

Norfolk Boreas Offshore Wind Farm

TerraConsult Ground

Investigations

Report

Part 3 of 6
Crossing 3

Applicant: Norfolk Boreas Limited
Document Reference: Exa.AS-3.D2.V1
Deadline 2
Date: December 2019
Revision: Version 1
Author: TerraConsult

Photo: Ormonde Offshore Wind Farm

Norfolk Vanguard Offshore Wind Farm

The Applicant

Responses to First

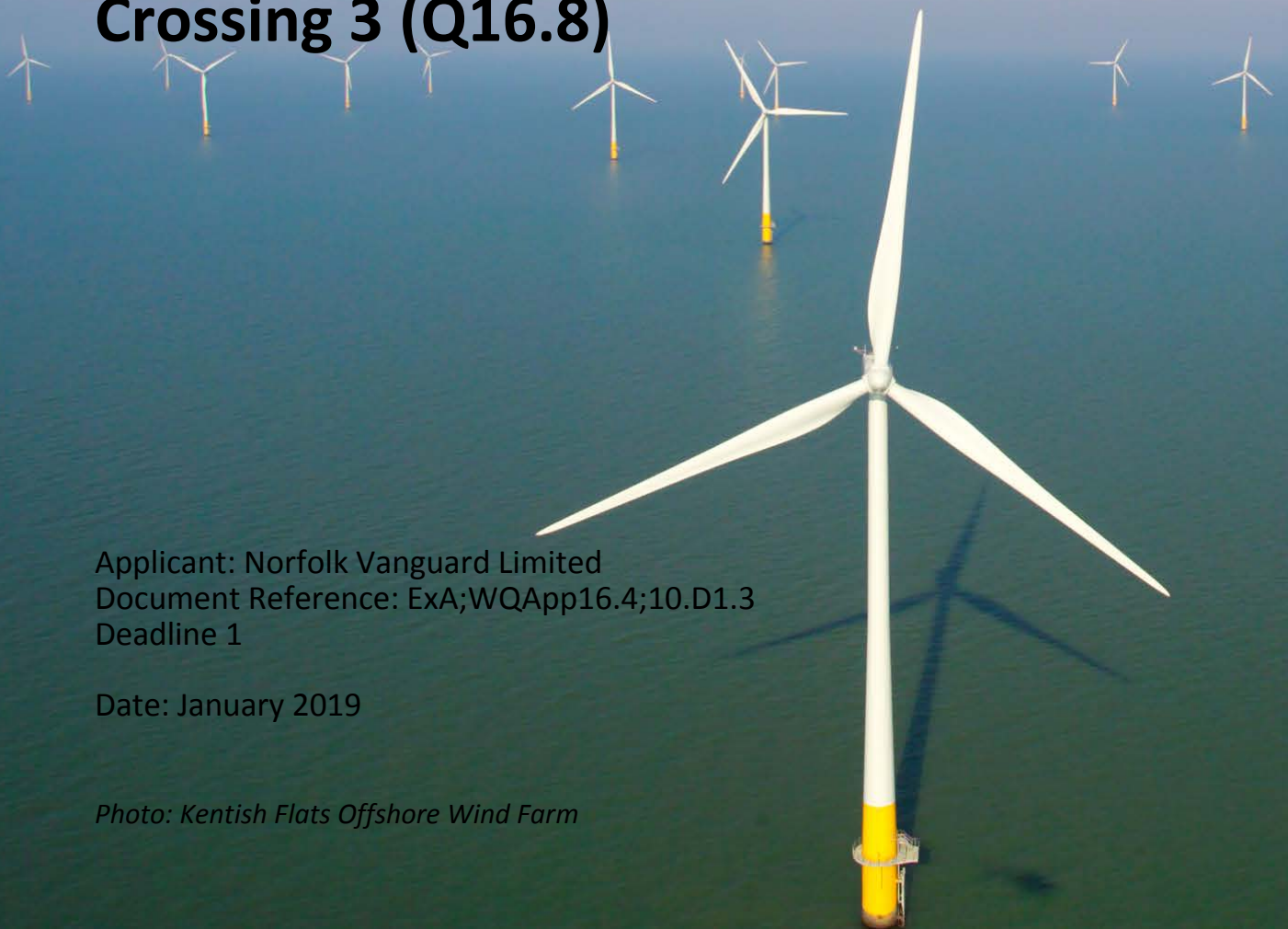
Written Questions

Appendix 16.4 – TerraConsult 2017
Ground Investigations Report:
Crossing 3 (Q16.8)

Applicant: Norfolk Vanguard Limited
Document Reference: ExA;WQApp16.4;10.D1.3
Deadline 1

Date: January 2019

Photo: Kentish Flats Offshore Wind Farm





November 2017
Report No 3318-R003-3

East Anglia (North) Offshore Wind Farm
Crossing 3 Site Investigation

Carried out for:

Gutteridge, Haskins and Davey Ltd (GHD)

TerraConsult

East Anglia (North) Offshore Wind Farm

Crossing 3 Site Investigation

Date: November 2017

Report No 3318-R003-3

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DISCLAIMER

This site investigation contract was completed by TerraConsult Ltd on the basis of a specification and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget, the degree of manpower and resources allocated to the project as agreed.

TerraConsult Ltd cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outwith the agreed scope of works.

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East Anglia (North) Offshore Wind Farm

Crossing 3 Site Investigation CONTENTS

1	INTRODUCTION	1
2	SITE DESCRIPTION	1
	2.1 Location and Topography	1
	2.2 Published Geology	2
3	FIELDWORK	2
	3.1 General	2
	3.2 Exploratory Holes	2
	3.3 Sampling	3
	3.4 In Situ Testing	3
	3.5 Instrumentation and Monitoring	3
	3.6 Surveying	3
4	LABORATORY TESTING.....	4
	4.1 Geotechnical Testing.....	4
	4.2 Geoenvironmental Testing.....	4
5	REFERENCES.....	5
6	LICENCES.....	5

DRAWINGS

3318(C3)D001-1 Site Location Plan

3318(C3)D002-1 Exploratory Hole Location Plan

APPENDICES

APPENDIX A Exploratory Hole Records

APPENDIX B Photographs

APPENDIX C Instrumentation Sampling and Monitoring Records

APPENDIX D Geotechnical Laboratory Test Results

APPENDIX E Geoenvironmental Laboratory Test Results

APPENDIX F Calibration Certificates

East Anglia (North) Offshore Wind Farm

Crossing 3 Site Investigation

1 INTRODUCTION

TerraConsult Limited (TCL) was commissioned by Gutteridge, Haskins and Davey Ltd (GHD) to carry out a ground investigation for the proposed cable route crossing the River Wensum, near Swanton Morley, Norfolk.

This report presents the factual records of the fieldwork and laboratory testing. The data is also presented separately in digital format following AGS4 (2011).

The scope of the investigation, which was specified by GHD, comprised:

- Boreholes formed by cable percussive techniques;
- In situ testing comprising of;
 - Standard penetration tests in boreholes;
 - Variable head permeability testing;
- Post fieldwork monitoring and sampling;
- Geotechnical laboratory testing;
- Geoenvironmental laboratory testing;
- Factual report (GIR) and AGS data.

The investigation was carried out in accordance with the contract specification and relevant standards (see References). The fieldwork was carried out between 04/08/17 and 14/08/17.

Whilst every attempt is made to record full details of the strata encountered in the exploratory holes, techniques of exploratory hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

All information given in this report is based on the ground conditions encountered during the site work and on the results of laboratory and field tests performed during the investigation. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations and water conditions between or below exploratory holes. It should be noted that groundwater levels, gas concentrations and gas flows usually vary due to seasonal, atmospheric and/or other effects and may at times differ to those measured during the investigation.

2 SITE DESCRIPTION

2.1 Location and Topography

The site is located approximately 6.9 km north-east of the centre of Dereham, Norfolk. The approximate location of Crossing 3 is located between Ordnance Survey National Grid Reference TG 042 176 and TG 040 176. A site location plan is presented as drawing reference 3318(C3)D001-1.

2.2 Published Geology

The online British Geological Survey (BGS) 1:50,000 scale map shows the site to be underlain by clay, silt, sand and gravel Alluvium overlying river terrace deposits. Beneath this lies the White Chalk Subgroup.

3 FIELDWORK

3.1 General

Fieldwork was undertaken between 04/08/17 and 14/08/17. The scope of the works, as provided by GHD comprised:

Table 1: Scope of Intrusive Works and In Situ Testing	
Exploratory Hole/In Situ Test Type	Proposed number
Cable percussion, SPTs, variable head permeability test, install	BH17-C3-01
Cable percussion, SPTs, variable head permeability test	BH17-C3-02
Cable percussion, SPTs, variable head permeability test, install	BH17-C3-03
Cable percussion, SPTs, variable head permeability test	BH17-C3-04

The exploratory hole locations were selected by GHD. The locations were set out by the GHD site representative prior to commencement.

3.2 Exploratory Holes

The exploratory holes were logged by an engineer in accordance with the recommendations of BS5930:2015, which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1. Methods of formation and geological descriptions, together with sample records, in situ test results and observations made during formation of the exploratory hole are given in the logs presented in Appendix A and should be read in conjunction with the Key included therein. Sample photographs are presented in Appendix B.

A summary of the exploratory holes formed is listed in the following table.

Table 2: Summary of Exploratory Positions							
Exploratory position:	Type:	Final depth (m):	Easting (mE):	Northing (mN):	Level (mAOD):	Start date:	End date:
BH17-C3-01	CP	16.50	604035.95	317597.72	17.53	08/08/2017	09/08/2017
BH17-C3-02	CP	17.00	604062.91	317610.41	16.84	04/08/2017	07/08/2017
BH17-C3-03	CP	20.00	604265.31	317755.75	23.57	09/08/2017	11/08/2017
BH17-C3-04	CP	17.10	604294.24	317784.53	22.33	11/08/2017	14/08/2017

Type: CP – cable percussion;

Prior to commencement, all exploratory positions were checked for services by reference to available plans, visual inspection and CAT survey. Inspection pits were excavated by hand and rechecked with a CAT at all borehole locations.

An exploratory hole location plan is presented as drawing 3318(C3)D002-1.

3.3 Sampling

Samples for geotechnical and geoenvironmental testing and strata description were taken during the formation of the exploratory holes in general accordance with the specification, BS5930:2015, BS10175:2011 and BS EN ISO 22475-1:2006. Soil and water samples for geochemical analysis were taken in accordance with the specification and stored in cool boxes for despatch directly to Concept Life Sciences (Formerly Scientific Analysis Laboratories, SAL) in Braintree, Essex.

A summary of water samples taken from monitoring installations is presented in Appendix C.

3.4 In Situ Testing

In situ testing was carried in accordance with BS 5930:2015, BS 1377-9 (1990), BS EN ISO 22282-1:2012 and BS EN ISO 22282-2:2012 unless otherwise stated. SPT results are presented on individual exploratory hole logs. Information relating to the identification and calibration of SPT hammers can also be found on the individual borehole logs. Hammer calibration certificates are presented in Appendix F. Due to the nature of the strata within which water strikes were encountered, no variable head permeability tests were undertaken at this site.

3.5 Instrumentation and Monitoring

Details of instrumentation installed is presented on the exploratory hole logs. A summary of the installed instrumentation is listed in the following table.

Table 3: Summary of Instrumentation							
Exploratory position:	Instrument type:	Instrument reference:	Internal diameter (mm):	Installed depth (m bgl):	Depth (m AOD):	Top of response zone (m bgl):	Base of response zone (m bgl):
BH17-C3-01	Standpipe	BH17-C3-01	50	16.50	1.03	1.00	15.00
BH17-C3-03	Standpipe	BH17-C3-03	50	20.00	2.33	6.00	9.00

Records of monitoring and gas/groundwater sampling carried out by TerraConsult during and after the fieldwork period to the date of issue of this report are presented in Appendix C. Calibration certificates are presented in Appendix F.

3.6 Surveying

On completion of the fieldworks, all exploratory positions were surveyed by use of GPS. Coordinates and reduced levels to Ordnance Survey are provided on the exploratory hole logs.

4 LABORATORY TESTING

4.1 Geotechnical Testing

The testing was scheduled by GHD and was carried out by GEO Site Testing Services Ltd (GSTL), Llanelli, Carmarthenshire, in accordance with BS 1377 (1990) and BRE SD1 unless otherwise stated. The testing is summarised below and the results are presented in Appendix D.

Table 4: Summary of Geotechnical Laboratory Testing

Lab test:	Number undertaken:	Method:	Remarks:
Atterburg Limit 4 Point Method	1	BS1377: Part 2: 4.3 & 5.3	
Particle size Distribution	4	BS1377: Part 2: 9.2	
BRE SD1 Suite	1	BRE SD1	
One dimensional consolidation	1	BS1377: Part 5: 3	
Triaxial 100mm single stage	1	BS1377: Part 7: 8	

4.2 Geoenvironmental Testing

The testing was scheduled by GHD and carried out by Concept Life Sciences. The results are presented in Appendix E.

5 REFERENCES

- AGS: 2010: Electronic transfer of geotechnical and geoenvironmental data (Edition 4 including addendum 3, 2011). Association of Geotechnical and Geoenvironmental Specialists.
- BRE Special Digest 1: 2005 Concrete in aggressive ground.
- BS 1377 : 1990 : Methods of test for soils for civil engineering purposes. Published in nine parts. British Standards Institution.
- BS 5930 : 2015 : Code of practice for site investigation. British Standards Institution.
- BS 10175 : 2011: Investigation of potentially contaminated sites – Code of Practice. British Standards Institution
- BS EN 1997-1: 2004 : Eurocode 7 – Geotechnical Design – Part 1: General rules. Including UK National Appendix of November 2007. British Standards Institution.
- BS EN ISO 14688-1 : 2002 : Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description. British Standards Institution.
- BS EN ISO 14688-2 : 2004 : Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification. British Standards Institution.
- BS EN ISO 14689-1 : 2003 : Geotechnical investigation and testing – Identification and classification of rock – Part 1: Identification and description. British Standards Institution.
- BS EN ISO 22282-1 : 2012 Geotechnical investigation and testing. Geohydraulic testing Part1: General Rules
- BS EN ISO 22282-2 : 2012 Geotechnical investigation and testing. Geohydraulic testing Part 2: Water Permeability Tests in a borehole using open systems
- BS EN ISO 22475-1 : 2006 : Geotechnical investigation and testing – Sampling methods and groundwater measurements – Part 1: Technical principals for execution (July 2011 reprint). British Standards Institution.
- BS EN ISO 22476-3 : 2005 : Geotechnical investigation and testing – Field Testing – Part 3: Standard penetration test

6 LICENCES

British Geological Survey Reproduction Licence Number: IPR/187-68CF CO8/053-CSL

Ordnance Survey Reproduction Licence Number. 100035365

DRAWINGS

3318(C3)D001-1 Site Location Plan

3318(C3)D002-1 Exploratory Hole Location Plan

Site Location Plan

TerraConsult



Address:
East Anglia

Notes:

AGS
Issue: FINAL
Scale: 1:25000

Project: East Anglia (North) Offshore Wind Farm
Project No: 3318
Client: GHD Ltd

Drawing No:
3318(C3)D001-1

Exploratory Hole Location Plan



Legend Key
Locations By Type - CP

AGS
Issue: FINAL
Scale: 1:3000

Project: East Anglia (North) Offshore Wind Farm
Project No: 3318
Client: GHD Ltd

Drawing No:
3318(C3)D002-1

APPENDICES

APPENDIX A Exploratory Hole Records

APPENDIX B Photographs

APPENDIX C Instrumentation Sampling and Monitoring Records

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APPENDIX E Geoenvironmental Laboratory Test Results

APPENDIX F Calibration Certificates

APPENDIX A

Exploratory Hole Records

Key sheet

Boreholes

Exploratory Hole Key Sheet

SAMPLES:

Undisturbed:	
U	Driven tube sample
UT	Thin wall driven tube sample
TW	Pushed thin wall tube sample
P	Pushed piston sample
L	Liner sample (from windowless or similar sampler), full recovery unless otherwise stated
CBR	CBR mould sample
BLK	Block sample
C	Core sample (from rotary core) taken for laboratory testing
Disturbed:	
D	Small sample
B	Bulk sample
AMAL	Amalgamated sample
Environmental:	
ES	Environmental soil sample
EW	Environmental water sample
Comments:	Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that an attempt was made to take a tube sample; however, there was no recovery. Sample recovery is given as a percentage.

