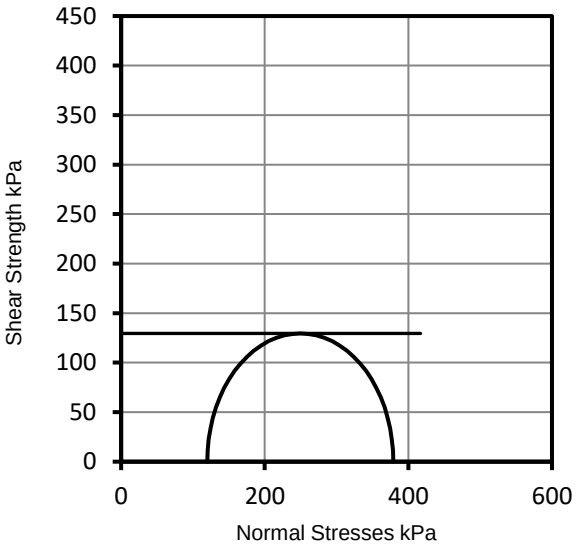
Borehole / Trial Pit	Depth (m)	Sample	Description
BH01	3.00	U8	**Brown slightly gravelly, slightly clayey SILT**

Initial Sample	Test Number	1
	Original Length (mm)	340.00
	Depth from Top (mm)	110.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		210.00
Diameter (mm)		102.85
Moisture Content (%)		12.00
Bulk Density (Mg/m3)		2.18
Dry Density (Mg/m3)		1.94
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	120
	Axial Strain (%)	20
	Membrane Corr. (kPa)	1.27
	Deviator Stress, (σ1 - σ3)f (kPa)	259
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	129
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES

Laboratory Test Report	42187 / 1

Site: Crewe WwTW **Job Number:** 42187

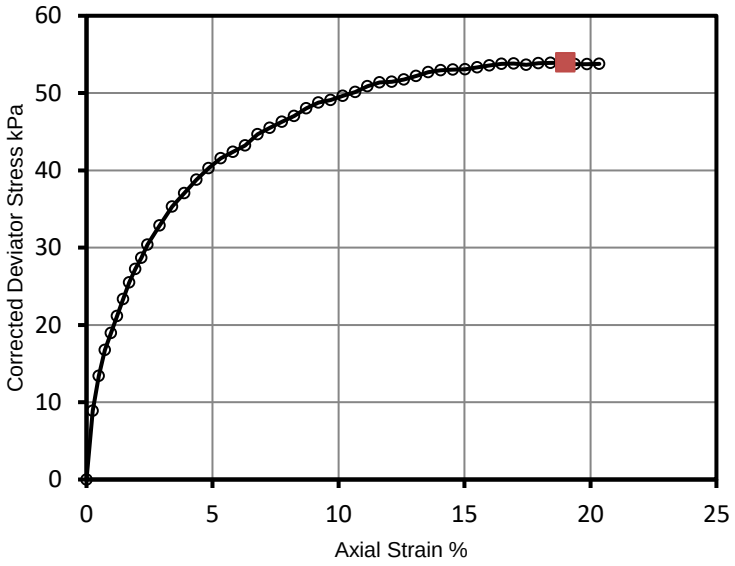
Client: Laing O'Rourke **Page:** 7

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

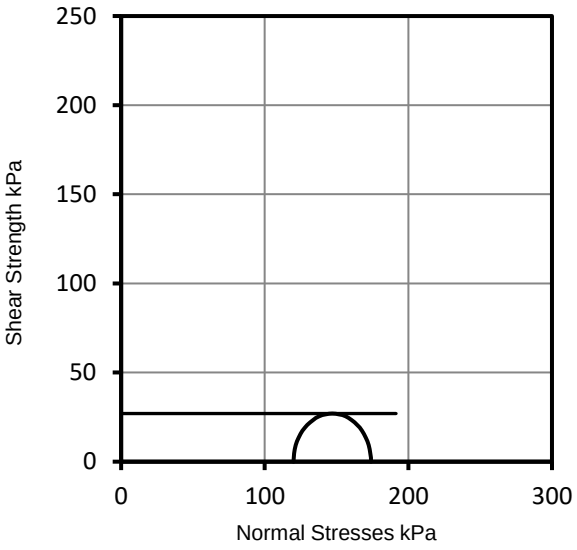
Borehole / Trial Pit	Depth (m)	Sample	Description
BH02	3.00	U5	**Brown / Grey slightly silty, slightly gravelly CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	420.00
	Depth from Top (mm)	190.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		206.36
Diameter (mm)		100.73
Moisture Content (%)		25.40
Bulk Density (Mg/m3)		2.16
Dry Density (Mg/m3)		1.72
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	120
	Axial Strain (%)	19
	Membrane Corr. (kPa)	1.24
	Deviator Stress, (σ1 - σ3)f (kPa)	54
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	27
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

Test Report - 42187 / 1

Site:	Crewe WwTW
Job Number:	42187
Originating Client:	Laing O'Rourke

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

Date: 04/04/2018

IAN FARMER ASSOCIATES

Unit 4, Faraday Close, Pattinson North Industrial Estate, Washington, NE38 8QJ. Tel: 0191 482 8500 Fax: 0191 482 8520
washington@ianfarmer.co.uk www.ianfarmer.co.uk

F.A.O.

Test Report - 42187A / 1

Site:	Crewe WwTW
Job Number:	42187A
Originating Client:	Laing O'Rourke
Originating Reference:	42187
Date Sampled:	05/03/2018
Date Scheduled:	16/03/2018
Date Testing Started:	26/03/2018
Date Testing Finished:	06/04/2018
Remarks:	

Authorised By:

Paul Cathcart
Laboratory Manager

Date: 06/04/2018

IAN FARMER ASSOCIATES

Laboratory Test Report | 42187A / 1

Site: Crewe WwTW **Job Number:** 42187A

Client: Laing O'Rourke **Page:** 2

Determination of Water Content, Liquid Limit and Plastic Limit and Derivation of Plasticity and Liquidity Index

Borehole / Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Water Content %	Sample Passing 425 µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
					Percentage %	Water Content %						
BH03	5.00	D12	Natural	16.9	100	17.0	24	15	9	0.21	CL	Brown slightly sandy, slightly gravelly CLAY
BH03	8.00	D17	Natural	20.8	100	21.0	48	24	24	-0.13	CI	Brown slightly sandy, slightly gravelly CLAY
BH10	3.00	D10	Natural	18	100	18.0	53	19	34	-0.03	CH	Brown CLAY
BH10	6.50	D16	Natural	9.8	100	9.8	29	15	14	-0.37	CL	Brown slightly gravelly CLAY
BH10	11.00	D23	Natural	20.5	55	33.0	41	22	19	0.60	CI	Brown gravelly CLAY

Method of Preparation: BS EN ISO 17892 : Part 1 : 2014 : Clause 5.1 Water content test preparation
BS 1377 : Part 1 : 2016 : Clause 8.4.3 Preparation of samples for plasticity tests
BS 1377 : Part 2 : 1990 : Clause 4.2 Preparation of samples for plastic limit tests

Method of Test: BS EN ISO 17892 : Part 1 : 2014 : Clause 5.2 Water content test execution
BS 1377 : Part 2 : 1990 : Clause 4.3 or 4.4 Determination of the liquid limit
BS 1377 : Part 2 : 1990 : Clause 5.3 Determination of the plastic limit and plasticity index

UKAS TESTING 1464

IAN FARMER ASSOCIATES

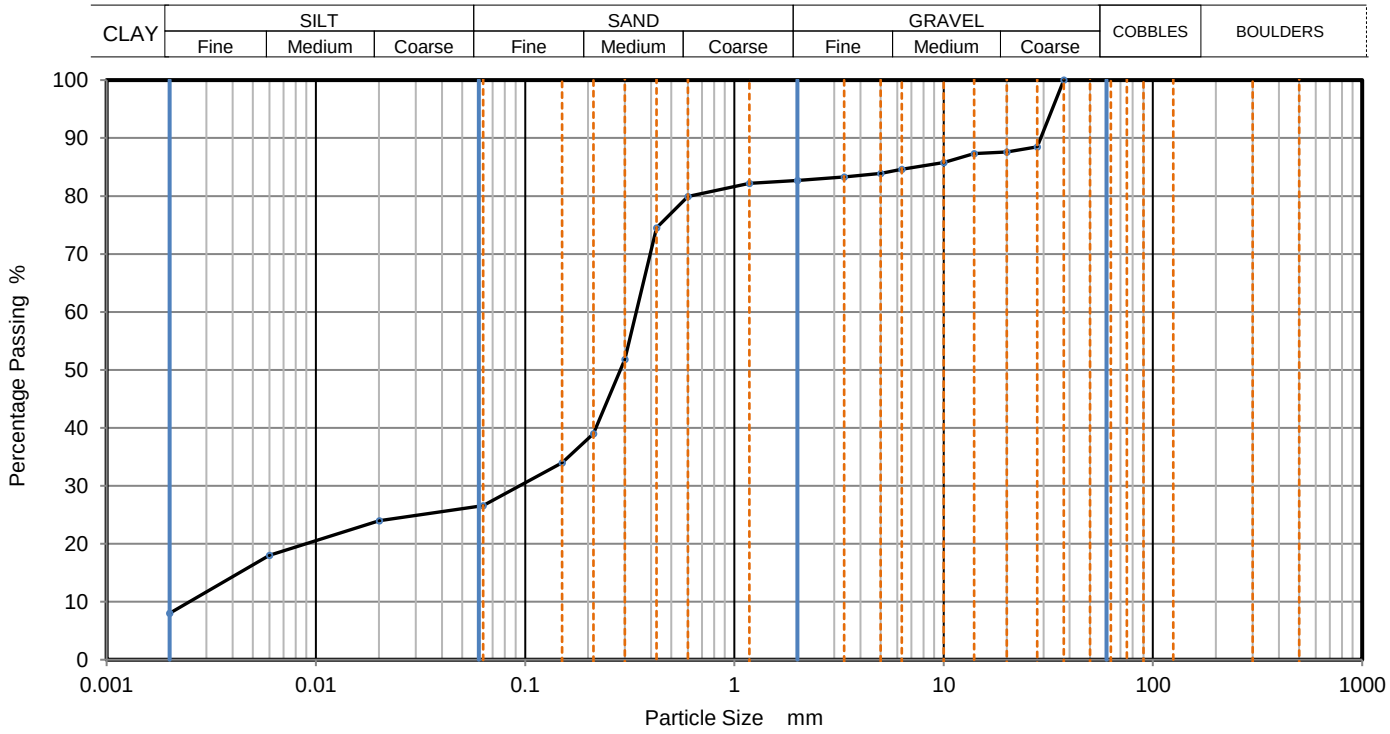
Laboratory Test Report | 42187A / 1

Site: Crewe WwTW | **Job Number:** 42187A

Client: Laing O'Rourke | **Page:** 3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH03	3.00	B7	Wet Sieve + Pipette	Brown slightly clayey, gravelly, silty SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0201	24
		0.0060	18
		0.0020	8
37.5	100		
28	89		
20	88		
14	87		
10	86		
6.3	85		
5	84		
3.35	83		
2	83	Particle density (assumed)	
1.18	82	2.65	Mg/m3
0.6	80		
0.425	75		
0.3	52		
0.212	39		
0.15	34		
0.063	27		

Dry Mass of sample, g: 1203

Sample Proportions	% dry mass
Very coarse	0
Gravel	17
Sand	56
Silt	19
Clay	8

Grading Analysis		
D100	mm	37.5
D60	mm	0.34
D30	mm	0.0943
D10	mm	0.00256
Uniformity Coefficient		130
Curvature Coefficient		10

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method
BS1377:Part 2:1990, clause 9.4 Determination of sedimentation by pipette method

UKAS TESTING 1464

IAN FARMER ASSOCIATES

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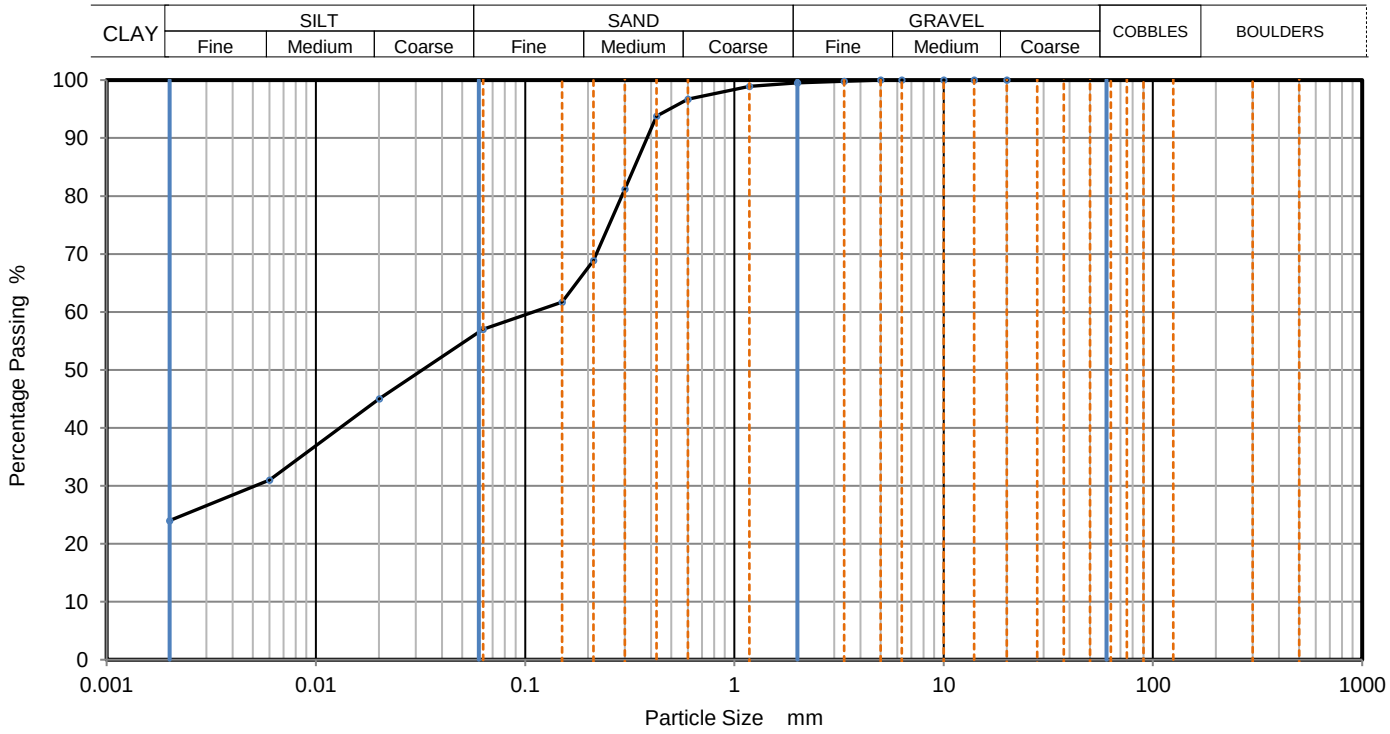
Client: Laing O'Rourke | **Page:** 4

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH03	5.00	B11	Wet Sieve + Pipette	Brown clayey, silty SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0201	45
		0.0060	31
		0.0020	24
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100	Particle density (assumed)	
1.18	99	2.65	Mg/m3
0.6	97		
0.425	94		
0.3	81		
0.212	69		
0.15	62		
0.063	57		

