

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 5 April 2016

Easting 473518.6

Scale 1 : 50

End Date 6 April 2016

Northing 171482.7 Ground level 69.50mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
05/04/16 0800hrs	1B	0.20 - 0.40					Grass over soft to firm dark brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse flint. (MADE GROUND)	0.50	69.00	
	1ES	0.20 - 0.40								
	2B	0.50 - 0.70					Firm light brown mottled dark orangish brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine and medium flint. (HEAD DEPOSITS)	0.90	68.60	
	2ES	0.50 - 0.70								
	3B	1.00 - 1.20								
	4D	1.20 - 1.65	1.20	S 13			Firm light brown mottled dark orangish brown slightly gravelly sandy CLAY. Gravel is subangular and rounded fine and medium flint. (HEAD DEPOSITS)			
	5B	2.00 - 2.20								
		2.20 - 2.65	2.20	C 12				2.40	67.10	
	6B	2.30 - 2.50								
	7D	2.80					Firm light orangish brown mottled light grey slightly gravelly sandy CLAY. Gravel is subangular to rounded fine and medium flint. (HEAD DEPOSITS)			
	8U	2.80 - 3.25	2.80					3.25	66.25	
	9D	3.25 - 3.70	3.20	S 16			Medium dense light brown slightly clayey medium and coarse SAND. (BOYN HILL GRAVEL MEMBER)			
								4.00	65.50	
	10B	4.00 - 4.45 4.00 - 4.20	4.00	C 24			Medium dense light brown very sandy subangular and subrounded fine to coarse flint GRAVEL. (BOYN HILL GRAVEL MEMBER)			
								5.00	64.50	
	11B	5.00 - 5.45 5.00 - 5.20	5.00	C 42			Very stiff light brown slightly sandy CLAY. (BOYN HILL GRAVEL MEMBER)			
								5.80	63.70	
	12B	5.80 - 6.00								
		6.00 - 6.45	6.00	C 36			Dense light brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	6.20	63.30	
	13B	6.20 - 6.40								
	14D	6.50								
	15U	6.50 - 6.85	6.50				Stiff dark brownish grey silty CLAY with rare shell fragments (up to 5mm). (LONDON CLAY FORMATION)			
	16D	6.85								
	17D	6.85 - 7.30	6.50	S 24						
	18D	7.50					7.50m: Burrow.			
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with arisings 18.00-8.00m and bentonite pellets 8.00-6.20m. A slotted standpipe (50mm) was installed to 6.20m, granular response zone 6.20-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT
31710CHECKED
JL

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 5 April 2016

Easting 473518.6

Scale 1 : 50

End Date 6 April 2016

Northing 171482.7 Ground level 69.50mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
05/04/16 1600hrs Dry	19U	8.00 - 8.45	7.00					9.00	60.50	
	20D	8.45								
	21D	8.45 - 8.90	7.00	S 22						
	22D	9.00								
	23U	9.50 - 9.95	7.00				Stiff to very stiff dark grey silty CLAY with frequent fine sand sized selenite. (LONDON CLAY FORMATION)			
	24D	9.95								
	25D	9.95 - 10.40	7.00	S 27						
	26D	10.50								
	27U	11.00 - 11.45	7.00							
	28D	11.45								
06/04/16 0800hrs Dry	29D	11.45 - 11.90	7.00	S 28				15.00	54.50	
	30D	12.00					12.00m: Rare shell fragments (up to 2mm).			
	31U	12.50 - 12.95	7.00							
	32D	12.95					12.95m: Rare mica crystals (up to 5mm).			
	33D	12.95 - 13.40	7.00	S 34			12.95 - 15.00m: Very stiff.			
	34D	13.50								
	35U	14.00 - 14.40	7.00							
	36D	14.40					14.40m: Frequent mica crystals (up to 5mm).			
	37D	14.40 - 14.85	7.00	S 33						
	38D	15.00					Very stiff dark grey silty CLAY with frequent fine and medium gravel sized pockets of light grey fine sand. (LONDON CLAY FORMATION)			
06/04/16 1400hrs Dry	39U	15.50 - 15.95	7.00					18.00	51.50	
	40D	15.95					15.95m: Rare shell fragments (up to 10mm).			
	41D	15.95 - 16.40	7.00	S 48						
	42D	16.50								
	43U	17.00 - 17.45	7.00							
	44D	17.45								
	45D	17.45 - 17.90	7.00	S 39						
Borehole completed at 18.00m.								{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks Groundwater not encountered.										
								CONTRACT 31710		CHECKED JJ

BOREHOLE LOG**BH02**

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 11 April 2016

Easting 473544.1

Scale 1 : 50

End Date 12 April 2016

Northing 171549.8 Ground level 68.10mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
11/04/16 0800hrs	1B 1ES 2B 2ES 3B 3ES	0.20 - 0.30 0.20 - 0.30 0.50 - 0.70 0.50 - 0.70 1.00 - 1.20 1.00 - 1.20 1.20 - 1.65				✓	Grass over dark brown mottled light brown slightly gravelly clayey medium and coarse SAND. Gravel is angular and subangular fine and medium brick and flint. (MADE GROUND)	1.00	67.10	
			1.20	C 2			Very soft light brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine and medium concrete and flint. (MADE GROUND) 1.00m: Subangular concrete cobble.	1.90	66.20	
	4B 4ES	2.00 - 2.20 2.00 - 2.20 2.20 - 2.65	2.20	C 13			Medium dense light brown slightly clayey very gravelly fine to coarse SAND. Gravel is subangular and subrounded fine to coarse flint. (BOYN HILL GRAVEL MEMBER)	2.70	65.40	
	5B	3.00 - 3.20 3.20 - 3.65	3.20	C 27			Medium dense light orangish brown clayey gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse flint. (BOYN HILL GRAVEL MEMBER)	4.30	63.80	
	6B 7B	4.00 - 4.20 4.20 - 4.65 4.30 - 4.50	4.20	C20			Stiff light brown slightly gravelly sandy CLAY. Gravel is subrounded and rounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	4.70	63.40	
	8D	5.00 - 5.45	4.50	S 13			Firm dark brownish grey silty CLAY with frequent fine sand sized selenite crystals. (LONDON CLAY FORMATION)			
	9D	6.00								
	10U	6.50 - 6.95	4.50							
	11D 12D	6.95 6.95 - 7.40	4.50	S 20			Stiff dark brownish grey silty CLAY with frequent fine sand sized selenite crystals. (LONDON CLAY FORMATION)	6.95	61.15	
	13D	7.50					7.50m: Subangular claystone cobble.			
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 4.50m.

BACKFILL: On completion, borehole backfilled with arisings 18.00-6.30m and bentonite pellets 6.30-4.30m. A slotted standpipe (50mm) was installed to 4.30m, granular response zone 4.30-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT
31710CHECKED
JL

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH02

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 11 April 2016

Easting 473544.1

Scale 1 : 50

End Date 12 April 2016

Northing 171549.8 Ground level 68.10mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
11/04/16 1615hrs Dry	14U	8.00 - 8.40	4.50				Stiff to very stiff dark brownish grey silty CLAY with rare shell fragments (up to 2mm). (LONDON CLAY FORMATION)	8.40	59.70	
	15D	8.40								
	16D	8.40 - 8.85	4.50	S 29						
	17D	9.00								
	18U	9.50 - 9.90	4.50							
	19D	9.90								
	20D	9.90 - 10.35	4.50	S 30						
	21D	10.50								
	22U	11.00 - 11.40	4.50					11.40	56.70	
	23D	11.40								
12/04/16 0800hrs Dry	24D	11.40 - 11.85	4.50	S 32			Very stiff dark grey silty CLAY with frequent fine sand sized selenite crystals. (LONDON CLAY FORMATION)			
	25D	12.00								
	26U	12.50 - 12.90	4.50							
	27D	12.90								
	28D	12.90 - 13.35	4.50	S 33						
	29D	13.50						13.50	54.60	
	30U	14.00 - 14.40	4.50							
	31D	14.40								
	32D	14.40 - 14.85	4.50	S 34						
	33D	15.00								
12/04/16 1400hrs Dry	34U	15.50 - 15.95	4.50				15.95m: Frequent shell fragments (10mm).			
	34D	15.95								
	35D	15.95 - 16.40	4.50	S 37						
	36D	16.50								
	37U	17.00 - 17.45	4.50							
	38D	17.45								
	39D	17.45 - 17.90	4.50	S 41				18.00	50.10	
							Borehole completed at 18.00m.	{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks							AGS		CONTRACT	CHECKED
Groundwater not encountered.									31710	JL

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 31 March 2016 Easting 473549.9

Scale 1 : 50

End Date 4 April 2016 Northing 171504.2 Ground level 68.60mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
31/03/16 1200hrs	1B	0.20 - 0.30					MADE GROUND comprising black TARMACADAM.	0.10	68.50	
	1ES	0.20 - 0.30					Light yellowish brown very gravelly medium and coarse SAND. Gravel is subangular and subrounded fine and medium flint and concrete. (MADE GROUND)	0.50 0.60	68.10 68.00	
	2B	0.60 - 0.70					MADE GROUND comprising light grey CONCRETE. (MADE GROUND)	1.10	67.50	
	2ES	0.60 - 0.70								
	3D	1.20					Dark greenish brown very clayey fine and medium SAND. (MADE GROUND?)			
	4D	1.20 - 1.65	1.20	S 11			Firm becoming stiff dark orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)			
	3ES	1.50								
	5B	1.80								
	6UT	2.00 - 2.45	2.00							
	7D	2.40								
	8D	2.40 - 2.85	2.40	S 26						
	9B	2.80 - 3.00					Medium dense light orangish brown sandy angular to subrounded fine and medium flint GRAVEL. (BOYN HILL GRAVEL MEMBER)	2.75	65.85	
		3.00 - 3.45	3.00	C 28						
31/03/16 1600hrs 3.10m										
01/04/16 0800hrs 3.10m	10B	3.80 - 4.00								
		4.00 - 4.45	4.00	C 45			Dense light orangish brown very gravelly fine to coarse SAND. Gravel is subangular to rounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	4.00	64.60	
	11B	4.80 - 5.00								
		5.00 - 5.45	5.00	C 46						
	12B	5.80 - 6.00								
		6.00 - 6.45	6.00	C 30						
	13D	6.30					Stiff light brown mottled dark orangish brown slightly sandy CLAY. (LONDON CLAY FORMATION)	6.30	62.30	
	14B	6.70 - 7.00					Stiff dark brownish grey silty CLAY with rare shell fragments (up to 3mm). (LONDON CLAY FORMATION)	6.60	62.00	
	15UT	7.00 - 7.45	7.00							
	16D	7.35								
	17D	7.50 - 7.95	7.00	S 21						
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with bentonite pellets 18.00-6.30m. A slotted standpipe (50mm) was installed to 6.30m, granular response zone 6.30-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks
3.50	3.50	3.10	20	


CONTRACT
31710
CHECKED
JL

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 31 March 2016 Easting 473549.9

Scale 1 : 50

End Date 4 April 2016 Northing 171504.2 Ground level 68.60mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
	18D	8.00					8.00m: Mica crystals (up to 15mm).			
	19UT	8.50 - 8.80	7.00					8.80	59.80	
	20D	8.80								
	21D	9.00 - 9.45	7.00	S 23			Stiff becoming very stiff dark grey silty CLAY with frequent fine sand sized selenite crystals and shell fragments (up to 3mm). (LONDON CLAY FORMATION)			
	22D	9.50								
	23UT	10.00 - 10.45	7.00							
	24D	10.40								
	25D	10.40 - 10.85	7.00	S 34			10.40m: Burrow cast (5mm).			
	26D	11.00								
	27UT	11.50 - 11.95	7.00							
01/04/15 1600hrs Dry	28D	11.95								
	29D	11.95 - 12.40	7.00	S 30						
04/04/16 0800hrs 12.10m	30D	12.50								
	31U	13.00 - 13.45	7.00							
	32D	13.40								
	33D	13.50 - 13.95	7.00	S 34			Very stiff dark grey silty CLAY with frequent fine and medium gravel sized pockets of silty sand. (LONDON CLAY FORMATION)	13.50	55.10	
	34D	14.00								
	35U	14.50 - 14.95	7.00							
	36D	14.90								
	37D	14.90 - 15.35	7.00	S 37			14.90m: Rare shell fragments (up to 3mm).			
	38D	15.50								
	39U	16.00 - 16.45	7.00							
	40D	16.45								
	41D	16.45 - 16.90	7.00	S 36						
	42D	17.00								
04/04/16 1400hrs Dry	43U	17.50 - 17.95	7.00							
	44D	17.95						18.00	50.60	
							Borehole completed at 18.00m.	{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks							AGS	CONTRACT 31710	CHECKED JI	

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 2

Start Date 6 April 2016

Easting 473501.8

Scale 1 : 50

End Date 8 April 2016

Northing 171510.4 Ground level 69.45mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
06/04/16 1400hrs	1B	0.20 - 0.40					MADE GROUND comprising dark grey BLOCK PAVING.	0.10	69.35	
	1ES	0.20 - 0.40					Light greyish brown slightly clayey sandy angular to subrounded fine to coarse concrete and flint GRAVEL.	0.50	68.95	
	2B	0.50 - 0.70					(MADE GROUND)			
06/04/16 1600hrs Dry	2ES	0.50 - 0.70					Soft to firm light brown mottled dark orangish brown slightly sandy gravelly CLAY. Gravel is subangular and subrounded fine and medium flint. (HEAD DEPOSITS)	0.90	68.55	
	3B	0.90 - 1.10								
	3ES	0.90 - 1.10								
07/04/16 0800hrs Dry		1.20 - 1.65	1.20	C 16			Stiff light orangish brown slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine and medium flint. (HEAD DEPOSITS)			
	4B	2.00 - 2.20								
		2.20 - 2.65	2.20	C 12						
	5B	2.40 - 2.70					Firm light orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)	2.40	67.05	
	6U	2.70 - 3.15	2.70							
	7D	3.15								
	8D	3.15 - 3.60	3.00	S 31						
	9B	3.50 - 3.70					Dense light brown slightly clayey very gravelly medium and coarse SAND. Gravel is subangular to rounded fine to coarse flint. (BOYN HILL GRAVEL MEMBER)	3.50	65.95	
	10B	4.00 - 4.20								
		4.20 - 4.65	4.20	C 31						
	11B	4.80 - 5.00					Loose light brown very gravelly fine to coarse SAND. Gravel is subangular and subrounded fine and medium flint. (BOYN HILL GRAVEL MEMBER)	4.70	64.75	
		5.00 - 5.45	5.00	C 8						
	12B	6.00 - 6.20								
	13D	6.20								
	14U	6.50 - 6.95	6.50				Stiff dark brownish grey silty CLAY. (LONDON CLAY FORMATION)	6.20	63.25	
	15D	6.95								
	16D	6.95 - 7.40	6.50	S 22						
	17D	7.50					Stiff dark brownish grey silty CLAY with rare shell fragments (up to 2mm). (LONDON CLAY FORMATION)	7.50	61.95	
							Continued Next Page	{8.00}		

EQUIPMENT: Light cable percussive (shell and auger) rig.

METHOD: Hand dug inspection pit 0.00-1.20m. Cable percussion (150mm) 1.20-18.00m.

CASING: 150mm diam to 7.00m.

BACKFILL: On completion, borehole backfilled with arisings 18.00-7.50m and bentonite pellets 7.50-6.20m. A slotted standpipe (50mm) was installed to 6.20m, granular response zone 6.20-1.00m, bentonite seal 1.00-0.20m, concrete and stopcock cover 0.20- 0.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks

Groundwater not encountered.