TESTS:

SPT S or SPT C	Standard Penetration Test, open shoe (S) or solid cone (C)
	The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single increment) the total blow count beyond the seating drive is given (without the N = prefix).
ICBR	In situ CBR
IV	In situ vane shear strength, peak (p) and remoulded (r), kPa
HV	Hand vane shear strength, peak (p) and remoulded (r), kPa
PP	Pocket penetrometer test, converted to shear strength, kPa
KFH, KRH, KPI	Variable head permeability tests (KFH = falling head test, KRH = rising head test, KPI = packer test), permeability value
PID/FID	Photo-ionisation detector/Flame-ionisation detector
	Test results provided in Field Records column

DRILLING RECORDS:

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930: 2015 and BS EN ISO 22575-1 (2006)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented.
NI	Non intact is used where the core is fragmented.
CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER:



Groundwater strike



Groundwater level after standing period

DEPTH REMARKS:

EoS	End of Shift
SoS	Start of Shift
EoBH	End of Borehole

INSTRUMENTATION:

Details of installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill. The type of instrument installed is indicated by a code adjacent to the Legend column at the base of the instrument.

SP	Standpipe
SPIE	Standpipe piezometer
PPIE	Pneumatic piezometer
EPIE	Electronic piezometer
HPIE	Hydraulic piezometer
GMP	Gas monitoring standpipe
(xx)	Internal diameter
ICE	Biaxial inclinometer
ICM	Inclinometer tubing for use with probe
SLIP	Slip indicator
ESET	Electronic settlement cell/gauge
ETM	Magnetic extensometer settlement point
ETR	Rod extensometer

EXPLORATORY HOLE TYPE:

CP	Cable percussion
DP	Dynamic probe
DCP	Dynamic cone penetrometer
HA	Hand auger
IP	Inspection pit
OP	Observation pit/trench
PC	Pavement core
RC	Rotary core
RO	Rotary open hole
SH	Shaft
SNC	Sonic (resonance)
TP	Trial pit/trench
TRAV	Traverse
WLS	Windowless (dynamic) sample
WS	Window (dynamic) sample



Project: **East Anglia (North) Offshore Wind Farm**
 Project No: **3318**
 Client: **GHD Ltd**

Reference

KEY SHEET

Borehole Log

Borehole formation details:

Type: IP CP	From: 0.00	To: 1.00 16.50	Start date: 08-08-17	End date: 08-08-17 09-08-17	Crew: TM TM	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 08-08-17 09-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 4 E(r)% 74
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Location details:

mE:	604035.95
mN:	317597.72
mAOD:	17.53
Grid:	OSGB

Backfill/ Instaln	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			17.33	0.20	Firm dark brown slightly sandy CLAY. Frequent rootlets. (TOPSOIL)			0.50	D1	
					Medium dense light yellowish brown very sandy slightly silty subangular to rounded fine to coarse GRAVEL of chalk and flint. (ALLUVIUM)			0.50 0.50 - 1.00	ES1 B1	
								1.00 1.00	D2 ES2	
						Dry		1.50 1.50 1.50 - 1.95	C ES3 B2	N=13 (2,3/3,3,3,4)
								2.00 2.00	D3 ES4	
								3.00 3.00 - 3.45	D4 B3	
						Dry	3.00	3.50	C	N=15 (3,3/3,4,4,4)
								4.50 4.50 - 4.95	C B4	N=9 (1,2/2,3,2,2)
				(9.90)				6.00 6.00 - 6.45	C D5	N=11 (2,3/2,3,3,3)
								7.50 7.50 - 7.95	C D6	N=19 (2,2/3,4,5,7)
						Dry	9.00	9.00 - 9.45	C B5	N=14 (1,2/2,3,4,5)
								10.00 - 10.45	D7	

Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: Rose to: Casing: Sealed: 1.00 0.80	Dia (mm): Depth: Casing: 200 7.50 7.50 150 16.50 16.50	From: To: Remarks:	From: to: Duration: Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: FINAL Scale: 1:50	Project: East Anglia (North) Offshore Wind Farm Project No: 3318 Client: GHD Ltd	Exploratory position reference: <h1>BH17-C3-01</h1> Sheet 1 of 2
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Borehole Log

Borehole formation details:

Type: IP CP	From: 0.00	To: 1.00 16.50	Start date: 08-08-17 08-08-17	End date: 08-08-17 09-08-17	Crew: TM TM	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 08-08-17 09-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 4 E(r)% 74
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Location details:

mE:	604035.95
mN:	317597.72
mAOD:	17.53
Grid:	OSGB

Backfill/ Instaln	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			7.43	10.10	Medium dense light yellowish brown very sandy slightly silty subangular to rounded fine to coarse GRAVEL of chalk and flint. (ALLUVIUM)					
					Medium dense light brownish grey very silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of flint and chalk. (ALLUVIUM)	Dry	10.50	10.50	S	N=23 (3,4/4,5,6,8)
			(3.90)			Dry	12.00	12.00 12.00 - 12.45	S D8	N=14 (2,3/3,3,4,4)
						Dry	13.50	13.50 13.50 - 13.95	S D9	N=21 (1,2/2,4,6,9)
			3.53	14.00	Medium dense light yellowish brown very silty very sandy subangular to rounded fine to coarse GRAVEL of chalk and flint. (ALLUVIUM)					
		SP		(2.50)		Dry	15.00	15.00 15.00 - 15.45	C D10	N=17 (1,0/1,3,5,8)
			1.03	16.50	Borehole ends at 16.50m (Blowing sands)					

Inst	Water	Casing	Depth	Type & No	Results
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Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: Rose to: Casing: Sealed:	Dia (mm): Depth: Casing:	From: To: Remarks:	From: to: Duration: Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: FINAL Scale: 1:50	Project: East Anglia (North) Offshore Wind Farm Project No: 3318 Client: GHD Ltd	Exploratory position reference: <h1>BH17-C3-01</h1> Sheet 2 of 2
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Borehole Log

Borehole formation details:												Location details:			
Type: IP CP	From: 0.00	To: 1.20 17.00	Start date: 04-08-17	End date: 04-08-17 07-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 04-08-17 07-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 8 E(r)% 73	mE: 604062.91	mN: 317610.41	mAOD: 16.84	Grid: OSGB

Backfill/ Instain	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing						
						Water	Casing	Depth	Type & No	Results/Remarks		
	▼		16.69	0.15	Firm dark brown slightly sandy CLAY. Occasional rootlets. (TOPSOIL)			0.50	D1			
					Very soft dark brown pseduofibrous PEAT. (ALLUVIUM)			0.50	ES1			
					(1.55)					0.60 - 0.80	B1	
										1.00	D2	
								Dry		1.00	ES2	
					15.14	1.70	Loose light brownish grey very silty fine to coarse SAND. (ALLUVIUM)			1.50	C	N=4 (1,0/0,1,1,2)
										1.50	ES3	
										1.50 - 1.95	B2	
										2.00	ES4	
					14.64	2.20	Dark greyish brown slightly silty fine to coarse SAND and angular to subrounded fine to coarse GRAVEL of flint. (ALLUVIUM)			2.30	D3	
		14.04	2.80	Medium dense light yellowish brown silty very sandy subangular to rounded fine to coarse GRAVEL of chalk and flint. (ALLUVIUM)			3.00 - 3.45	B3				
					Dry	3.00	3.50	C	N=13 (1,2/3,3,3,4)			
					Dry	4.50	4.50	C	N=17 (1,1/2,3,5,7)			
					Dry	6.00	6.00	C	N=28 (2,3/5,7,8,8)			
					Dry	7.50	7.50	C	N=25 (1,3/4,6,7,8)			
					Dry	9.00	9.00	C	N=16 (1,2/4,3,4,5)			
		9.04	7.80	Medium dense light brownish grey very silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of flint and chalk. (ALLUVIUM)			9.00	D4				
					Dry	9.00	9.00 - 9.45	C				

Groundwater entries:		Diameter & casing:		Depth related remarks:		Chiselling details:	
Struck: 2.20	Rose to: 0.67	Casing: 2.00	Sealed:	Dia (mm): 200	Depth: 7.50	Casing: 7.50	Remarks:
				150	17.00	17.00	
Project: East Anglia (North) Offshore Wind Farm				Exploratory position reference:			
Project No: 3318				BH17-C3-02			
Client: GHD Ltd							
Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.				Sheet 1 of 2			
Log issue: FINAL							
Scale: 1:50							

Borehole Log

Borehole formation details:												Location details:			
Type: IP CP	From: 0.00	To: 1.20 17.00	Start date: 04-08-17	End date: 04-08-17 07-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 04-08-17 07-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 8 E(r)% 73	mE: 604062.91	mN: 317610.41	mAOD: 16.84	Grid: OSGB

Backfill/ Instaln	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
				(6.80)	Medium dense light brownish grey very silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of flint and chalk. (ALLUVIUM)	Dry	10.50	10.50 10.50 - 10.95	C D5	N=14 (2,2/2,3,4,5)
						Dry	12.00	12.00 12.00 - 12.45 12.00 - 13.00	S D6 B7	N=13 (1,2/2,3,3,5)
						Dry	13.50	13.50 13.50 - 13.95	S D7	N=18 (2,3/3,4,5,6)
			2.24	14.60	Medium dense light yellowish brown silty very sandy subangular to rounded fine to coarse GRAVEL of chalk and flint. (ALLUVIUM)	Dry	15.00	15.00 15.00	C B8	N=26 (2,2/4,5,7,10)
				(2.40)						
			-0.16	17.00	Borehole ends at 17.00m (Blowing sands)					

Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: Rose to: Casing: Sealed:	Dia (mm): Depth: Casing:	From: To: Remarks:	From: to: Duration: Tool:

<p>Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.</p> <p>Log issue: FINAL</p> <p>Scale: 1:50</p>	<p>Project: East Anglia (North) Offshore Wind Farm</p> <p>Project No: 3318</p> <p>Client: GHD Ltd</p>	<p>Exploratory position reference:</p> <h2>BH17-C3-02</h2> <p>Sheet 2 of 2</p>
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Borehole Log

Borehole formation details:

Type: IP CP	From: 0.00	To: 1.20 20.00	Start date: 09-08-17	End date: 09-08-17 11-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 09-08-17 11-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 8 E(r)% 73
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Location details:

mE:	604265.31
mN:	317755.75
mAOD:	23.57
Grid:	OSGB

Backfill/ Instaln	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			23.27	(0.30) 0.30	Dark orangish brown slightly silty gravelly clayey fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. Frequent rootlets and plant matter. (ALLUVIUM)			0.50 0.50 0.50 - 1.00	D1 ES1 B1	
			22.57	(0.70) 1.00	Dark orangish brown gravelly slightly clayey fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)			1.00 1.00	D2 ES2	
				(1.80)	Medium dense dark orangish brown slightly silty gravelly fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)	Dry		1.50 1.50 1.50 - 1.95	C ES3 B2	N=24 (1,2/4,5,6,9)
			20.77	2.80	Very dense dark orangish brown sandy slightly silty GRAVEL. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)			3.00 - 3.45	B3	
				(1.40)		Dry	3.00	3.50	C	50 (2,4/50 for 245mm)
			19.37	4.20	Dense dark orangish brown slightly silty gravelly fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)	Dry	4.50	4.50 4.50 - 4.95	C B4	N=41 (1,3/6,8,12,15)
				(4.90)		Dry	6.00	6.00 6.00 - 6.45	C B5	N=40 (2,5/8,9,11,12)
					7.20 - 9.10 m: Becomes slightly gravelly	Dry	7.50	7.50 7.50 - 7.95	S D4	N=11 (1,2/2,2,3,4)
			14.47	9.10	Firm to stiff dark brownish grey slightly sandy gravelly CLAY. Gravel of subangular to subrounded fine to coarse chalk and occasional flint. Rare dark orangish brown staining. (ALLUVIUM)	Dry	9.00	9.00 9.00 - 9.45	C B6	N=23 (1,3/4,5,7,7)

Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: Rose to: Casing: Sealed: 7.20 6.76 7.20	Dia (mm): Depth: Casing: 200 6.20 6.20 150 9.50 9.50	From: To: Remarks:	From: to: Duration: Tool:

<p>Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.</p> <p>Log issue: FINAL</p> <p>Scale: 1:50</p>	<p>Project: East Anglia (North) Offshore Wind Farm</p> <p>Project No: 3318</p> <p>Client: GHD Ltd</p>	<p>Exploratory position reference:</p> <h1>BH17-C3-03</h1> <p>Sheet 1 of 2</p>
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Borehole Log

Borehole formation details:

Type: IP CP	From: 0.00	To: 1.20 20.00	Start date: 09-08-17	End date: 09-08-17 11-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 09-08-17 11-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 8 E(r)% 73
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Location details:

mE:	604265.31
mN:	317755.75
mAOD:	23.57
Grid:	OSGB

Backfill/ Instaln	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
				(3.40)	Firm to stiff dark brownish grey slightly sandy gravelly CLAY. Gravel of subangular to subrounded fine to coarse chalk and occasional flint. Rare dark orangish brown staining. (ALLUVIUM)			10.50 - 10.95	U1	80 (80%)
								11.00	D5	
			11.07	12.50	Firm to stiff dark grey slightly sandy gravelly CLAY. Gravel of subangular to subrounded fine to coarse chalk and occasional flint. Rare dark orangish brown staining. (ALLUVIUM) <i>12.50 m: Occasionally mottle dark brownish grey</i>	Dry	9.50	12.00 12.00 - 12.45	S D6	N=27 (2,5/5,7,7,8)
								13.50 - 13.95	U2	90 (60%)
								14.00	D7	
								15.00 15.00 - 15.45	S D8	50 (2,7/50 for 275mm)
				(7.50)	<i>15.00 - 20.00 m: Becomes stiff to very stiff</i>	Dry	9.50	16.50 - 16.95	U3	100 (60%)
								17.00	D9	
								18.00 18.00 - 18.45	S D10	50 (9,6/50 for 290mm)
								19.50 - 19.95	U4	100 (100%)
			3.57	20.00	Borehole ends at 20.00m (Target depth)					
						Water	Casing	20.00 Depth	B7 Type & No	Results

Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: Rose to: Casing: Sealed:	Dia (mm): Depth: Casing:	From: To: Remarks:	From: to: Duration: Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: FINAL Scale: 1:50	Project: East Anglia (North) Offshore Wind Farm Project No: 3318 Client: GHD Ltd	Exploratory position reference: <h1>BH17-C3-03</h1> Sheet 2 of 2
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Borehole Log

Borehole formation details:

Type: IP CP	From: 0.00	To: 1.20 17.10	Start date: 11-08-17 14-08-17	End date: 11-08-17 14-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 11-08-17 14-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 8 E(r)% 73	Location details:	
											mE:	604294.24	
											mN:	317784.53	
											mAOD:	22.33	
											Grid:	OSGB	