Dry Mass of sample, g: 673

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	42
Silt	33
Clay	24

Grading Analysis		
D100	mm	6.3
D60	mm	0.109
D30	mm	0.00542
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method
BS1377:Part 2:1990, clause 9.4 Determination of sedimentation by pipette method

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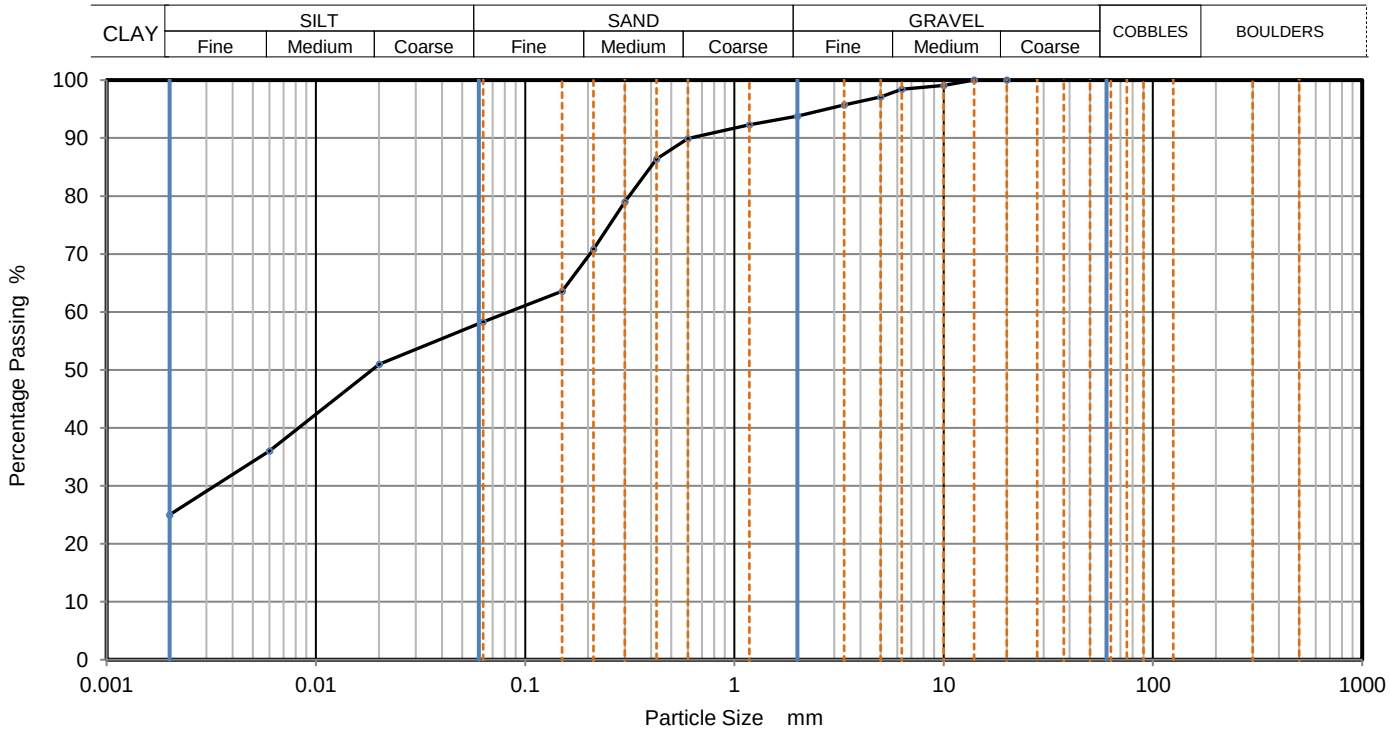
Client: Laing O'Rourke | **Page:** 5

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH10	6.50	B17	Wet Sieve + Pipette	Brown slightly gravelly, clayey, silty SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0201	51
		0.0060	36
		0.0020	25
20	100		
14	100		
10	99		
6.3	98		
5	97		
3.35	96		
2	94	Particle density (assumed)	
1.18	92	2.65	Mg/m3
0.6	90		
0.425	86		
0.3	79		
0.212	71		
0.15	64		
0.063	58		

Dry Mass of sample, g: 771

Sample Proportions	% dry mass
Very coarse	0
Gravel	6
Sand	36
Silt	33
Clay	25

Grading Analysis		
D100	mm	14
D60	mm	0.0835
D30	mm	0.00329
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method
BS1377:Part 2:1990, clause 9.4 Determination of sedimentation by pipette method

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IAN FARMER ASSOCIATES	Laboratory Test Report	42187A / 1

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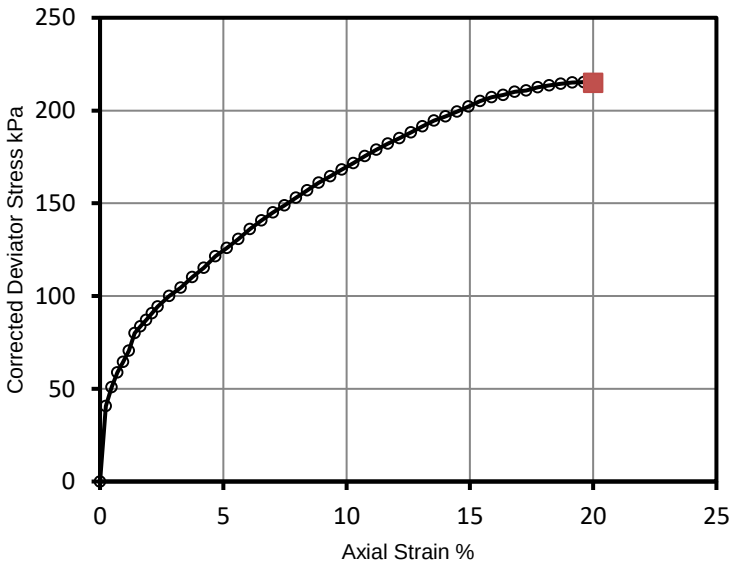
Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

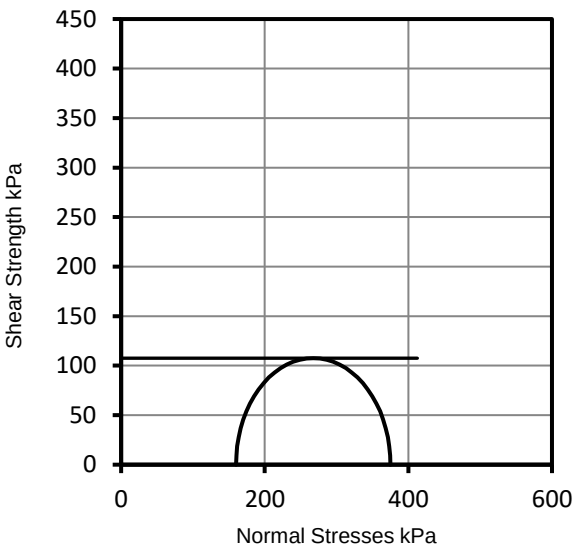
Borehole / Trial Pit	Depth (m)	Sample	Description
BH03	4.00	U9	**Brown silty CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	297.02
	Depth from Top (mm)	40.95
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		214.04
Diameter (mm)		102.36
Moisture Content (%)		15.40
Bulk Density (Mg/m3)		2.16
Dry Density (Mg/m3)		1.87
Membrane Thickness (mm)		0.3
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	160
	Axial Strain (%)	20
	Membrane Corr. (kPa)	1.11
	Deviator Stress, (σ1 - σ3)f (kPa)	215
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	108
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES	Laboratory Test Report	42187A / 1

Site: Crewe WwTW **Job Number:** 42187A

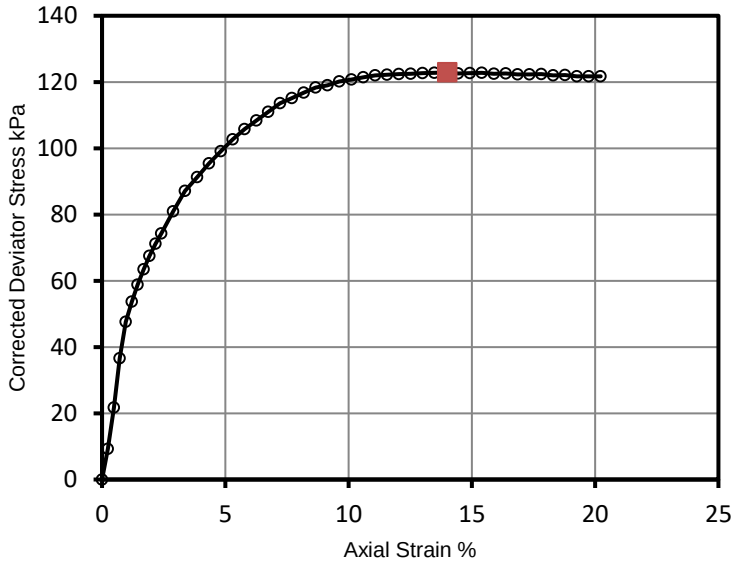
Client: Laing O'Rourke **Page:** 7

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

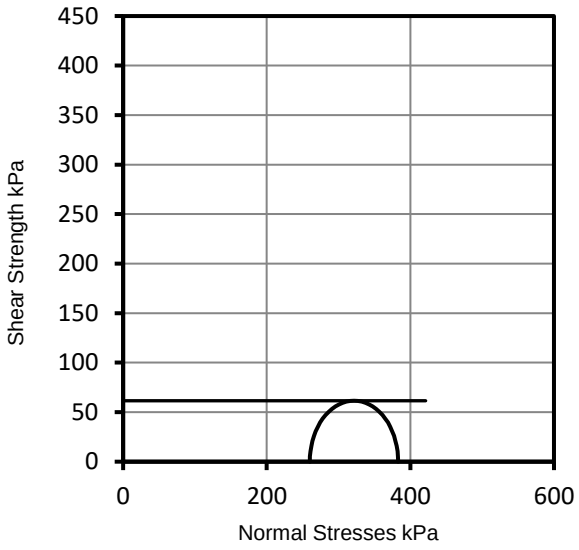
Borehole / Trial Pit	Depth (m)	Sample	Description
BH03	6.50	U14	**Brown silty CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	293.42
	Depth from Top (mm)	46.38
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		207.67
Diameter (mm)		102.34
Moisture Content (%)		28.20
Bulk Density (Mg/m3)		1.85
Dry Density (Mg/m3)		1.44
Membrane Thickness (mm)		0.32
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	260
	Axial Strain (%)	14
	Membrane Corr. (kPa)	0.9
	Deviator Stress, (σ1 - σ3)f (kPa)	123
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	61
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

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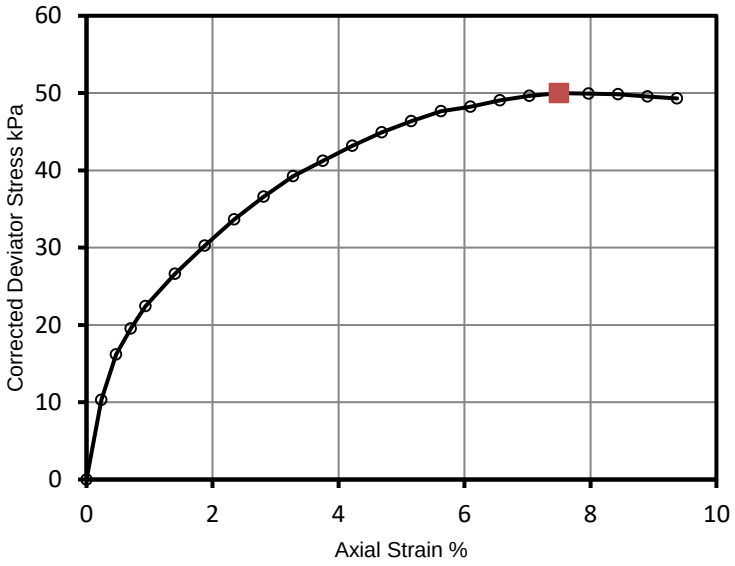
Client: Laing O'Rourke **Page:** 8

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

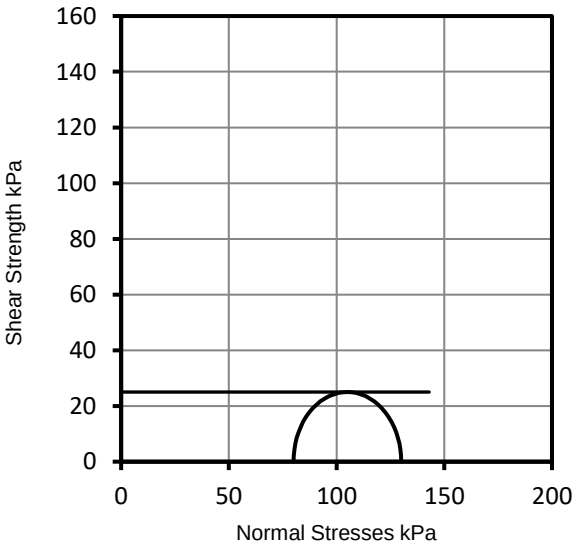
Borehole / Trial Pit	Depth (m)	Sample	Description
BH10	2.00	U5	**Brown CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	384.21
	Depth from Top (mm)	51.11
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		213.30
Diameter (mm)		100.61
Moisture Content (%)		37.50
Bulk Density (Mg/m3)		1.91
Dry Density (Mg/m3)		1.39
Membrane Thickness (mm)		0.3
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	80
	Axial Strain (%)	7.5
	Membrane Corr. (kPa)	0.54
	Deviator Stress, (σ1 - σ3)f (kPa)	50
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	25
	Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES

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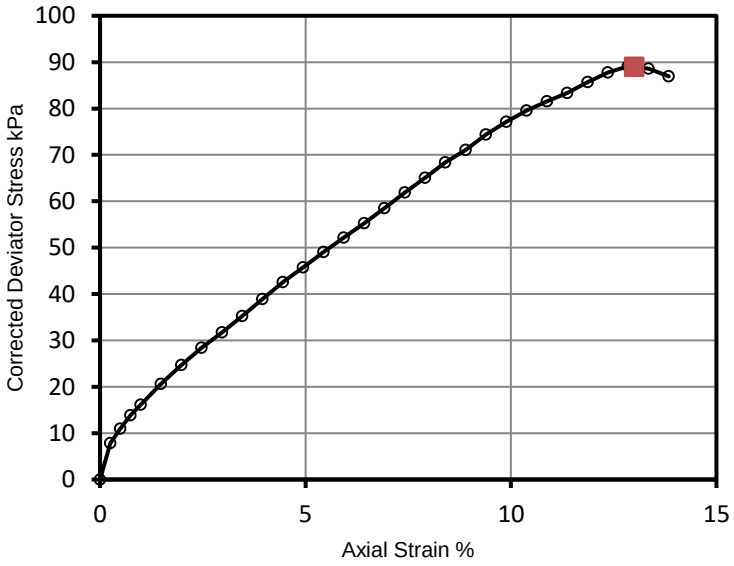
Client: Laing O'Rourke **Page:** 9

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

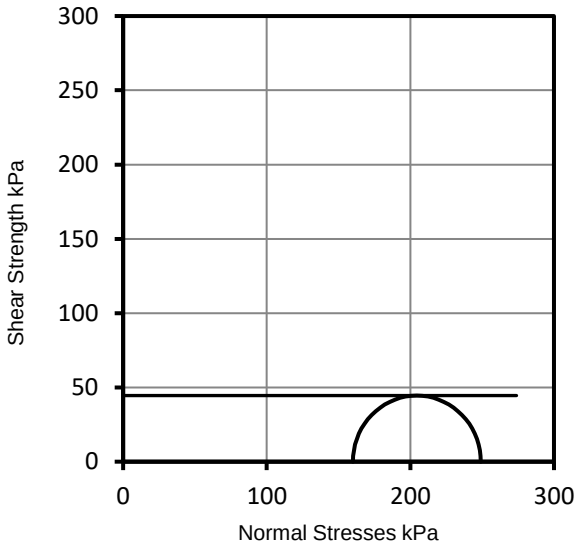
Borehole / Trial Pit	Depth (m)	Sample	Description
BH10	4.00	U12	**Brown silty CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	283.27
	Depth from Top (mm)	32.64
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		202.30
Diameter (mm)		103.13
Moisture Content (%)		14.30
Bulk Density (Mg/m3)		2.17
Dry Density (Mg/m3)		1.89
Membrane Thickness (mm)		0.3
Membrane Type		Latex
Rate of Strain (%/min)		2.0
Test Results	Cell Pressure (kPa)	160
	Axial Strain (%)	13
	Membrane Corr. (kPa)	0.78
	Deviator Stress, (σ1 - σ3)f (kPa)	89
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	45
	Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

Test Report - 42187A / 1

Site:	Crewe WwTW
Job Number:	42187A
Originating Client:	Laing O'Rourke

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

Date: 06/04/2018

IAN FARMER ASSOCIATES

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washington@ianfarmer.co.uk www.ianfarmer.co.uk

F.A.O.