CONTRACT
31710CHECKED
JL

BOREHOLE LOG

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 2 of 2

Start Date 6 April 2016

Easting 473501.8

Scale 1 : 50

End Date 8 April 2016

Northing 171510.4 Ground level 69.45mOD

Depth 18.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru- ment	description	depth (m)	reduced level (m)	legend
	18U	8.00 - 8.35	7.00							
	19D	8.35								
	20D	8.50 - 8.95	7.00	S 24				9.00	60.45	
	21D	9.00					Stiff dark brownish grey silty CLAY with frequent fine sand sized selenite. (LONDON CLAY FORMATION)			
	22U	9.50 - 9.90	7.00							
	23D	9.90								
	24D	9.90 - 10.35	7.00	S 29						
	25D	10.50								
07/04/16 1615hrs Dry	26U	11.00 - 11.35	7.00							
	27D	11.35								
08/04/16 0800hrs Dry	28D	11.50 - 11.95	7.00	S 29			11.50m: Burrow.			
	29D	12.00								
	30UT	12.50 - 12.90	7.00							
	31D	12.90					12.90m: Rare shell fragments (up to 2mm).			
	32D	12.90 - 13.35	7.00	S 31			12.90 - 13.35m: Very stiff.			
	33D	13.50								
	34UT	14.00 - 14.45	7.00					14.45	55.00	
	35D	14.45								
	36D	14.45 - 14.90	7.00	S 35			Very stiff dark grey silty CLAY with frequent fine and medium sand sized pockets of light grey fine sand and rare shell fragments (up to 2mm). (LONDON CLAY FORMATION)			
	37D	15.00								
	38UT	15.50 - 15.90	7.00							
	39D	15.90								
	40D	15.90 - 16.35	7.00	S 36						
	41D	16.50								
	42UT	17.00 - 17.40	7.00							
08/04/16 1400hrs Dry	43D	17.40								
	44D	17.40 - 17.85	7.00	S 36				18.00	51.45	
							Borehole completed at 18.00m.	{18.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks										
Groundwater not encountered.							AGS	CONTRACT 31710	CHECKED JI	

STANDARD PENETRATION TEST

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows	pen (mm)	pen (mm)	pen (mm)			
BH01	1.20	1.65	1.20	Dry	1 2	75 75	2 3 4 4	75 75 75 75			S	13	81
BH01	2.20	2.65	2.20	Dry	1 2	75 75	3 3 3 3	75 75 75 75			C	12	81
BH01	3.25	3.70	3.20	Dry	1 2	75 75	2 4 5 5	75 75 75 75			S	16	81
BH01	4.00	4.45	4.00	3.60	3 4	75 75	6 6 6 6	75 75 75 75			C	24	81
BH01	5.00	5.45	5.00	4.10	3 4	75 75	8 11 11 12	75 75 75 75			C	42	81
BH01	6.00	6.45	6.00	4.90	4 8	75 75	8 6 12 10	75 75 75 75			C	36	81
BH01	6.85	7.30	6.50	6.60	3 4	75 75	5 5 7 7	75 75 75 75			S	24	81
BH01	8.45	8.90	7.00	Dry	2 3	75 75	4 6 6 6	75 75 75 75			S	22	81
BH01	9.95	10.40	7.00	Dry	3 4	75 75	5 6 8 8	75 75 75 75			S	27	81
BH01	11.45	11.90	7.00	Dry	2 5	75 75	5 6 8 9	75 75 75 75			S	28	81
BH01	12.95	13.40	7.00	Dry	5 6	75 75	6 8 10 10	75 75 75 75			S	34	81
BH01	14.40	14.85	7.00	Dry	5 5	75 75	7 8 8 10	75 75 75 75			S	33	81
BH01	15.95	16.40	7.00	Dry	5 6	75 75	8 8 11 21	75 75 75 75			S	48	81
BH01	17.45	17.90	7.00	Dry	6 7	75 75	8 10 10 11	75 75 75 75			S	39	81
BH02	1.20	1.65	1.20	Dry	1 0	75 75	0 1 1 0	75 75 75 75			C	2	81
BH02	2.20	2.65	2.20	Dry	1 2	75 75	2 3 3 5	75 75 75 75			C	13	81
BH02	3.20	3.65	3.20	Dry	1 2	75 75	4 6 8 9	75 75 75 75			C	27	81
BH02	4.20	4.65	4.20	Dry	3 2	75 75	3 4 6 7	75 75 75 75			C	20	81
BH02	5.00	5.45	4.50	Dry	1 2	75 75	2 3 4 4	75 75 75 75			S	13	81
BH02	6.95	7.40	4.50	Dry	2 3	75 75	4 4 6 6	75 75 75 75			S	20	81
BH02	8.40	8.85	4.50	Dry	4 4	75 75	6 7 8 8	75 75 75 75			S	29	81
BH02	9.90	10.35	4.50	Dry	3 4	75 75	5 6 7 12	75 75 75 75			S	30	81
BH02	11.40	11.85	4.50	Dry	4 5	75 75	6 8 8 10	75 75 75 75			S	32	81
BH02	12.90	13.35	4.50	Dry	5 6	75 75	7 8 8 10	75 75 75 75			S	33	81

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. ** Denotes no effective penetration.

CONTRACT

31710

CHECKED

Jl

STANDARD PENETRATION TEST

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows	pen (mm)	pen (mm)	pen (mm)			
BH02	14.40	14.85	4.50	Dry	3 5	75 75	6 8 9 11	75 75 75 75			S	34	81
BH02	15.95	16.40	4.50	Dry	5 6	75 75	8 8 10 11	75 75 75 75			S	37	81
BH02	17.45	17.90	4.50	Dry	4 5	75 75	7 11 10 13	75 75 75 75			S	41	81
BH03	1.20	1.65	1.20	Dry	1 2	75 75	2 3 2 4	75 75 75 75			S	11	81
BH03	2.40	2.85	2.40	Dry	1 3	75 75	3 4 6 13	75 75 75 75			S	26	81
BH03	3.00	3.45	3.00	Dry	2 4	75 75	9 7 6 6	75 75 75 75			C	28	81
BH03	4.00	4.45	4.00	3.10	6 6	75 75	9 11 13 12	75 75 75 75			C	45	81
BH03	5.00	5.45	5.00	3.60	4 8	75 75	9 12 15 10	75 75 75 75			C	46	81
BH03	6.00	6.45	6.00	5.30	2 5	75 75	6 7 8 9	75 75 75 75			C	30	81
BH03	7.50	7.95	7.00	6.20	3 4	75 75	4 5 6 6	75 75 75 75			S	21	81
BH03	9.00	9.45	7.00	Dry	3 4	75 75	5 5 6 7	75 75 75 75			S	23	81
BH03	10.40	10.85	7.00	Dry	4 5	75 75	7 8 8 11	75 75 75 75			S	34	81
BH03	11.95	12.40	7.00	Dry	3 4	75 75	6 7 7 10	75 75 75 75			S	30	81
BH03	13.50	13.95	7.00	Dry	5 9	75 75	7 8 9 10	75 75 75 75			S	34	81
BH03	14.90	15.35	7.00	Dry	4 5	75 75	7 9 10 11	75 75 75 75			S	37	81
BH03	16.45	16.90	7.00	Dry	4 6	75 75	7 9 10 10	75 75 75 75			S	36	81
BH04	1.20	1.65	1.20	Dry	2 2	75 75	4 4 4 4	75 75 75 75			C	16	81
BH04	2.20	2.65	2.20	Dry	1 2	75 75	3 3 3 3	75 75 75 75			C	12	81
BH04	3.15	3.60	3.00	Dry	1 4	75 75	4 8 9 10	75 75 75 75			S	31	81
BH04	4.20	4.65	4.20	4.00	3 4	75 75	6 8 8 9	75 75 75 75			C	31	81
BH04	5.00	5.45	5.00	4.60	3 2	75 75	2 2 2 2	75 75 75 75			C	8	81
BH04	6.95	7.40	6.50	Dry	2 3	75 75	4 6 5 7	75 75 75 75			S	22	81
BH04	8.50	8.95	7.00	Dry	3 4	75 75	4 6 7 7	75 75 75 75			S	24	81
BH04	9.90	10.35	7.00	Dry	4 4	75 75	6 7 7 9	75 75 75 75			S	29	81

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. ** Denotes no effective penetration.

CONTRACT

31710

CHECKED

JI



SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole no.	borehole depth (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
					blows	pen (mm)	blows		pen (mm)				
BH04	11.50	11.95	7.00	Dry	3 5	75 75	5 8 8 8	75 75 75 75		S	29	81	
BH04	12.90	13.35	7.00	Dry	4 4	75 75	6 7 9 9	75 75 75 75		S	31	81	
BH04	14.45	14.90	7.00	Dry	4 5	75 75	7 8 9 11	75 75 75 75		S	35	81	
BH04	15.90	16.35	7.00	Dry	5 7	75 75	7 8 10 11	75 75 75 75		S	36	81	
BH04	17.40	17.85	7.00	Dry	4 6	75 75	7 8 10 11	75 75 75 75		S	36	81	

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. N values have not been subjected to any correction.
3. Test carried out using split spoon S, solid cone C.
4. Where full test drive not completed, linearly extrapolated N value reported.
5. <1 Denotes hammer self weight penetration (sank under own weight).
6. ** Denotes no effective penetration.

CONTRACT
31710

CHECKED
JI

TRIAL PIT LOG



TP02

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473558.7

Scale 1 : 25

End Date 4 April 2016

Northing 171510.2 Ground level 68.50mOD

Depth 2.70 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
1.10m: seepage	1B		0.20	MADE GROUND comprising black TARMACADAM.	0.10	68.40	
	1ES		0.20	Light yellowish brown sandy subangular to rounded fine to coarse flint, brick and concrete GRAVEL. (MADE GROUND)	0.35	68.15	
				Dark greenish grey slightly clayey gravelly coarse SAND with a medium subangular brick cobble content. Gravel is angular and subangular fine to coarse brick and flint. (MADE GROUND)			
	2B		0.80				
	2ES		0.80		1.10	67.40	
				Firm to stiff light orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)			
	3B	H 92	1.50				
			1.60				
	3ES		1.60		2.10	66.40	
	4B		2.50	Light orangish brown sandy subangular to rounded fine and medium flint GRAVEL. (BOYN HILL GRAVEL MEMBER)			
Damp	4ES		2.50		2.70	65.80	
				Trial pit completed at 2.70m.			

Notes

Trial pit excavated by JCB 3CX mechanical excavator.
Groundwater seepage encountered at 1.10m.
Trial pit sides remained stable and vertical.
Trial pit dimensions 0.70x1.50x2.70m.
On completion, the trial pit was backfilled with materials arising.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT

31710

CHECKED

JI

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

Geotechnical Engineering Limited
SOAKAWAY TEST



CLIENT KNOWLES & SON (OXFORD) LTD
 SITE UNIVERSITY OF READING HEALTH AND LIFE SCIENCES BUILDING TRIAL PIT **TP02**
 DATE 04/04/2016

TEST 1 LENGTH 1.50 m BREADTH 0.70 m DEPTH 2.70 m WATER LEVEL Dry m FILL LEVEL 1.68 m V_{p75-25} 0.536 m³ a_{p50} 3.294 m² t_{p75-25} min soil infiltration rate, f ms⁻¹ Insufficient water take to calculate infiltration rate	Time (minutes)
TEST 2 LENGTH m BREADTH m DEPTH m WATER LEVEL m FILL LEVEL m V_{p75-25} m³ a_{p50} m² t_{p75-25} min soil infiltration rate, f ms⁻¹	Time (minutes)
TEST 3 LENGTH m BREADTH m DEPTH m WATER LEVEL m FILL LEVEL m V_{p75-25} m³ a_{p50} m² t_{p75-25} min soil infiltration rate, f ms⁻¹	Time (minutes)
Remarks Test carried out in accordance with BRE 365 (2007).	
CONTRACT CHECKED 31710 JI	

TRIAL PIT LOG



TP03

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473477.7

Scale 1 : 25

End Date 4 April 2016

Northing 171610.6 Ground level 69.15mOD

Depth 2.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	Grass over soft dark brown slightly gravelly sandy CLAY. Gravel is subangular and subrounded fine to coarse flint. (MADE GROUND)	0.30	68.85	
	1ES		0.20				
				Soft light brown mottled dark orangish brown sandy CLAY. (MADE GROUND)	1.10	68.05	
	2B		0.70				
	2ES		0.70				
		H 28	0.80	Light grey slightly silty fine to coarse SAND. (MADE GROUND)	1.70	67.45	
	3B		1.30				
	3ES		1.30				
	4B	H 61	1.80	Firm light orangish brown mottled light grey sandy CLAY. (HEAD DEPOSITS)	2.00	67.15	
	4ES		1.80				
				Trial pit completed at 2.00m.			

Notes

Trial pit excavated by JCB 3CX mechanical excavator.
Groundwater not encountered.
Trial pit sides remained stable and vertical.
Trial pit dimensions 0.60x1.60x2.00m.
On completion, the trial pit was backfilled with materials arising.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT

31710

CHECKED

JI

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

Geotechnical Engineering Limited

IN-SITU HAND VANE/POCKET PENETROMETER



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	depth (m)	hand vane peak (kPa)	average hand vane peak (kPa)	hand vane remoulded (kPa)	average hand vane remoulded (kPa)	pocket penetrometer (kg/cm ²)	average pocket penetrometer (kPa)*	remarks
TP02	1.50	100 68 108	92	49 45 52	49			
TP03	0.80	30 28 25	28	12 12 10	11			
TP03	1.80	66 57 60	61	42 40 26	36			
general remarks:								
Hand vane test results reported as undrained shear strength. *Average pocket penetrometer results reported as undrained shear strength.							CONTRACT 31710	CHECKED JI

TRIAL PIT LOG**IP01**

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473506.9

Scale 1 : 25

End Date 4 April 2016

Northing 171508.7 Ground level 69.50mOD

Depth 1.00 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	Soft dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. (MADE GROUND)	0.40	69.10	
	1ES		0.20				
	2B		0.60	Dark greenish grey slightly gravelly clayey fine and medium SAND. Gravel is angular and subangular fine and medium flint. (MADE GROUND)	0.90	68.60	
	2ES		0.60				
	3B		0.90- 1.00	Firm to stiff light orangish brown mottled light brown slightly sandy slightly gravelly CLAY. Gravel subangular and subrounded fine and medium flint. (HEAD DEPOSITS)	1.00	68.50	
	3ES		0.90- 1.00				
Trial pit completed at 1.00m.							

Notes

Trial pit excavated by hand.
Groundwater was not encountered.
Trial pit sides remained stable.
On completion, the trial pit was backfilled and the surface reinstated.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT

31710

CHECKED

J1

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

TRIAL PIT DETAIL

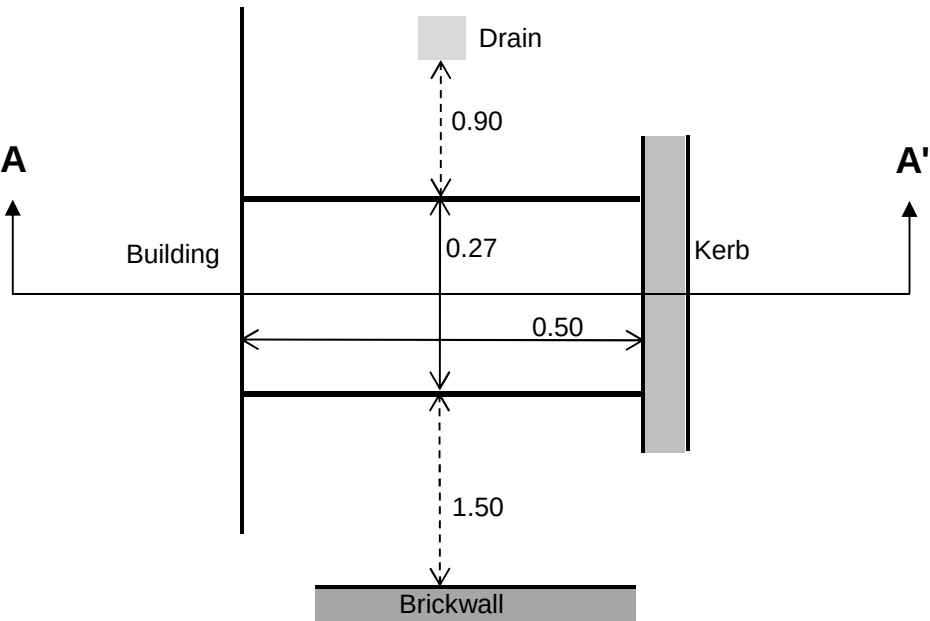
CLIENT KNOWLES AND SON (OXFORD) LTD

SITE UNIVERSITY OF READING HEALTH AND LIFE S

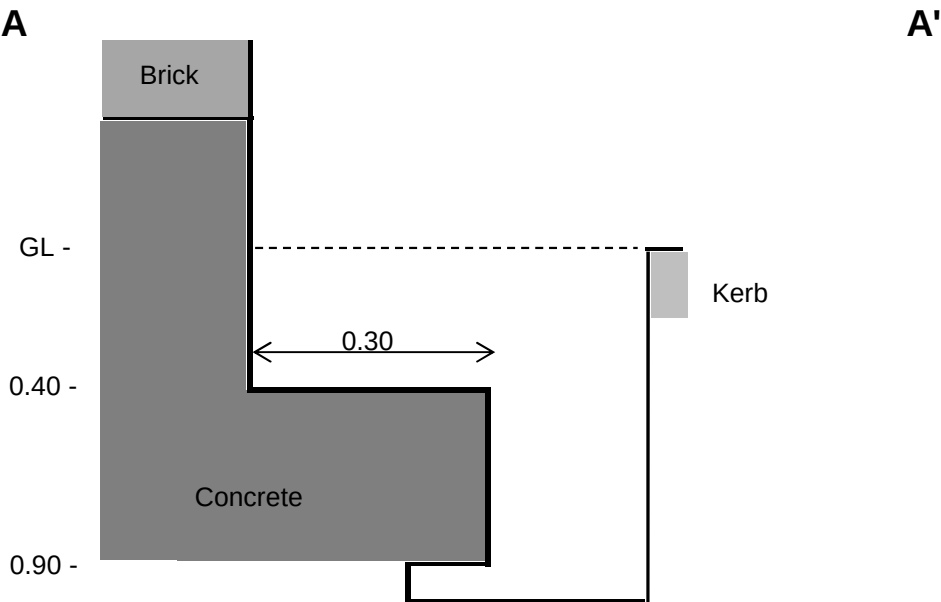


IP01

Plan View



Section A - A'



All measurements in metres.
Not to scale.