Backfill/Instaln	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			22.03	(0.30) 0.30	Dark orangish brown gravelly slightly silty clayey fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. Frequent rootlets. (ALLUVIUM)					
			21.63	(0.40) 0.70	Dark orangish brown gravelly slightly clayey fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)			0.50 0.50 0.60 - 0.80	D1 ES1 B1	
					Dense dark orangish brown very sandy slightly silty GRAVEL. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)			1.00 1.00	D2 ES2	
						Dry	1.50	1.50 1.50 1.50 - 1.95 2.00	C ES3 B2 ES4	N=37 (2,5/6,8,11,12)
						Dry	3.00	3.00 3.00 - 3.45	C B3	N=20 (1,3/3,4,6,7)
					3.20 - 4.10 m: Becomes slightly gravelly					
				(6.80)		Dry	4.50	4.50 4.50 - 4.95	C B4	N=46 (3,6/9,11,12,14)
						Dry	6.00	6.00 6.00 - 6.45	C B5	N=30 (2,4/5,7,8,10)
			14.83	7.50	Medium dense orange brown slightly gravelly slightly silty fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)	Dry	7.40	7.50 7.50 - 7.95	C B6	N=11 (3,2/3,2,3,3)
						Dry	9.00	9.00 9.00 - 9.45	C B7	N=12 (2,3/3,2,3,4)

Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: 9.10 Rose to: 7.19 Casing: 9.10 Sealed: 9.10	Dia (mm): 200 Depth: 6.00 Casing: 6.00	From: To: Remarks:	From: to: Duration: Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: FINAL Scale: 1:50	Project: East Anglia (North) Offshore Wind Farm Project No: 3318 Client: GHD Ltd	Exploratory position reference: <h1>BH17-C3-04</h1> Sheet 1 of 2
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Borehole Log

Borehole formation details:

Type: IP CP	From: 0.00	To: 1.20 17.10	Start date: 11-08-17 14-08-17	End date: 11-08-17 14-08-17	Crew: GB GB	Plant: Hand tools Dando 2000	Barrel type: n/a n/a	Drill Bit: n/a n/a	Logged: 11-08-17 14-08-17	Logger: VS VS	Remarks: SPT hammer ID: SI 8 E(r)% 73
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Location details:

mE:	604294.24
mN:	317784.53
mAOD:	22.33
Grid:	OSGB

Backfill/Instaln	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
				(7.30)	Medium dense orange brown slightly gravelly slightly silty fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. (ALLUVIUM)	Dry	10.50	10.50 10.50 - 10.95	C B8	N=14 (2,2/3,4,4,3)
						Dry	12.00	12.00 12.00 - 12.45	C B9	N=12 (1,2/2,3,3,4)
						Dry	13.50	13.50 13.50 - 13.95	C B10	N=14 (2,2/3,3,4,4)
			7.53	14.80	Medium dense dark orangish brown gravelly slightly silty fine to coarse SAND. Gravel of subangular to subrounded fine to coarse flint. Occasional cobbles of subangular to subrounded flint. (ALLUVIUM)	Dry	15.00	15.00 15.00	C B11	N=20 (2,3/4,4,6,6)
				(2.30)		Dry	16.50	16.50 16.50 - 16.95	C B12	N=35 (4,6/7,9,9,10)
			5.23	17.10	Borehole ends at 17.10m (Blowing sands)					

Inst	Water	Casing	Depth	Type & No	Results
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Groundwater entries:	Diameter & casing:	Depth related remarks:	Chiselling details:
Struck: Rose to: Casing: Sealed:	Dia (mm): Depth: Casing:	From: To: Remarks:	From: to: Duration: Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: FINAL Scale: 1:50	Project: East Anglia (North) Offshore Wind Farm Project No: 3318 Client: GHD Ltd	Exploratory position reference: <h2 style="text-align: center;">BH17-C3-04</h2>
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APPENDIX B

Photographs

BH17-C3-01

None taken

BH17-C3-02

None taken

BH17-C3-03



1.00 m



9.10 m

BH17-C3-04



0.50 m



2.00 m



16.50 m

APPENDIX C

Instrumentation Sampling and Monitoring Records



No: 3318

GROUNDWATER AND GROUND GAS MONITORING

Site: East Anglia OWF

GROUND GAS AND GROUNDWATER MONITORING DATA

Location	Date	Monitored by	Well Details		Groundwater					Gas										Weather			
			Standpipe diameter (mm)	Depth to Base (m bgl)	Water Depth (m bgl)	Water Sample Taken?	Water Temp °C	Odour	Colour	Atmospheric Pressure (mbar)	Atmospheric Pressure Comment	Relative Pressure (Pa)	Flow (l/h)	CH ₄ (% v/v)	GSV CH ₄ (l/hr)	CO ₂ (% v/v)	GSV CO ₂ (l/hr)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)	VOC (ppm)	Conditions	Ambient Temp °C
BH17-C3-01	22/08/17	VS	51	14.80	1.16	Y				1017	NM	0.0	0.0	0.0	0.0000	0.4	0.0000	18.5	0	0	NM	Sunny, dry	21
	31/08/17	VS	51	14.05	1.13	N				1015	NM	0.0	0.0	0.0	0.0000	1.2	0.0000	18.0	0	0	NM	Sunny, dry	19
	14/09/17	VS	51	13.30	1.08	N				1002	NM	0.0	0.0	0.0	0.0000	0.3	0.0000	20.3	0	0	NM	Showers	15
BH17-C3-03	22/08/17	VS	51	9.05	5.73	Y				1018	NM	0.0	0.0	0.0	0.0000	0.2	0.0000	18.6	0	0	NM	Sunny, dry	21
	31/08/17	VS	51	8.87	5.76	N				1013	NM	0.0	0.0	0.0	0.0000	0.3	0.0000	18.7	0	0	NM	Sunny, dry	19
	14/09/17	VS	51	8.75	5.76	N				997	NM	0.0	0.0	0.0	0.0000	0.1	0.0000	19.5	0	0	NM	Showers	15

NOTES:
 NM = Not Measured.
 (x) = Peak value recorded.
 [grey] = Below detection limit.

GSV (l/HR) = [gas concentration (%v/v)] x [gas well flow rate (l/hr)]

APPENDIX D

Geotechnical Laboratory Test Results

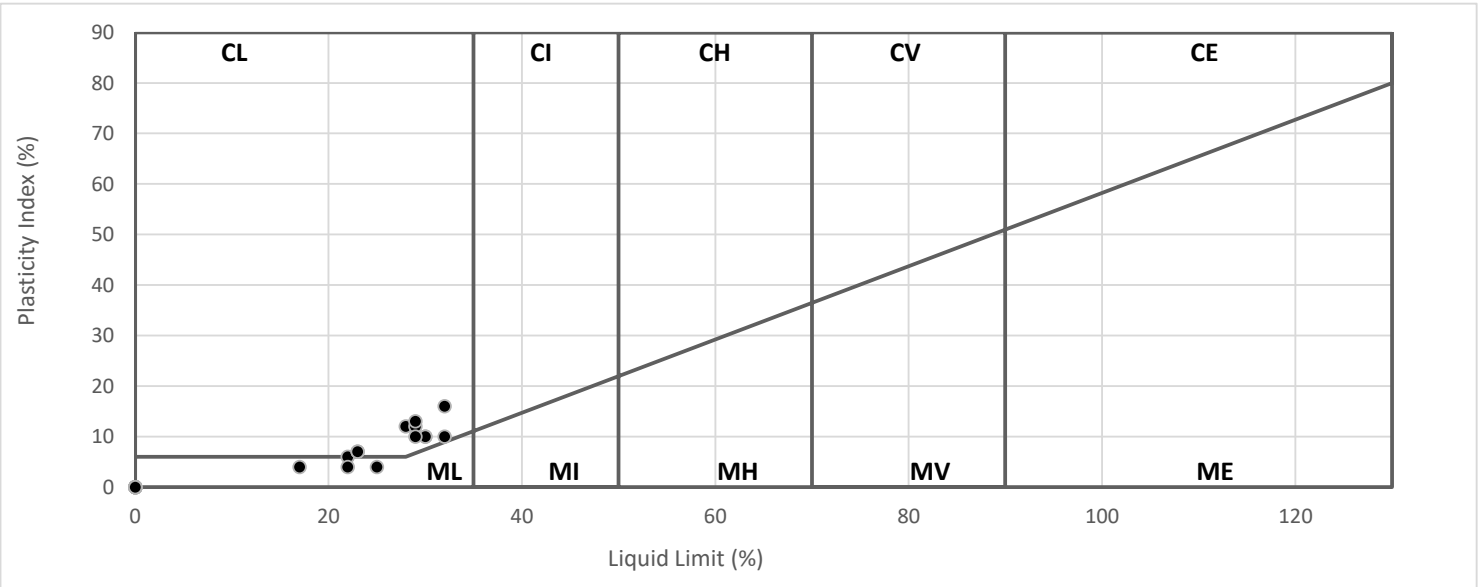
Report References: GSTL 35625
 CLS 684646

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)

Contract Number	36525
Site Name	E Anglia Wind Farm - Cable Route

Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing .425mm %	Remarks
				-							
BH17-C3-03	6	B	9.00	-	9.45	20	22	16	6	80	M/CL Low Plasticity
BH17-C4-03	2	D	1.00	-	-	24	29	17	12	100	CL Low Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	20/09/2017	Sean Penn
DB	Approved	21/09/2017	Ben Sharp

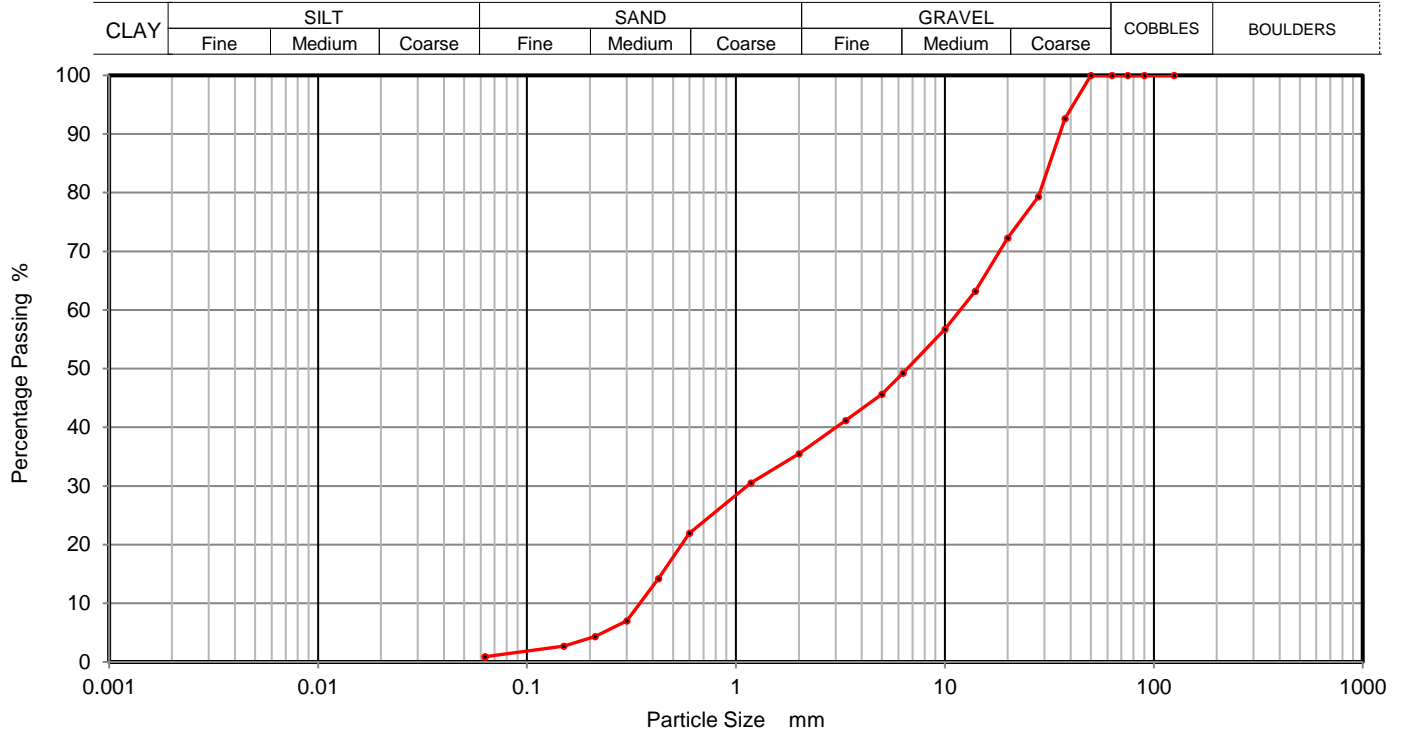




**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	36525
Borehole/Pit No.	BH17-C3-01
Sample No.	3
Depth Top	3.00
Depth Base	3.45
Sample Type	B

Site Name	E Anglia Wind Farm - Cable Route
Soil Description	Brown slightly silty fine to coarse sandy fine to coarse GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	93		
28	79		
20	72		
14	63		
10	57		
6.3	49		
5	46		
3.35	41		
2	35		
1.18	31		
0.6	22		
0.425	14		
0.3	7		
0.212	4		
0.15	3		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	34
Silt and Clay	1

Grading Analysis	
Uniformity Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	20/09/2017	Sean Penn
RO/MH	Approved	21/09/2017	Ben Sharp

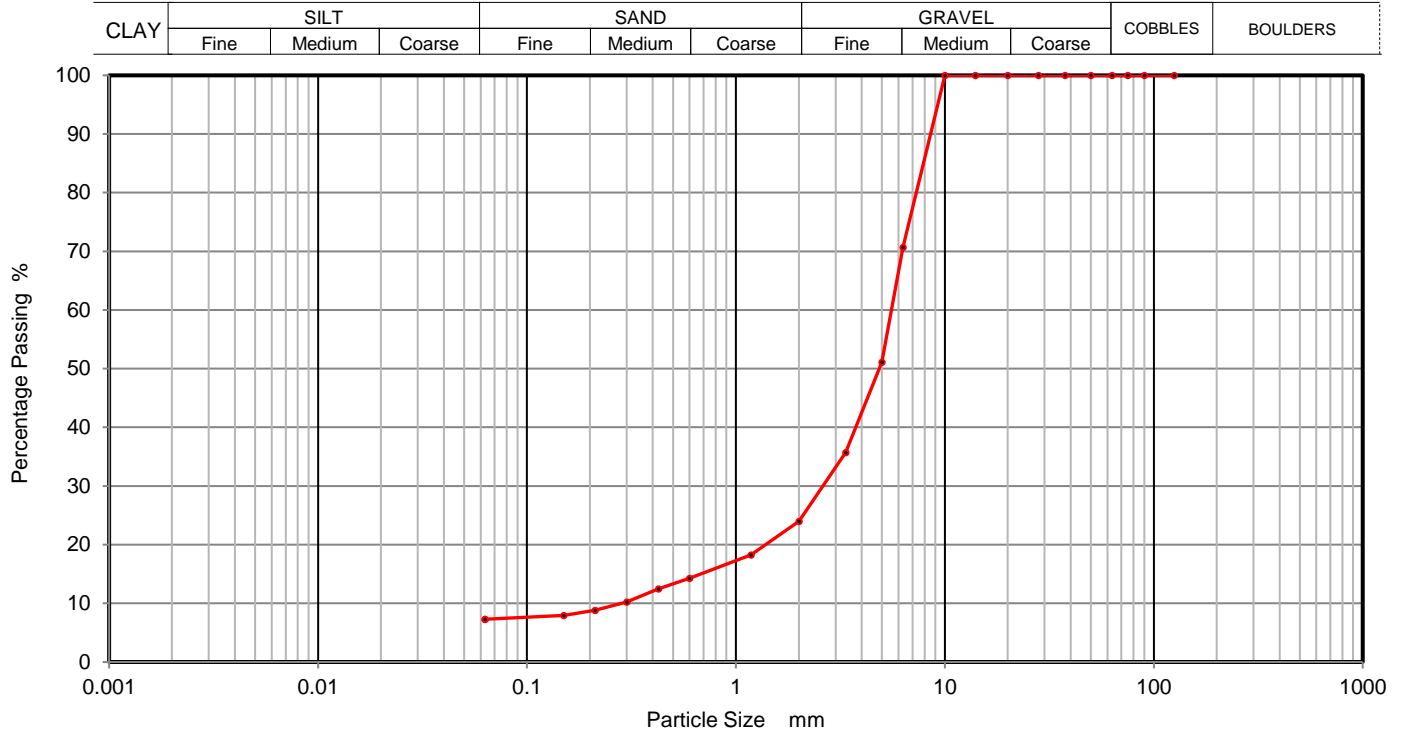




**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	36525
Borehole/Pit No.	BH17-C3-02
Sample No.	2
Depth Top	1.00
Depth Base	
Sample Type	D