Test Report - 42187B / 1

Site:	Crewe WwTW
Job Number:	42187B
Originating Client:	Laing O'Rourke
Originating Reference:	42187
Date Sampled:	15/03/2018
Date Scheduled:	16/03/2018
Date Testing Started:	26/03/2018
Date Testing Finished:	06/04/2018
Remarks:	

Authorised By:

Paul Cathcart
Laboratory Manager

Date: 06/04/2018

IAN FARMER ASSOCIATES

Laboratory Test Report 42187B / 1

Site: Crewe WwTW **Job Number:** 42187B

Client: Laing O'Rourke **Page:** 2

Determination of Water Content, Liquid Limit and Plastic Limit and Derivation of Plasticity and Liquidity Index

Borehole / Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Water Content %	Sample Passing 425 µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
					Percentage %	Water Content %						
BH05K	4.00	D9	Natural	15.6	100	16.0	27	13	14	0.19	CL	Brown slightly sandy CLAY
BH12	1.20	D2	Natural	34.8	100	35.0	57	22	35	0.37	CH	Brown slightly sandy CLAY
BH13	1.20	B6	Sieved	23.6	63	34.0	54	24	30	0.35	CH	Brown sandy, silty CLAY
BH13	3.00	D8	Natural	16.2	100	16.0	49	22	27	-0.21	CI	Brown slightly gravelly CLAY

Method of Preparation: BS EN ISO 17892 : Part 1 : 2014 : Clause 5.1 Water content test preparation
BS 1377 : Part 1 : 2016 : Clause 8.4.3 Preparation of samples for plasticity tests
BS 1377 : Part 2 : 1990 : Clause 4.2 Preparation of samples for plastic limit tests

Method of Test: BS EN ISO 17892 : Part 1 : 2014 : Clause 5.2 Water content test execution
BS 1377 : Part 2 : 1990 : Clause 4.3 or 4.4 Determination of the liquid limit
BS 1377 : Part 2 : 1990 : Clause 5.3 Determination of the plastic limit and plasticity index

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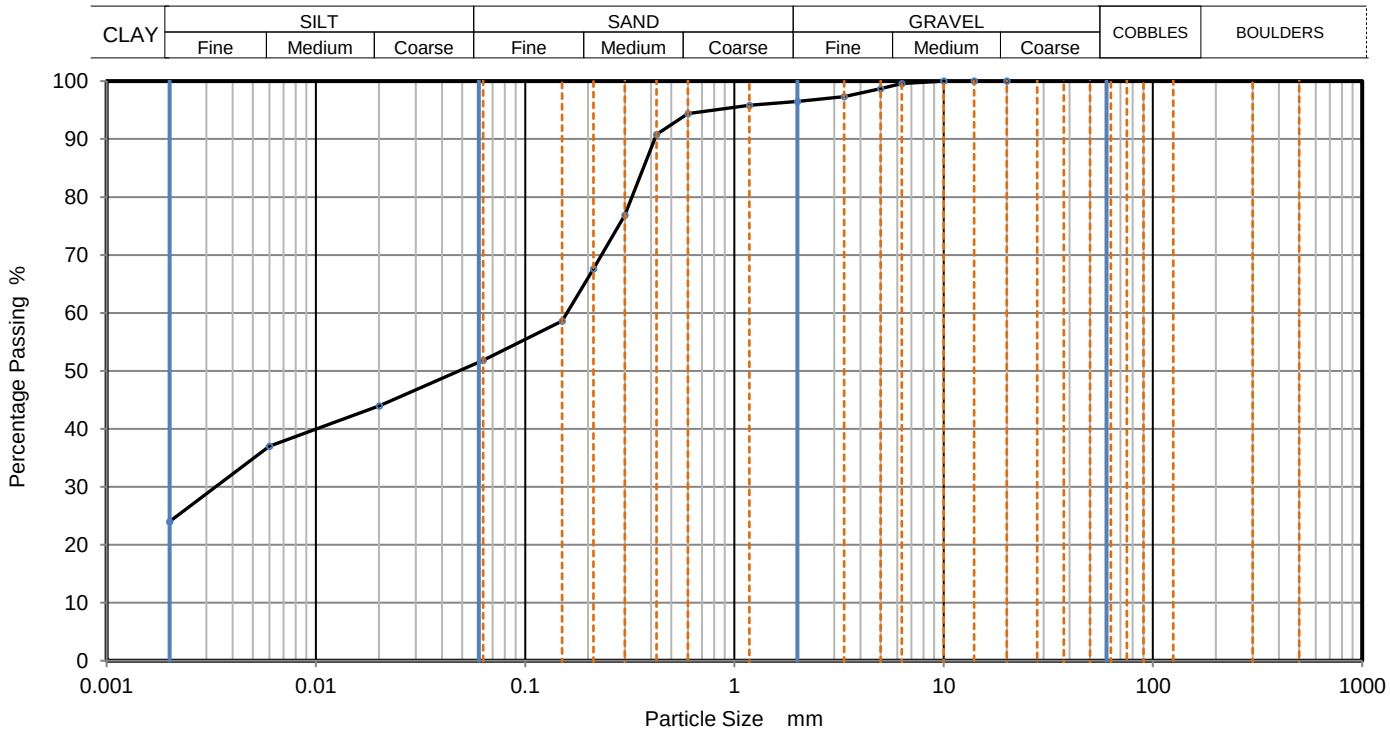
Laboratory Test Report | 42187B / 1

Site: Crewe WwTW | **Job Number:** 42187B

Client: Laing O'Rourke | **Page:** 3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH05K	4.00	B8	Wet Sieve + Pipette	Brown slightly gravelly, clayey, silty SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0201	44
		0.0060	37
		0.0020	24
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	97		
2	97	Particle density (assumed)	
1.18	96	2.65	Mg/m3
0.6	94		
0.425	91		
0.3	77		
0.212	68		
0.15	59		
0.063	52		

Dry Mass of sample, g: 447

Sample Proportions	% dry mass
Very coarse	0
Gravel	4
Sand	45
Silt	27
Clay	24

Grading Analysis		
D100	mm	10
D60	mm	0.158
D30	mm	0.0033
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method
BS1377:Part 2:1990, clause 9.4 Determination of sedimentation by pipette method

UKAS TESTING 1464

IAN FARMER ASSOCIATES

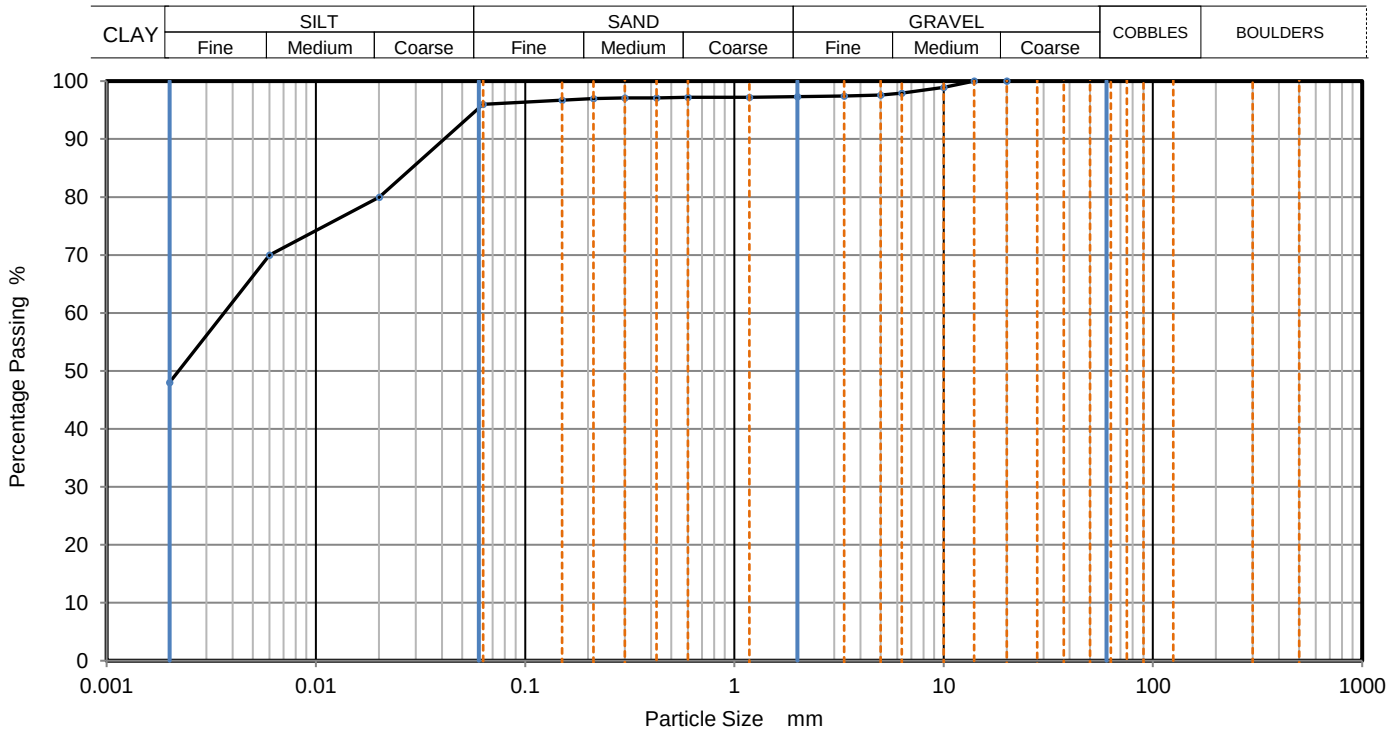
Laboratory Test Report | 42187B / 1

Site: Crewe WwTW | **Job Number:** 42187B

Client: Laing O'Rourke | **Page:** 4

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Testing Type	Description
BH12	1.20	B3	Wet Sieve + Pipette	Brown CLAY / SILT



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0201	80
		0.0060	70
		0.0020	48
20	100		
14	100		
10	99		
6.3	98		
5	98		
3.35	97		
2	97	Particle density (assumed)	
1.18	97	2.65	Mg/m3
0.6	97		
0.425	97		
0.3	97		
0.212	97		
0.15	97		
0.063	96		

Dry Mass of sample, g: 368

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	1
Silt	49
Clay	48

Grading Analysis		
D100	mm	14
D60	mm	0.00368
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Method of Preparation: BS 1377:Part 1:1990, clause 7 3 Initial preparation
BS 1377:Part 1:1990, clause 7.4.5 Preparation of particle size tests

Method of Test: BS1377:Part 2:1990, clause 9.2 Determination of particle size distribution by wet sieving method
BS1377:Part 2:1990, clause 9.4 Determination of sedimentation by pipette method

UKAS TESTING 1464

IAN FARMER ASSOCIATES	Laboratory Test Report	42187B / 1

Site: Crewe WwTW **Job Number:** 42187B

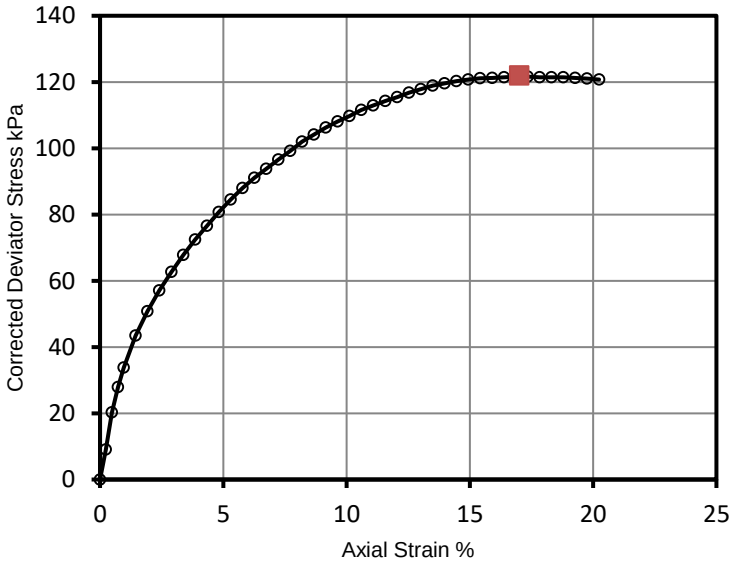
Client: Laing O'Rourke **Page:** 5

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

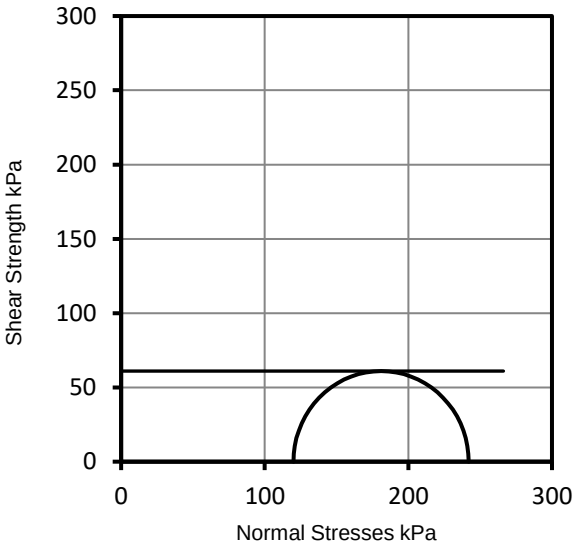
Borehole / Trial Pit	Depth (m)	Sample	Description
BH05K	3.00	U6	**Brown slightly silty, slightly gravelly CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	450.00
	Depth from Top (mm)	220.00
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		207.51
Diameter (mm)		101.22
Moisture Content (%)		16.30
Bulk Density (Mg/m3)		2.22
Dry Density (Mg/m3)		1.91
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	120
	Axial Strain (%)	17
	Membrane Corr. (kPa)	1.15
	Deviator Stress, (σ1 - σ3)f (kPa)	122
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	61
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES

Laboratory Test Report	42187B / 1

Site: Crewe WwTW **Job Number:** 42187B

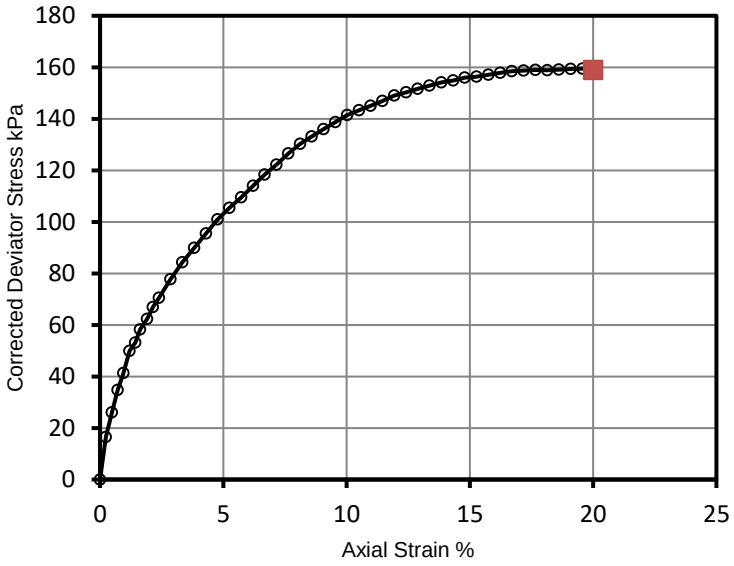
Client: Laing O'Rourke **Page:** 6

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

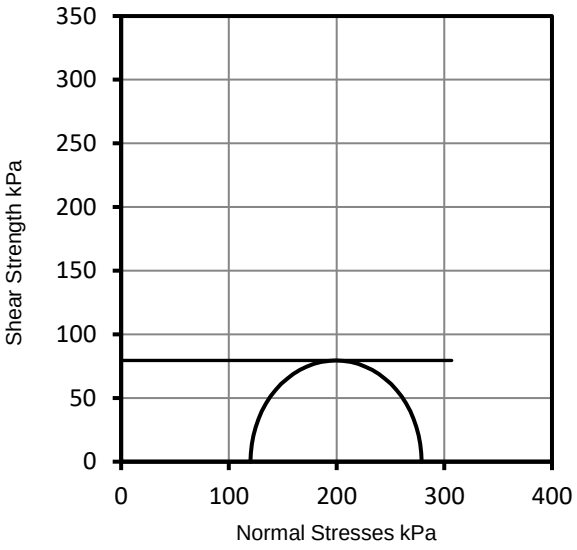
Borehole / Trial Pit	Depth (m)	Sample	Description
BH12	3.00	U6	**Brown slightly gravelly, CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	450.00
	Depth from Top (mm)	210.24
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		209.51
Diameter (mm)		102.33
Moisture Content (%)		17.00
Bulk Density (Mg/m3)		2.24
Dry Density (Mg/m3)		1.91
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	120
	Axial Strain (%)	20
	Membrane Corr. (kPa)	1.25
	Deviator Stress, (σ1 - σ3)f (kPa)	159
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	80
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES	Laboratory Test Report	42187B / 1

Site: Crewe WwTW **Job Number:** 42187B

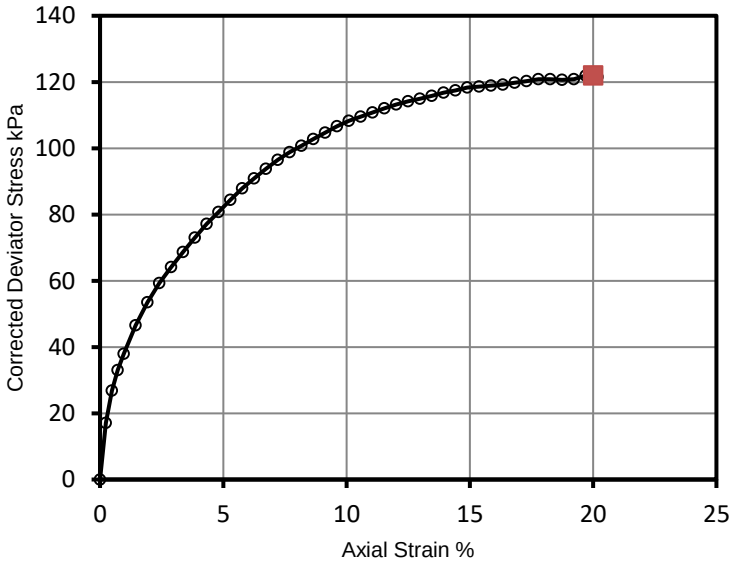
Client: Laing O'Rourke **Page:** 7

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

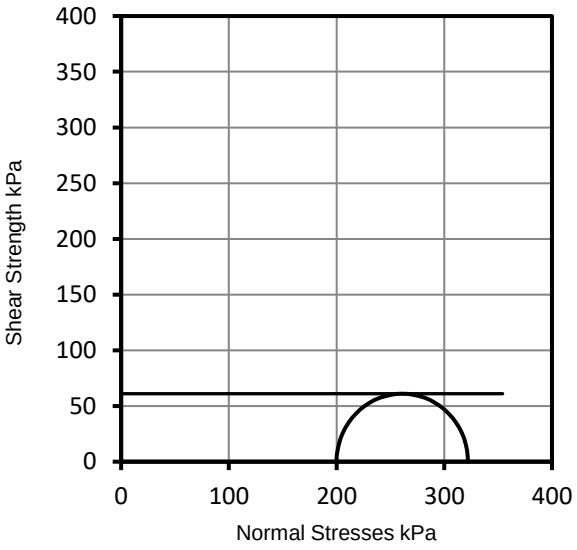
Borehole / Trial Pit	Depth (m)	Sample	Description
BH12	5.00	U10	**Brown slightly silty, slightly gravelly CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	30.00
	Depth from Top (mm)	61.30
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		208.16
Diameter (mm)		100.28
Moisture Content (%)		14.60
Bulk Density (Mg/m3)		2.16
Dry Density (Mg/m3)		1.88
Membrane Thickness (mm)		0.33
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	200
	Axial Strain (%)	20
	Membrane Corr. (kPa)	1.25
	Deviator Stress, (σ1 - σ3)f (kPa)	122
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	61
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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This is provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES	Laboratory Test Report	42187B / 1

Site: Crewe WwTW **Job Number:** 42187B

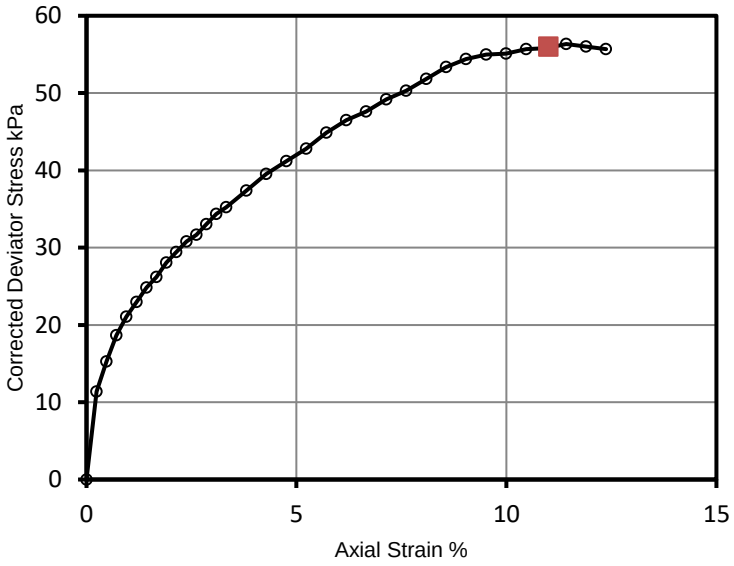
Client: Laing O'Rourke **Page:** 8

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

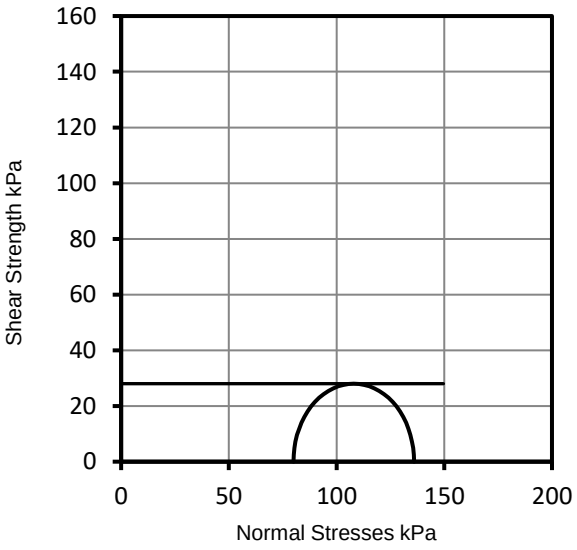
Borehole / Trial Pit	Depth (m)	Sample	Description
BH13	2.00	U7	**Brown slightly silty CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	450.00
	Depth from Top (mm)	118.13
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		210.15
Diameter (mm)		101.28
Moisture Content (%)		32.30
Bulk Density (Mg/m3)		1.95
Dry Density (Mg/m3)		1.47
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	80
	Axial Strain (%)	11
	Membrane Corr. (kPa)	0.82
	Deviator Stress, (σ1 - σ3)f (kPa)	56
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	28
	Mode of Failure	Compound

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

IAN FARMER ASSOCIATES	Laboratory Test Report	42187B / 1

Site: Crewe WwTW **Job Number:** 42187B

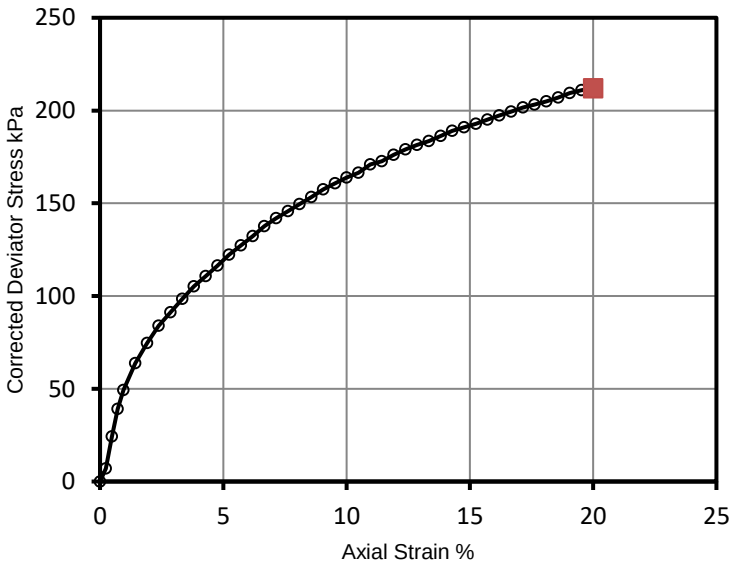
Client: Laing O'Rourke **Page:** 9

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen (Definitive Method)

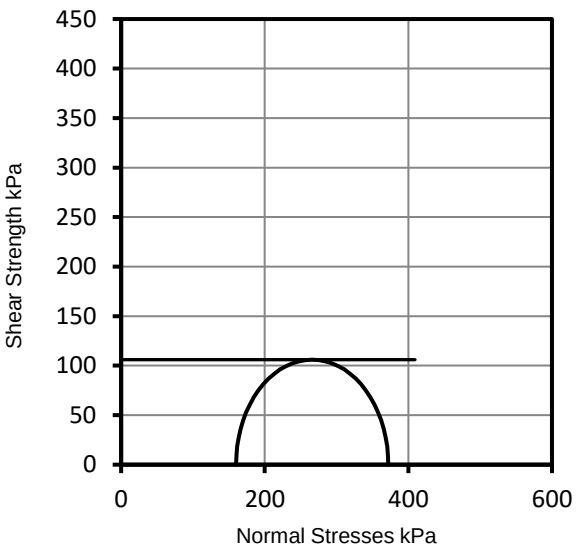
Borehole / Trial Pit	Depth (m)	Sample	Description
BH13	4.00	U10	**Brown slightly silty, slightly gravelly CLAY**

Initial Sample	Test Number	1
	Original Length (mm)	380.00
	Depth from Top (mm)	126.55
	Condition	Undisturbed
	Orientation	Vertical
Length (mm)		209.92
Diameter (mm)		101.08
Moisture Content (%)		12.80
Bulk Density (Mg/m3)		2.30
Dry Density (Mg/m3)		2.04
Membrane Thickness (mm)		0.34
Membrane Type		Latex
Rate of Strain (%/min)		1.9
Test Results	Cell Pressure (kPa)	160
	Axial Strain (%)	20
	Membrane Corr. (kPa)	1.29
	Deviator Stress, (σ1 - σ3)f (kPa)	212
	Undrained Shear Strength, cu = ½(σ1 - σ3)f (kPa)	106
	Mode of Failure	Plastic

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
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Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:8.4 Determination of undrained shear strength in triaxial compression without measurement of pore pressure (Definitive method)

UKAS TESTING 1484

Test Report - 42187B / 1

Site:	Crewe WwTW
Job Number:	42187B
Originating Client:	Laing O'Rourke

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

Date: 06/04/2018

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02249
Issue Number: 1 **Date:** 06 April, 2018

Client:
Ian Farmer Associates (Newcastle)
Unit 4, Faraday Close
Pattinson North Industrial Estate
Washington
Tyne and Wear
NE38 8QJ

Project Manager: Paul Cathcart/Tim Robinson
Project Name: Crewe WwTW
Project Ref: 42187
Order No: 44219
Date Samples Received: 27/03/18
Date Instructions Received: 27/03/18
Date Analysis Completed: 06/04/18

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 18/02249

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02249/1	18/02249/2	18/02249/3	18/02249/4	18/02249/5	18/02249/6	18/02249/7	18/02249/8	Units	Method ref
Client Sample No	1	1	2	2	10	5	3	5		
Client Sample ID	BH01	BH02	BH04	BH06	BH06	TP01	TP02	TP03		
Depth to Top	0.20	0.20	1.20	1.20	5.00	1.00	0.50	0.30		
Depth To Bottom										
Date Sampled	01-Mar-18	28-Feb-18	23-Feb-18	26-Feb-18	26-Feb-18	28-Feb-18	07-Mar-18	06-Mar-18		
Sample Type	Soil - B	Soil - B	Soil - B	Soil - B	Soil - B	Soil - D	Soil - D	Soil - B		
Sample Matrix Code	5	5	6	3A	1	5	6	1A		
% Stones >10mm$_A$	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	11.2	% w/w	A-T-044
pH BRE$_D$	8.26	8.21	7.51	8.20	7.74	8.21	7.89	8.27	pH	A-T-031s
Chloride BRE, SO4 equiv. (water sol 2:1)$_D^{M\#}$	<7	<7	10	<7	<7	<7	<7	<7	mg/l	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1)$_D$	1.9	6.5	4.9	0.9	<0.4	1.1	6.6	0.4	mg/l	A-T-026s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	28	44	31	40	<10	45	54	<10	mg/l	A-T-026s
Magnesium BRE (water sol 2:1)$_D$	19	16	13	18	7	16	21	4	mg/l	A-T-SOLMETS