CONTRACT
31710

CHECKED
JI

TRIAL PIT LOG



IP02

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473532.0

Scale 1 : 25

End Date 4 April 2016

Northing 171500.8 Ground level 68.95mOD

Depth 1.25 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	MADE GROUND comprising black TARMACADAM.	0.10	68.85	
	1ES		0.20	Light yellowish brown sandy subangular to rounded fine to coarse flint brick and concrete GRAVEL. (MADE GROUND)	0.35	68.60	
	2B		0.50	Dark greenish grey slightly clayey gravelly coarse SAND with a medium subangular brick cobble content. Gravel is angular and subangular fine to coarse brick and flint. (MADE GROUND)	0.80	68.15	
	2ES		0.50				
				Soft to firm light brown sandy CLAY. (HEAD DEPOSITS)			
	3B		1.00				
	3ES		1.00		1.25	67.70	
				Trial pit completed at 1.25m.			

Notes

Trial pit excavated by hand.
Groundwater was not encountered.
Trial pit sides remained stable.
On completion, the trial pit was backfilled and the surface reinstated.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT

31710

CHECKED

JI

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

TRIAL PIT DETAIL

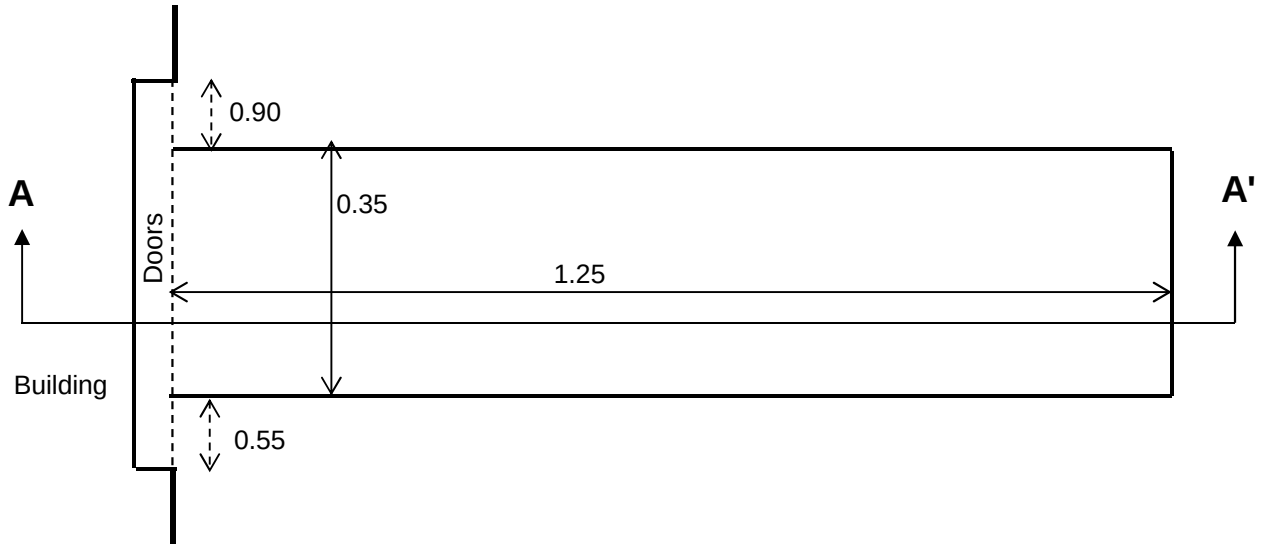
CLIENT KNOWLES AND SON (OXFORD) LTD

SITE UNIVERSITY OF READING HEALTH AND LIFE S

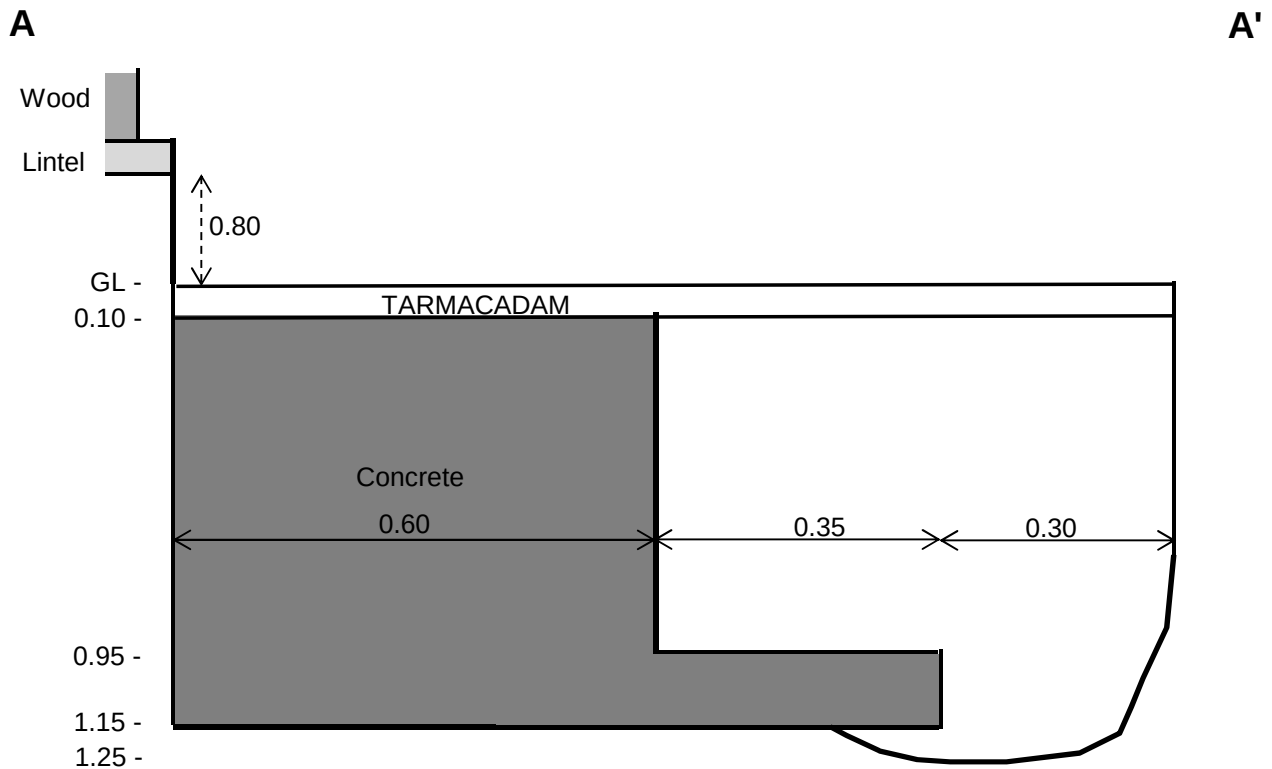


IP02

Plan View



Section A - A'



All measurements in metres.
Not to scale.

CONTRACT
31710

CHECKED
JI

TRIAL PIT LOG**IP03**

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Sheet 1 of 1

Start Date 4 April 2016

Easting 473511.6

Scale 1 : 25

End Date 4 April 2016

Northing 171488.1 Ground level 69.55mOD

Depth 0.60 m

water record	sample/test			description	depth (m)	level (m)	legend
	no/type	result	depth (m)				
Dry	1B		0.20	Grass over dark brown slightly clayey slightly gravelly fine SAND. Gravel is subangular to rounded fine and medium flint. Frequent rootlets. (MADE GROUND)	0.30	69.25	
	1ES		0.20				
	2B		0.50	Firm to stiff light orangish brown mottled light brown slightly gravelly sandy CLAY. Gravel is subangular to rounded fine and medium flint. (HEAD DEPOSITS)	0.60	68.95	
	2ES		0.50				
				Trial pit completed at 0.60m.			

Notes

Trial pit excavated by hand.
Groundwater was not encountered.
Trial pit sides remained stable.
On completion, the trial pit was backfilled and the surface reinstated.

Sketch of Foundation - Not to scale. All dimensions in metres.



CONTRACT

31710

CHECKED

J1

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

TRIAL PIT DETAIL

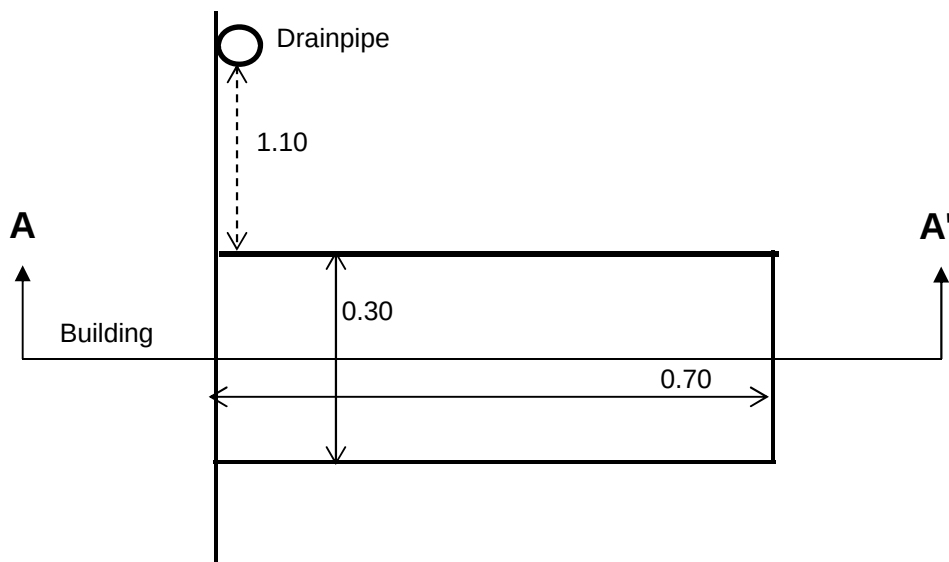
CLIENT KNOWLES AND SON (OXFORD) LTD

SITE UNIVERSITY OF READING HEALTH AND LIFE S

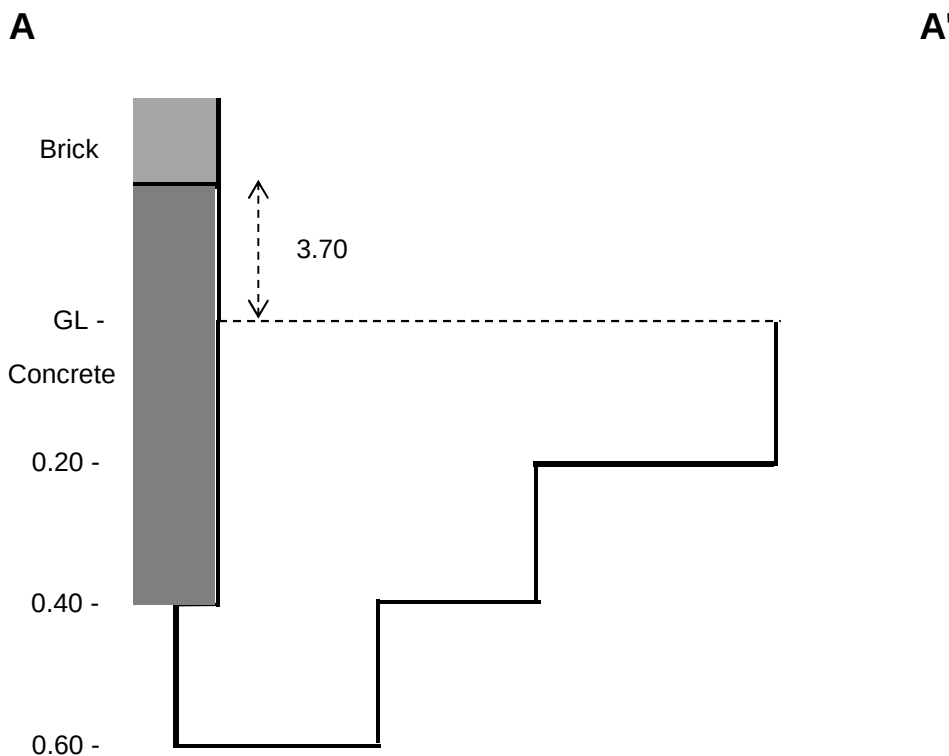


IP03

Plan View



Section A - A'



All measurements in metres.
Not to scale.

CONTRACT	CHECKED
31710	JI

Easting	473521.0
Northing	171481.8
Ground level	69.35mOD

[illegible]

Test carried out in accordance with operating instructions for the dynamic cone penetrometer Model A2465 by CNS Farnell Ltd.
CBR correlation based on the relationship $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 * \text{Log}_{10}(\text{mm/blow})$ developed by TRL taken from The Highways Agency Interim Advice Note 73/06 - Design Guidance for Road Pavement Foundations (2009)

CONTRACT 31710	CHECKED JJ
--------------------------	----------------------

DYNAMIC CONE PENETROMETER TESTING



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES

BUILDING

DATE 1 April 2016

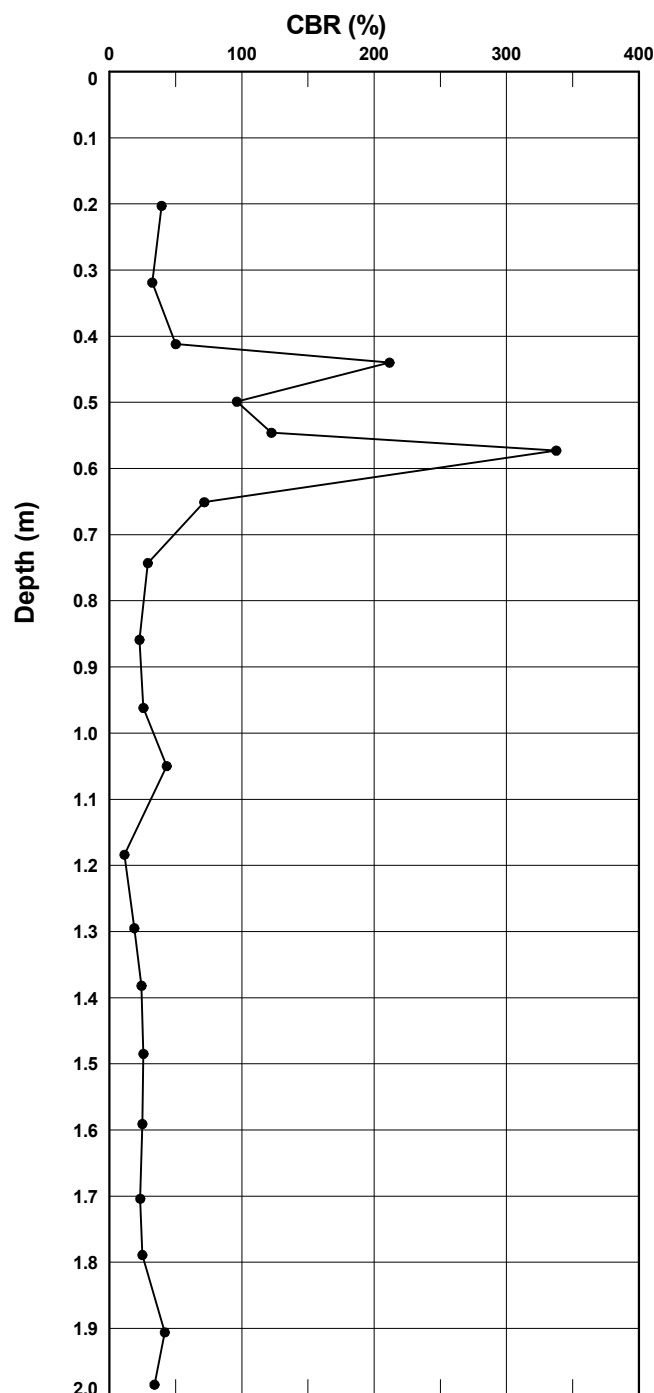
DCP02

Easting 473543.7

Northing 171479.5

Ground level 69.00mOD

Initial scale reading (mm) 0 Datum bgl (mm) 100

[illegible]

Remarks:

Test carried out in accordance with operating instructions for the dynamic cone penetrometer Model A2465 by

CNS Farnell Ltd.