Site Name	E Anglia Wind Farm - Cable Route
Soil Description	Black slightly silty fine to coarse sandy fine to medium GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	71		
5	51		
3.35	36		
2	24		
1.18	18		
0.6	14		
0.425	12		
0.3	10		
0.212	9		
0.15	8		
0.063	7		

Sample Proportions	% dry mass
Cobbles	0
Gravel	76
Sand	17
Silt and Clay	7

Grading Analysis	
Uniformity Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	20/09/2017	Sean Penn
RO/MH	Approved	21/09/2017	Ben Sharp

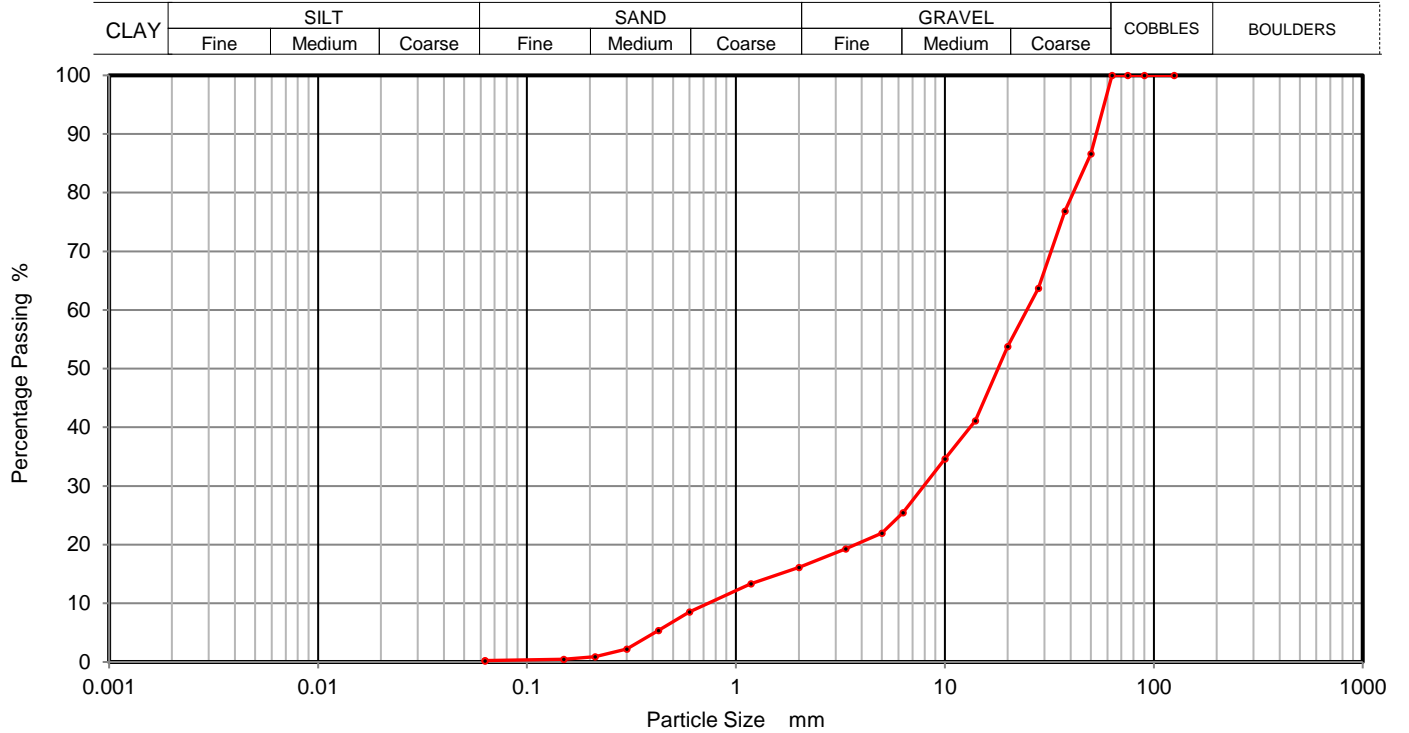




**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	36525
Borehole/Pit No.	BH17-C3-03
Sample No.	3
Depth Top	3.00
Depth Base	3.45
Sample Type	B

Site Name	E Anglia Wind Farm - Cable Route
Soil Description	Brown fine to coarse sandy fine to coarse GRAVEL



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	87		
37.5	77		
28	64		
20	54		
14	41		
10	35		
6.3	25		
5	22		
3.35	19		
2	16		
1.18	13		
0.6	9		
0.425	5		
0.3	2		
0.212	1		
0.15	0		
0.063	0		

Sample Proportions	% dry mass
Cobbles	0
Gravel	84
Sand	16
Silt and Clay	0

Grading Analysis	
Uniformity Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	20/09/2017	Sean Penn
RO/MH	Approved	21/09/2017	Ben Sharp

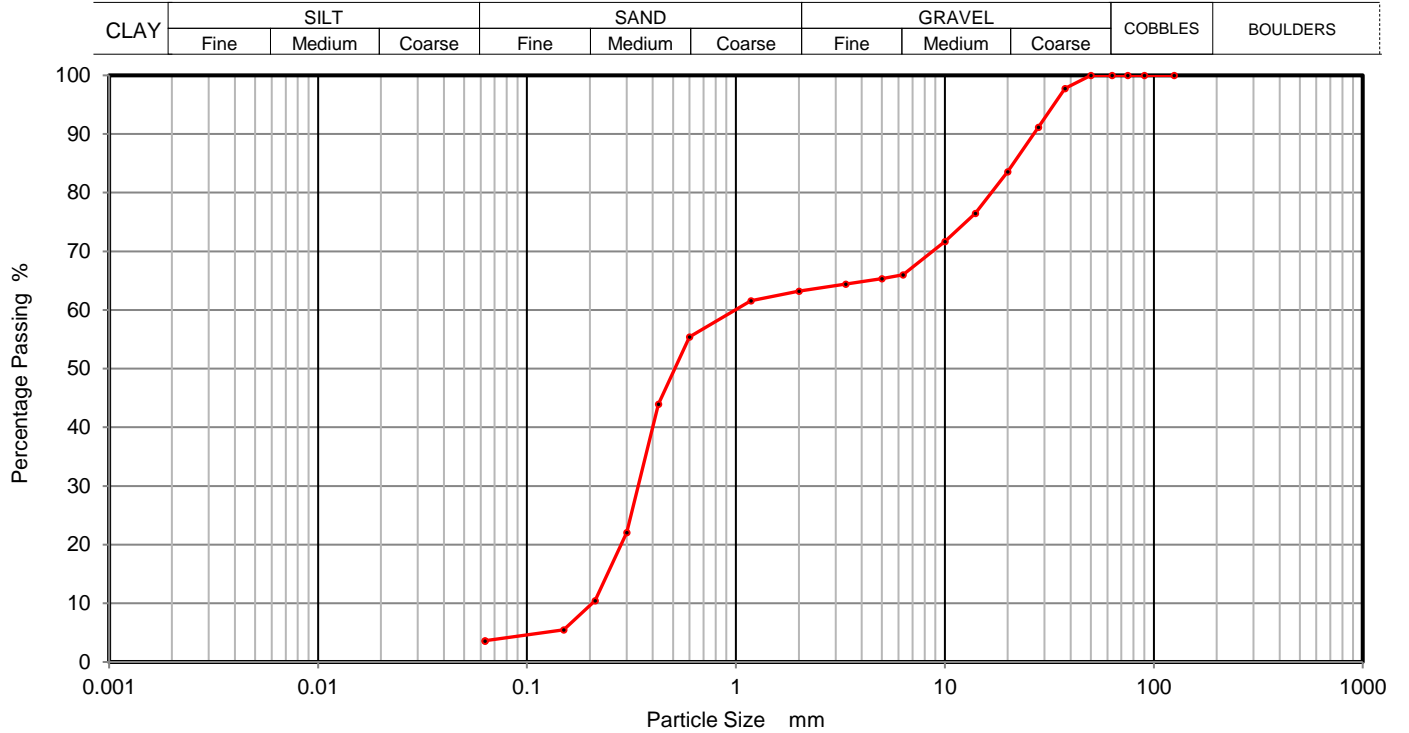




**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number	36525
Borehole/Pit No.	BH17-C3-04
Sample No.	2
Depth Top	1.50
Depth Base	1.95
Sample Type	B

Site Name	E Anglia Wind Farm - Cable Route
Soil Description	Brown slightly silty fine to coarse gravelly fine to coarse SAND



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	
90	100	0.0060	
75	100	0.0019	
63	100		
50	100		
37.5	98		
28	91		
20	84		
14	76		
10	72		
6.3	66		
5	65		
3.35	64		
2	63		
1.18	62		
0.6	55		
0.425	44		
0.3	22		
0.212	10		
0.15	5		
0.063	4		

Sample Proportions	% dry mass
Cobbles	0
Gravel	37
Sand	59
Silt and Clay	4

Grading Analysis	
Uniformity Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	20/09/2017	Sean Penn
RO/MH	Approved	21/09/2017	Ben Sharp





ONE DIMENSIONAL CONSOLIDATION TEST
BS1377:Part 5:1990, clause 3

Contract Number

36525

Borehole/Trialpit No.

BH17-C3-03

Site Name

E Anglia Wind Farm - Cable Route

Sample No.

1

Soil Description

Grey slightly sandy fine gravelly silty CLAY

Depth Top (m)

10.50

Depth Base (m)

10.95

Lab Temperature

20°C

Sample Location

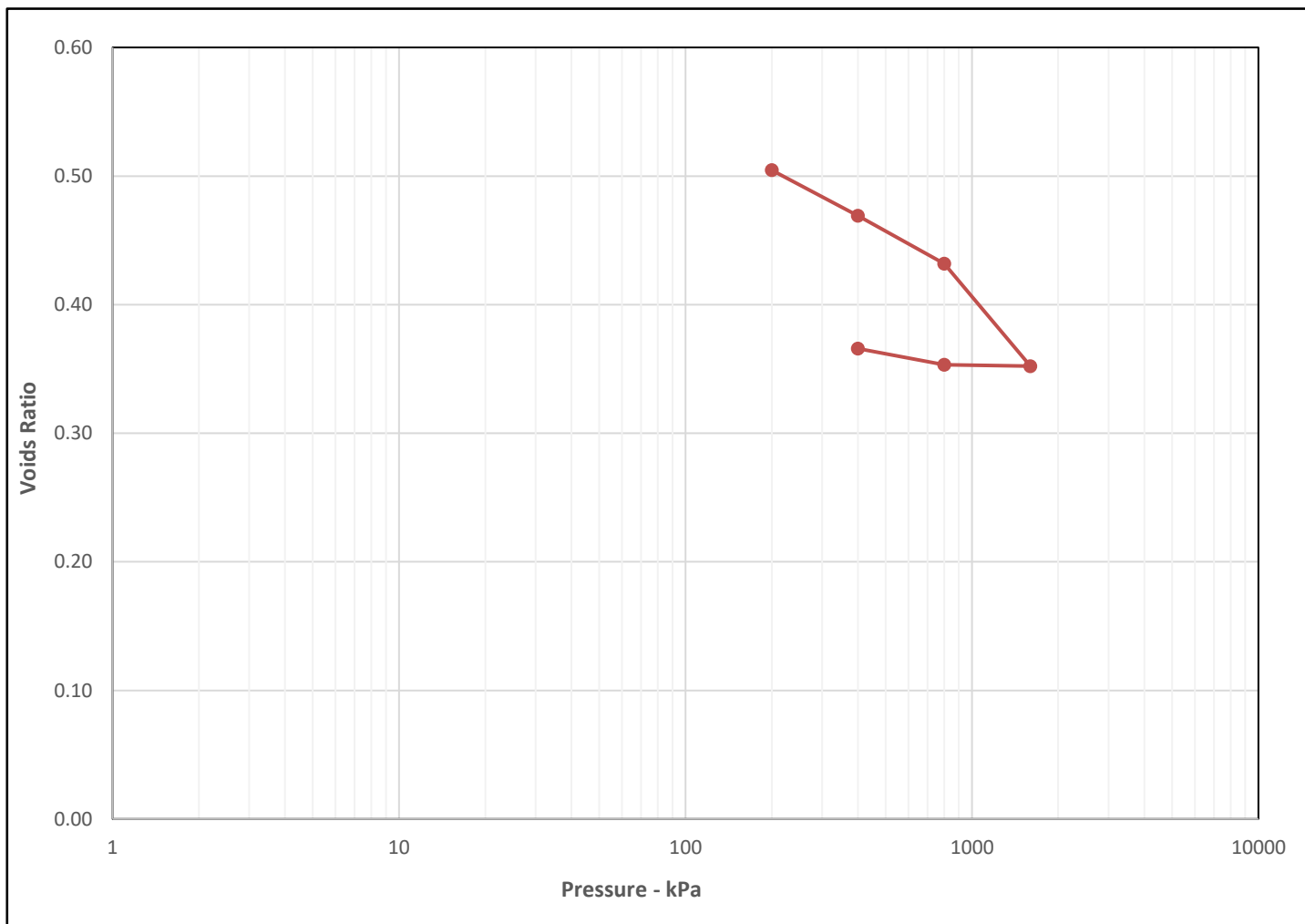
Middle

Remarks

Cv Calculated Using T90

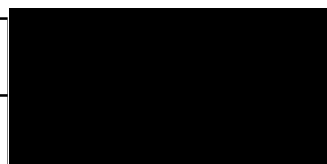
Sample Type

U



Initial Sample Conditions		Pressure Range			Mv m2/MN	Cv m2/yr	Pressure Range			Mv m2/MN	Cv m2/yr
Moisture Content (%)	18	0	-	200	0.18	13		-			
Bulk Density (Mg/m3)	2.00	200	-	400	0.12	7.7		-			
Dry Density (Mg/m3)	1.70	400	-	800	0.064	5.8		-			
Voids Ratio	0.5609	800	-	1600	0.1	6.1		-			
Degree of saturation	83.9	1600	-	800	0.001	7.6		-			
Height (mm)	19.82	800	-	400	0.023	8.2		-			
Diameter (mm)	75.01		-					-			
Particle Density (Mg/m3)	2.65		-					-			