Envirolab Job Number: 18/02249

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02249/9	18/02249/10	18/02249/11	18/02249/12	18/02249/13	18/02249/14			Units	Method ref
Client Sample No	3	4	4	2	4	4				
Client Sample ID	TP04	TP05	TP06	TP07	TP08	TP09				
Depth to Top	0.50	0.50	0.50	0.50	0.50	0.50				
Depth To Bottom										
Date Sampled	06-Mar-18	28-Feb-18	06-Mar-18	27-Feb-18	23-Feb-18	28-Feb-18				
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D				
Sample Matrix Code	5A	5A	3A	3A	5	6AE				
% Stones >10mm$_A$	4.3	0.8	6.7	<0.1	<0.1	7.6			% w/w	A-T-044
pH BRE$_D$	8.20	8.23	8.38	8.42	8.34	8.33			pH	A-T-031s
Chloride BRE, SO4 equiv. (water sol 2:1)$_D^{M\#}$	<7	<7	<7	<7	<7	<7			mg/l	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1)$_D$	4.3	<0.4	0.7	<0.4	0.7	16.7			mg/l	A-T-026s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	47	37	32	<10	24	54			mg/l	A-T-026s
Magnesium BRE (water sol 2:1)$_D$	17	18	11	12	13	5			mg/l	A-T-SOLMETS

REPORT NOTES

General:
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All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

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Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02254
Issue Number: 1 **Date:** 06 April, 2018

Client:
Ian Farmer Associates (Newcastle)
Unit 4, Faraday Close
Pattinson North Industrial Estate
Washington
Tyne and Wear
NE38 8QJ

Project Manager: Paul Cathcart/Tim Robinson
Project Name: Crewe WwTW
Project Ref: 42187B
Order No: 44221
Date Samples Received: 27/03/18
Date Instructions Received: 27/03/18
Date Analysis Completed: 06/04/18

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 18/02254

Client Project Name: Crewe WwTW

Client Project Ref: 42187B

Lab Sample ID	18/02254/1	18/02254/2	18/02254/3	18/02254/4	18/02254/5				Units	Method ref
Client Sample No	2	8	1	3	6					
Client Sample ID	BH05K	BH05K	BH12	BH12	BH13					
Depth to Top	1.20	4.00	0.30	1.20	1.20					
Depth To Bottom										
Date Sampled	14-Mar-18	15-Mar-18	12-Mar-18	12-Mar-18	09-Mar-18					
Sample Type	Soil - B	Soil - B	Soil - B	Soil - B	Soil - B					
Sample Matrix Code	5	5A	5A	5	3A					
% Stones >10mm$_A$	1.4	2.8	20.8	<0.1	10.9				% w/w	A-T-044
pH BRE$_D$	8.26	8.48	9.52	8.60	8.63				pH	A-T-031s
Chloride BRE, SO4 equiv. (water sol 2:1)$_D^{M\#}$	11	<7	22	38	71				mg/l	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1)$_D$	<0.4	<0.4	1.0	0.5	0.8				mg/l	A-T-026s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	19	<10	82	21	361				mg/l	A-T-026s
Magnesium BRE (water sol 2:1)$_D$	19	2	2	15	35				mg/l	A-T-SOLMETS

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Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
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A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

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Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

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Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02257
Issue Number: 1 **Date:** 06 April, 2018

Client:
Ian Farmer Associates (Newcastle)
Unit 4, Faraday Close
Pattinson North Industrial Estate
Washington
Tyne and Wear
NE38 8QJ

Project Manager: Paul Cathcart/Tim Robinson
Project Name: Crewe WwTW
Project Ref: 42187A
Order No: 44220
Date Samples Received: 27/03/18
Date Instructions Received: 27/03/18
Date Analysis Completed: 06/04/18

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 18/02257

Client Project Name: Crewe WwTW

Client Project Ref: 42187A

Lab Sample ID	18/02257/1	18/02257/2	18/02257/3	18/02257/4	18/02257/5				Units	Method ref
Client Sample No	7	11	16	3	9					
Client Sample ID	BH03	BH03	BH03	BH10	BH10					
Depth to Top	3.00	5.00	8.00	0.70	3.00					
Depth To Bottom										
Date Sampled	02-Mar-18	05-Mar-18	05-Mar-18	07-Mar-18	07-Mar-18					
Sample Type	Soil - B	Soil - B	Soil - B	Soil - B	Soil - B					
Sample Matrix Code	5A	5	5A	3A	3					
% Stones >10mm$_A$	<0.1	<0.1	<0.1	<0.1	<0.1				% w/w	A-T-044
pH BRE$_D$	8.31	7.79	8.07	8.93	8.53				pH	A-T-031s
Chloride BRE, SO4 equiv. (water sol 2:1)$_D^{M\#}$	10	<7	<7	19	54				mg/l	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1)$_D$	<0.4	<0.4	<0.4	2.4	<0.4				mg/l	A-T-026s
Sulphate BRE (water sol 2:1)$_D^{M\#}$	21	16	13	50	15				mg/l	A-T-026s
Magnesium BRE (water sol 2:1)$_D$	15	20	20	7	17				mg/l	A-T-SOLMETS

REPORT NOTES

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Soil chemical analysis:
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For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Results of Geotechnical Tests

Rock

IAN FARMER ASSOCIATES

Unit 4, Faraday Close, Pattinson North Industrial Estate, Washington, NE38 8QJ. Tel: 0191 482 8500 Fax: 0191 482 8520
washington@ianfarmer.co.uk www.ianfarmer.co.uk

F.A.O.

Test Report - 42187R / 1

Site:	Crewe WwTW
Job Number:	42187R
Originating Client:	Laing O'Rourke
Originating Reference:	42187
Date Sampled:	19/03/2018
Date Scheduled:	20/03/2018
Date Testing Started:	28/03/2018
Date Testing Finished:	03/04/2018

Remarks:

Authorised By:

Tim Robinson
Quality Technician

Date: 03/04/2018

IAN FARMER ASSOCIATES

Laboratory Test Report 42187R / 1

Site: Crewe WwTW **Job Number:** 42187R

Client: Laing O'Rourke **Page:** 2

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Hole No.	Depth m	Sample	Rock Type	Specimen Dimensions2			Bulk Density2	Water Content 1	Uniaxial Compression3				Remarks
				Dia. mm	Length mm	H/D	Mg/m3	%	Condition	Stress Rate MPa/s	Mode of failure	UCS MPa	
BH03	13.61	C23	Red / Brown MUDSTONE	87.3	125.6	*1.4	2.33	14.5	as received	0.4511	AC	3.2	
BH03	15.23	C25	Red / Brown MUDSTONE	88.6	137.9	*1.6	2.24	17.8	as received	0.4377	AC	1.4	
BH06	11.72	C17	Red / Brown MUDSTONE	85.6	135.6	*1.6	2.31	17.2	as received	0.4691	AC	1.6	

Notes
1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS
2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density
3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials
above notes apply unless annotated otherwise in the remarks

*Denotes length diameter ratio outside ISRM specification

Mode of failure :
S - Single shear MS - multiple shear
AC - Axial cleavage F - Fragmented

Method of Preparation: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Method of Test: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

IAN FARMER ASSOCIATES

Laboratory Test Report	42187R / 1

Site: Crewe WwTW **Job Number:** 42187R

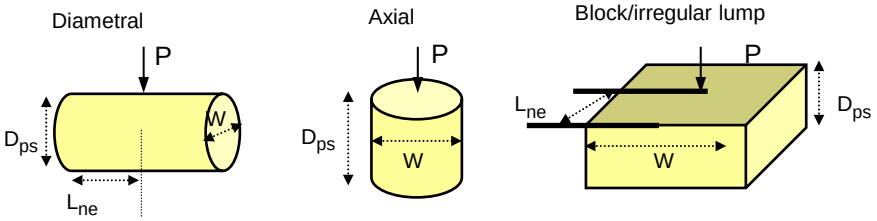
Client: Laing O'Rourke **Page:** 3

Point Load Strength Index Tests
Summary of Results

Borehole No.	Depth m	Sample	Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
				Type (D, A, I, B)	Direction (PL, PD or U)		Lne mm	W mm	Dps mm	Dps' mm	kN	mm	Is . MPa	Is (50) MPa	
BH03	8.11	C19	Red / Grey MUDSTONE As received	A	PD	YES		87.8	56.6	51.6	0.1	79.5	0.02	0.02	
BH03	9.08	C20	Red / Brown SANDSTONE As received	A	PD	YES		88.7	56.1	27.1	0.3	79.6	0.05	0.06	
BH03	10.54	C21	Red / Brown SANDSTONE As received	A	PD	YES		87.1	78.3	63.3	0.1	93.2	0.01	0.02	
BH03	11.78	C22	Red / Brown SANDSTONE As received	A	PD	YES		87.5	42.5	35.5	0.1	68.8	0.02	0.02	
BH03	12.59	C24	Grey / Red MUDSTONE As received	A	PD	YES		87.3	97.3	47.3	0.8	104.0	0.07	0.10	
BH03	16.02	C26	Red / Brown SANDSTONE As received	A	PD	YES		87.5	101.5	48.5	0.9	106.3	0.08	0.11	
BH03	18.32	C27	Red / Brown MUDSTONE As received	A	PD	YES		87.3	28.0	19.0	0.1	55.8	0.02	0.02	
BH03	19.3	C28	Red / Brown MUDSTONE As received	A	PD	YES		88.2	124.3	101.3	1.3	118.1	0.09	0.13	
BH03	21.78	C29	Red / Brown MUDSTONE As received	A	PD	YES		87.4	45.4	24.4	0.5	71.1	0.09	0.11	
BH06	8.3	C15	Grey MUDSTONE As received	A	PD	YES		85.8	102.3	69.3	0.1	105.7	0.01	0.01	
BH06	11.2	C16	Red / Brown MUDSTONE As received	A	PD	YES		87.4	10.1	7.1	0.1	33.5	0.06	0.05	
BH06	13.15	C18	Red / Brown MUDSTONE As received	A	PD	YES		88.3	113.3	92.3	0.5	112.8	0.04	0.06	
BH06	14.58	C19	Red / Brown MUDSTONE As received	A	PD	YES		88.4	111.4	105.4	0.3	111.9	0.02	0.03	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
PL - Parallel to planes of weakness
PD - Perpendicular to planes of weakness
U - Unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P
Size factor, F = (De/50)0.45 for all tests.

Detailed legend for test and dimensions, based on ISRM



Method of Preparation: ISRM 2007 Suggested method for point load strength index (pages 125 - 132)

Method of Test: ISRM 2007 Suggested method for point load strength index (pages 125 - 132)

Test Report - 42187R / 1

Site:	Crewe WwTW
Job Number:	42187R
Originating Client:	Laing O'Rourke

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

Date: 03/04/2018

APPENDIX 4

CHEMICAL TESTING

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/01785
Issue Number: 1 **Date:** 21 March, 2018

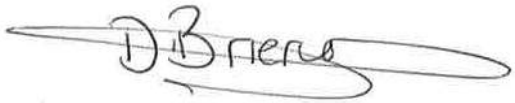
Client:
Ian Farmer Associates (Warrington)
14/15 Rufford Court
Hardwick Grange
Warrington
WA1 4RF

Project Manager: Hannah Hadwin
Project Name: Crewe WwTW
Project Ref: 42187
Order No: 44191
Date Samples Received: 26/02/18
Date Instructions Received: 12/03/18
Date Analysis Completed: 21/03/18

Prepared by:

Holly Neary-King
Administrative Assistant

Approved by:



Danielle Brierley
Client Manager

Envirolab Job Number: 18/01785

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/1	18/01785/3	18/01785/4	18/01785/5	18/01785/7	18/01785/11	18/01785/12	18/01785/15	Units	Method ref
Client Sample No	1	3	1	3	2		3	1		
Client Sample ID	TP01	TP01	TP02	TP02	TP03	TP04	TP04	TP05		
Depth to Top	0.25	1.00	0.25	1.00	0.50	0.50	1.00	0.25		
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	06-Mar-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	5A	6AE	3	1A	5A	6	5A		
% Moisture at <40C$_A$	19.8	15.0	22.5	18.6	10.9	13.4	22.2	15.7	% w/w	A-T-044
% Stones >10mm$_A$	1.6	<0.1	2.0	<0.1	17.0	<0.1	<0.1	<0.1	% w/w	A-T-044
pH$_D$	7.69	8.25	7.92	8.15	8.08	8.24	7.96	8.21	pH	A-T-031s
Total Organic Carbon$_D^{M\#}$	1.21	-	0.97	-	-	-	-	0.18	% w/w	A-T-032s
Arsenic$_D^{M\#}$	3	2	<1	2	<1	2	5	2	mg/kg	A-T-024s
Barium$_D$	93	103	129	171	52	125	176	160	mg/kg	A-T-024s
Beryllium$_D^{\#}$	0.9	0.8	0.9	1.1	<0.5	0.7	0.7	0.8	mg/kg	A-T-024s
Boron (water soluble)$_D^{M\#}$	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	mg/kg	A-T-027s
Cadmium$_D^{M\#}$	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	mg/kg	A-T-024s
Copper$_D^{M\#}$	22	12	20	18	3	22	136	14	mg/kg	A-T-024s
Chromium$_D^{M\#}$	21	19	24	27	9	20	41	26	mg/kg	A-T-024s
Lead$_D^{M\#}$	22	13	21	17	2	26	205	8	mg/kg	A-T-024s
Mercury$_D$	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	0.20	<0.17	mg/kg	A-T-024s
Nickel$_D^{M\#}$	17	19	19	28	7	20	23	25	mg/kg	A-T-024s
Selenium$_D^{M\#}$	2	2	2	2	<1	2	<1	2	mg/kg	A-T-024s
Vanadium$_D^{M\#}$	28	23	28	32	11	24	27	30	mg/kg	A-T-024s
Zinc$_D^{M\#}$	50	54	51	48	12	42	134	39	mg/kg	A-T-024s
Leachate Prep BS EN 12457-1 (2:1) (1 no)$_A$	*	-	*	-	*	-	-	*		A-T-001
pH (leachable)$_A^{\#}$	7.97	-	8.23	-	7.42	-	-	8.02	pH	A-T-031w
Ammoniacal nitrogen (leachable)$_A$	0.08	-	<0.02	-	<0.02	-	-	<0.02	mg/l	A-T-033w
Cyanide (free) (leachable)$_A$	<0.005	-	<0.005	-	<0.005	-	-	<0.005	mg/l	A-T-042wFCN
Cyanide (total) (leachable)$_A$	<0.005	-	<0.005	-	<0.005	-	-	<0.005	mg/l	A-T-042wTCN
Aluminium (leachable)$_A$	6060	-	691	-	21700	-	-	519	µg/l	A-T-049w
Arsenic (leachable)$_A^{\#}$	4	-	2	-	1	-	-	<1	µg/l	A-T-025w
Boron (leachable)$_A^{\#}$	19	-	18	-	<10	-	-	21	µg/l	A-T-025w
Cadmium (leachable 0.05ug/l)$_A$	0.07	-	<0.05	-	<0.05	-	-	<0.05	µg/l	A-T-025w
Copper (leachable)$_A^{\#}$	14	-	8	-	5	-	-	2	µg/l	A-T-025w
Chromium (leachable)$_A^{\#}$	<1	-	<1	-	<1	-	-	<1	µg/l	A-T-025w
Iron (leachable)$_A^{\#}$	153	-	36	-	200	-	-	<10	µg/l	A-T-025w
Lead (leachable)$_A^{\#}$	5	-	2	-	3	-	-	<1	µg/l	A-T-025w
Manganese (leachable)$_A^{\#}$	6	-	2	-	6	-	-	12	µg/l	A-T-025w
Mercury (leachable)$_A^{\#}$	<0.1	-	<0.1	-	<0.1	-	-	<0.1	µg/l	A-T-025w
Nickel (leachable)$_A^{\#}$	2	-	1	-	<1	-	-	<1	µg/l	A-T-025w