CBR correlation based on the relationship $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 * \text{Log}_{10}(\text{mm/blow})$ developed by TRL taken from The Highways Agency Interim Advice Note 73/06 - Design Guidance for Road Pavement Foundations (2009)

CONTRACT

31710

CHECKED

JI



APPENDIX D

GAS MONITORING

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole / trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH01	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	18/04/16 09:50:00	1017	-0.52								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH01	18/04/16 09:51:00										0.0			
BH01	18/04/16 09:52:00										0.0			
BH01	18/04/16 09:53:00										0.0			
BH01	18/04/16 09:54:00										0.0			
BH01	18/04/16 09:55:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:56:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:57:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:58:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:59:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 10:00:00			3.4	0.0	13.0	0.0	0	0	1.7				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	18/04/16 10:01:00			3.3	0.0	13.0	0.0	0	0	1.7				
BH01	18/04/16 10:02:00			3.2	0.0	13.0	0.0	0	1	1.7				
BH01	18/04/16 10:03:00			3.1	0.0	13.0	0.0	0	1	1.6				
BH01	18/04/16 10:04:00			3.1	0.0	13.1	0.0	0	1	1.5				
BH01	18/04/16 10:05:00												3.91	
BH01	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH01	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:00:00	1003	0.38								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:01:00										0.0			
BH01	25/04/16 10:02:00										0.0			
BH01	25/04/16 10:03:00										0.0			
BH01	25/04/16 10:04:00										0.0			
BH01	25/04/16 10:05:00			2.8	0.1	11.2	2.0	0	0	1.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	25/04/16 10:06:00			2.8	0.1	11.1	2.0	0	0	1.8				
BH01	25/04/16 10:07:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:08:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:09:00			3.2	0.1	10.7	2.0	0	0	1.8				
BH01	25/04/16 10:10:00			3.5	0.1	10.5	2.0	0	0	1.8				
BH01	25/04/16 10:11:00			3.7	0.1	10.3	2.0	0	0	1.8				
BH01	25/04/16 10:12:00			3.9	0.1	10.1	2.0	0	0	1.8				
BH01	25/04/16 10:13:00			4.0	0.1	10.0	2.0	0	0	1.8				
BH01	25/04/16 10:14:00			4.1	0.1	9.9	2.0	0	0	1.8				
BH01	25/04/16 10:15:00												3.50	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH02	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	18/04/16 11:30:00	1010	-0.51								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH02	18/04/16 11:31:00										0.0			
BH02	18/04/16 11:32:00										0.0			
BH02	18/04/16 11:33:00										0.0			
BH02	18/04/16 11:34:00										0.0			
BH02	18/04/16 11:35:00			4.3	0.0	11.9	0.0	0	1	1.4				
BH02	18/04/16 11:36:00			4.3	0.0	11.8	0.0	0	0	1.4				
BH02	18/04/16 11:37:00			4.6	0.0	11.6	0.0	0	0	1.3				
BH02	18/04/16 11:38:00			4.8	0.0	11.4	0.0	0	0	1.3				
BH02	18/04/16 11:39:00			5.0	0.0	11.3	0.0	0	0	0.2				
BH02	18/04/16 11:40:00			5.1	0.0	11.2	0.0	0	0	1.1				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	18/04/16 11:41:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:42:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:43:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:44:00			5.0	0.0	11.3	0.0	0	0	1.1				
BH02	18/04/16 11:45:00												3.22	
BH02	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH02	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:00:00	1003	0.33								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:01:00										0.0			
BH02	25/04/16 11:02:00										0.0			
BH02	25/04/16 11:03:00										0.0			
BH02	25/04/16 11:04:00										0.0			
BH02	25/04/16 11:05:00			2.2	0.0	17.7	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	25/04/16 11:06:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:07:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:08:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:09:00			2.2	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:10:00			2.1	0.0	17.9	0.0	0	0	0.6				
BH02	25/04/16 11:11:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:12:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:13:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:14:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:15:00												3.82	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole / trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH03	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	18/04/16 09:00:00	1019	-0.81								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH03	18/04/16 09:01:00										0.0			
BH03	18/04/16 09:02:00										0.0			
BH03	18/04/16 09:03:00										0.0			
BH03	18/04/16 09:04:00										0.0			
BH03	18/04/16 09:05:00			0.2	0.0	19.8	0.0	0	0	0.9				
BH03	18/04/16 09:06:00			0.2	0.0	19.9	0.0	0	0	0.8				
BH03	18/04/16 09:07:00			0.3	0.0	19.7	0.0	0	0	0.8				
BH03	18/04/16 09:08:00			0.3	0.0	19.5	0.0	0	0	0.8				
BH03	18/04/16 09:09:00			0.4	0.0	19.2	1.0	0	0	0.8				
BH03	18/04/16 09:10:00			0.5	0.0	18.7	1.0	0	0	0.9				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	18/04/16 09:11:00			0.7	0.1	18.2	1.0	0	0	0.9				
BH03	18/04/16 09:12:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:13:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:14:00			0.9	0.1	18.0	1.0	0	1	0.9				
BH03	18/04/16 09:15:00												3.52	
BH03	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH03	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:00:00	1004									0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:01:00										0.0			
BH03	25/04/16 10:02:00										0.0			
BH03	25/04/16 10:03:00										0.0			
BH03	25/04/16 10:04:00										0.0			
BH03	25/04/16 10:05:00			3.4	0.0	16.1	0.0	0	0	0.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	25/04/16 10:06:00			3.8	0.1	15.6	1.0	0	0	0.8				
BH03	25/04/16 10:07:00			4.3	0.1	15.0	1.0	0	0	0.7				
BH03	25/04/16 10:08:00			5.0	0.1	14.2	1.0	0	0	0.6				
BH03	25/04/16 10:09:00			5.2	0.1	14.0	1.0	0	0	0.5				
BH03	25/04/16 10:10:00			5.0	0.1	14.3	1.0	0	0	0.5				
BH03	25/04/16 10:11:00			5.0	0.1	14.3	1.0	0	0	0.5				
BH03	25/04/16 10:12:00			4.7	0.1	14.6	1.0	0	0	0.5				
BH03	25/04/16 10:13:00			4.7	0.1	14.7	1.0	0	0	0.5				
BH03	25/04/16 10:14:00			4.7	0.1	14.8	1.0	0	0	0.5				
BH03	25/04/16 10:15:00												3.25	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH04	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	18/04/16 10:20:00	1016	-0.29								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH04	18/04/16 10:21:00										0.0			
BH04	18/04/16 10:22:00										0.0			
BH04	18/04/16 10:23:00										0.0			
BH04	18/04/16 10:24:00										0.0			
BH04	18/04/16 10:25:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:26:00			1.3	0.0	18.5	0.0	0	0	0.7				
BH04	18/04/16 10:27:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:28:00			1.1	0.0	18.7	0.0	0	0	0.6				
BH04	18/04/16 10:29:00			1.1	0.0	18.8	0.0	0	0	0.6				
BH04	18/04/16 10:30:00			1.3	0.0	18.6	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	18/04/16 10:31:00			1.4	0.0	18.4	0.0	0	0	0.6				
BH04	18/04/16 10:32:00			1.4	0.0	18.5	0.0	0	0	0.6				
BH04	18/04/16 10:33:00			1.6	0.0	18.2	0.0	0	0	0.6				
BH04	18/04/16 10:34:00			1.7	0.0	18.1	0.0	0	0	0.6				
BH04	18/04/16 10:35:00												3.83	
BH04	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH04	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:40:00	1003	0.68								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:41:00										0.0			
BH04	25/04/16 10:42:00										0.0			
BH04	25/04/16 10:43:00										0.0			
BH04	25/04/16 10:44:00										0.0			
BH04	25/04/16 10:45:00			2.6	0.0	16.1	0.0	0	1	1.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	25/04/16 10:46:00			2.7	0.0	16.0	0.0	0	0	1.7				
BH04	25/04/16 10:47:00			2.7	0.0	15.9	0.0	0	0	1.7				
BH04	25/04/16 10:48:00			2.8	0.0	15.8	0.0	0	0	1.6				
BH04	25/04/16 10:49:00			2.9	0.0	15.7	0.0	0	0	1.6				
BH04	25/04/16 10:50:00			3.0	0.0	15.6	0.0	0	0	1.5				
BH04	25/04/16 10:51:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:52:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:53:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:54:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:55:00												3.91	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl



APPENDIX E

LABORATORY TESTING



2718

GEOTECHNICAL ENGINEERING LIMITED



For the attention of Jon Ind

Version No. 1

Page No. 1 of 29

Date of Issue 23/05/2016

TEST REPORT

PROJECT/SITE	University of Reading - Health and Life Sciences Building	Samples received	14/04/2016
GEL REPORT NUMBER	31710	Schedule received	14/04/2016
Your ref/PO:	0	Testing commenced	19/04/2016
Test report refers to	Schedule 1	Status	Final

SUMMARY OF RESULTS ATTACHED

TEST METHOD & DESCRIPTION	QUANTITY	ACCREDITED TEST
BS EN ISO 17892-1: 2014:5. Water Content	16	YES
BS1377: Part 2: 1990:4.2-4.4&5.2-5.4, Liquid & Plastic Limits	16	YES
BS1377: Part 2: 1990:9.2, Particle Size Distribution - Wet Sieve	5	YES
BS1377: Part 2: 1990:9.4, Particle Size Distribution - Pipette	2	YES
BS1377: Part 4: 1990:7, California Bearing Ratio (CBR)	1	YES
BS1377: Part 7: 1990:8&9, Undrained Triaxial Compression	15	NO
BS1377: Part 8: 1990: Effective Stress Testing	2	NO
Hand vane (non BS1377)	15	NO
BRE SD1 Reduced Suite: pH, Sulphate - water and acid soluble, sulphur (subcontracted)	10	YES

Remarks This report may not be partially reproduced without written permission from this laboratory.	Approved Signatories: S Robinson (Client Manager) C Andrew (Client Manager) W Jones (Technical Support) J Hanson (Director) N Parry (Director) 
---	--

Doc TR01

Rev No. 14

Revision date 23/10/15

DC:JH

Geotechnical Engineering Ltd

Centurion House
Olympus Park, Quedgeley
Gloucester GL2 4NF

Registered number: 00700739

VAT Number: 682 5857 89

www.geoeng.co.uk

geotech@geoeng.co.uk

TEL: 01452 527743

Fax: 01452 729314

Payments: Geotechnical Engineering Limited

Sort code: 30-15-99 Bank account: 00072116

LIQUID AND PLASTIC LIMITS**BS.1377 : Part 2 : 1990 : 4 and 5**

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
BH01	2B	0.50	0.50	14.4	BXE	40	47	17	30	Brown mottled reddish brown slightly sandy gravelly CLAY
BH01	3B	1.00	1.00	17.0	BXE	19	44	16	28	Reddish brown mottled light grey slightly sandy slightly gravelly CLAY
BH01	5B	2.00	2.00	21.3	BXE	26	42	15	27	Reddish brown slightly sandy slightly gravelly CLAY
BH01	7D	2.80	2.80	26.5	AXE	0	42	17	25	Brown slightly sandy CLAY
BH01	11B	5.00	5.00	29.2	BXE	6	67	28	39	Brown slightly sandy slightly gravelly CLAY
BH01	18D	7.50	7.50	25.9	AXE	0	64	23	41	Grey slightly sandy CLAY
BH02	7B	4.30	4.30	25.9	BXE	18	66	27	39	Brown slightly sandy slightly gravelly CLAY
BH02	9D	6.00	6.00	28.3	AXE	0	62	22	40	Grey slightly sandy CLAY
BH03	5B	1.80	1.80	19.3	BXE	11	42	16	26	Orangish brown mottled greyish brown slightly sandy slightly gravelly CLAY
BH03	16D	7.35	7.35	25.8	AXE	0	64	25	39	Grey slightly sandy CLAY
BH03	27UT	11.50	11.75	25.2	AXE	0	68	26	42	Dark grey slightly sandy CLAY
BH03	40D	16.45	16.45	22.2	BXE	1	56	21	35	Dark grey slightly sandy CLAY with rare shell fragments
BH04	3B	0.90	0.90	12.7	BXE	50	39	16	23	Orangish brown slightly sandy gravelly CLAY
BH04	4B	2.00	2.00	23.7	BXE	22	44	15	29	Orangish brown slightly sandy slightly gravelly CLAY
BH04	7D	3.15	3.15	25.4	AXE	0	59	23	36	Orangish brown mottled grey slightly sandy CLAY
TP03	4B	1.80	1.80	22.3	BXE	12	49	15	34	Brown and grey mottled reddish brown slightly sandy slightly gravelly CLAY

general remarks:

natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014

NP denotes non-plastic

denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892

specimen preparation:

A - as received

B - washed on 0.425mm sieve

C - air dried

D - oven dried (60°C)

E - oven dried (105°C)

F - not known

test method:

X - cone penetrometer (test 4.3)

Y - one point cone penetrometer (test 4.4)

Z - Casagrande apparatus (test 4.5)

CONTRACT

31710

CHECKED

CA

Geotechnical Engineering Limited

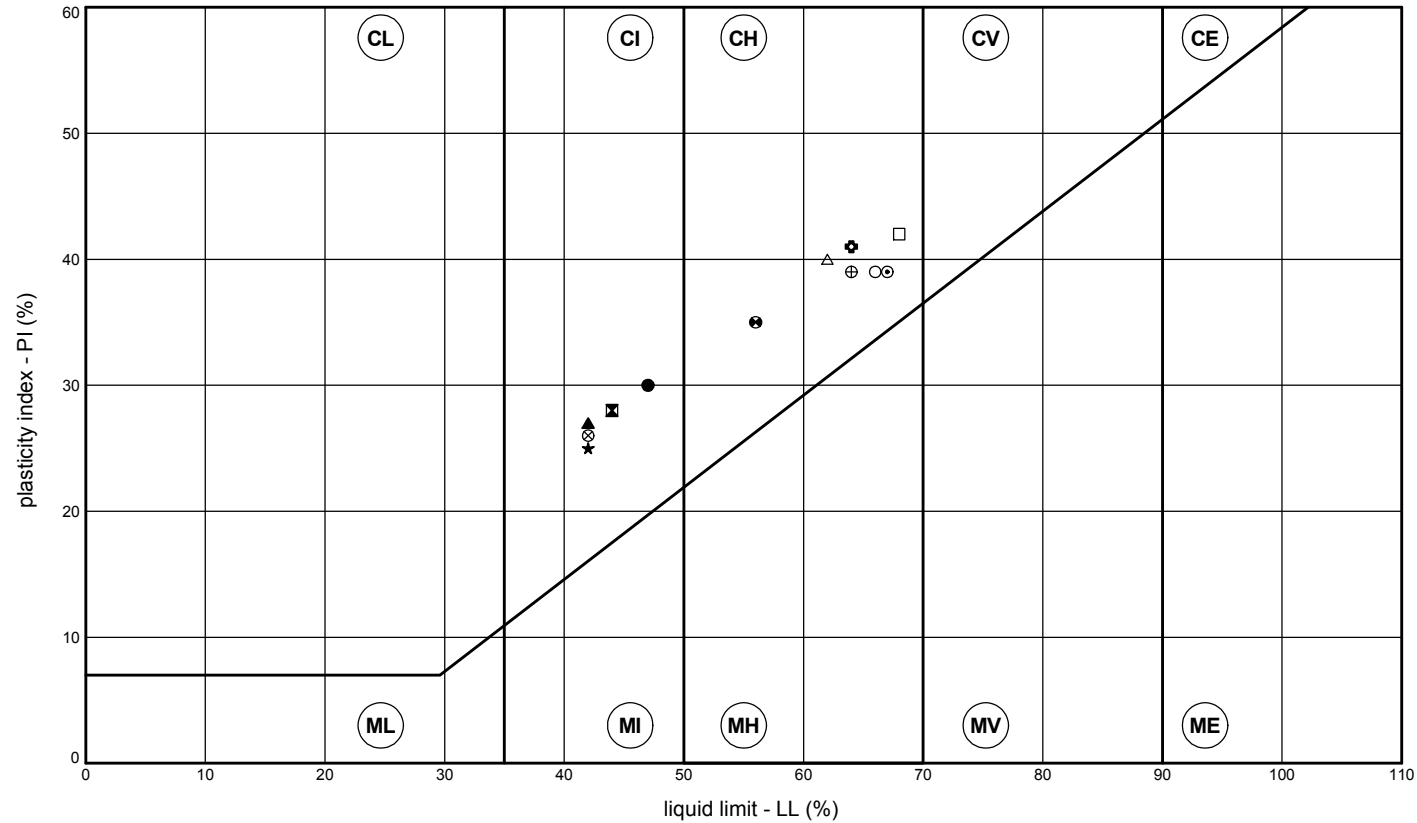
ATTERBERG LINE PLOT



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE

 SCIENCES BUILDING



	BH/TP No.	depth (m)	LL	PL	PI	remarks
●	BH01	0.50	47	17	30	
⊠	BH01	1.00	44	16	28	
▲	BH01	2.00	42	15	27	
★	BH01	2.80	42	17	25	
⊙	BH01	5.00	67	28	39	
⊕	BH01	7.50	64	23	41	
○	BH02	4.30	66	27	39	
△	BH02	6.00	62	22	40	
⊗	BH03	1.80	42	16	26	
⊕	BH03	7.35	64	25	39	
□	BH03	11.75	68	26	42	
⊗	BH03	16.45	56	21	35	