Operators	Checked	20/09/2017	Sean Penn
LG	Approved	21/09/2017	Ben Sharp

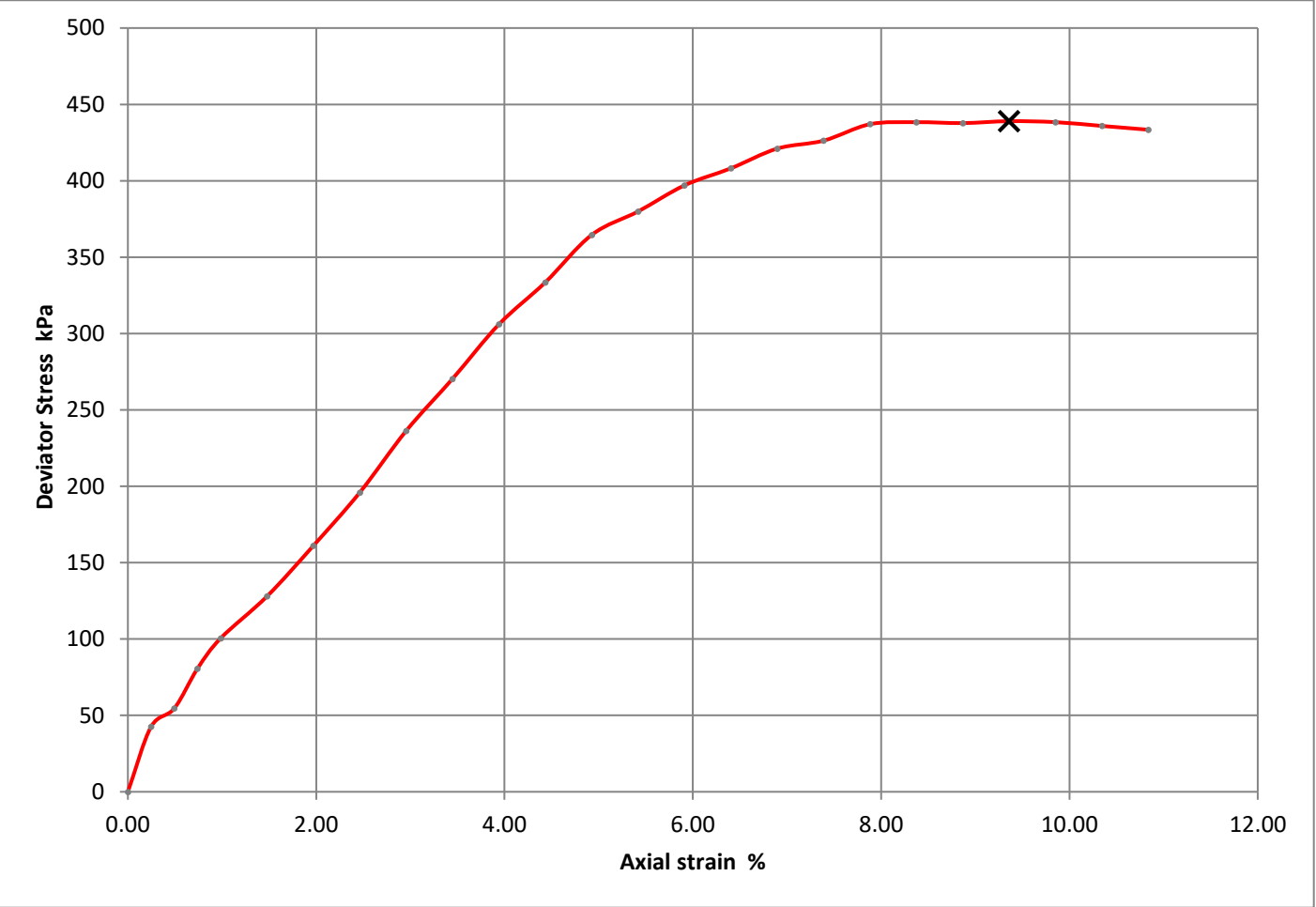




Single Stage Unconsolidated-Undrained Triaxial Test
BS 1377 : 1990 Part 7 : 8

Contract Number	36525
Borehole/Pit No.	BH17-C3-03
Sample No.	3
Depth Top (m)	16.50
Depth Base (m)	16.95
Sample Type	U

Site Name	E Anglia Wind Farm - Cable Route
Soil Description	Green/brown silty CLAY



Moisture Content (%)	19
Bulk Density (Mg/m ³)	2.23
Dry Density (Mg/m ³)	1.88
Specimen Length (mm)	203
Specimen Diameter (mm)	102
Cell Pressure (kPa)	300
Deviator Stress (kPa)	439
Undrained Shear Strength (kPa)	220
Failure Strain (%)	9.4
Mode Of Failure	Plastic
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	3.00

Specimen Post Test	Sample Split
PICTURE NOT AVAILABLE	PICTURE NOT AVAILABLE

Checked	20/09/2017	Sean Penn
Approved	21/09/2017	Paul Evans





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Braintree
Essex
CM7 2RT
Tel : 01376 560120
Fax : 01376 552923

Report Number: Supplement 1C to Report Number
684646-1

Date of Report: 23-Oct-2017

Customer: TerraConsult (South) Limited
Suite F17 Dugard House
Peartree Road
Colchester
Essex
CO3 0UL

Customer Contact: Victoria Smith

Customer Job Reference:

Customer Site Reference: Happisburgh/East Anglia

Date Job Received at Concept: 05-Sep-2017

Date Analysis Started: 26-Sep-2017

Date Analysis Completed: 29-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

Report checked
and authorised by :
Chelsea Entwistle
Senior Customer Service
Advisor

Issued by :
Aislinn Arthey
Customer Service Advis

Concept Reference: 684646 Project Site: Happisburgh/East Anglia Customer Reference:					
Soil Analysed as Soil BRE SD1 (SE)					
Concept Reference					684646 005
Customer Sample Reference					BH17-C3-02 D2 @ 1.00m
Date Sampled					Deviating
Matrix Class					Other
Determinand	Method	Test Sample	LOD	Units	
(Water soluble) Ammonia expressed as NH4	T710	AR	0.01	g/l	<0.01
(Water soluble) Cl-	T710	A40	0.01	g/l	0.01
Magnesium	T112	A40	1	mg/l	15
(Water soluble) NO3	T710	A40	0.01	g/l	<0.01
pH	T7	A40			5.7
(Water Soluble) SO4 expressed as SO4	T242	A40	0.01	g/l	1.1
SO4(Total)	T102	A40	0.02	%	1.6
Sulphur (total)	T6	A40	0.01	%	0.99
Moisture @ 105C	T162	AR	0.1	%	76
Retained on 2mm	T2	A40	0.1	%	0.3

Index to symbols used in Supplement 1C to Report Number 684646-1

Value	Description
A40	Assisted dried < 40C
AR	As Received
M	Analysis is MCERTS accredited
N	Analysis is not UKAS accredited

Notes

Supplement 1C Report reissued to include only sample 005
Retained on 2mm is removed before analysis
The date of sampling has not been provided and therefore the time from sampling to analysis is unknown. It is possible therefore that the results provided may be compromised

Method Index

Value	Description
T162	Grav (1 Dec) (105 C)
T2	Grav
T6	ICP/OES
T112	ICP/OES (SIM)(Water Extract)
T7	Probe
T102	ICP/OES (HCl extract)
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T710	2:1 Extraction / Discrete Analyser

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
(Water soluble) Ammonia expressed as NH4	T710	AR	0.01	g/l	N	005
(Water soluble) Cl-	T710	A40	0.01	g/l	N	005
Magnesium	T112	A40	1	mg/l	N	005
(Water soluble) NO3	T710	A40	0.01	g/l	N	005
pH	T7	A40			N	005
(Water Soluble) SO4 expressed as SO4	T242	A40	0.01	g/l	N	005
SO4(Total)	T102	A40	0.02	%	N	005
Sulphur (total)	T6	A40	0.01	%	N	005
Moisture @ 105C	T162	AR	0.1	%	N	005
Retained on 2mm	T2	A40	0.1	%	N	005

APPENDIX E

Geoenvironmental Laboratory Test Results

Report References: 677813
 677853



CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of
Concept Life Sciences Analytical & Development
Services Limited registered in England and
Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

3 Crittall Drive
Springwood Industrial
Estate
Braintree
Essex
CM7 2RT
Tel : 01376 560120
Fax : 01376 552923

Report Number: Supplement 1C to Report Number
677813-1

Date of Report: 23-Oct-2017

Customer: TerraConsult Limited
Unit 34
Bold Business Centre
Bold Lane
Sutton
St Helens
WA9 4TX

Customer Contact: Mr Jimmy Thorburn

Customer Job Reference: 3318

Customer Purchase Order: PO-001839

Customer Site Reference: Norfolk Vanguard Cable Route

Date Job Received at Concept: 31-Jul-2017

Date Analysis Started: 29-Aug-2017

Date Analysis Completed: 12-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

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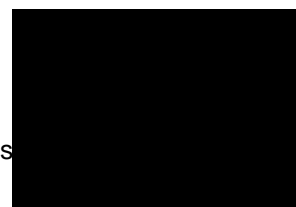
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



Report checked
and authorised by :
Chelsea Entwistle
Senior Customer Service
Advisor

Issued by :
Aislinn Arthey
Customer Service Advisor



Concept Reference: 677813										
Project Site: Norfolk Vanguard Cable Route										
Customer Reference: 3318										
Soil Analysed as Soil										
Miscellaneous										
Concept Reference			677813 002		677813 006		677813 018		677813 026	
Customer Sample Reference			BH17-C3-01 ES2 @ 1.00m		BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m		BH17-C3-04 ES2 @ 1.00m	
Date Sampled			08-AUG-2017		07-AUG-2017		10-AUG-2017		14-AUG-2017	
Matrix Class			Other		Other		Sandy Soil		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units						
Arsenic	T257	A40	2.0	mg/kg	17	10	9	31		
Barium	T257	A40	2	mg/kg	29	92	13	27		
Beryllium	T245	A40	0.5	mg/kg	<0.5	0.8	<0.5	0.7		
Boron (water-soluble)	T82	A40	1	mg/kg	<1	<1	<1	<1		
Cadmium	T257	A40	0.1	mg/kg	0.1	0.8	<0.1	0.3		
Chromium	T257	A40	0.5	mg/kg	19	14	9.5	17		
Copper	T257	A40	2	mg/kg	8	17	4	14		
Lead	T257	A40	2	mg/kg	10	8	6	12		
Mercury	T245	A40	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0		
Nickel	T257	A40	0.5	mg/kg	15	18	7.3	23		
Selenium	T257	A40	3	mg/kg	<3	<3	<3	<3		
Vanadium	T257	A40	0.1	mg/kg	44	42	22	37		
Zinc	T257	A40	2	mg/kg	33	14	19	52		
Moisture @105C	T162	AR	0.1	%	7.6	74	7.3	12		
Retained on 2mm	T2	A40	0.1	%	58.3	<0.1	31.3	27.4		

Concept Reference: 677813										
Project Site: Norfolk Vanguard Cable Route										
Customer Reference: 3318										
Soil Analysed as Soil										
Asbestos										
Concept Reference			677813 005		677813 017					
Customer Sample Reference			BH17-C3-02 ES1 @ 0.50m		BH17-C3-03 ES1 @ 0.50m					
Date Sampled			07-AUG-2017		10-AUG-2017					
Determinand	Method	Test Sample	LOD	Units						
Asbestos ID	T27	A40			Asbestos not detected	Asbestos not detected				

Concept Reference: 677813										
Project Site: Norfolk Vanguard Cable Route										
Customer Reference: 3318										
Soil Analysed as Soil										
Soil Organic Matter										
Concept Reference			677813 006		677813 018					
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m					
Date Sampled			07-AUG-2017		10-AUG-2017					
Matrix Class			Other		Sandy Soil					
Determinand	Method	Test Sample	LOD	Units						
Soil Organic Matter	T287	A40	0.1	%	43	0.3				

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
TPH CWG						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units		
Benzene	T209	AR	10	µg/kg	<10	<10
Toluene	T209	AR	10	µg/kg	<10	<10
EthylBenzene	T209	AR	10	µg/kg	<10	<10
M/P Xylene	T209	AR	10	µg/kg	<10	<10
O Xylene	T209	AR	10	µg/kg	<10	<10
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	2	<1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C10-C12 aliphatic)	T219	AR	2	mg/kg	<2	<2
TPH (C10-C12 aromatic)	T219	AR	2	mg/kg	<2	<2
TPH (C12-C16 aliphatic)	T219	AR	2	mg/kg	<2	<2
TPH (C12-C16 aromatic)	T219	AR	2	mg/kg	<2	<2
TPH (C16-C21 aliphatic)	T219	AR	2	mg/kg	<2	<2
TPH (C16-C21 aromatic)	T219	AR	2	mg/kg	<2	<2
TPH (C21-C35 aliphatic)	T219	AR	2	mg/kg	6	<2
TPH (C21-C35 aromatic)	T219	AR	2	mg/kg	18	<2
TPH (C35-C40 aliphatic)	T219	AR	2	mg/kg	<2	<2
TPH (C35-C40 aromatic)	T219	AR	2	mg/kg	<2	<2

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Organochlorine insecticides						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units		
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	<0.01	<0.01
Hexachlorobenzene	T1	AR	0.01	mg/kg	<0.01	<0.01
Heptachlor	T16	AR	0.01	mg/kg	<0.01	<0.01
Aldrin	T16	AR	0.01	mg/kg	<0.01	<0.01
Heptachlor epoxide	T16	AR	0.01	mg/kg	<0.01	<0.01
Chlordane	T16	AR	0.01	mg/kg	<0.01	<0.01
Endosulphan	T16	AR	0.01	mg/kg	<0.01	<0.01
DDE	T16	AR	0.01	mg/kg	<0.01	<0.01
Dieldrin	T16	AR	0.01	mg/kg	<0.01	<0.01
Endrin	T16	AR	0.01	mg/kg	<0.01	<0.01
DDD	T16	AR	0.01	mg/kg	<0.01	<0.01
DDT	T16	AR	0.01	mg/kg	(131) <0.01	(131) <0.01

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Organophosphorous insecticides						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units		
Dichlorvos	T16	AR	0.01	mg/kg	<0.01	<0.01
Mevinphos	T16	AR	0.01	mg/kg	<0.01	<0.01
Dimethoate	T16	AR	0.01	mg/kg	<0.01	<0.01
Diazinon	T16	AR	0.01	mg/kg	<0.01	<0.01
Pirimiphos methyl	T16	AR	0.01	mg/kg	⁽¹⁶²⁾ <0.02	⁽¹⁶²⁾ <0.02
Malathion	T16	AR	0.01	mg/kg	<0.01	<0.01
Fenitrothion	T16	AR	0.01	mg/kg	<0.01	<0.01
Parathion	T16	AR	0.01	mg/kg	<0.01	<0.01
Azinphos methyl	T16	AR	0.01	mg/kg	<0.01	<0.01

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Triazines Suite						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units		
Simazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01
Atrazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01
Propazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01
Trietazine	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01
Prometryn	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01
Terbutryn	T16	AR	0.01	mg/kg	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Urons						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units		
Chlorotoluron	T310	AR	0.01	mg/kg	<0.01	<0.01
Diuron	T310	AR	0.01	mg/kg	<0.01	<0.01
Isoproturon	T310	AR	0.01	mg/kg	<0.01	<0.01
Linuron	T310	AR	0.01	mg/kg	<0.01	<0.01
Monuron	T310	AR	0.01	mg/kg	<0.01	<0.01

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Phenoxy Acetic acid herbicides						
Concept Reference		677813 006		677813 018		
Customer Sample Reference		BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m		
Date Sampled		07-AUG-2017		10-AUG-2017		
Matrix Class		Other		Sandy Soil		
Determinand	Method	Test Sample	LOD	Units		
Mecoprop	T16	AR	0.01	mg/kg	(36) <0.02	(36) <0.02
Phenoxy Acetic acid herbicide: MCPA	T16	AR	0.01	mg/kg	(36) <0.02	(36) <0.02
Dichlorprop	T16	AR	0.01	mg/kg	(36) <0.02	(36) <0.02
Phenoxy Acetic acid herbicide: 2,4-D	T16	AR	0.01	mg/kg	(36) <0.02	(36) <0.02
Fenoprop	T16	AR	0.01	mg/kg	(36) <0.02	(36) <0.02
Phenoxy Acetic acid herbicide: 2,4,5-T	T16	AR	0.01	mg/kg	(36) <0.02	(36) <0.02

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Phenols (Speciated)						
Concept Reference		677813 006		677813 018		
Customer Sample Reference		BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m		
Date Sampled		07-AUG-2017		10-AUG-2017		
Matrix Class		Other		Sandy Soil		
Determinand	Method	Test Sample	LOD	Units		
Resorcinol	T17	AR	0.05	mg/kg	<0.05	<0.05
Catechol	T17	AR	0.05	mg/kg	<0.05	<0.05
Phenol	T17	AR	0.1	mg/kg	<0.1	<0.1
Cresols	T17	AR	0.05	mg/kg	<0.05	<0.05
Xylenols	T17	AR	0.05	mg/kg	<0.05	<0.05
Naphthols	T17	AR	0.05	mg/kg	<0.05	<0.05
Trimethyl phenol	T17	AR	0.05	mg/kg	<0.05	<0.05
Total Phenols	T17	AR	0.1	mg/kg	<0.1	<0.1