Envirolab Job Number: 18/01785

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/1	18/01785/3	18/01785/4	18/01785/5	18/01785/7	18/01785/11	18/01785/12	18/01785/15	Units	Method ref
Client Sample No	1	3	1	3	2		3	1		
Client Sample ID	TP01	TP01	TP02	TP02	TP03	TP04	TP04	TP05		
Depth to Top	0.25	1.00	0.25	1.00	0.50	0.50	1.00	0.25		
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	06-Mar-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	5A	6AE	3	1A	5A	6	5A		
Selenium (leachable)$_A^{\#}$	<1	-	<1	-	<1	-	-	<1	µg/l	A-T-025w
Zinc (leachable)$_A^{\#}$	44	-	21	-	12	-	-	67	µg/l	A-T-025w

Envirolab Job Number: 18/01785

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/1	18/01785/3	18/01785/4	18/01785/5	18/01785/7	18/01785/11	18/01785/12	18/01785/15	Units	Method ref
Client Sample No	1	3	1	3	2		3	1		
Client Sample ID	TP01	TP01	TP02	TP02	TP03	TP04	TP04	TP05		
Depth to Top	0.25	1.00	0.25	1.00	0.50	0.50	1.00	0.25		
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	06-Mar-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	5A	6AE	3	1A	5A	6	5A		
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_A$ #	NAD	NAD	NAD	-	NAD	NAD	NAD	NAD		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	-	N/A	N/A	N/A	N/A		

Envirolab Job Number: 18/01785

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/1	18/01785/3	18/01785/4	18/01785/5	18/01785/7	18/01785/11	18/01785/12	18/01785/15	Units	Method ref
Client Sample No	1	3	1	3	2		3	1		
Client Sample ID	TP01	TP01	TP02	TP02	TP03	TP04	TP04	TP05		
Depth to Top	0.25	1.00	0.25	1.00	0.50	0.50	1.00	0.25		
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	06-Mar-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	5A	6AE	3	1A	5A	6	5A		
PAH-16MS										
Acenaphthene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.28	<0.01	mg/kg	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.49	<0.02	mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	1.32	<0.04	mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	1.36	<0.04	mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.30	<0.05	mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.62	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	0.55	<0.07	mg/kg	A-T-019s
Chrysene$_A^{M\#}$	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	1.56	<0.06	mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.17	<0.04	mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	4.07	<0.08	mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.28	<0.01	mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.95	<0.03	mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	2.62	<0.03	mg/kg	A-T-019s
Pyrene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	3.24	<0.07	mg/kg	A-T-019s
PAH (total 16)$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	18.8	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 18/01785

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/1	18/01785/3	18/01785/4	18/01785/5	18/01785/7	18/01785/11	18/01785/12	18/01785/15	Units	Method ref
Client Sample No	1	3	1	3	2		3	1		
Client Sample ID	TP01	TP01	TP02	TP02	TP03	TP04	TP04	TP05		
Depth to Top	0.25	1.00	0.25	1.00	0.50	0.50	1.00	0.25		
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	06-Mar-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	5A	6AE	3	1A	5A	6	5A		
Topsoil quality BS3882:2015 (without classification)										
% Clay$_A$	22.6	-	14.3	-	-	-	-	40.9	% w/w	Subcon Yara
% Silt$_A$	46.1	-	50.8	-	-	-	-	37.8	% w/w	Subcon Yara
% Sand$_A$	31.2	-	34.9	-	-	-	-	21.3	% w/w	Subcon Yara
Textural class	Clay Loam	-	Sandy Silt Loam	-	-	-	-	Clay		Calc
% Coarse Fragment Content >2mm$_A$	7.0	-	17.7	-	-	-	-	8.6	% w/w	A-T-044
% Coarse Fragment Content >20mm$_A$	<0.1	-	<0.1	-	-	-	-	<0.1	% w/w	A-T-044
% Coarse Fragment Content >50mm$_A$	<0.1	-	<0.1	-	-	-	-	<0.1	% w/w	A-T-044
Carbonate as CaCO3$_D$	<0.8	-	<0.8	-	-	-	-	<0.8	% w/w	CO3s
pH$_D$	7.02	-	7.47	-	-	-	-	7.86	pH	A-T-031s
Electrical conductivity$_D$	1770	-	1810	-	-	-	-	1780	µs/cm	A-T-037s
Nitrogen, Total %$_A$	0.147	-	0.189	-	-	-	-	0.070	%	Subcon Yara
Loss on ignition (440°C)$_D$	2.6	-	3.4	-	-	-	-	1.2	% w/w	A-T-030s
Extractable phosphate$_D$	17.7	-	42.7	-	-	-	-	<15.3	mg/l	A-T-EXTMETS
Extractable potassium$_D$	151	-	112	-	-	-	-	148	mg/l	A-T-EXTMETS
Extractable magnesium$_D$	229	-	230	-	-	-	-	529	mg/l	A-T-EXTMETS
Carbon:Nitrogen Ratio	10.4	-	10.9	-	-	-	-	10.1	:1	Calc-no stones
Zinc (HNO3 extractable)$_D$	56	-	55	-	-	-	-	40	mg/kg	A-T-024s
Copper (HNO3 extractable)$_D$	23	-	23	-	-	-	-	13	mg/kg	A-T-024s
Nickel (HNO3 extractable)$_D$	25	-	21	-	-	-	-	25	mg/kg	A-T-024s
% Visible Contaminants >2mm$_A$	<0.1	-	<0.1	-	-	-	-	<0.1	% w/w	A-T-044
% Visible Contaminants Plastics$_A$	<0.1	-	<0.1	-	-	-	-	<0.1	% w/w	A-T-044
Sharps, number (in 1kg of sample)$_A$	0	-	0	-	-	-	-	0	N/A	A-T-044
Acceptable textural classification?	Yes	-	Yes	-	-	-	-	No		Calc

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Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/1	18/01785/3	18/01785/4	18/01785/5	18/01785/7	18/01785/11	18/01785/12	18/01785/15	Units	Method ref
Client Sample No	1	3	1	3	2		3	1		
Client Sample ID	TP01	TP01	TP02	TP02	TP03	TP04	TP04	TP05		
Depth to Top	0.25	1.00	0.25	1.00	0.50	0.50	1.00	0.25		
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	06-Mar-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	5A	6AE	3	1A	5A	6	5A		
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C8-C10$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Ali >C10-C12$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C12-C16$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Ali >C16-C21$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	11.6	<0.1	mg/kg	A-T-023s
Ali >C21-C35$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	67.4	7.1	mg/kg	A-T-023s
Total Aliphatics$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	78.9	7.1	mg/kg	A-T-023s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C8-C9$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C9-C10$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
Aro >C10-C12$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	A-T-023s
Aro >C12-C16$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.2	<0.1	mg/kg	A-T-023s
Aro >C16-C21$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	6.6	<0.1	mg/kg	A-T-023s
Aro >C21-C35$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	23.4	<0.1	mg/kg	A-T-023s
Total Aromatics$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	31.1	<0.1	mg/kg	A-T-023s
TPH (Ali & Aro)$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	110	7.1	mg/kg	A-T-023s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-022s

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Client Project Name: Crewe WwTW

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Lab Sample ID	18/01785/17	18/01785/19	18/01785/22	18/01785/23	18/01785/24	18/01785/26	18/01785/30		Units	Method ref
Client Sample No	3	2	1	2	3	1	1			
Client Sample ID	TP05	TP06	TP07	TP07	TP07	TP08	TP09			
Depth to Top	1.00	0.50	0.30	0.60	1.20	0.25	0.25			
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	23-Mar-18	27-Feb-18			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	5A	6E	5AE	3A	6AE	5A			
% Moisture at <40C$_A$	17.4	12.4	24.8	11.5	20.1	16.9	13.6		% w/w	A-T-044
% Stones >10mm$_A$	<0.1	3.1	<0.1	<0.1	<0.1	3.8	<0.1		% w/w	A-T-044
pH$_D$	7.62	7.94	7.27	8.20	7.99	7.74	8.10		pH	A-T-031s
Total Organic Carbon$_D^{M\#}$	-	-	1.97	-	-	1.50	0.28		% w/w	A-T-032s
Arsenic$_D^{M\#}$	2	<1	2	1	6	2	2		mg/kg	A-T-024s
Barium$_D$	174	143	114	155	195	110	130		mg/kg	A-T-024s
Beryllium$_D^{\#}$	0.9	<0.5	<0.5	<0.5	0.9	<0.5	0.7		mg/kg	A-T-024s
Boron (water soluble)$_D^{M\#}$	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		mg/kg	A-T-027s
Cadmium$_D^{M\#}$	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5		mg/kg	A-T-024s
Copper$_D^{M\#}$	20	23	22	17	16	18	12		mg/kg	A-T-024s
Chromium$_D^{M\#}$	29	19	26	18	28	17	23		mg/kg	A-T-024s
Lead$_D^{M\#}$	11	8	31	7	10	23	13		mg/kg	A-T-024s
Mercury$_D$	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17		mg/kg	A-T-024s
Nickel$_D^{M\#}$	28	18	17	17	29	15	22		mg/kg	A-T-024s
Selenium$_D^{M\#}$	2	<1	<1	1	<1	2	1		mg/kg	A-T-024s
Vanadium$_D^{M\#}$	32	21	22	19	32	19	26		mg/kg	A-T-024s
Zinc$_D^{M\#}$	45	34	57	32	47	38	39		mg/kg	A-T-024s
Leachate Prep BS EN 12457-1 (2:1) (1 no)$_A$	-	-	-	*	-	-	-			A-T-001
pH (leachable)$_A^{\#}$	-	-	-	7.76	-	-	-		pH	A-T-031w
Ammoniacal nitrogen (leachable)$_A$	-	-	-	<0.02	-	-	-		mg/l	A-T-033w
Cyanide (free) (leachable)$_A$	-	-	-	<0.005	-	-	-		mg/l	A-T-042wFCN
Cyanide (total) (leachable)$_A$	-	-	-	<0.005	-	-	-		mg/l	A-T-042wTCN
Aluminium (leachable)$_A$	-	-	-	6010	-	-	-		µg/l	A-T-049w
Arsenic (leachable)$_A^{\#}$	-	-	-	2	-	-	-		µg/l	A-T-025w
Boron (leachable)$_A^{\#}$	-	-	-	35	-	-	-		µg/l	A-T-025w
Cadmium (leachable 0.05ug/l)$_A$	-	-	-	0.11	-	-	-		µg/l	A-T-025w
Copper (leachable)$_A^{\#}$	-	-	-	7	-	-	-		µg/l	A-T-025w
Chromium (leachable)$_A^{\#}$	-	-	-	<1	-	-	-		µg/l	A-T-025w
Iron (leachable)$_A^{\#}$	-	-	-	104	-	-	-		µg/l	A-T-025w
Lead (leachable)$_A^{\#}$	-	-	-	2	-	-	-		µg/l	A-T-025w
Manganese (leachable)$_A^{\#}$	-	-	-	4	-	-	-		µg/l	A-T-025w
Mercury (leachable)$_A^{\#}$	-	-	-	<0.1	-	-	-		µg/l	A-T-025w
Nickel (leachable)$_A^{\#}$	-	-	-	1	-	-	-		µg/l	A-T-025w

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Lab Sample ID	18/01785/17	18/01785/19	18/01785/22	18/01785/23	18/01785/24	18/01785/26	18/01785/30		Units	Method ref
Client Sample No	3	2	1	2	3	1	1			
Client Sample ID	TP05	TP06	TP07	TP07	TP07	TP08	TP09			
Depth to Top	1.00	0.50	0.30	0.60	1.20	0.25	0.25			
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	23-Mar-18	27-Feb-18			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	5A	6E	5AE	3A	6AE	5A			
Selenium (leachable)$_A^{\#}$	-	-	-	<1	-	-	-		µg/l	A-T-025w
Zinc (leachable)$_A^{\#}$	-	-	-	53	-	-	-		µg/l	A-T-025w

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Client Project Ref: 42187

Lab Sample ID	18/01785/17	18/01785/19	18/01785/22	18/01785/23	18/01785/24	18/01785/26	18/01785/30		Units	Method ref
Client Sample No	3	2	1	2	3	1	1			
Client Sample ID	TP05	TP06	TP07	TP07	TP07	TP08	TP09			
Depth to Top	1.00	0.50	0.30	0.60	1.20	0.25	0.25			
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	23-Mar-18	27-Feb-18			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	5A	6E	5AE	3A	6AE	5A			
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_A^{\#}$	-	NAD	NAD	NAD	-	NAD	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	-	N/A	N/A	N/A	-	N/A	N/A			

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Client Project Ref: 42187

Lab Sample ID	18/01785/17	18/01785/19	18/01785/22	18/01785/23	18/01785/24	18/01785/26	18/01785/30		Units	Method ref
Client Sample No	3	2	1	2	3	1	1			
Client Sample ID	TP05	TP06	TP07	TP07	TP07	TP08	TP09			
Depth to Top	1.00	0.50	0.30	0.60	1.20	0.25	0.25			
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	23-Mar-18	27-Feb-18			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	5A	6E	5AE	3A	6AE	5A			
PAH-16MS										
Acenaphthene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01		mg/kg	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02		mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	0.38	<0.04		mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	0.56	<0.04		mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	0.29	<0.05		mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	0.16	<0.05		mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	0.16	<0.07		mg/kg	A-T-019s
Chrysene$_A^{M\#}$	<0.06	<0.06	<0.06	<0.06	<0.06	0.52	<0.06		mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08	<0.08	0.53	<0.08		mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	0.20	<0.03		mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	<0.03	<0.03	<0.03	0.03	<0.03	0.23	<0.03		mg/kg	A-T-019s
Pyrene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	1.10	<0.07		mg/kg	A-T-019s
PAH (total 16)$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08	<0.08	4.18	<0.08		mg/kg	A-T-019s