CONTRACT	CHECKED
31710	CA

Geotechnical Engineering Limited

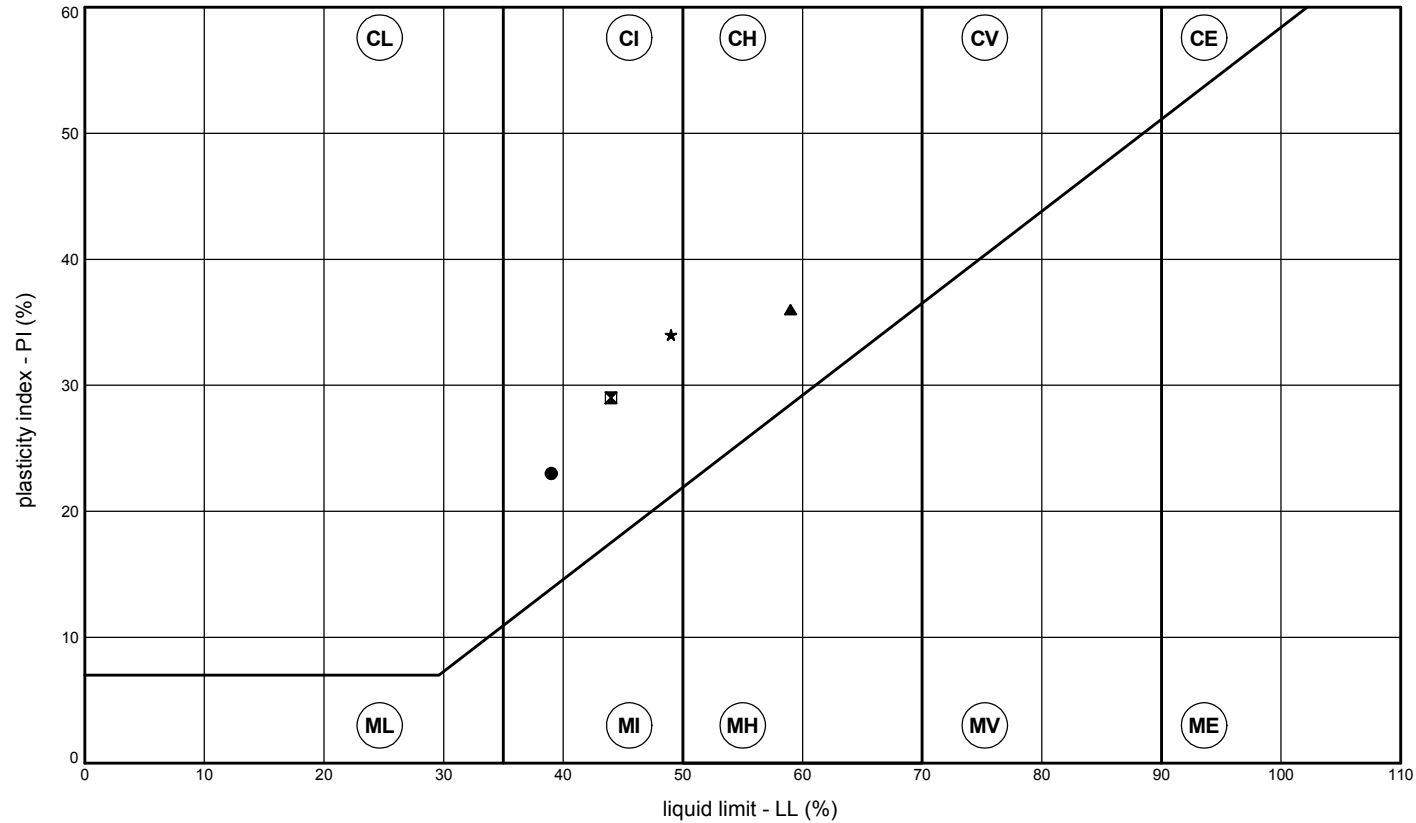
ATTERBERG LINE PLOT



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE

 SCIENCES BUILDING



	BH/TP No.	depth (m)	LL	PL	PI	remarks
●	BH04	0.90	39	16	23	
⊠	BH04	2.00	44	15	29	
▲	BH04	3.15	59	23	36	
★	TP03	1.80	49	15	34	

CONTRACT	CHECKED
31710	CA

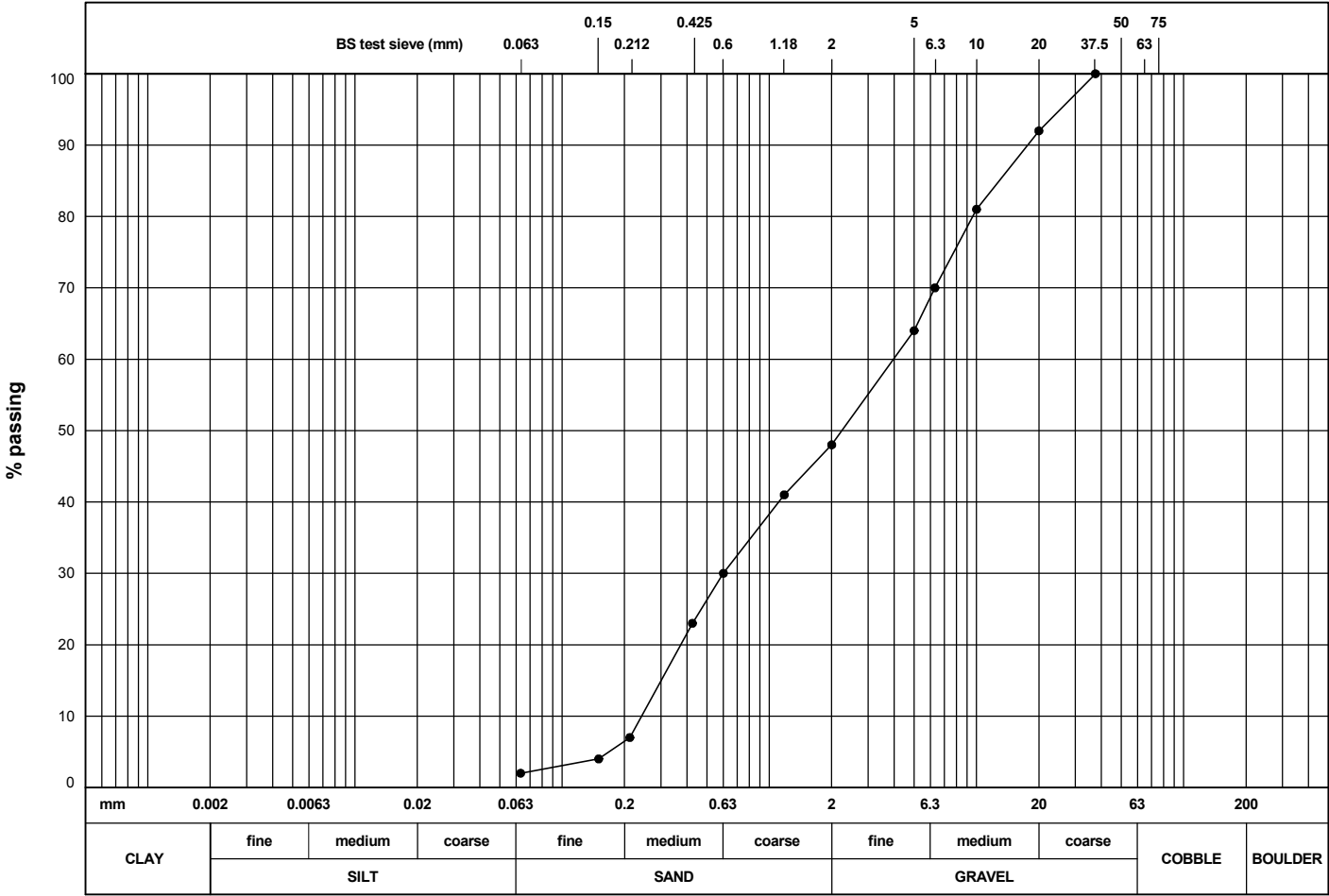
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH01
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	10B
DESCRIPTION	Yellowish brown slightly silty very sandy GRAVEL	SAMPLE DEPTH (m)	4.00
		SPECIMEN DEPTH (m)	4.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	64	20	
SILT	2	75		2	48	6	
SILT & CLAY	46	63		1.18	41	2	
SAND	52	50		0.6	30		
GRAVEL	0	37.5	100	0.425	23		
COBBLE & BOULDER		20	92	0.212	7		
test method(s)	9.2#	10	81	0.15	4		
test method:		6.3	70	0.063	2		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

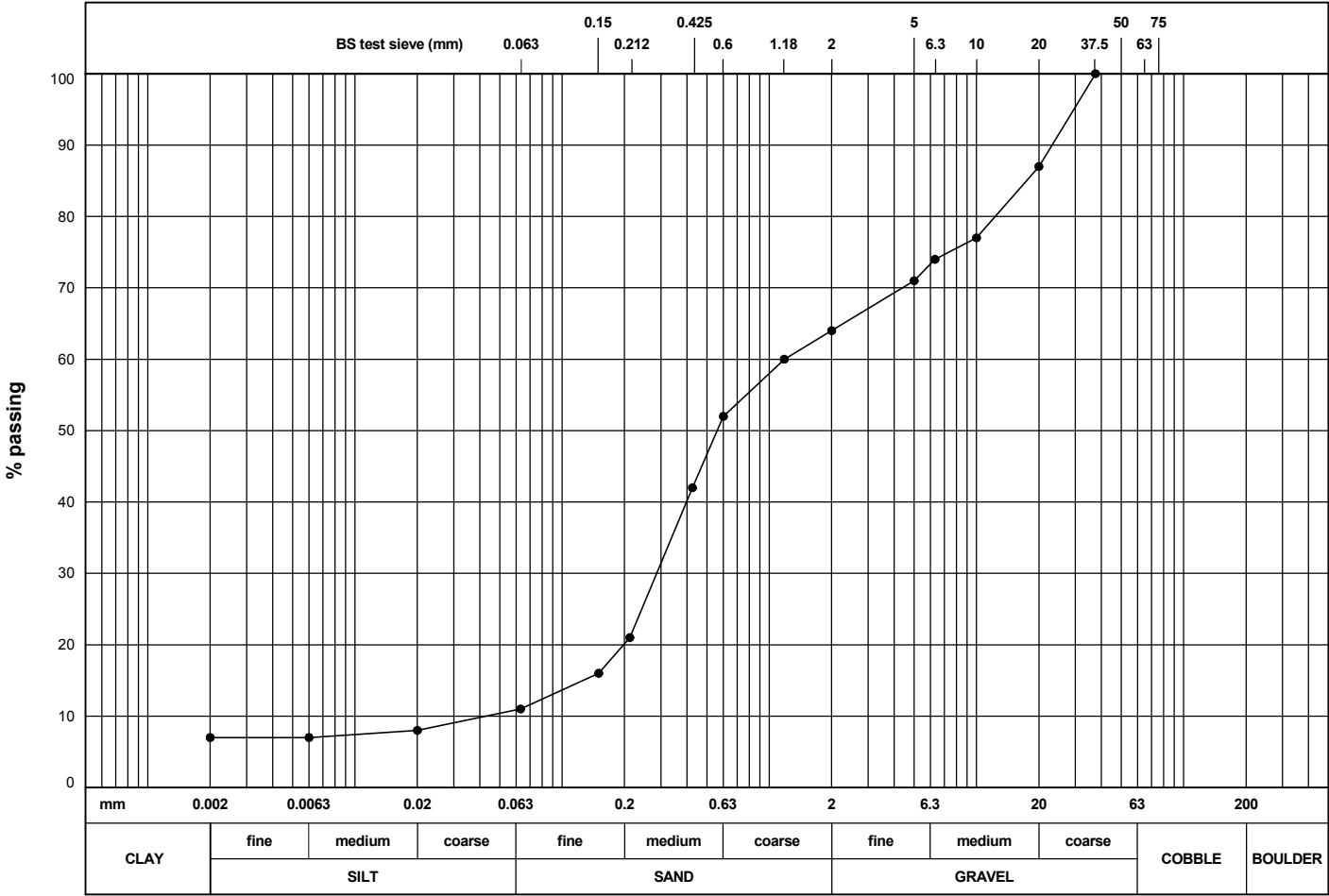
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH02
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	4B
DESCRIPTION	Brown clayey very gravelly SAND	SAMPLE DEPTH (m)	2.00
		SPECIMEN DEPTH (m)	2.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	7	150		5	71	20	8
SILT	4	75		2	64	6	7
SILT & CLAY	11	63		1.18	60	2	7
SAND	53	50		0.6	52		
GRAVEL	36	37.5	100	0.425	42		
COBBLE & BOULDER	0	20	87	0.212	21		
test method(s)	9.2# & 9.4	10	77	0.15	16		
test method:		6.3	74	0.063	11		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

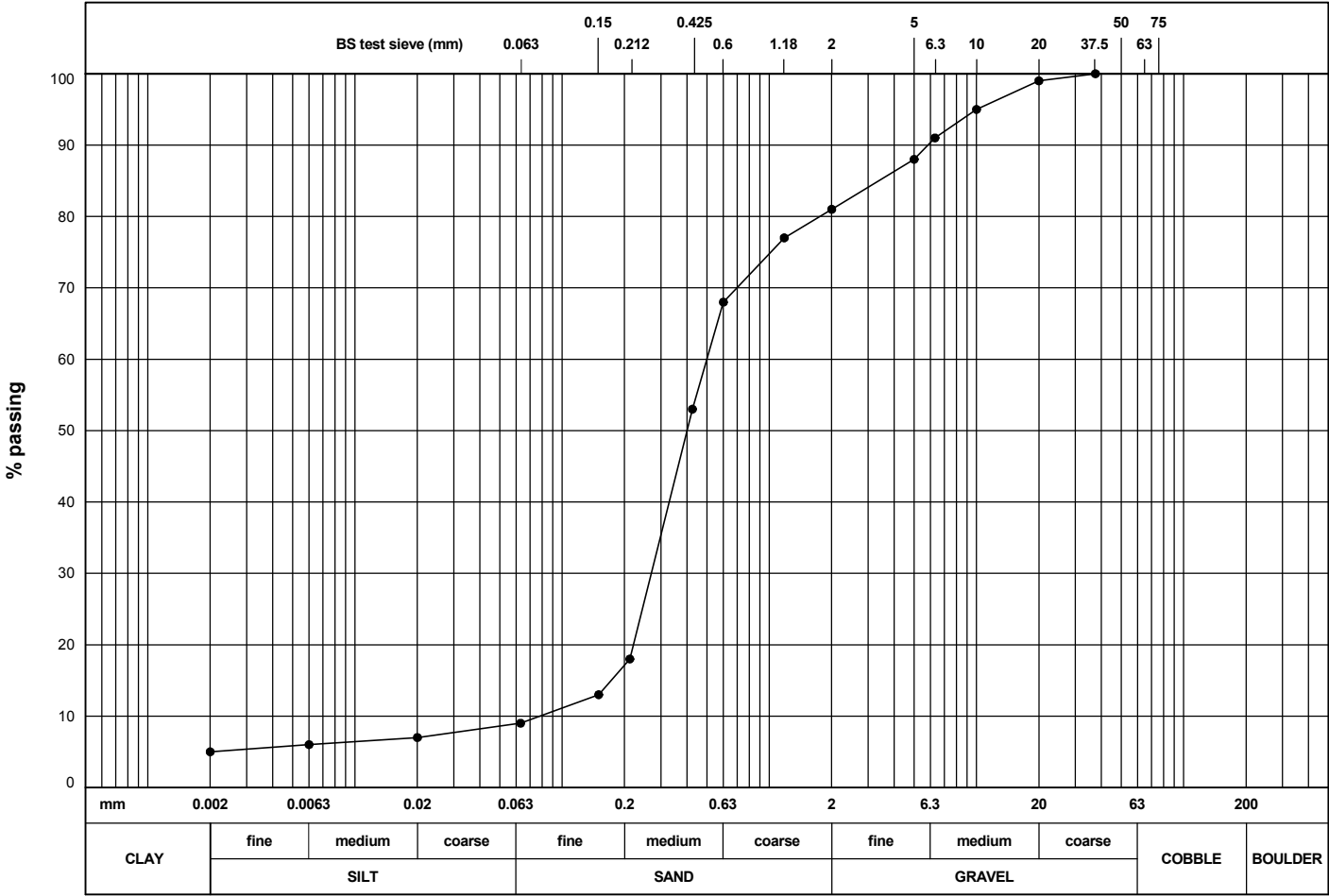
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH02
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	5B
DESCRIPTION	Yellowish brown clayey gravelly SAND	SAMPLE DEPTH (m)	3.00
		SPECIMEN DEPTH (m)	3.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	5	150		5	88	20	7
SILT	4	75		2	81	6	6
SILT & CLAY	9	63		1.18	77	2	5
SAND	72	50		0.6	68		
GRAVEL	19	37.5	100	0.425	53		
COBBLE & BOULDER	0	20	99	0.212	18		
test method(s)	9.2 & 9.4	10	95	0.15	13		
test method:		6.3	91	0.063	9		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