Index to symbols used in Supplement 1C to Report Number 677813-1

Value	Description
A40	Assisted dried < 40C
AR	As Received
64	Analysis was performed by an alternative technique
131	Result is outside of the scope of accreditation due to a QC Failure
162	LOD determined by matrix spike recovery
36	LOD Raised due to low Matrix spike recovery
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Urons and Triazines analysis transferred to Concept Life Sciences Cambridge
PAAH, OCP and OPP analysis transferred to Concept Life Sciences Manchester
BTEX: Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.
Retained on 2mm is removed before analysis
Asbestos subcontracted to REC Limited
Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis except OCP, OPP, Triazines, Urons and PAAH
Supplement 1C report reissued to include 002, 005, 006, 017, 018 and 026
Phenols, OCP, OPP, BTEX/MTBE: These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T245	ICP/OES (Aqua Regia Extraction)
T2	Grav
T54	GC/MS (Headspace)
T82	ICP/OES (Sim)
T162	Grav (1 Dec) (105 C)
T27	PLM
T219	GC/FID (SE)
T257	ICP/OES (SIM) (Aqua Regia Extraction)
T287	Calc TOC/0.58
T17	HPLC
T1	GC/MS (HR)
T310	LC/MS/MS
T16	GC/MS
T209	GC/MS (Head Space)(MCERTS)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T257	A40	2.0	mg/kg	N	002,006
Arsenic	T257	A40	2	mg/kg	M	018,026
Barium	T257	A40	2	mg/kg	N	002,006
Barium	T257	A40	2	mg/kg	U	018,026
Beryllium	T245	A40	0.5	mg/kg	N	002,006
Beryllium	T245	A40	0.5	mg/kg	U	018,026
Boron (water-soluble)	T82	A40	1	mg/kg	N	002,006,018,026
Cadmium	T257	A40	0.1	mg/kg	N	002,006
Cadmium	T257	A40	0.1	mg/kg	M	018,026
Chromium	T257	A40	0.5	mg/kg	N	002,006
Chromium	T257	A40	0.5	mg/kg	M	018,026
Copper	T257	A40	2	mg/kg	N	002,006
Copper	T257	A40	2	mg/kg	M	018,026
Lead	T257	A40	2	mg/kg	N	002,006
Lead	T257	A40	2	mg/kg	M	018,026
Mercury	T245	A40	1.0	mg/kg	N	002,006
Mercury	T245	A40	1.0	mg/kg	U	018,026
Nickel	T257	A40	0.5	mg/kg	N	002,006
Nickel	T257	A40	0.5	mg/kg	M	018,026
Selenium	T257	A40	3	mg/kg	N	002,006
Selenium	T257	A40	3	mg/kg	U	018,026
Vanadium	T257	A40	0.1	mg/kg	N	002,006
Vanadium	T257	A40	0.1	mg/kg	U	018,026
Zinc	T257	A40	2	mg/kg	N	002,006
Zinc	T257	A40	2	mg/kg	M	018,026
Moisture @105C	T162	AR	0.1	%	N	002,006,018,026
Retained on 2mm	T2	A40	0.1	%	N	002,006,018,026
Asbestos ID	T27	A40			SU	005,017
Soil Organic Matter	T287	A40	0.1	%	N	006,018
Benzene	T209	AR	10	µg/kg	N	006
Benzene	T209	AR	10	µg/kg	M	018
Toluene	T209	AR	10	µg/kg	N	006
Toluene	T209	AR	10	µg/kg	M	018
EthylBenzene	T209	AR	10	µg/kg	N	006
EthylBenzene	T209	AR	10	µg/kg	M	018
M/P Xylene	T209	AR	10	µg/kg	N	006
M/P Xylene	T209	AR	10	µg/kg	M	018
O Xylene	T209	AR	10	µg/kg	N	006
O Xylene	T209	AR	10	µg/kg	M	018
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	N	006
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	018
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	006,018
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	N	006,018
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	N	006,018
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	N	006,018
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	006,018
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	006,018
TPH (C10-C12 aliphatic)	T219	AR	2	mg/kg	N	006,018

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
TPH (C10-C12 aromatic)	T219	AR	2	mg/kg	N	006,018
TPH (C12-C16 aliphatic)	T219	AR	2	mg/kg	N	006,018
TPH (C12-C16 aromatic)	T219	AR	2	mg/kg	N	006,018
TPH (C16-C21 aliphatic)	T219	AR	2	mg/kg	N	006,018
TPH (C16-C21 aromatic)	T219	AR	2	mg/kg	N	006,018
TPH (C21-C35 aliphatic)	T219	AR	2	mg/kg	N	006,018
TPH (C21-C35 aromatic)	T219	AR	2	mg/kg	N	006,018
TPH (C35-C40 aliphatic)	T219	AR	2	mg/kg	N	006,018
TPH (C35-C40 aromatic)	T219	AR	2	mg/kg	N	006,018
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	N	006
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	U	018
Hexachlorobenzene	T1	AR	0.01	mg/kg	N	006
Hexachlorobenzene	T1	AR	0.01	mg/kg	U	018
Heptachlor	T16	AR	0.01	mg/kg	N	006
Heptachlor	T16	AR	0.01	mg/kg	U	018
Aldrin	T16	AR	0.01	mg/kg	N	006
Aldrin	T16	AR	0.01	mg/kg	U	018
Heptachlor epoxide	T16	AR	0.01	mg/kg	N	006
Heptachlor epoxide	T16	AR	0.01	mg/kg	U	018
Chlordane	T16	AR	0.01	mg/kg	N	006
Chlordane	T16	AR	0.01	mg/kg	U	018
Endosulphan	T16	AR	0.01	mg/kg	N	006
Endosulphan	T16	AR	0.01	mg/kg	U	018
DDE	T16	AR	0.01	mg/kg	N	006
DDE	T16	AR	0.01	mg/kg	U	018
Dieldrin	T16	AR	0.01	mg/kg	N	006
Dieldrin	T16	AR	0.01	mg/kg	U	018
Endrin	T16	AR	0.01	mg/kg	N	006
Endrin	T16	AR	0.01	mg/kg	U	018
DDD	T16	AR	0.01	mg/kg	N	006
DDD	T16	AR	0.01	mg/kg	U	018
DDT	T16	AR	0.01	mg/kg	N	006
DDT	T16	AR	0.01	mg/kg	U	018
Dichlorvos	T16	AR	0.01	mg/kg	N	006
Dichlorvos	T16	AR	0.01	mg/kg	U	018
Mevinphos	T16	AR	0.01	mg/kg	N	006
Mevinphos	T16	AR	0.01	mg/kg	U	018
Dimethoate	T16	AR	0.01	mg/kg	N	006
Dimethoate	T16	AR	0.01	mg/kg	U	018
Diazinon	T16	AR	0.01	mg/kg	N	006
Diazinon	T16	AR	0.01	mg/kg	U	018
Pirimiphos methyl	T16	AR	0.01	mg/kg	N	006
Pirimiphos methyl	T16	AR	0.01	mg/kg	U	018
Malathion	T16	AR	0.01	mg/kg	N	006
Malathion	T16	AR	0.01	mg/kg	U	018
Fenitrothion	T16	AR	0.01	mg/kg	N	006
Fenitrothion	T16	AR	0.01	mg/kg	U	018
Parathion	T16	AR	0.01	mg/kg	N	006
Parathion	T16	AR	0.01	mg/kg	U	018
Azinphos methyl	T16	AR	0.01	mg/kg	N	006
Azinphos methyl	T16	AR	0.01	mg/kg	U	018
Simazine	T16	AR	0.01	mg/kg	N	006,018
Atrazine	T16	AR	0.01	mg/kg	N	006,018
Propazine	T16	AR	0.01	mg/kg	N	006,018
Trietazine	T16	AR	0.01	mg/kg	N	006,018
Prometryn	T16	AR	0.01	mg/kg	N	006,018
Terbutryn	T16	AR	0.01	mg/kg	N	006,018
Chlorotoluron	T310	AR	0.01	mg/kg	N	006,018
Diuron	T310	AR	0.01	mg/kg	N	006,018
Isoproturon	T310	AR	0.01	mg/kg	N	006,018
Linuron	T310	AR	0.01	mg/kg	N	006,018
Monuron	T310	AR	0.01	mg/kg	N	006,018
Mecoprop	T16	AR	0.01	mg/kg	N	006,018
Phenoxy Acetic acid herbicide: MCPA	T16	AR	0.01	mg/kg	N	006,018
Dichlorprop	T16	AR	0.01	mg/kg	N	006,018
Phenoxy Acetic acid herbicide: 2,4-D	T16	AR	0.01	mg/kg	N	006,018
Fenoprop	T16	AR	0.01	mg/kg	N	006,018
Phenoxy Acetic acid herbicide: 2,4,5-T	T16	AR	0.01	mg/kg	N	006,018
Resorcinol	T17	AR	0.05	mg/kg	N	006
Resorcinol	T17	AR	0.05	mg/kg	M	018

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Catechol	T17	AR	0.05	mg/kg	N	006,018
Phenol	T17	AR	0.1	mg/kg	N	006
Phenol	T17	AR	0.1	mg/kg	M	018
Cresols	T17	AR	0.05	mg/kg	N	006
Cresols	T17	AR	0.05	mg/kg	M	018
Xylenols	T17	AR	0.05	mg/kg	N	006
Xylenols	T17	AR	0.05	mg/kg	M	018
Naphthols	T17	AR	0.05	mg/kg	N	006,018
Trimethyl phenol	T17	AR	0.05	mg/kg	N	006
Trimethyl phenol	T17	AR	0.05	mg/kg	M	018
Total Phenols	T17	AR	0.1	mg/kg	N	006,018





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Concept Life Sciences

Certificate of Analysis

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Tel : 01376 560120
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Report Number: Supplement 1A to Report Number
677813-1

Date of Report: 18-Oct-2017

Customer: TerraConsult Limited
Unit 34
Bold Business Centre
Bold Lane
Sutton
St Helens
WA9 4TX

Customer Contact: Mr Jimmy Thorburn

Customer Job Reference: 3318

Customer Purchase Order: PO-001839

Customer Site Reference: Norfolk Vanguard Cable Route

Date Job Received at Concept: 31-Jul-2017

Date Analysis Started: 29-Aug-2017

Date Analysis Completed: 12-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

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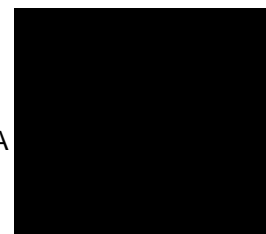
Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



Report checked
and authorised by :
Chelsea Entwistle
Senior Customer Service
Advisor

Issued by :
Aislinn Arthey
Customer Service A



Waste Acceptance Criteria

Customer Sample Reference : BH17-C3-02 ES2 @ 1.00m
 SAL Sample Reference : 677813 006
 Project Site : Norfolk Vanguard Cable Route
 Customer Reference : 3318
 Test Portion Mass (g) : 87.5
 Date Sampled : 07-AUG-2017
 Matrix Class : Other

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			N	6.4		>6.0	
Loss on Ignition @450C	Ign @450C/Grav	0.1	%	N	39			10.0
Total Organic Carbon	OX/IR	0.1	%	N	25	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	N	<0.040	6.0		
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	N	(13) 100	500.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PCB EC7 (Sum)	Calc	0.00035	mg/kg	N	<0.14	1.0		
Moisture @ 105C	Grav (1 Dec) (105 C)	0.1	%	N	74			
Retained on 2mm	Grav	0.1	%	N	<0.1			

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.011	mg/kg	N	<0.011	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0022	mg/kg	N	<0.0022	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.011	mg/kg	N	<0.011	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00022	mg/kg	N	<0.00022	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	11	mg/kg	N	56	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.011	mg/kg	N	<0.011	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0054	mg/kg	N	<0.0054	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	11	mg/kg	N	560	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.54	mg/kg	N	4.0	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0032	mg/kg	N	<0.0032	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00054	mg/kg	N	<0.00054	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.011	mg/kg	N	<0.011	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.011	mg/kg	N	<0.011	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry (CF)	0.22	mg/kg	N	<0.22	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0054	mg/kg	N	<0.0054	0.1	0.5	7.0
SO4--	Calc / Discrete Analyser	5.4	mg/kg	N	1200	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	110	mg/kg	N	2400	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.022	mg/kg	N	<0.022	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as amended)

The 2:1 moisture extract was not produced because the moisture content of the sample was greater than 200%. Therefore, the exact application of the two-step leaching test is precluded on technical grounds (ref: Section 5.2.4 BS EN 12457-3:2002). Results are derived from a single step leaching at L/S 10/1 as prescribed by the EA guidance. (Ref Section C4.1.1 Guidance on Sampling and Testing of Wastes to meet Landfill Waste Acceptance Procedures Version 1 April 2005, Environment Agency)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

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

Waste Acceptance Criteria

Customer Sample Reference : BH17-C3-03 ES2 @ 1.00m
 SAL Sample Reference : 677813 018
 Project Site : Norfolk Vanguard Cable Route
 Customer Reference : 3318
 Test Portion Mass (g) : 175
 Date Sampled : 10-AUG-2017
 Matrix Class : Sandy Soil

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			M	8.3		>6.0	
Loss on Ignition @450C	Ign @450C/Grav	0.1	%	M	0.9			10.0
Total Organic Carbon	OX/IR	0.1	%	N	0.2	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	M	(13) <10	500.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PCB EC7 (Sum)	Calc	0.00035	mg/kg	N	<0.14	1.0		
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	7.3			
Retained on 2mm	Grav	0.1	%	N	31.3			

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	0.0058	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.021	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	28	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.017	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	72	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	4.5	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry (CF)	0.20	mg/kg	N	<0.20	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
SO4--	Calc / Discrete Analyser	5.0	mg/kg	N	7.3	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	100	mg/kg	N	440	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	<0.020	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as amended)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

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

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
Total and Speciated USEPA16 PAH (SE) (MCERTS)						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Test Sample			AR		AR	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	LOD	Units	Symbol		
Naphthalene	GC/MS	0.1	mg/kg	N	<0.1	-
Naphthalene	GC/MS	0.1	mg/kg	U	-	<0.1
Acenaphthylene	GC/MS	0.1	mg/kg	N	<0.1	-
Acenaphthylene	GC/MS	0.1	mg/kg	U	-	<0.1
Acenaphthene	GC/MS	0.1	mg/kg	N	<0.1	-
Acenaphthene	GC/MS	0.1	mg/kg	M	-	<0.1
Fluorene	GC/MS	0.1	mg/kg	N	<0.1	-
Fluorene	GC/MS	0.1	mg/kg	M	-	<0.1
Phenanthrene	GC/MS	0.1	mg/kg	N	<0.1	-
Phenanthrene	GC/MS	0.1	mg/kg	U	-	<0.1
Anthracene	GC/MS	0.1	mg/kg	N	<0.1	-
Anthracene	GC/MS	0.1	mg/kg	M	-	<0.1
Fluoranthene	GC/MS	0.1	mg/kg	N	<0.1	<0.1
Pyrene	GC/MS	0.1	mg/kg	N	<0.1	<0.1
Benzo(a)Anthracene	GC/MS	0.1	mg/kg	N	<0.1	-
Benzo(a)Anthracene	GC/MS	0.1	mg/kg	M	-	<0.1
Chrysene	GC/MS	0.1	mg/kg	N	<0.1	-
Chrysene	GC/MS	0.1	mg/kg	M	-	<0.1
Benzo(b)fluoranthene	GC/MS	0.1	mg/kg	N	0.1	-
Benzo(b)fluoranthene	GC/MS	0.1	mg/kg	U	-	<0.1
Benzo(k)fluoranthene	GC/MS	0.1	mg/kg	N	<0.1	<0.1
Benzo(a)Pyrene	GC/MS	0.1	mg/kg	N	<0.1	-
Benzo(a)Pyrene	GC/MS	0.1	mg/kg	M	-	<0.1
Indeno(123-cd)Pyrene	GC/MS	0.1	mg/kg	N	<0.1	-
Indeno(123-cd)Pyrene	GC/MS	0.1	mg/kg	M	-	<0.1
Dibenzo(ah)Anthracene	GC/MS	0.1	mg/kg	N	<0.1	-
Dibenzo(ah)Anthracene	GC/MS	0.1	mg/kg	M	-	<0.1
Benzo(ghi)Perylene	GC/MS	0.1	mg/kg	N	<0.1	-
Benzo(ghi)Perylene	GC/MS	0.1	mg/kg	M	-	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS	0.1	mg/kg	N	0.1	-
Polyaromatic Hydrocarbons (Total)	GC/MS	0.1	mg/kg	U	-	<0.1