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Lab Sample ID	18/01785/17	18/01785/19	18/01785/22	18/01785/23	18/01785/24	18/01785/26	18/01785/30		Units	Method ref
Client Sample No	3	2	1	2	3	1	1			
Client Sample ID	TP05	TP06	TP07	TP07	TP07	TP08	TP09			
Depth to Top	1.00	0.50	0.30	0.60	1.20	0.25	0.25			
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	23-Mar-18	27-Feb-18			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	5A	6E	5AE	3A	6AE	5A			
Topsoil quality BS3882:2015 (without classification)										
% Clay$_A$	-	-	15.8	-	-	-	-		% w/w	Subcon Yara
% Silt$_A$	-	-	53.2	-	-	-	-		% w/w	Subcon Yara
% Sand$_A$	-	-	31.0	-	-	-	-		% w/w	Subcon Yara
Textural class	-	-	Sandy Silt Loam	-	-	-	-			Calc
% Coarse Fragment Content >2mm$_A$	-	-	6.3	-	-	-	-		% w/w	A-T-044
% Coarse Fragment Content >20mm$_A$	-	-	<0.1	-	-	-	-		% w/w	A-T-044
% Coarse Fragment Content >50mm$_A$	-	-	<0.1	-	-	-	-		% w/w	A-T-044
Carbonate as CaCO3$_D$	-	-	<0.8	-	-	-	-		% w/w	CO3s
pH$_D$	-	-	7.37	-	-	-	-		pH	A-T-031s
Electrical conductivity$_D$	-	-	1790	-	-	-	-		µs/cm	A-T-037s
Nitrogen, Total %$_A$	-	-	0.231	-	-	-	-		%	Subcon Yara
Loss on ignition (440°C)$_D$	-	-	4.7	-	-	-	-		% w/w	A-T-030s
Extractable phosphate$_D$	-	-	19.3	-	-	-	-		mg/l	A-T-EXTMETS
Extractable potassium$_D$	-	-	80	-	-	-	-		mg/l	A-T-EXTMETS
Extractable magnesium$_D$	-	-	331	-	-	-	-		mg/l	A-T-EXTMETS
Carbon:Nitrogen Ratio	-	-	12.0	-	-	-	-		:1	Calc-no stones
Zinc (HNO3 extractable)$_D$	-	-	51	-	-	-	-		mg/kg	A-T-024s
Copper (HNO3 extractable)$_D$	-	-	20	-	-	-	-		mg/kg	A-T-024s
Nickel (HNO3 extractable)$_D$	-	-	16	-	-	-	-		mg/kg	A-T-024s
% Visible Contaminants >2mm$_A$	-	-	<0.1	-	-	-	-		% w/w	A-T-044
% Visible Contaminants Plastics$_A$	-	-	<0.1	-	-	-	-		% w/w	A-T-044
Sharps, number (in 1kg of sample)$_A$	-	-	0	-	-	-	-		N/A	A-T-044
Acceptable textural classification?	-	-	Yes	-	-	-	-			Calc

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Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/01785/17	18/01785/19	18/01785/22	18/01785/23	18/01785/24	18/01785/26	18/01785/30		Units	Method ref
Client Sample No	3	2	1	2	3	1	1			
Client Sample ID	TP05	TP06	TP07	TP07	TP07	TP08	TP09			
Depth to Top	1.00	0.50	0.30	0.60	1.20	0.25	0.25			
Depth To Bottom										
Date Sampled	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	27-Feb-18	23-Mar-18	27-Feb-18			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	5A	6E	5AE	3A	6AE	5A			
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Ali >C8-C10$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Ali >C10-C12$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Ali >C12-C16$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Ali >C16-C21$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Ali >C21-C35$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Total Aliphatics$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C8-C9$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C9-C10$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
Aro >C10-C12$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		mg/kg	A-T-023s
Aro >C12-C16$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1		mg/kg	A-T-023s
Aro >C16-C21$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	2.3	<0.1		mg/kg	A-T-023s
Aro >C21-C35$_A^{\#}$	<0.1	<0.1	<0.1	<0.1	<0.1	3.8	<0.1		mg/kg	A-T-023s
Total Aromatics$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	6.6	<0.1		mg/kg	A-T-023s
TPH (Ali & Aro)$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	6.6	<0.1		mg/kg	A-T-023s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		mg/kg	A-T-022s

REPORT NOTES

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Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02399
Issue Number: 1 **Date:** 11 April, 2018

Client:
Ian Farmer Associates (Warrington)
14/15 Rufford Court
Hardwick Grange
Warrington
WA1 4RF

Project Manager: Hannah Hadwin
Project Name: Crewe WwTW
Project Ref: 42187
Order No: 44300
Date Samples Received: 29/03/18
Date Instructions Received: 03/04/18
Date Analysis Completed: 11/04/18

Prepared by:

Holly Neary-King
Administrative Assistant

Approved by:

Richard Wong
Client Manager

UKAS TESTING
1247

Envirolab Job Number: 18/02399

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02399/1	18/02399/2	18/02399/3	18/02399/4					Units	Method ref
Client Sample No										
Client Sample ID	BH05	BH03	BH04	BH01						
Depth to Top										
Depth To Bottom										
Date Sampled	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18						
Sample Type	Water - EW	Water - EW	Water - EW	Water - EW						
Sample Matrix Code	N/A	N/A	N/A	N/A						
pH (w)$_A^{\#}$	7.96	7.92	7.87	7.98					pH	A-T-031w
Redox Potential (w)$_A$	183	181	-11.6	120					mV	A-T-048
Electrical conductivity @ 20degC (w)$_A^{\#}$	818	938	1509	1057					µs/cm	A-T-037w
Dissolved oxygen$_A$	4.5	2.5	0.6	2.2					mg/l	A-T-048
COD (settled)$_A^{\#}$	44	23	331	30					mg/l	A-T-034w
Alkalinity (total) (w) Colorimetry$_A^{\#}$	405	363	438	426					mg/l Ca CO3	A-T-038w
Hardness Total$_A^{\#}$	542	522	734	762					mg/l Ca CO3	A-T-049w
Total Suspended Solids (w)$_A^{\#}$	1157	17269	2041	1686					mg/l	A-T-036w
Ammonia / Ammoniacal Nitrogen as NH3 (w)$_A^{\#}$	0.187	0.235	26.59	0.610					mg/l	A-T-033w
Chloride (w)$_A^{\#}$	33	39	39	20					mg/l	A-T-026w
Fluoride (w)$_A^{\#}$	0.11	0.17	<0.10	0.17					mg/l	A-T-026w
Nitrite (w)$_A^{\#}$	<0.10	<0.10	<0.10	<0.10					mg/l	A-T-026w
Nitrate (w)$_A^{\#}$	0.63	1.56	<0.10	<0.10					mg/l	A-T-026w
Nitrogen, Total Oxidised TOxN (w)$_A^{\#}$	0.2	0.4	<0.1	<0.1					mg/l	A-T-026w
Sulphate (w)$_A^{\#}$	38	146	37	135					mg/l	A-T-026w
Cyanide (total) (w)$_A^{\#}$	<0.005	<0.005	<0.005	<0.005					mg/l	A-T-042wTCN
Phenols - Total by HPLC (w)$_A$	<0.01	<0.01	<0.01	<0.01					mg/l	A-T-050w
DOC (w)$_A^{\#}$	10.8	1.7	122	5.6					mg/l	A-T-032w
Arsenic (dissolved)$_A^{\#}$	<1	<1	31	3					µg/l	A-T-025w
Boron (dissolved)$_A^{\#}$	44	49	44	53					µg/l	A-T-025w
Cadmium (dissolved)$_A^{\#}$	<0.2	<0.2	<0.2	<0.2					µg/l	A-T-025w
Copper (dissolved)$_A^{\#}$	3	<1	<1	<1					µg/l	A-T-025w
Chromium (dissolved)$_A^{\#}$	<1	<1	3	<1					µg/l	A-T-025w
Chromium (hexavalent) (w)$_A^{\#}$	<0.01	<0.01	<0.01	<0.01					mg/l	A-T-040w
Iron (dissolved)$_A^{\#}$	28	31	53400	108					µg/l	A-T-025w
Lead (dissolved)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-025w
Mercury (dissolved)$_A^{\#}$	<0.1	<0.1	<0.1	<0.1					µg/l	A-T-025w
Nickel (dissolved)$_A^{\#}$	3	2	23	3					µg/l	A-T-025w
Selenium (dissolved)$_A^{\#}$	<1	<1	2	<1					µg/l	A-T-025w
Zinc (dissolved)$_A^{\#}$	11	6	23	6					µg/l	A-T-025w

Envirolab Job Number: 18/02399

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02399/1	18/02399/2	18/02399/3	18/02399/4					Units	Method ref
Client Sample No										
Client Sample ID	BH05	BH03	BH04	BH01						
Depth to Top										
Depth To Bottom										
Date Sampled	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18						
Sample Type	Water - EW	Water - EW	Water - EW	Water - EW						
Sample Matrix Code	N/A	N/A	N/A	N/A						
PAH 16MS (w)										
Acenaphthene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Acenaphthylene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Anthracene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Benzo(a)anthracene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Benzo(a)pyrene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Benzo(b)fluoranthene $(w)_A^{\#}$	<0.01	0.02	<0.01	<0.01					µg/l	A-T-019w
Benzo(ghi)perylene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Benzo(k)fluoranthene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Chrysene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Dibenzo(ah)anthracene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Fluoranthene $(w)_A^{\#}$	<0.01	0.01	<0.01	<0.01					µg/l	A-T-019w
Fluorene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Indeno(123-cd)pyrene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Naphthalene $(w)_A^{\#}$	<0.01	<0.01	0.16	<0.01					µg/l	A-T-019w
Phenanthrene $(w)_A^{\#}$	<0.01	<0.01	<0.01	<0.01					µg/l	A-T-019w
Pyrene $(w)_A^{\#}$	<0.01	0.01	<0.01	<0.01					µg/l	A-T-019w
PAH (total 16) $(w)_A^{\#}$	<0.01	0.04	0.16	<0.01					µg/l	A-T-019w

Envirolab Job Number: 18/02399

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02399/1	18/02399/2	18/02399/3	18/02399/4					Units	Method ref
Client Sample No										
Client Sample ID	BH05	BH03	BH04	BH01						
Depth to Top										
Depth To Bottom										
Date Sampled	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18						
Sample Type	Water - EW	Water - EW	Water - EW	Water - EW						
Sample Matrix Code	N/A	N/A	N/A	N/A						
TPH UKCWG										
Ali >C5-C6 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Ali >C6-C8 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Ali >C8-C10 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Ali >C10-C12 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Ali >C12-C16 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Ali >C16-C21 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Ali >C21-C35 $(w)_A^{\#}$	169	<5	<5	<5					µg/l	A-T-023w
Ali >C35-C44 $(w)_A$	<5	<5	<5	<5					µg/l	A-T-023w
Total Aliphatics $(w)_A$	169	<5	<5	<5					µg/l	A-T-022+23w
Aro >C5-C7 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Aro >C7-C8 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Aro >C8-C9 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Aro >C9-C10 $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Aro >C10-C12 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Aro >C12-C16 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Aro >C16-C21 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Aro >C21-C35 $(w)_A^{\#}$	<5	<5	<5	<5					µg/l	A-T-023w
Aro >C35-C44 $(w)_A$	<5	<5	<5	<5					µg/l	A-T-023w
Total Aromatics $(w)_A$	<5	<5	<5	<5					µg/l	A-T-022+23w
TPH (Ali & Aro) $(w)_A$	169	<5	<5	<5					µg/l	A-T-022+23w
BTEX - Benzene $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - Toluene $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - Ethyl Benzene $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - m & p Xylene $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - o Xylene $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
MTBE $(w)_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w

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Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02976
Issue Number: 1 **Date:** 02 May, 2018

Client:
Ian Farmer Associates (Warrington)
14/15 Rufford Court
Hardwick Grange
Warrington
WA1 4RF

Project Manager: Hannah Hadwin
Project Name: Crewe WwTW
Project Ref: 42187
Order No: 44424
Date Samples Received: 20/04/18
Date Instructions Received: 20/04/18
Date Analysis Completed: 02/05/18

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Georgia King
Admin & Client Services Supervisor

UKAS TESTING 1247

Envirolab Job Number: 18/02976

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02976/1	18/02976/2	18/02976/3						Units	Method ref
Client Sample No										
Client Sample ID	BH05	BH04	BH01							
Depth to Top										
Depth To Bottom										
Date Sampled	19-Apr-18	19-Apr-18	19-Apr-18							
Sample Type	Water - EW	Water - EW	Water - EW							
Sample Matrix Code	N/A	N/A	N/A							
pH (w)$_A^\#$	7.98	6.68	7.31						pH	A-T-031w
Redox Potential (w)$_A$	252	50.8	49.9						mV	A-T-048
Electrical conductivity @ 20degC (w)$_A^\#$	891	1383	1206						µs/cm	A-T-037w
Dissolved oxygen$_A$	0.6	<0.5	1.0						mg/l	A-T-048
COD (settled)$_A^\#$	93	317	37						mg/l	A-T-034w
BOD (settled, 5 day)$_A$	3	10	<1						mg/l	A-T-048
Alkalinity (total) (w) Colorimetry$_A^\#$	416	449	437						mg/l Ca CO3	A-T-038w
Hardness Total$_A^\#$	430	596	676						mg/l Ca CO3	A-T-049w
Total Suspended Solids (w)$_A^\#$	910	7333	1772						mg/l	A-T-036w
Ammonia / Ammoniacal Nitrogen as NH3 (w)$_A^\#$	0.732	18.73	0.590						mg/l	A-T-033w
Chloride (w)$_A^\#$	22	35	19						mg/l	A-T-026w
Fluoride (w)$_A^\#$	0.18	0.26	0.23						mg/l	A-T-026w
Nitrite (w)$_A^\#$	<0.10	<0.10	<0.10						mg/l	A-T-026w
Nitrate (w)$_A^\#$	<0.10	<0.10	<0.10						mg/l	A-T-026w
Nitrogen, Total Oxidised TOxN (w)$_A^\#$	<0.1	<0.1	<0.1						mg/l	A-T-026w
Sulphate (w)$_A^\#$	38	11	149						mg/l	A-T-026w
Cyanide (total) (w)$_A^\#$	<0.005	<0.005	<0.005						mg/l	A-T-042wTCN
Phenols - Total by HPLC (w)$_A$	<0.01	<0.01	<0.01						mg/l	A-T-050w
DOC (w)$_A^\#$	19.1	75.2	6.2						mg/l	A-T-032w
Aluminium (dissolved)$_A$	37	56	30						µg/l	A-T-049w
Arsenic (dissolved)$_A^\#$	6	23	3						µg/l	A-T-025w
Boron (dissolved)$_A^\#$	18	18	21						µg/l	A-T-025w
Cadmium (dissolved)$_A^\#$	<0.2	<0.2	<0.2						µg/l	A-T-025w
Copper (dissolved)$_A^\#$	<1	2	2						µg/l	A-T-025w
Chromium (dissolved)$_A^\#$	2	3	7						µg/l	A-T-025w
Chromium (hexavalent) (w)$_A^\#$	<0.01	<0.01	<0.01						mg/l	A-T-040w
Iron (dissolved)$_A^\#$	6260	51600	200						µg/l	A-T-025w
Lead (dissolved)$_A^\#$	<1	<1	<1						µg/l	A-T-025w
Mercury (dissolved)$_A^\#$	<0.1	<0.1	<0.1						µg/l	A-T-025w
Nickel (dissolved)$_A^\#$	3	19	2						µg/l	A-T-025w
Selenium (dissolved)$_A^\#$	<1	2	<1						µg/l	A-T-025w
Zinc (dissolved)$_A^\#$	6	13	3						µg/l	A-T-025w