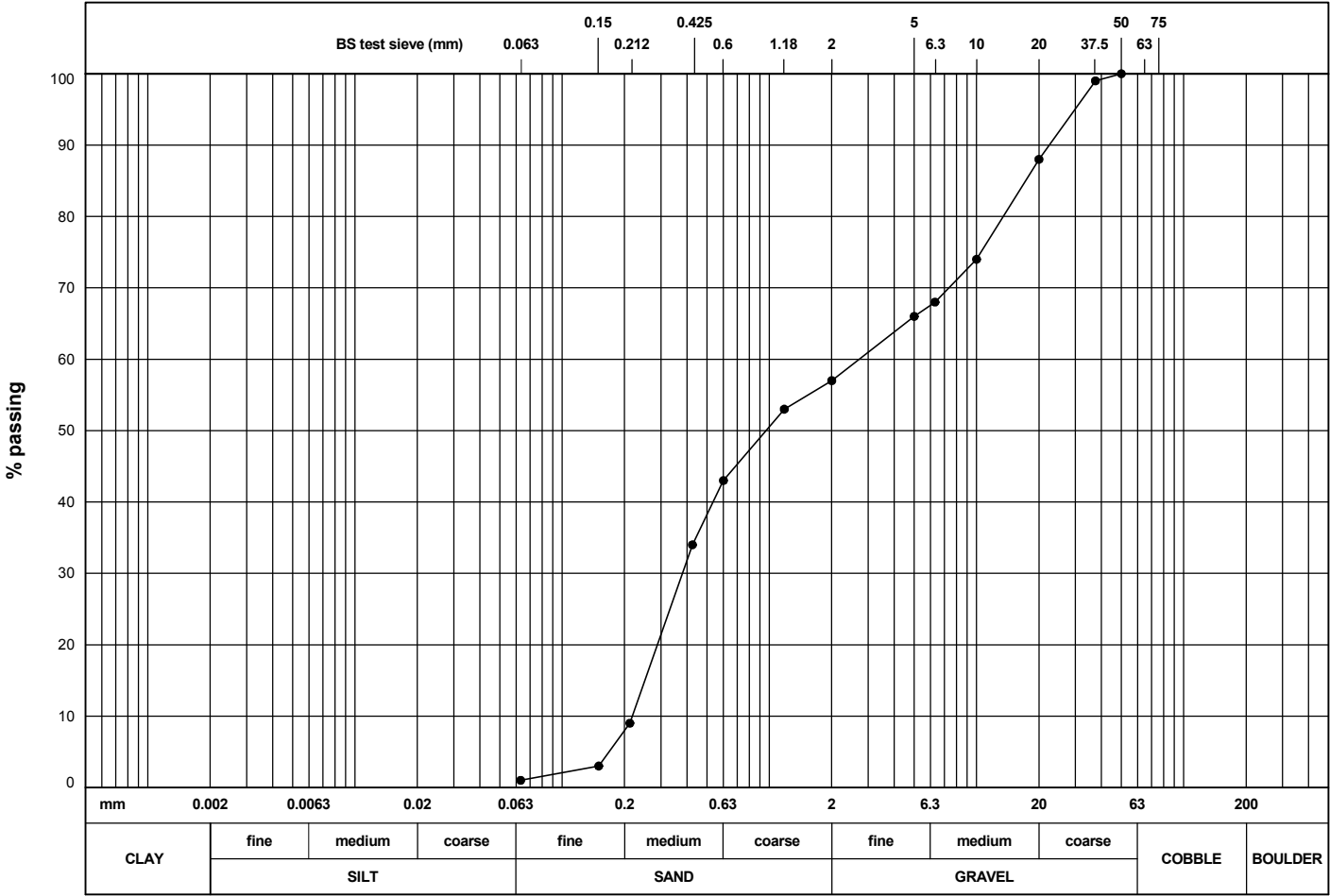
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	11B
		SAMPLE DEPTH (m)	4.80
DESCRIPTION	Yellowish brown slightly clayey very gravelly SAND	SPECIMEN DEPTH (m)	4.80



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	66	20	
SILT		75		2	57	6	
SILT & CLAY	1	63		1.18	53	2	
SAND	56						
GRAVEL	43						
COBBLE & BOULDER	0						
test method(s)	9.2#	50	100	0.6	43		
		37.5	99	0.425	34		
test method:		20	88	0.212	9		
9.2 - wet sieving		10	74	0.15	3		
9.3 - dry sieving		6.3	68	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

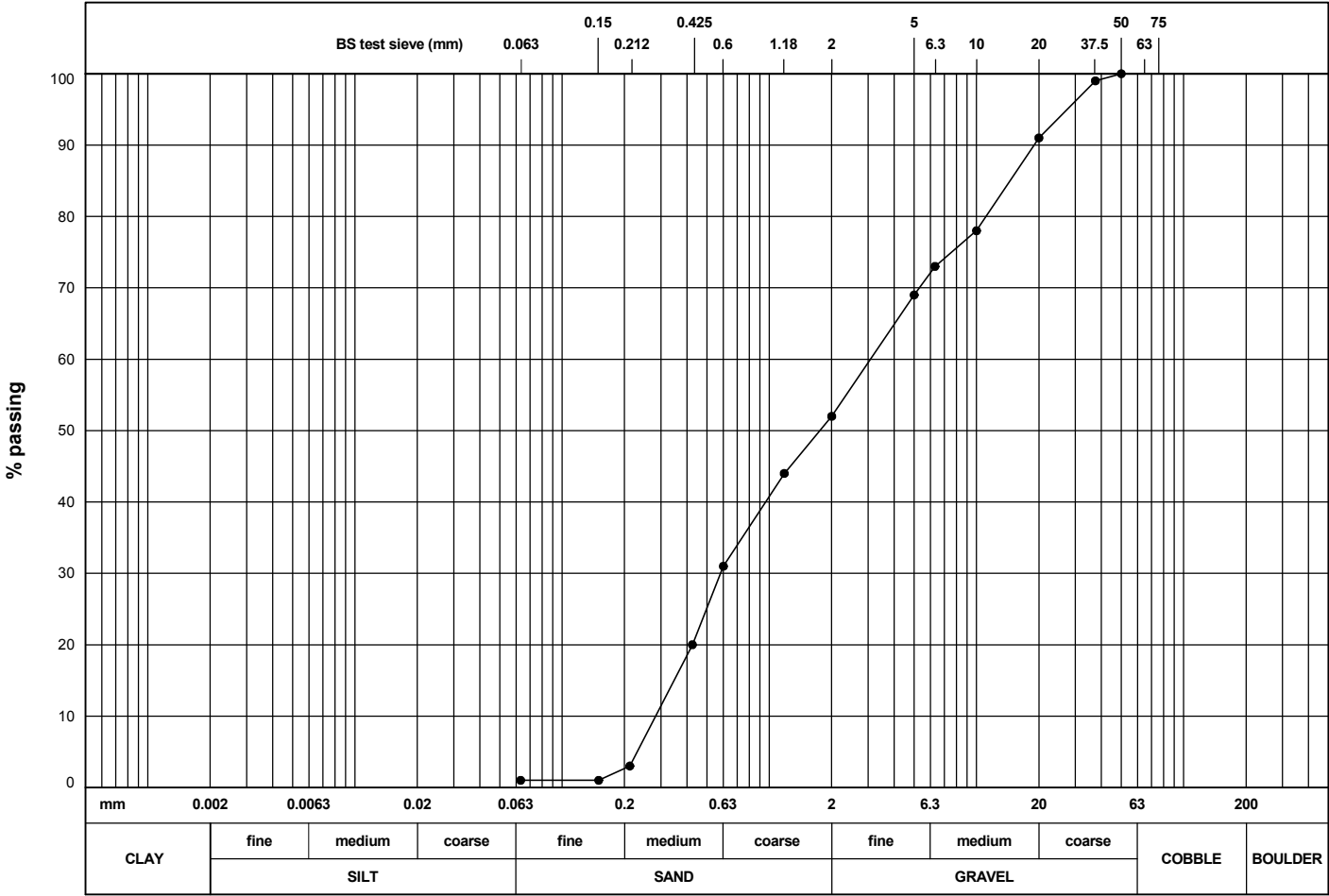
Geotechnical Engineering Limited

PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	10B
DESCRIPTION	Yellowish brown slightly silty very gravelly SAND	SAMPLE DEPTH (m)	4.00
		SPECIMEN DEPTH (m)	4.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	69	20	
SILT		75		2	52	6	
SILT & CLAY	1	63		1.18	44	2	
SAND	51						
GRAVEL	48						
COBBLE & BOULDER	0						
test method(s)	9.2#	50	100	0.6	31		
		37.5	99	0.425	20		
test method:		20	91	0.212	3		
9.2 - wet sieving		10	78	0.15	1		
9.3 - dry sieving		6.3	73	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						31710	CA

CALIFORNIA BEARING RATIO**BS.1377 : Part 4 : 1990 : 7**

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH/TP No.

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES
BUILDING

SAMPLE No./TYPE

2B

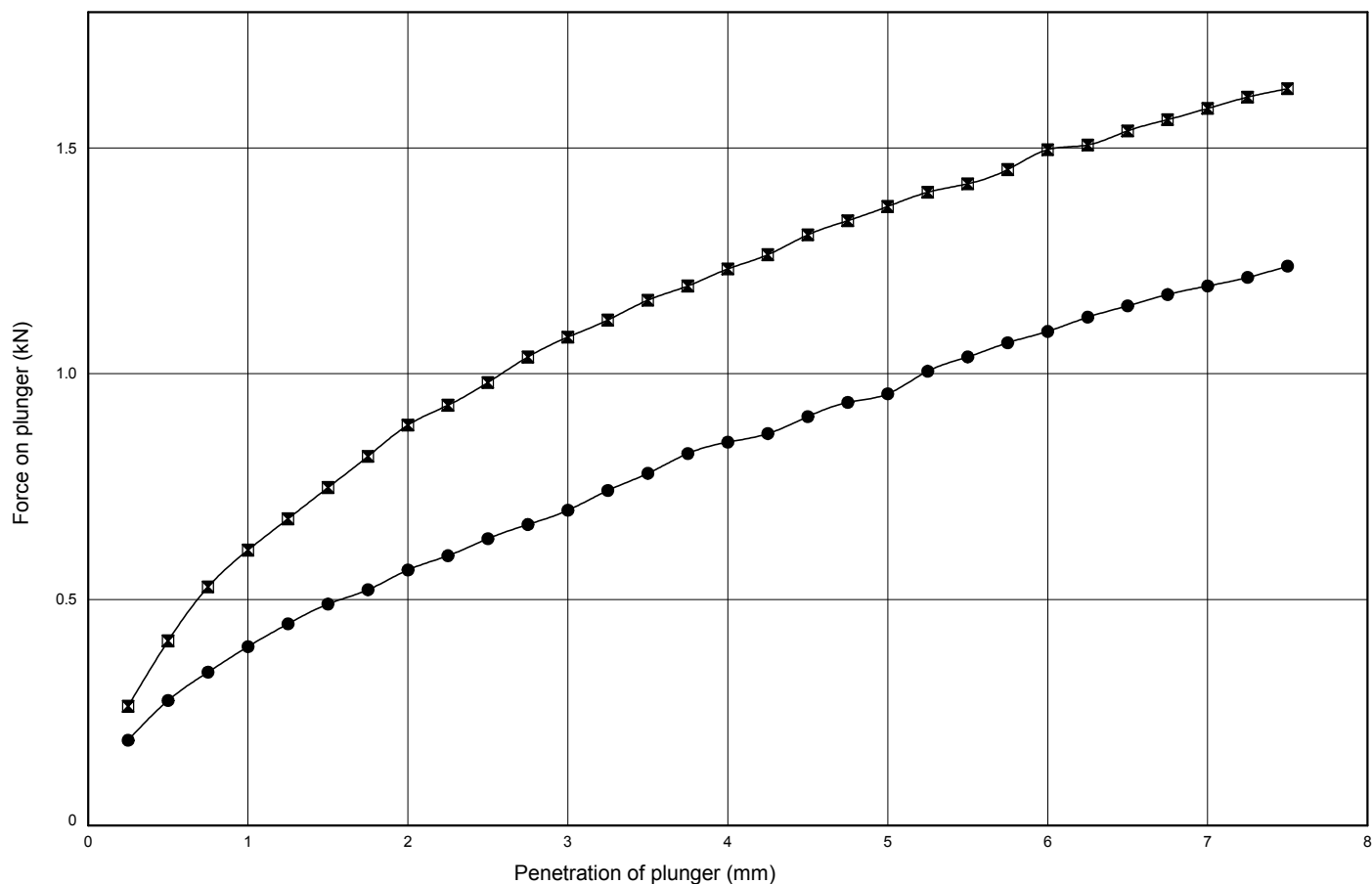
SAMPLE DEPTH (m)

0.50

DESCRIPTION Brown mottled reddish brown slightly sandy gravelly CLAY

SPECIMEN DEPTH (m)

0.50



sample preparation:		Dynamic compaction - 2.5Kg rammer	
proportion >20mm removed (%)	4.4	sample condition	Unsoaked
surcharge mass (kg)	10	amount of swell (mm)	N/A
INITIAL CONDITIONS		FINAL CONDITIONS	
moisture content (%)	12	moisture content - top (%)	16
bulk density (Mg/m ³)	2.04	moisture content - base (%)	14
dry density (Mg/m ³)	1.83		
remarks:			
● ● ● ● ● Top ■ ■ ■ ■ ■ Base		CBR value top (%)	4.8
		CBR value base (%)	7.4
		average CBR value (%)	
		CONTRACT	CHECKED
		31710	CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES**BS.1377 : Part 5 : 1990 : 3**

CLIENT KNOWLES & SON (OXFORD) LIMITED

BH/TP No.

BH01

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES
BUILDING

SAMPLE No./TYPE

8U

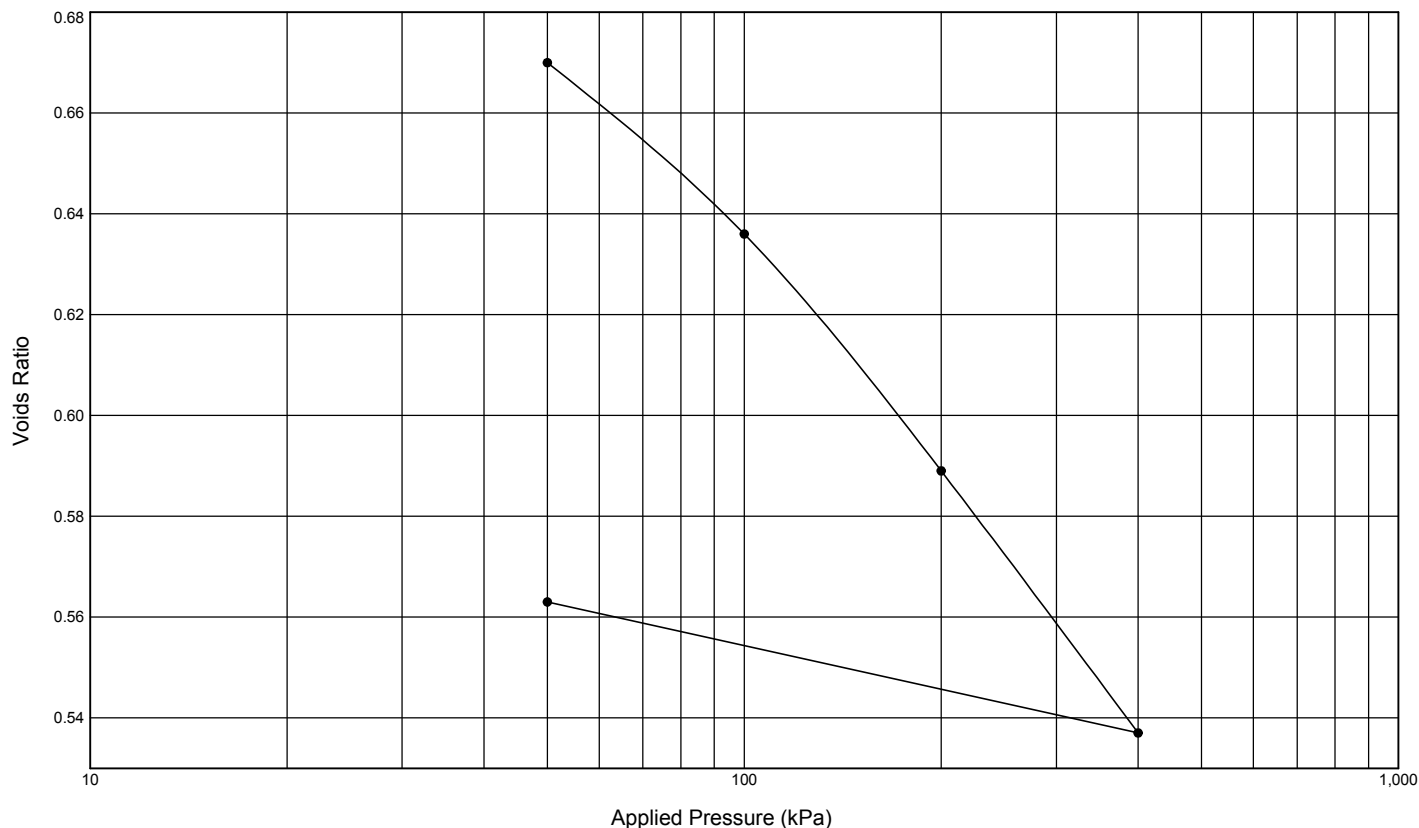
SAMPLE DEPTH (m)