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
BTEX						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Test Sample			AR		AR	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	LOD	Units	Symbol		
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	N	<10	-
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	-	<10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	N	<10	-
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	-	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	N	<10	-
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	-	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	N	<10	-
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	-	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	N	<10	-
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	-	<10

Concept Reference: 677813						
Project Site: Norfolk Vanguard Cable Route						
Customer Reference: 3318						
Soil Analysed as Soil						
PCBs EC7 (SE)						
Concept Reference			677813 006		677813 018	
Customer Sample Reference			BH17-C3-02 ES2 @ 1.00m		BH17-C3-03 ES2 @ 1.00m	
Test Sample			AR		AR	
Date Sampled			07-AUG-2017		10-AUG-2017	
Matrix Class			Other		Sandy Soil	
Determinand	Method	LOD	Units	Symbol		
Polychlorinated biphenyl BZ#28	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#28	GC/MS	20	µg/kg	M	-	<20
Polychlorinated biphenyl BZ#52	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#52	GC/MS	20	µg/kg	M	-	<20
Polychlorinated biphenyl BZ#101	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#101	GC/MS	20	µg/kg	M	-	<20
Polychlorinated biphenyl BZ#118	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#118	GC/MS	20	µg/kg	M	-	<20
Polychlorinated biphenyl BZ#153	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#153	GC/MS	20	µg/kg	M	-	<20
Polychlorinated biphenyl BZ#138	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#138	GC/MS	20	µg/kg	M	-	<20
Polychlorinated biphenyl BZ#180	GC/MS	20	µg/kg	N	<20	-
Polychlorinated biphenyl BZ#180	GC/MS	20	µg/kg	M	-	<20

Index to symbols used in Supplement 1A to Report Number 677813-1

Value	Description
8:1	Leachate to BS EN 12457-3 (8:1)
2:1	Leachate to BS EN 12457-3 (2:1)
A40	Assisted dried < 40C
AR	As Received
13	Results have been blank corrected.
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

BTEX: Samples submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised.
Retained on 2mm is removed before analysis
Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis except ANC
pH, LOI & TOC were performed on assisted dried samples (<40 degree centigrade). All other results relate to samples as received.
PAH, BTEX/MTBE, TPH & PCB: These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.
Supplement 1A report reissued to include only samples 006 and 018



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Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

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Tel : 01376 560120
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Report Number: Supplement 1B to Report Number
677853-1

Date of Report: 18-Oct-2017

Customer: TerraConsult (South) Limited
Suite F17 Dugard House
Peartree Road
Colchester
Essex
CO3 0UL

Customer Contact: Victoria Smith

Customer Job Reference: 3318

Customer Site Reference: East Anglia OWF

Date Job Received at Concept: 24-Aug-2017

Date Analysis Started: 25-Aug-2017

Date Analysis Completed: 04-Sep-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



1549

Report checked
and authorised by :
Aislinn Arthey
Customer Service Advisor

Issued by :
Aislinn Arthey
Customer Service Advis

Concept Reference: 677853						
Project Site: East Anglia OWF						
Customer Reference: 3318						
Water Analysed as Water						
Heavy Metals (9)						
Concept Reference			677853 002	677853 003		
Customer Sample Reference			C3-01	C3-03		
Date Sampled			22-AUG-2017	22-AUG-2017		
Determinand	Method	Test Sample	LOD	Units		
As (Dissolved)	T281	F	0.0002	mg/l	0.0013	0.029
Cd (Dissolved)	T281	F	0.00002	mg/l	<0.00002	0.00065
Cr (Dissolved)	T281	F	0.001	mg/l	<0.001	⁽¹⁴⁹⁾ <0.005
Cu (Dissolved)	T281	F	0.0005	mg/l	0.0010	0.026
Pb (Dissolved)	T281	F	0.0003	mg/l	<0.0003	0.0078
Hg (Dissolved)	T281	F	0.00005	mg/l	<0.00005	⁽¹⁴⁹⁾ <0.00025
Ni (Dissolved)	T281	F	0.001	mg/l	0.002	0.018
Se (Dissolved)	T281	F	0.0005	mg/l	0.0044	0.14
Zn (Dissolved)	T281	F	0.002	mg/l	0.005	0.049

Concept Reference: 677853						
Project Site: East Anglia OWF						
Customer Reference: 3318						
Water Analysed as Water						
Total and Speciated USEPA16 PAH (SE)						
Concept Reference			677853 002	677853 003		
Customer Sample Reference			C3-01	C3-03		
Date Sampled			22-AUG-2017	22-AUG-2017		
Determinand	Method	Test Sample	LOD	Units		
Naphthalene	T149	AR	0.01	µg/l	<0.01	<0.01
Acenaphthylene	T149	AR	0.01	µg/l	<0.01	<0.01
Acenaphthene	T149	AR	0.01	µg/l	<0.01	<0.01
Fluorene	T149	AR	0.01	µg/l	<0.01	<0.01
Phenanthrene	T149	AR	0.01	µg/l	<0.01	<0.01
Anthracene	T149	AR	0.01	µg/l	<0.01	<0.01
Fluoranthene	T149	AR	0.01	µg/l	<0.01	<0.01
Pyrene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(a)Anthracene	T149	AR	0.01	µg/l	<0.01	<0.01
Chrysene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(a)Pyrene	T149	AR	0.01	µg/l	<0.01	<0.01
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	<0.01	<0.01
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	<0.01	<0.01
PAH(total)	T149	AR	0.01	µg/l	<0.01	<0.01

Concept Reference: 677853
 Project Site: East Anglia OWF
 Customer Reference: 3318

Water Analysed as Water
 TPH (CWG) with MTBE & BTEX SE

Concept Reference		677853 002	677853 003			
Customer Sample Reference		C3-01	C3-03			
Date Sampled		22-AUG-2017	22-AUG-2017			
Determinand	Method	Test Sample	LOD	Units		
Benzene	T54	AR	1	µg/l	<1	<1
Toluene	T54	AR	1	µg/l	<1	<1
EthylBenzene	T54	AR	1	µg/l	<1	<1
M/P Xylene	T54	AR	1	µg/l	<1	<1
O Xylene	T54	AR	1	µg/l	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/l	<1	<1
TPH (C5-C6 aliphatic)	T54	AR	0.020	mg/l	<0.020	<0.020
TPH (C6-C7 aromatic)	T54	AR	0.020	mg/l	<0.020	<0.020
TPH (C6-C8 aliphatic)	T54	AR	0.020	mg/l	<0.020	<0.020
TPH (C7-C8 aromatic)	T54	AR	0.020	mg/l	<0.020	<0.020
TPH (C8-C10 aliphatic)	T54	AR	0.020	mg/l	<0.020	<0.020
TPH (C8-C10 aromatic)	T54	AR	0.020	mg/l	<0.020	<0.020
TPH (C10-C12 aliphatic)	T219	AR	0.01	mg/l	<0.01	<0.01
TPH (C10-C12 aromatic)	T219	AR	0.01	mg/l	<0.01	<0.01
TPH (C12-C16 aliphatic)	T219	AR	0.01	mg/l	<0.01	<0.01
TPH (C12-C16 aromatic)	T219	AR	0.01	mg/l	<0.01	0.01
TPH (C16-C21 aliphatic)	T219	AR	0.01	mg/l	0.01	0.02
TPH (C16-C21 aromatic)	T219	AR	0.01	mg/l	0.02	0.03
TPH (C21-C35 aliphatic)	T219	AR	0.01	mg/l	0.05	0.04
TPH (C21-C35 aromatic)	T219	AR	0.01	mg/l	0.04	0.04

Concept Reference: 677853
 Project Site: East Anglia OWF
 Customer Reference: 3318

Water Analysed as Water
 Organochlorine insecticides

Concept Reference		677853 002	677853 003			
Customer Sample Reference		C3-01	C3-03			
Date Sampled		22-AUG-2017	22-AUG-2017			
Determinand	Method	Test Sample	LOD	Units		
Hexachlorocyclohexane	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Hexachlorobenzene	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Heptachlor	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Aldrin	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Heptachlor epoxide	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Chlordane	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Endosulphan	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
DDE	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Dieldrin	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
Endrin	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
DDD	T16	AR	0.01	µg/l	<0.01	⁽¹⁰⁰⁾ <0.10
DDT	T16	AR	0.01	µg/l	⁽³⁶⁾ <0.02	^(100,36) <0.20

Concept Reference: 677853						
Project Site: East Anglia OWF						
Customer Reference: 3318						
Water Analysed as Water						
Organophosphorous insecticides						
Concept Reference			677853 002	677853 003		
Customer Sample Reference			C3-01	C3-03		
Date Sampled			22-AUG-2017	22-AUG-2017		
Determinand	Method	Test Sample	LOD	Units		
Dichlorvos	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Mevinphos	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Dimethoate	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Diazinon	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Pirimiphos methyl	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Malathion	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Fenitrothion	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Parathion	T16	AR	0.01	µg/l	<0.01	(100) <0.10
Azinphos methyl	T16	AR	0.01	µg/l	<0.01	(100) <0.10

Index to symbols used in Supplement 1B to Report Number 677853-1

Value	Description
AR	As Received
F	Filtered
149	LOD raised due to high dissolved solids
100	LOD determined by sample aliquot used for analysis
36	LOD Raised due to low Matrix spike recovery
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplement 1B Report Reissued to include only samples 002 and 003
OCP and OPP analysis transferred to Concept Life Sciences Manchester

Method Index

Value	Description
T16	GC/MS
T149	GC/MS (SIR)
T281	ICP/MS (Filtered)
T219	GC/FID (SE)
T54	GC/MS (Headspace)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
As (Dissolved)	T281	F	0.0002	mg/l	U	002-003
Cd (Dissolved)	T281	F	0.00002	mg/l	U	002-003
Cr (Dissolved)	T281	F	0.001	mg/l	U	002-003
Cu (Dissolved)	T281	F	0.0005	mg/l	U	002-003
Pb (Dissolved)	T281	F	0.0003	mg/l	U	002-003
Hg (Dissolved)	T281	F	0.00005	mg/l	U	002-003
Ni (Dissolved)	T281	F	0.001	mg/l	U	002-003
Se (Dissolved)	T281	F	0.0005	mg/l	U	002-003
Zn (Dissolved)	T281	F	0.002	mg/l	U	002-003
Naphthalene	T149	AR	0.01	µg/l	U	002-003
Acenaphthylene	T149	AR	0.01	µg/l	U	002-003
Acenaphthene	T149	AR	0.01	µg/l	U	002-003
Fluorene	T149	AR	0.01	µg/l	U	002-003
Phenanthrene	T149	AR	0.01	µg/l	U	002-003
Anthracene	T149	AR	0.01	µg/l	U	002-003
Fluoranthene	T149	AR	0.01	µg/l	U	002-003
Pyrene	T149	AR	0.01	µg/l	U	002-003

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Benzo(a)Anthracene	T149	AR	0.01	µg/l	U	002-003
Chrysene	T149	AR	0.01	µg/l	U	002-003
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	N	002-003
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	U	002-003
Benzo(a)Pyrene	T149	AR	0.01	µg/l	U	002-003
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	U	002-003
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	U	002-003
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	U	002-003
PAH(total)	T149	AR	0.01	µg/l	N	002-003
Benzene	T54	AR	1	µg/l	U	002-003
Toluene	T54	AR	1	µg/l	U	002-003
EthylBenzene	T54	AR	1	µg/l	U	002-003
m/P Xylene	T54	AR	1	µg/l	U	002-003
O Xylene	T54	AR	1	µg/l	U	002-003
Methyl tert-Butyl Ether	T54	AR	1	µg/l	U	002-003
TPH (C5-C6 aliphatic)	T54	AR	0.020	mg/l	N	002-003
TPH (C6-C7 aromatic)	T54	AR	0.020	mg/l	N	002-003
TPH (C6-C8 aliphatic)	T54	AR	0.020	mg/l	N	002-003
TPH (C7-C8 aromatic)	T54	AR	0.020	mg/l	N	002-003
TPH (C8-C10 aliphatic)	T54	AR	0.020	mg/l	N	002-003
TPH (C8-C10 aromatic)	T54	AR	0.020	mg/l	N	002-003
TPH (C10-C12 aliphatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C10-C12 aromatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C12-C16 aliphatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C12-C16 aromatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C16-C21 aliphatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C16-C21 aromatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C21-C35 aliphatic)	T219	AR	0.01	mg/l	N	002-003
TPH (C21-C35 aromatic)	T219	AR	0.01	mg/l	N	002-003
Hexachlorocyclohexane	T16	AR	0.01	µg/l	N	002-003
Hexachlorobenzene	T16	AR	0.01	µg/l	N	002-003
Heptachlor	T16	AR	0.01	µg/l	N	002-003
Aldrin	T16	AR	0.01	µg/l	N	002-003
Heptachlor epoxide	T16	AR	0.01	µg/l	N	002-003
Chlordane	T16	AR	0.01	µg/l	N	002-003
Endosulphan	T16	AR	0.01	µg/l	N	002-003
DDE	T16	AR	0.01	µg/l	N	002-003
Dieldrin	T16	AR	0.01	µg/l	N	002-003
Endrin	T16	AR	0.01	µg/l	N	002-003
DDD	T16	AR	0.01	µg/l	N	002-003
DDT	T16	AR	0.01	µg/l	N	002-003
Dichlorvos	T16	AR	0.01	µg/l	N	002-003
Mevinphos	T16	AR	0.01	µg/l	N	002-003
Dimethoate	T16	AR	0.01	µg/l	N	002-003
Diazinon	T16	AR	0.01	µg/l	N	002-003
Pirimiphos methyl	T16	AR	0.01	µg/l	N	002-003
Malathion	T16	AR	0.01	µg/l	N	002-003
Fenitrothion	T16	AR	0.01	µg/l	N	002-003
Parathion	T16	AR	0.01	µg/l	N	002-003
Azinphos methyl	T16	AR	0.01	µg/l	N	002-003

APPENDIX F Calibration Certificates

SPT, DS and DP hammer(s)	SI 3, SI 4, SI 5
Gas monitor(s)	GFM 435 s/n 11378

SPT Calibration Report



Hammer Energy Measurement Report

Type of Hammer: SPT HAMMER
 Client: SI DRILLING
 Test No: EQU1695
 Test Depth (m): 8.70
 Date of Test: **29 December 2016**
 Valid until: **29 December 2017**
 Hammer ID: **SI 3**

Mass of the hammer: $m = 63.5\text{kg}$
 Falling height: $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

Diameter: $d_r = 0.052\text{m}$
 Length of the instrumented rod: 0.558m
 Area: $A = 11.61\text{cm}^2$
 Modulus: $E_a = 206843\text{MPa}$