Envirolab Job Number: 18/02976

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02976/1	18/02976/2	18/02976/3						Units	Method ref
Client Sample No										
Client Sample ID	BH05	BH04	BH01							
Depth to Top										
Depth To Bottom										
Date Sampled	19-Apr-18	19-Apr-18	19-Apr-18							
Sample Type	Water - EW	Water - EW	Water - EW							
Sample Matrix Code	N/A	N/A	N/A							
PAH 16MS (w)										
Acenaphthene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Acenaphthylene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Anthracene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Benzo(a)anthracene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Benzo(a)pyrene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Benzo(b)fluoranthene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Benzo(ghi)perylene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Benzo(k)fluoranthene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Chrysene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Dibenzo(ah)anthracene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Fluoranthene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Fluorene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Indeno(123-cd)pyrene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Naphthalene $(w)_A^{\#}$	<0.01	0.01	<0.01						µg/l	A-T-019w
Phenanthrene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
Pyrene $(w)_A^{\#}$	<0.01	<0.01	<0.01						µg/l	A-T-019w
PAH (total 16) $(w)_A^{\#}$	<0.01	0.01	<0.01						µg/l	A-T-019w

Envirolab Job Number: 18/02976

Client Project Name: Crewe WwTW

Client Project Ref: 42187

Lab Sample ID	18/02976/1	18/02976/2	18/02976/3						Units	Method ref
Client Sample No										
Client Sample ID	BH05	BH04	BH01							
Depth to Top										
Depth To Bottom										
Date Sampled	19-Apr-18	19-Apr-18	19-Apr-18							
Sample Type	Water - EW	Water - EW	Water - EW							
Sample Matrix Code	N/A	N/A	N/A							
TPH UKCWG										
Ali >C5-C6 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Ali >C6-C8 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Ali >C8-C10 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Ali >C10-C12 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Ali >C12-C16 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Ali >C16-C21 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Ali >C21-C35 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Ali >C35-C44 $(w)_A$	<5	<5	<5						µg/l	A-T-023w
Total Aliphatics $(w)_A$	<5	<5	<5						µg/l	A-T-022+23w
Aro >C5-C7 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Aro >C7-C8 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Aro >C8-C9 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Aro >C9-C10 $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
Aro >C10-C12 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Aro >C12-C16 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Aro >C16-C21 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Aro >C21-C35 $(w)_A^{\#}$	<5	<5	<5						µg/l	A-T-023w
Aro >C35-C44 $(w)_A$	<5	<5	<5						µg/l	A-T-023w
Total Aromatics $(w)_A$	<5	<5	<5						µg/l	A-T-022+23w
TPH (Ali & Aro) $(w)_A$	<5	<5	<5						µg/l	A-T-022+23w
BTEX - Benzene $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
BTEX - Toluene $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
BTEX - Ethyl Benzene $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
BTEX - m & p Xylene $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
BTEX - o Xylene $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w
MTBE $(w)_A^{\#}$	<1	<1	<1						µg/l	A-T-022w

REPORT NOTES

General:
This report shall not be reproduced, except in full, without written approval from Envirolab.
All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

APPENDIX 5

PHOTOGRAPHS

Photographs of Rock Core

Core Photographs
BH03

Core Photographs
BH03

Core Photographs
BH03

Core Photographs
BH03

Core Photographs
BH03

Core Photographs
BH06

Core Photographs
BH06

Core Photographs
BH06

Photographs of Trial Pit

Trial Pit Photographs
TP01

Trial Pit Photographs
TP02

Trial Pit Photographs
TP02

Trial Pit Photographs
TP02

Trial Pit Photographs
TP03

Trial Pit Photographs
TP03

Trial Pit Photographs
TP03

Trial Pit Photographs
TP04

Trial Pit Photographs
TP04

Trial Pit Photographs
TP04

Trial Pit Photographs
TP06

Trial Pit Photographs
TP06

Trial Pit Photographs
TP06

Trial Pit Photographs
TP07

Trial Pit Photographs
TP07

Trial Pit Photographs
TP08

Trial Pit Photographs
TP08

Trial Pit Photographs
TP09

APPENDIX 6

MONITORING

IAN FARMER ASSOCIATES
Geotechnical & Environmental Specialists

Gas and Groundwater Monitoring Results

Contract Number:	*42187*	**Gas Monitor:**	*G503222*
Contract Name:	*Crewe WwTW*	**Readings Taken By:**	*PN*
Date:	*21st March 2018*	**Checked By:**	*HH*

Background Readings:		
Weather Conditions:	*Sunny, 4°*	
Ground Conditions (dry / wet etc):	*Wet*	
Atmospheric Pressure (Start):	*1027mb*	
Atmospheric Pressure (Finish):	*1026mb*	
Time (Start): 09:00 Time (Finish):	11:30	

O_2% v/v	CO_2% v/v	CH_4% v/v	CO ppm	H_2S ppm
20.8	*0.0*	*0.0*	*0*	*0*

Hole No:	VOC ppm	O_2% v/v	CO_2% v/v	CH_4% v/v		CO ppm	H_2S ppm	Rel Pressure (mb)	Gas flow Rate (l/hr)	Depth to base of well	SWL	LNAPL or DNAPL
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	mBGL	mBGL	mBGL
BH01	*0.0*	*10.7*	*1.2*	*23.2*	*22.6*	*0*	*0*	*-0.17*	*0.1*	*5.94*	*1.37*	*ND*
BH03	*0.0*	*20.7*	*0.8*	*0.0*	*0.0*	*0*	*0*	*0.17*	*0.1*	*9.57*	*5.17*	*ND*
BH04	*0.0*	*0.0*	*17.8*	*92.8*	*92.7*	*0*	*0*	*0.97*	*0.2*	*5.84*	*3.14*	*ND*
BH05	*0.0*	*17.7*	*0.7*	*0.4*	*0.4*	*0*	*0*	*-0.49*	*0.1*	*5.81*	*2.21*	*ND*

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: BH10 informed by personal on site that the BH has been concreted over

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Geotechnical & Environmental Specialists

Gas and Groundwater Monitoring Results

Contract Number:	*42187*	**Gas Monitor:**	*G503701*
Contract Name:	*Crewe WwTW*	**Readings Taken By:**	*P Nicol*
Date:	*28th March 2018*	**Checked By:**	*HH*

Background Readings:		O_2% v/v	CO_2% v/v	CH_4% v/v	CO ppm	H_2S ppm
Weather Conditions:	*Overcast, 5 °C*					
Ground Conditions (dry / wet etc):	*Wet*					
Atmospheric Pressure (Start):	*999mb*	*10.9*	*0.1*	*0.0*	*0.0*	*0.0*
Atmospheric Pressure (Finish):	*999mb*					
Time (Start): 09:40 Time (Finish):	12:10					

Hole No:	VOC ppm	O_2% v/v	CO_2% v/v	CH_4% v/v		CO ppm	H_2S ppm	Rel Pressure (mb)	Gas flow Rate (l/hr)	Depth to base of well	SWL	LNAPL or DNAPL
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	mBGL	mBGL	mBGL
BH01	*0.0*	*7.6*	*2.5*	*32.4*	*27.6*	*0*	*0*	*0.44*	*0.1*	*5.44*	*1.31*	*ND*
BH03	*0.0*	*7.0*	*5.4*	*9.8*	*9.7*	*0*	*0*	*-0.31*	*0.1*	9.34	5.37	*ND*
BH04	*0.0*	*0.0*	*18.2*	*79.2*	*79.2*	*0*	*0*	*0.30*	*0.2*	*5.37*	*2.85*	*ND*
BH05	*0.0*	*16.2*	*1.5*	*0.0*	*0.0*	*0*	*0*	*-0.42*	*0.1*	*5.59*	*1.83*	*ND*

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: ND - not detected

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Gas and Groundwater Monitoring Results

Contract Number:	*42187*	**Gas Monitor:**	*G503701*
Contract Name:	*Crewe WwTW*	**Readings Taken By:**	*PN*
Date:	*4th April 2018*	**Checked By:**	*HH*

Background Readings:		
Weather Conditions:	*Light rain, 8 °C*	
Ground Conditions (dry / wet etc):	*Wet*	
Atmospheric Pressure (Start):	*985MB*	
Atmospheric Pressure (Finish):	*985MB*	
Time (Start): 09:45 Time (Finish):	10:55	

O_2% v/v	CO_2% v/v	CH_4% v/v	CO ppm	H_2S ppm
20.9	*0.1*	*0.0*	*0*	*0*

Hole No:	VOC ppm	O_2% v/v	CO_2% v/v	CH_4% v/v		CO ppm	H_2S ppm	Rel Pressure (mb)	Gas flow Rate (l/hr)	Depth to base of well	SWL	LNAPL or DNAPL
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	mBGL	mBGL	mBGL
BH01	*0.0*	*4.1*	*2.7*	*37.9*	*33.0*	*0*	*0*	*-0.36*	*0.1*	*5.42*	*1.09*	*ND*
BH03	*0.0*	*0.4*	*10.8*	*35.6*	*35.6*	*0*	*0*	*0.03*	*0.1*	*9.24*	*4.97*	*ND*
BH04	*0.0*	*0.0*	*16.9*	*53.9*	*53.8*	*0*	*0*	*1.05*	*0.2*	*6.27*	*3.05*	*ND*
BH05	*0.0*	*14.2*	*2.8*	*0.0*	*0.0*	*0*	*0*	*0.37*	*0.2*	*5.57*	*1.35*	*ND*

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: ND - not detected

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Geotechnical & Environmental Specialists

Gas and Groundwater Monitoring Results

Contract Number:	*42187*	**Gas Monitor:**	*G503222*
Contract Name:	*Crewe WwTW*	**Readings Taken By:**	*PN*
Date:	*19th April 2018*	**Checked By:**	*HH*

Background Readings:			O_2% v/v	CO_2% v/v	CH_4% v/v	CO ppm	H_2S ppm
	Weather Conditions:	*Sunny*					
	Ground Conditions (dry / wet etc):	*Wet*					
	Atmospheric Pressure (Start):	*1019mb*	*20.7*	*0.0*	*0.0*	*0*	*0*
	Atmospheric Pressure (Finish):	*1019mb*					
	Time (Start): 09:10	Time (Finish): 13:15					

Hole No:	VOC ppm	O_2% v/v	CO_2% v/v	CH_4% v/v		CO ppm	H_2S ppm	Rel Pressure (mb)	Gas flow Rate (l/hr)	Depth to base of well	SWL	LNAPL or DNAPL
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	mBGL	mBGL	mBGL
BH01	*0.0*	*0.0*	*3.4*	*46.0*	*45.7*	*0*	*0*	*1.92*	*0.1*	*5.42*	*1.55*	*ND*
BH04	*0.0*	*0.0*	*17.4*	*81.8*	*81.7*	*0*	*0*	*1.34*	*0.1*	*5.28*	*3.39*	*ND*
BH05	*0.0*	*6.4*	*1.9*	*0.0*	*0.0*	*0*	*0*	*-0.75*	*0.1*	*5.56*	*1.20*	*ND*

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: BH03 has been destroyed

ND - not detected

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Gas and Groundwater Monitoring Results

Contract Number:	*42187*	**Gas Monitor:**	*GA10157*
Contract Name:	*Crewe WwTw*	**Readings Taken By:**	*PN*
Date:	*3rd May 2018*	**Checked By:**	*HH*

Background Readings:			O_2% v/v	CO_2% v/v	CH_4% v/v	CO ppm	H_2S ppm
	Weather Conditions:	*Sunny, 13 °C*					
	Ground Conditions (dry / wet etc):	*Damp*					
	Atmospheric Pressure (Start):	*1014mb*	*20.8*	*0.1*	*0.0*	*0*	*0*
	Atmospheric Pressure (Finish):	*1014mb*					
	Time (Start): 9:25 Time (Finish):	10:05					

Hole No:	VOC ppm	O_2% v/v	CO_2% v/v	CH_4% v/v		CO ppm	H_2S ppm	Rel Pressure (mb)	Gas flow Rate (l/hr)	Depth to base of well	SWL	LNAPL or DNAPL
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	mBGL	mBGL	mBGL
BH01	*0.0*	*1.7*	*4.1*	*11.5*	*11.0*	*0*	*0*	*-1.26*	*0.1*	*5.42*	*1.59*	*ND*
BH05	*0.0*	*4.8*	*5.1*	*0.0*	*0.0*	*0*	*0*	*-1.29*	*0.0*	*5.56*	*1.65*	*ND*

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: Informed by Lima that BH04 has been destroyed.

ND - not detected

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Geotechnical & Environmental Specialists

Gas and Groundwater Monitoring Results

Contract Number:	*42187*	**Gas Monitor:**	*G503628*
Contract Name:	*Crewe WwTW*	**Readings Taken By:**	*PN*
Date:	*18th May 2018*	**Checked By:**	*HH*

Background Readings:			O_2% v/v	CO_2% v/v	CH_4% v/v	CO ppm	H_2S ppm
	Weather Conditions:	*Sunny*					
	Ground Conditions (dry / wet etc):	*Dry*					
	Atmospheric Pressure (Start):	*1021mb*	*20.4*	*0.0*	*0.0*	*0*	*0*
	Atmospheric Pressure (Finish):	*1021mb*					
	Time (Start): 09:05 Time (Finish):	09:35					

Hole No:	VOC ppm	O_2% v/v	CO_2% v/v	CH_4% v/v		CO ppm	H_2S ppm	Rel Pressure (mb)	Gas flow Rate (l/hr)	Depth to base of well	SWL	LNAPL or DNAPL
	Steady	Steady	Steady	Peak	Steady	Steady	Steady	Steady	Steady	mBGL	mBGL	mBGL
BH01	*Borehole destroyed*											
BH05	*0.0*	*1.0*	*5.6*	*0.0*	*0.0*	*0*	*0*	*-1.52*	*0.0*	*5.56*	*1.76*	*ND*

>>>> = Flow above detection limit of 30 l/hr, <<< = Negative flow greater than -10 l/hr. >Max = In excess of lower explosive limit.

Remarks: ND - not detected

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Groundwater Monitoring Results

Contract Number:	*42187*
Contract Name:	*Crewe WwTW*
Date:	*28th March 2018*
Weather Conditions:	*Sunny*

Borehole Number	SWL	LNAPL DNAPL	pH	Temperature	Redox Potential	Dissolved Oxygen	Electrical Conductivity
	mBGL	mBGL		Steady	mv	ppm	µs/cm
BH01	*1.31*	*ND*	*8.01*	*6.85*	*-56.8*	*8.5*	*1089*
BH03	*5.55*	*ND*	*7.78*	*7.81*	*33.1*	*8.0*	*1120*
BH04	*2.85*	*ND*	*6.71*	*8.3*	*-118.2*	*3.8*	*1369*
BH05	*1.83*	*ND*	*7.21*	*7.7*	*29.0*	*8.2*	*970*

Remarks: *ND - not detected*

Readings Taken By:	PN
Checked By:	HH

IAN FARMER ASSOCIATES
Geotechnical & Environmental Specialists

Groundwater Monitoring Results

Contract Number:	*42187*
Contract Name:	*Crewe WwTW*
Date:	*19th April 2018*
Weather Conditions:	*Sunny*

Borehole Number	SWL	LNAPL DNAPL	pH	Temperature	Redox Potential	Dissolved Oxygen	Electrical Conductivity
	mBGL	mBGL		Steady	mv	ppm	µs/cm
BH01	*1.55*	*ND*	*7.71*	*13.5*	*-55.4*	*8.5*	*1080*
BH04	*3.39*	*ND*	*7.01*	*10.5*	*-109.8*	*3.8*	*1250*
BH05	*1.20*	*ND*	*7.29*	*10.3*	*28.1*	*8.1*	*990*

Remarks: *ND - not detected*

Readings Taken By:	PN
Checked By:	HH