2.80

DESCRIPTION Orangish brown mottled light grey slightly sandy CLAY

SPECIMEN DEPTH (m)

2.80



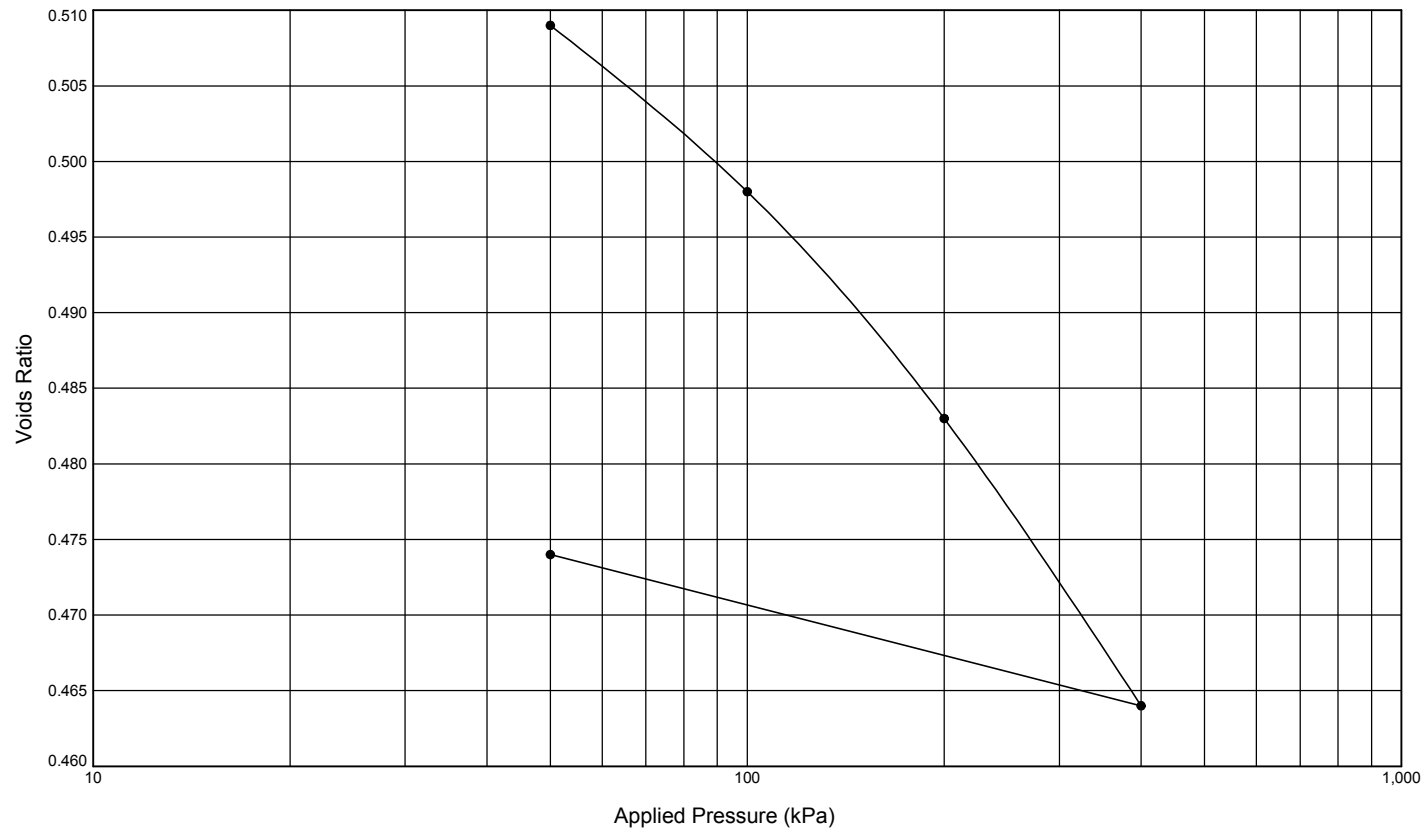
Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.33				
specimen height	(mm)	18.89				
initial moisture content	(%)	26.8				
final moisture content	(%)	22.8				
initial bulk density	(Mg/m ³)	1.98	50	0.670	0.724	1.4
initial dry density	(Mg/m ³)	1.56	100	0.636	0.408	1.3
initial voids ratio		0.733	200	0.589	0.290	1.5
initial degree of saturation	(%)	99	400	0.537	0.163	1.6
particle density	(Mg/m ³)	#2.70	50	0.563	0.049	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES



BS.1377 : Part 5 : 1990 : 3

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6UT
		SAMPLE DEPTH (m)	2.00
DESCRIPTION	Orangish brown mottled grey sandy CLAY	SPECIMEN DEPTH (m)	2.30



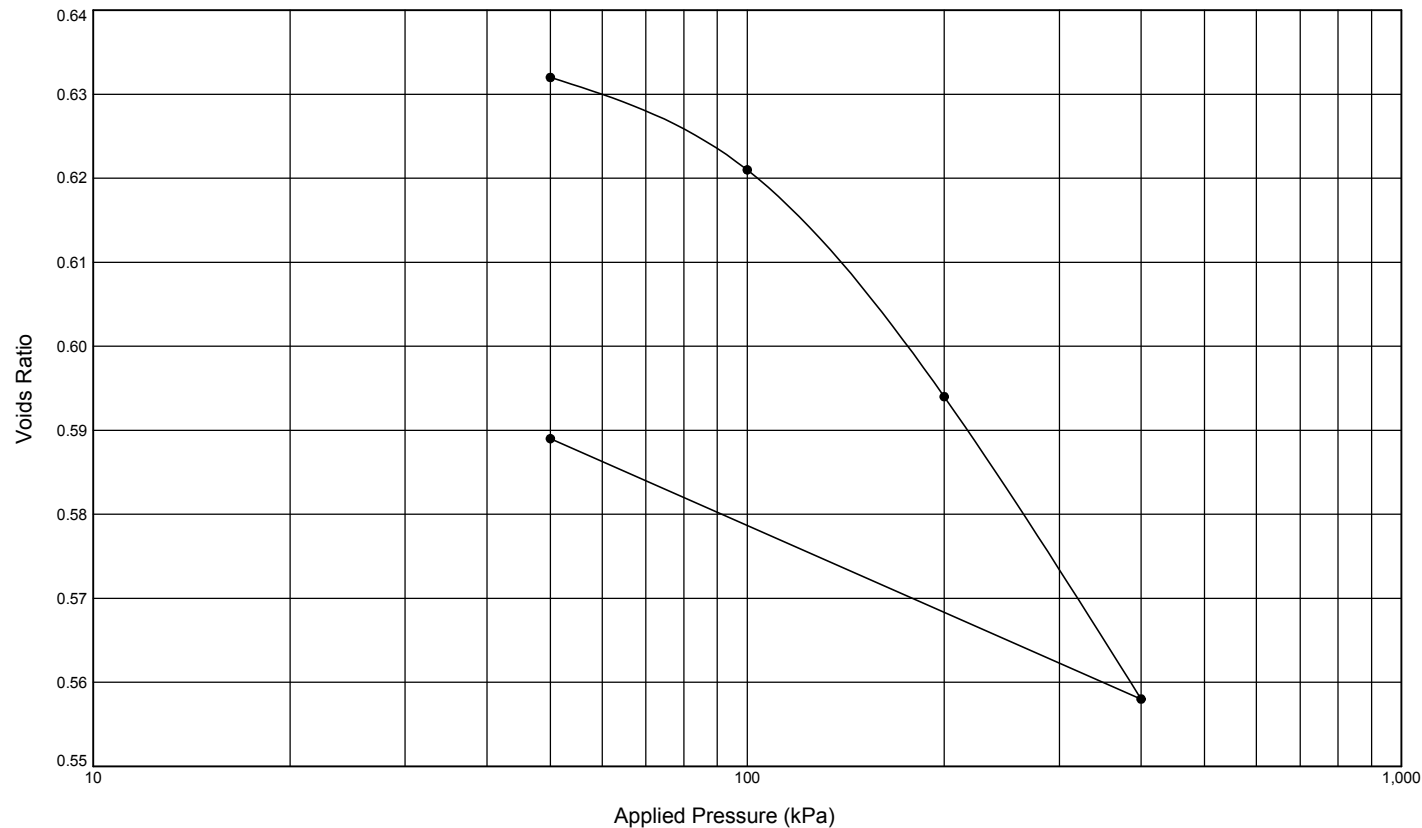
Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.55				
specimen height	(mm)	18.10				
initial moisture content	(%)	16.6				
final moisture content	(%)	17.4				
initial bulk density	(Mg/m ³)	2.05	50	0.509	0.335	6.8
initial dry density	(Mg/m ³)	1.76	100	0.498	0.147	3.5
initial voids ratio		0.535	200	0.483	0.098	7.8
initial degree of saturation	(%)	84	400	0.464	0.065	3.0
particle density	(Mg/m ³)	#2.70	50	0.474	0.019	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES



BS.1377 : Part 5 : 1990 : 3

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6U
		SAMPLE DEPTH (m)	2.70
DESCRIPTION	Orange brown slightly sandy slightly gravelly CLAY	SPECIMEN DEPTH (m)	2.80



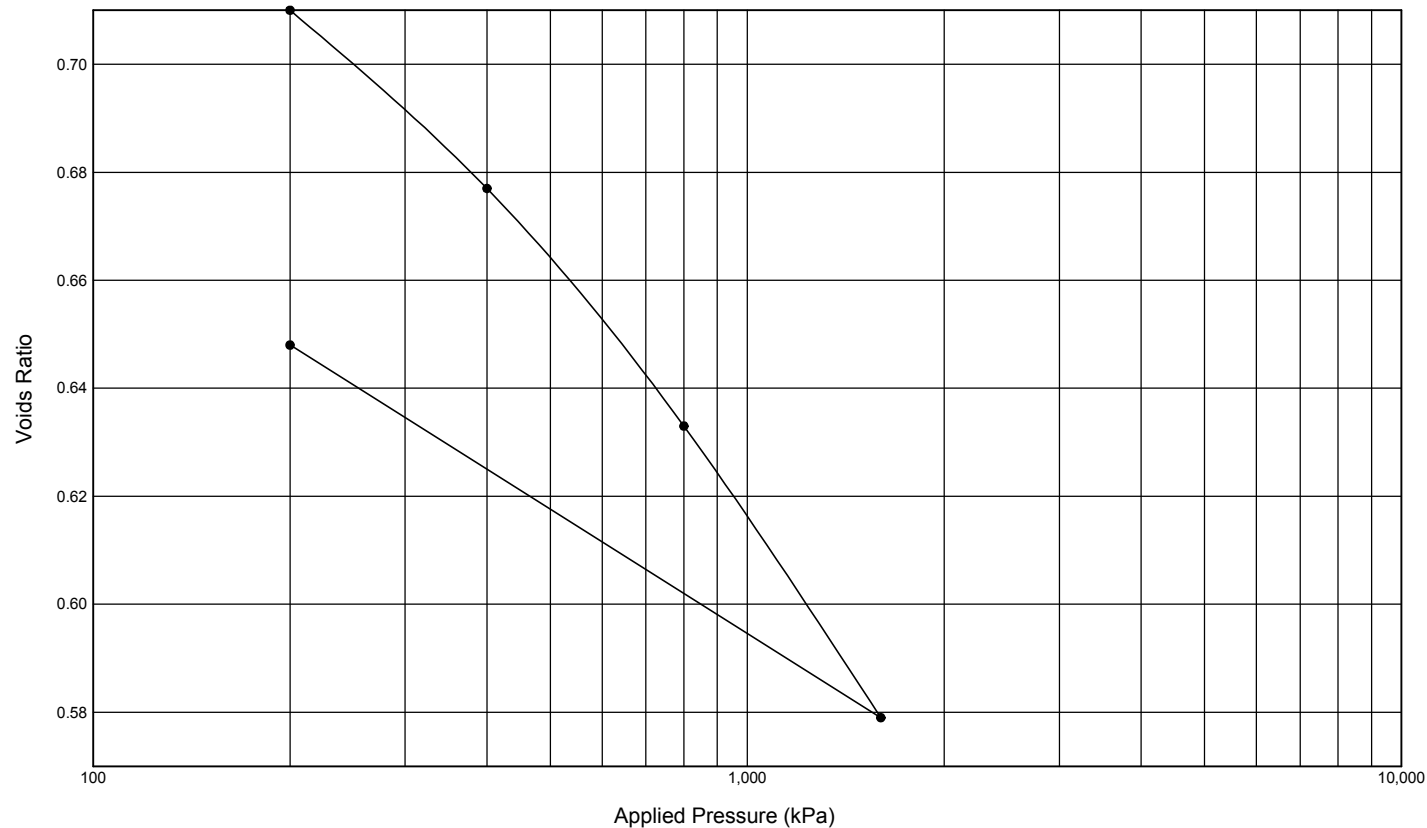
Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.43				
specimen height	(mm)	19.04				
initial moisture content	(%)	24.1				
final moisture content	(%)	23.8				
initial bulk density	(Mg/m ³)	2.02	50	0.632	0.350	12
initial dry density	(Mg/m ³)	1.63	100	0.621	0.135	1.9
initial voids ratio		0.661	200	0.594	0.165	0.79
initial degree of saturation	(%)	99	400	0.558	0.112	0.59
particle density	(Mg/m ³)	#2.70	50	0.589	0.055	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES



BS.1377 : Part 5 : 1990 : 3

CLIENT	KNOWLES & SON (OXFORD) LIMITED	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	14U
		SAMPLE DEPTH (m)	6.50
DESCRIPTION	Grey brown slightly sandy silty CLAY	SPECIMEN DEPTH (m)	6.50



Test and sample details			Test results			
			pressure stage (kPa)	voids ratio	laboratory coefficients of compressibility (m ² /MN)	consolidation (m ² /year)
specimen diameter	(mm)	63.19				
specimen height	(mm)	19.99				
initial moisture content	(%)	26.5				
final moisture content	(%)	25.4				
initial bulk density	(Mg/m ³)	1.91	200	0.710	0.211	2.0
initial dry density	(Mg/m ³)	1.51	400	0.677	0.096	0.41
initial voids ratio		0.785	800	0.633	0.066	0.38
initial degree of saturation	(%)	91	1600	0.579	0.042	0.40
particle density	(Mg/m ³)	#2.70	200	0.648	0.031	
swelling pressure	(kPa)	N/A				
P'o to P'o +100 kPa	(kPa)					
laboratory temperature	(°C)	20 ± 2				
method of time fitting		root time				
remarks: # denotes particle density has been assigned an assumed value.					CONTRACT 31710	CHECKED CA

UNDRAINED TRIAXIAL COMPRESSION**BS.1377 : Part 7 : 1990 : 8 and 9**

CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	code	moisture content (%)	density		cell pressure (kPa)	deviator stress (kPa)	failure strain (%)	failure mode	shear strength* (kPa)	description and remarks
	no./ type	depth (m)				bulk (Mg/m ³)	dry (Mg/m ³)						
BH01	15U	6.50	6.55	UU100	25.4	2.04	1.63	135	219	6.8	S	110	Greyish brown slightly sandy silty CLAY
BH01	23U	9.50	9.55	UU100	25.2	2.09	1.67	195	328	8.7	S	164	Greyish brown slightly sandy silty CLAY
BH01	31U	12.50	12.65	UU100	24.4	2.08	1.67	255	234	6.8	S	117	Brown slightly sandy CLAY
BH01	39U	15.50	15.55	UU100	22.4	2.10	1.71	315	470	8.3	S	235	Greyish brown sandy silty CLAY with rare shell fragments
BH02	14U	8.00	8.10	UU100	25.2	2.00	1.60	165	239	7.3	S	120	Dark brownish grey slightly sandy silty CLAY
BH02	22U	11.00	11.05	UU100	23.7	1.99	1.61	225	219	4.3	S	110	Greyish brown slightly sandy silty CLAY
BH02	30U	14.00	14.08	UU100	21.8	2.07	1.70	285	480	7.7	S	240	Brown slightly sandy silty CLAY with rare shell fragments
BH02	37U	17.00	17.23	UU100	22.6	2.04	1.66	345	390	5.8	S	195	Brown mottled grey slightly sandy silty CLAY
BH03	23UT	10.00	10.05	UU100	24.1	2.06	1.66	205	275	5.8	S	138	Dark brown slightly sandy silty CLAY
BH03	31U	13.00	13.05	UU100	25.8	2.04	1.62	265	226	6.3	S	113	Brown slightly sandy silty CLAY
BH03	39U	16.00	16.14	UU100	21.5	2.13	1.75	325	394	6.8	S	197	Brown sandy silty CLAY
BH04	14U	6.50	6.55	UU100	23.7	2.06	1.66	135	217	6.8	S	109	Brown slightly sandy silty CLAY
BH04	22U	9.50	9.55	UU100	25.1	2.07	1.66	195	333	5.8	S	167	Greyish brown slightly sandy silty CLAY
BH04	30UT	12.50	12.55	UU100	25.9	2.00	1.59	255	187	2.9	S	94	Brown slightly sandy silty CLAY with rare shell fragments
BH04	38UT	15.50	15.58	UU100	21.4	2.06	1.70	315	483	5.8	S	242	Brown slightly sandy slightly gravelly silty CLAY

general remarks: * shear strength taken as half deviator stress at failure for each stage.
denotes sample unsuitable to test.