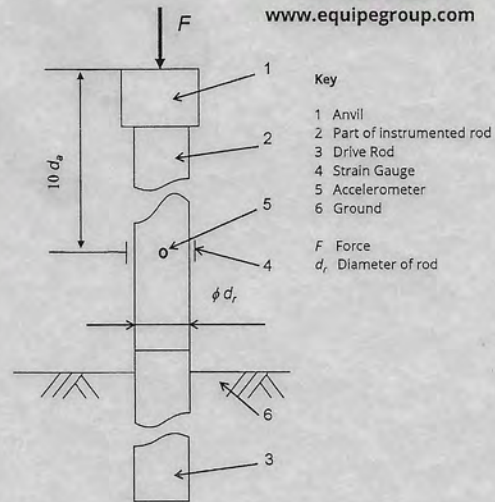
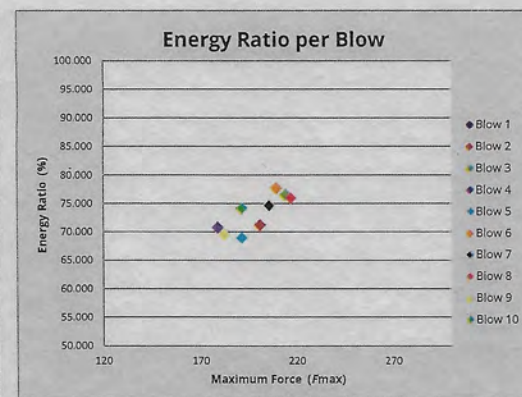
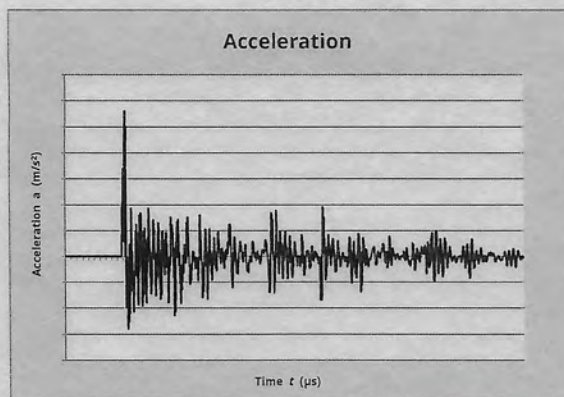
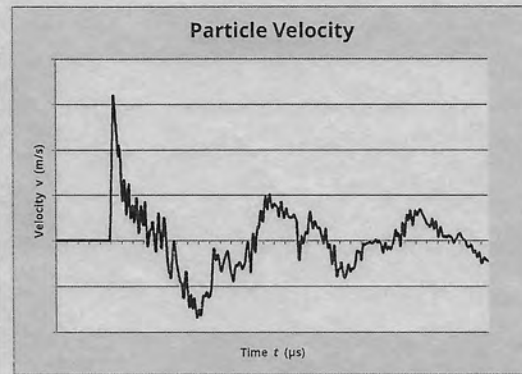
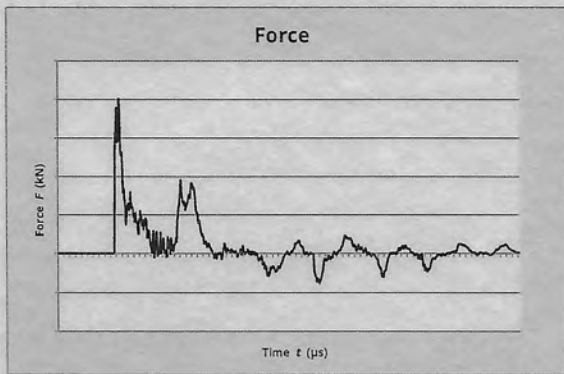


Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011



Observations:
1.

$E_{\text{meas}} = 0.355\text{ kN-m}$
 $E_{\text{theor}} = 0.473\text{ kN-m}$

$$\text{Energy Ratio} = \frac{E_{\text{meas}}}{E_{\text{theor}}} = 75.14\%$$

Equipe SPT Analyzer Operators:

KS

Prepared by:

Checked by:

ate

10/01/2017

SPT Calibration Report



www.equipegroup.com

Hammer Energy Measurement Report

Type of Hammer SPT HAMMER
 Client SI DRILLING
 Test No EQU1694
 Test Depth (m) 8.70
 Date of Test **29 December 2016**
 Valid until **29 December 2017**
 Hammer ID **4 CUT DOWN**

Mass of the hammer $m = 63.5\text{kg}$
 Falling height $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

Diameter $d_r = 0.052\text{ m}$
 Length of the instrumented rod 0.558 m
 Area $A = 11.61\text{ cm}^2$
 Modulus $E_o = 206843\text{ MPa}$

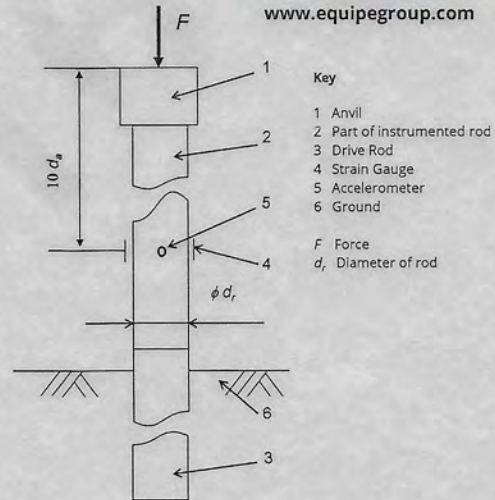
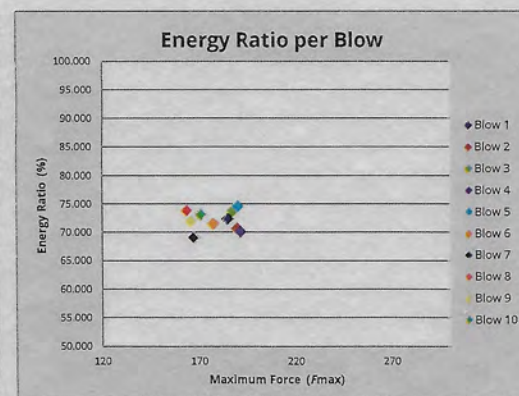
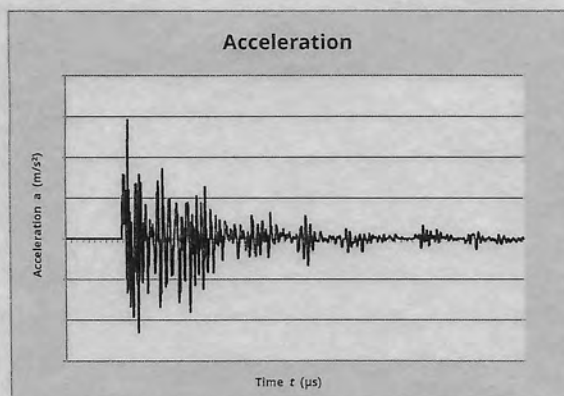
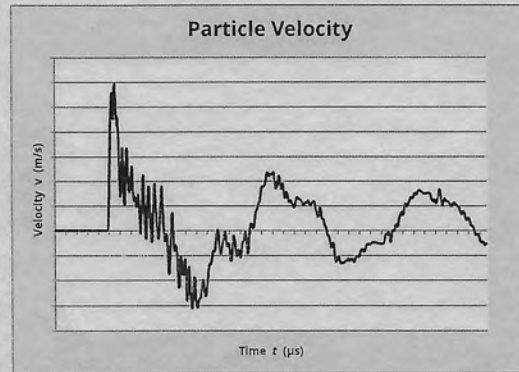
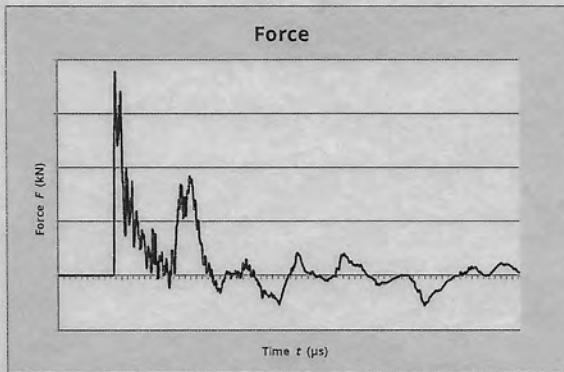


Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011



Observations:

1.

$E_{\text{meas}} = 0.351\text{ kN-m}$

$E_{\text{theor}} = 0.473\text{ kN-m}$

$$\text{Energy Ratio} = \frac{E_{\text{meas}}}{E_{\text{theor}}} = 74.14\%$$

Equipe SPT Analyzer Operators:

KS

Prepared by:

Checked by:

Date

10/01/2017

SPT Calibration Report



Hammer Energy Measurement Report

Type of Hammer SPT HAMMER
 Client SI DRILLING
 Test No EQU1690
 Test Depth (m) 8.70
 Date of Test **29 December 2016**
 Valid until **29 December 2017**
 Hammer ID **SI 05**

Mass of the hammer $m = 63.5\text{kg}$
 Falling height $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

Diameter $d_r = 0.052\text{ m}$
 Length of the instrumented rod 0.558 m
 Area $A = 11.61\text{ cm}^2$
 Modulus $E_a = 206843\text{ MPa}$

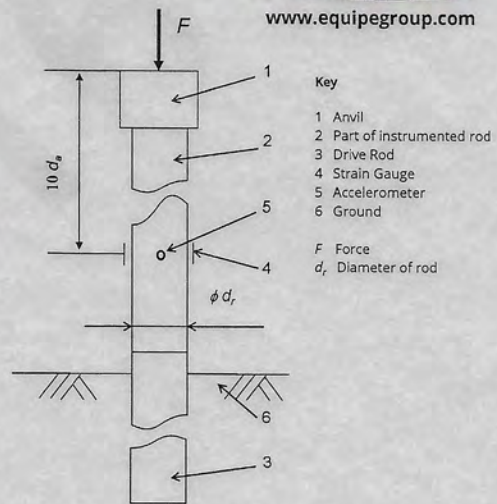
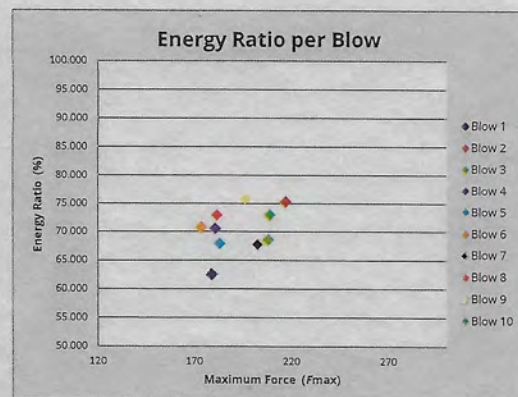
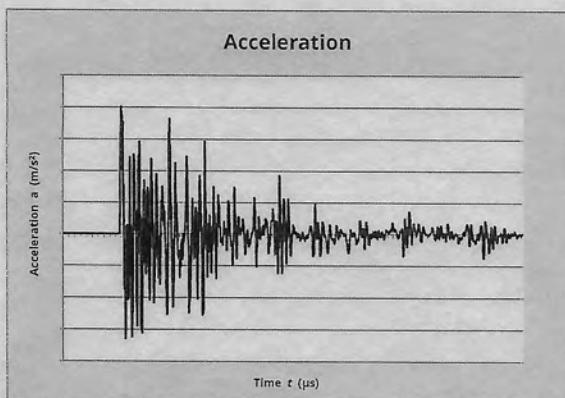
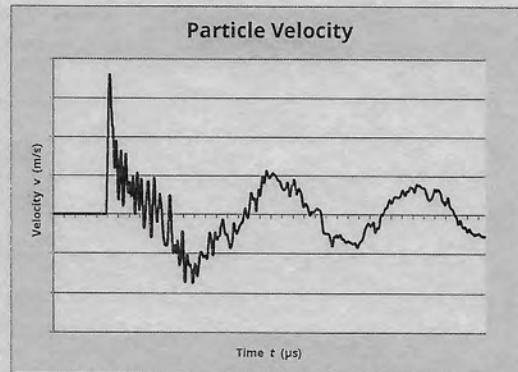


Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011



Observations:
 1.

$E_{\text{meas}} = 0.343\text{ kN-m}$
 $E_{\text{theor}} = 0.473\text{ kN-m}$

$$\text{Energy Ratio } (E_r) = \frac{E_{\text{meas}}}{E_{\text{theor}}} = 72.53\%$$

Equipe SPT Analyzer Operators:

KS

Prepared by:

Checked by:

Date

10/01/2017

TEST DATE AND CONDITIONS		
Date	21/06/2017	
Atmospheric Pressure	997	mB
Ambient Temperature	23.0	°C
Envionics Serial No.	5089	

GAS DATA LTD	
Pegasus House	
Seven Stars Estate	
Wheler Rd	
Coventry	
CV3 4LB	
Tel 02476303311 Fax 02476307711	



**GFM435 Final Inspection & Calibration
Check Certificate**

Customer	Terraconsult (South) Ltd
Certificate Number	119385
Order Number	317112

Serial Number	11378	Recalibration DUE Date
Software Version	G435-00.0024/0004	21/06/2018

Instrument Checks				
Keyboard	✓		Display Contrast	✓
Pump Flow In	400	Accept > 200 cc/min	Pump Flow @ -200mB	200
Clock Set / Running	✓		Labels Fitted	✓

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value %	Instrument Gas Readings %	True Gas Value %
	59.7	60	39.7	40	20.8	20.9
	Accept +/- 3.0		Accept +/- 3.0		Accept +/- 0.5	
	5.0	5	4.8	5	6.0	6
	Accept +/- 0.3		Accept +/- 0.3		Accept +/- 0.3	
Zero Reading 100% N ₂	0.0	0.0	0.0	0.0	0.0	0.0
	Accept +/- 0.0		Accept +/- 0.0		Accept +/- 0.1	

Optional Gas Checks						
Applied Gas & Range of GFM		Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H ₂ S	5000	1500	0	Accept +/- 0.0	1500	Accept +/- 5.0
CO	2000	1000	0	Accept +/- 0.0	1000	Accept +/- 5.0
				Accept +/- 0.0		Accept +/- 5.0
				Accept +/- 0.0		Accept +/- 5.0
Hexane	2.0%	2.0%	0	Accept +/- 0.0	1.99	Accept +/- 10.0

Cross Gas Effects								
Applied Gas (ppm)		Instrument Readings (ppm)						
Gas Type	Concentration	Toxic 1:	H ₂ S	Toxic 2:	CO	Toxic 3:	Hex	Toxic 4:
H ₂ S	1500	1500		0		0		
CO	1000	60		1000		0		
Hexane	2.0%	0		0		1.99		

Pressure Checks			
Atmospheric Pressure [AP] (mB)			
Current Atmospheric Pressure (mB)	Instrument Atmospheric Pressure Reading (mB)		
All Ports Open to Atmosphere	Open Ports	997	Accept +/- 2.0
AP Port (Internal)	+800 mB	801	Accept +/- 5.0
AP Port (Internal)	+1200mB	1199	Accept +/- 5.0

Flow Checks					
Borehole Flow	Instrument Flow Reading (l/h)	Differential Pressure			
		Instrument DP Reading (Pa)		Applied DP Pressure (Pa)	
-30.0	-29.8	Accept +/- 3.0	-272	Accept +/- 50	-276
-3.0	-3.1	Accept +/- 1.0	-15	Accept +/- 6.0	-14
0.0	0.0	Accept +/- 0.0	0.0	Accept +/- 0.5	0.0
+3.0	3.0	Accept +/- 0.5	13	Accept +/- 3.0	14
+30.0	30.0	Accept +/- 3.0	294	Accept +/- 50	295
+60.0	58.5	Accept +/- 6.0	843	Accept +/- 130	876
+90.0	85.9	Accept +/- 9.0	1616	Accept +/- 250	1717

All test performed with equipment that is traceable to National Standards unless otherwise stated



TerraConsult

Leaders in
waste management
environmental &
ground engineering
consultancy

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