code:
 CD - Consolidated drained M - Multistage 38 - 38mm dia. x 76mm
 CU - Consolidated undrained S - Set of 3 specimens 70 - 69mm dia. x 140mm
 UU - Unconsolidated undrained R - Remoulded 100 - 106mm dia. x 200mm

failure mode:
 B - barrelling (plastic failure) I - intermediate
 S - shear (brittle failure) O - other (see remarks)

membrane correction applied
 sample taken vertically (unless specified)
 rate of strain = 2%/min (unless specified)

membrane thickness:
 38 - 0.2mm 70 - 0.4mm
 106 - 0.4mm

CONTRACT
31710

CHECKED
CA



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES & SON (OXFORD) LTD	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	15UT
		SAMPLE DEPTH (m)	7.00-7.45
DESCRIPTION	Grey brown, slightly sandy, slightly gravelly, silty CLAY	SPECIMEN DEPTH (m)	7.15

TYPE OF SPECIMEN	Undisturbed / Vertical
TYPE OF TEST	Single Specimen Multistage
SIDE DRAINS FITTED	Yes
DRAINAGE CONDITIONS	Both ends and radial boundary

		STAGE	1	2	3	
INITIAL CONDITIONS	Length	mm	206.35	204	*	202 *
	Diameter	mm	103.18	102	*	101 *
	Moisture Content	%	25			
	Bulk Density	Mg/m ³	2.00			
	Dry Density	Mg/m ³	1.60			
FINAL CONDITIONS	Moisture Content	%				21
	Bulk Density	Mg/m ³				2.05
	Dry Density	Mg/m ³				1.69
SATURATION (by cell pressure and back pressure increments)	Initial PWP	kPa	-3			
	Saturated PWP	kPa	393			
	Final Cell Pressure	kPa	400			
	B Value		1			
CONSOLIDATION	Cell Pressure	kPa	412.5	485		630
	Back Pressure	kPa	340	340		340
	Initial PWP	kPa	404	430		516
	Final PWP	kPa	340	339		340
	c _v	m ² /yr	0.21	0.18		0.12
	m _v	m ² /MN	0.655	0.284		0.163
COMPRESSION	k (calculated value)	m/s	4.3E-11	1.6E-11		6.0E-12
	Cell Pressure	kPa	412.5	485		630
	Back Pressure	kPa	340	340		340
	σ ₃	kPa	72.5	145		290
	Rate of Strain	%/hr	0.062	0.054		0.0365
	Axial Strain (ε)	%	2.7	2.9		6.3
FAILURE CONDITIONS (based on maximum stress ratio)	δu _f	kPa	32	58		113
	σ _{3f}	kPa	41	87		177
	(σ ₁ - σ ₃) _f	kPa	71	131		269
	(σ ₁ /σ ₃) _f		2.7	2.5		2.5
FAILURE MODE (also see photo)	INTER	EFFECTIVE STRESS	c' kPa :		φ' deg :	
		PARAMETERS	2.6		25.0	
remarks	* Calculated values		CONTRACT		CHECKED	
			31710		NP	



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES & SON (OXFORD) LTD

BH/TP No.

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

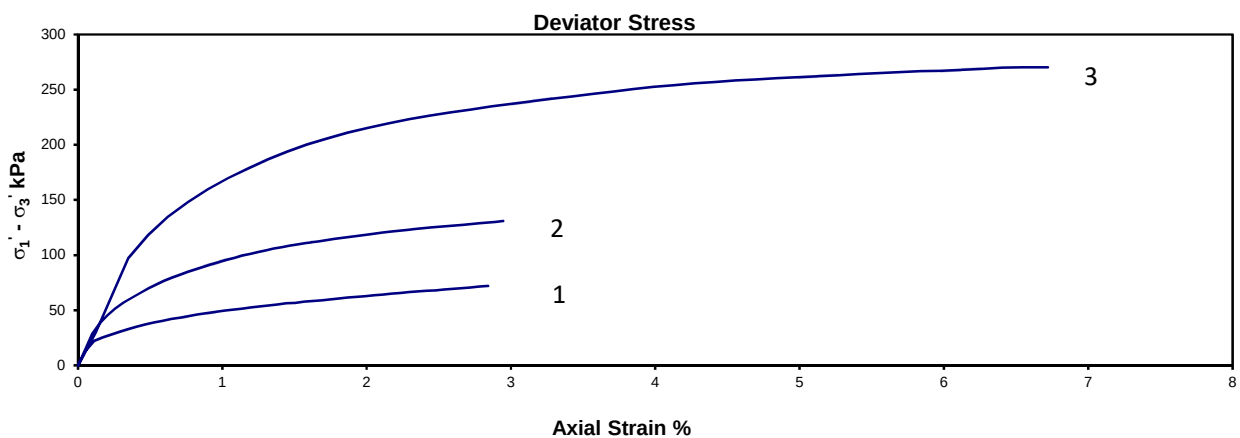
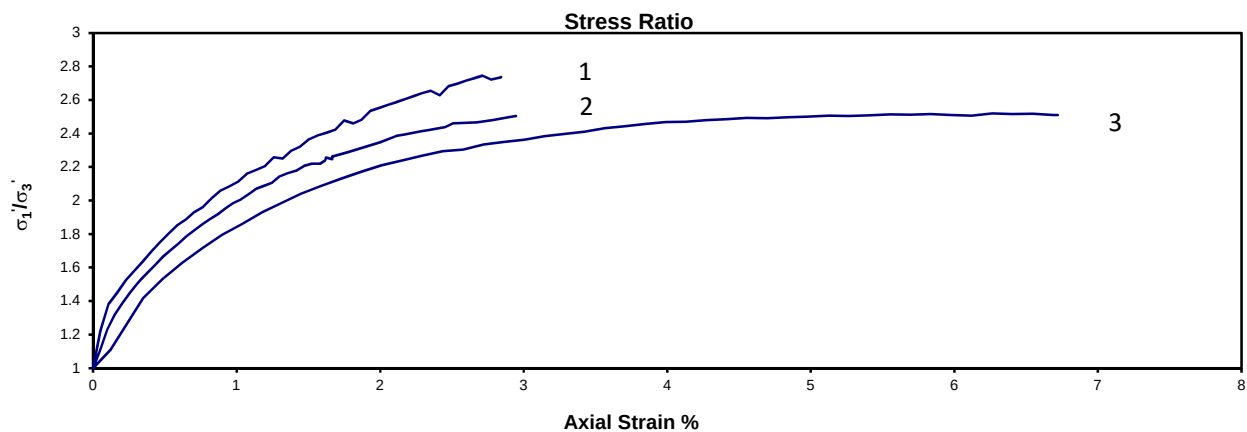
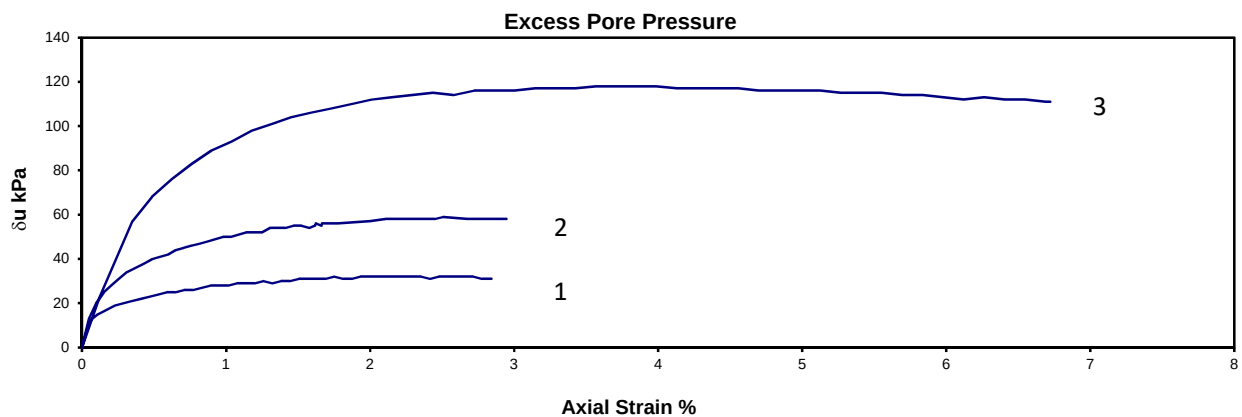
15UT

SAMPLE DEPTH (m)

7.00-7.45

SPECIMEN DEPTH (m)

7.15



remarks

CONTRACT

CHECKED

31710

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES & SON (OXFORD) LTD

BH/TP No.

BH03

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

15UT

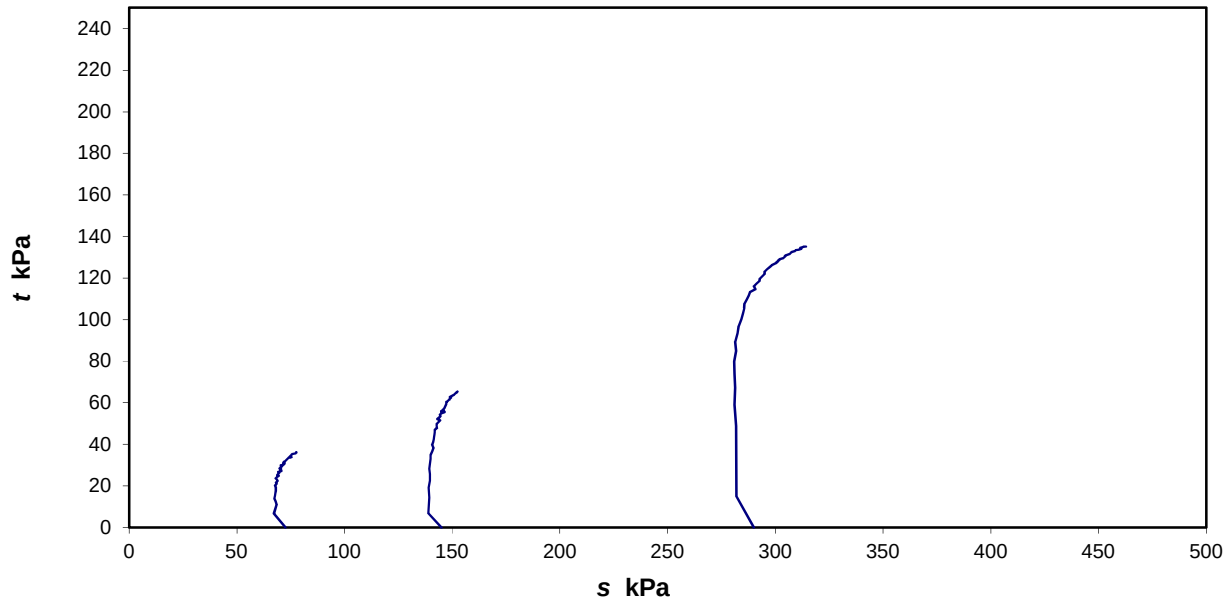
SAMPLE DEPTH (m)

7.00-7.45

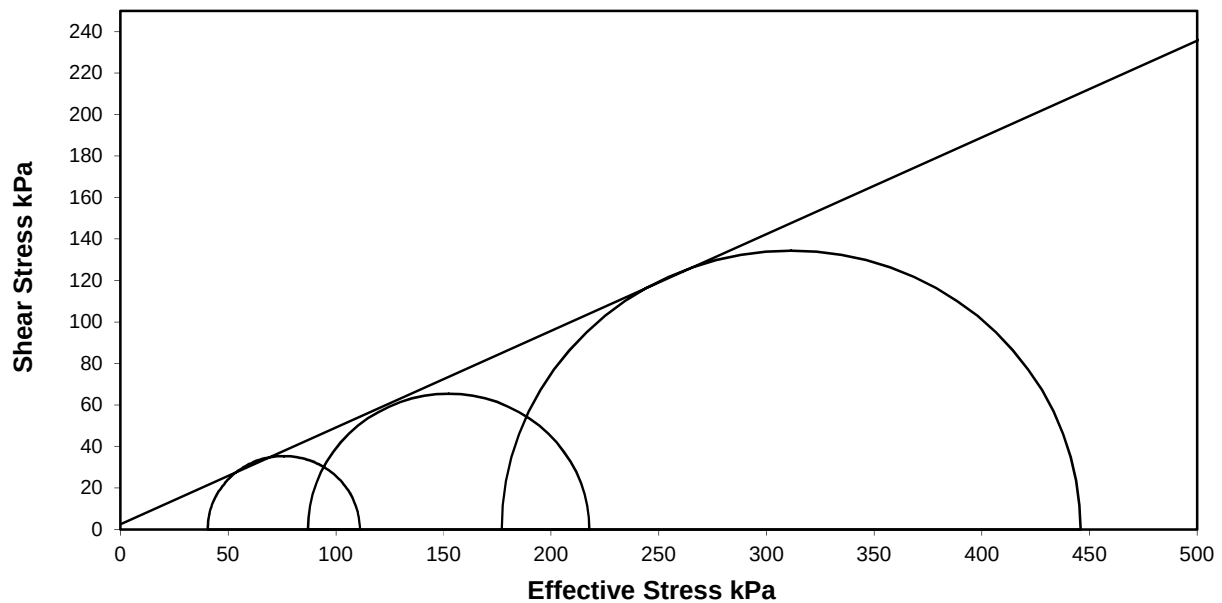
SPECIMEN DEPTH (m)

7.15

Stress Path



Mohr Circles



remarks

CONTRACT

31710

CHECKED

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES & SON (OXFORD) LTD	BH/TP No.	BH03
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	15UT
		SAMPLE DEPTH (m)	7.00-7.45
		SPECIMEN DEPTH (m)	7.15



Failure Mode

INTER

remarks

Please note the photo is intended to show the mode of failure only.

CONTRACT

31710

CHECKED

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES AND SON (OXFORD) LTD	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6U
DESCRIPTION	Orangish brown mottled light grey, slightly gravelly, sandy CLAY	SAMPLE DEPTH (m)	2.70-3.15
		SPECIMEN DEPTH (m)	2.90

TYPE OF SPECIMEN	Undisturbed / Vertical
TYPE OF TEST	Single Specimen Multistage
SIDE DRAINS FITTED	Yes
DRAINAGE CONDITIONS	Both ends and radial boundary

		STAGE	1	2	3	
INITIAL CONDITIONS	Length	mm	206.45	207	*	206 *
	Diameter	mm	105.23	106	*	105 *
	Moisture Content	%	22			
	Bulk Density	Mg/m ³	2.03			
	Dry Density	Mg/m ³	1.66			
FINAL CONDITIONS	Moisture Content	%				22
	Bulk Density	Mg/m ³				2.04
	Dry Density	Mg/m ³				1.67
SATURATION (by cell pressure and back pressure increments)	Initial PWP	kPa	-3			
	Saturated PWP	kPa	386			
	Final Cell Pressure	kPa	400			
	B Value		1			
CONSOLIDATION	Cell Pressure	kPa	370	400		460
	Back Pressure	kPa	340	340		340
	Initial PWP	kPa	358	367		342
	Final PWP	kPa	338	338		372
	c _v	m ² /yr	0.46	0.41		0.32
	m _v	m ² /MN	0.227	0.254		0.409
	k (calculated value)	m/s	3.3E-11	3.2E-11		4.0E-11
COMPRESSION	Cell Pressure	kPa	370	400		460
	Back Pressure	kPa	340	340		340
	σ ₃ '	kPa	30	60		120
	Rate of Strain	%/hr	0.131	0.116		0.09
FAILURE CONDITIONS (based on maximum stress ratio)	Axial Strain (ε)	%	1.6	1.6		2.7
	δu _f	kPa	11	25		46
	σ _{3f} '	kPa	19	35		74
	(σ ₁ ' - σ ₃ ') _f	kPa	61	94		152
	(σ ₁ '/σ ₃ ') _f		4.2	3.7		3.1
FAILURE MODE (also see photo)	EFFECTIVE STRESS PARAMETERS		c' kPa :		φ' deg :	
	INTER		10.1		26.6	
remarks	* Calculated values		CONTRACT		CHECKED	
			31710		NP	

Geotechnical Engineering Ltd, Centurion House, Olympus Park, Quedgeley, Gloucester, GL2 4NF, Tel - 01452 527743



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES AND SON (OXFORD) LTD

BH/TP No.

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

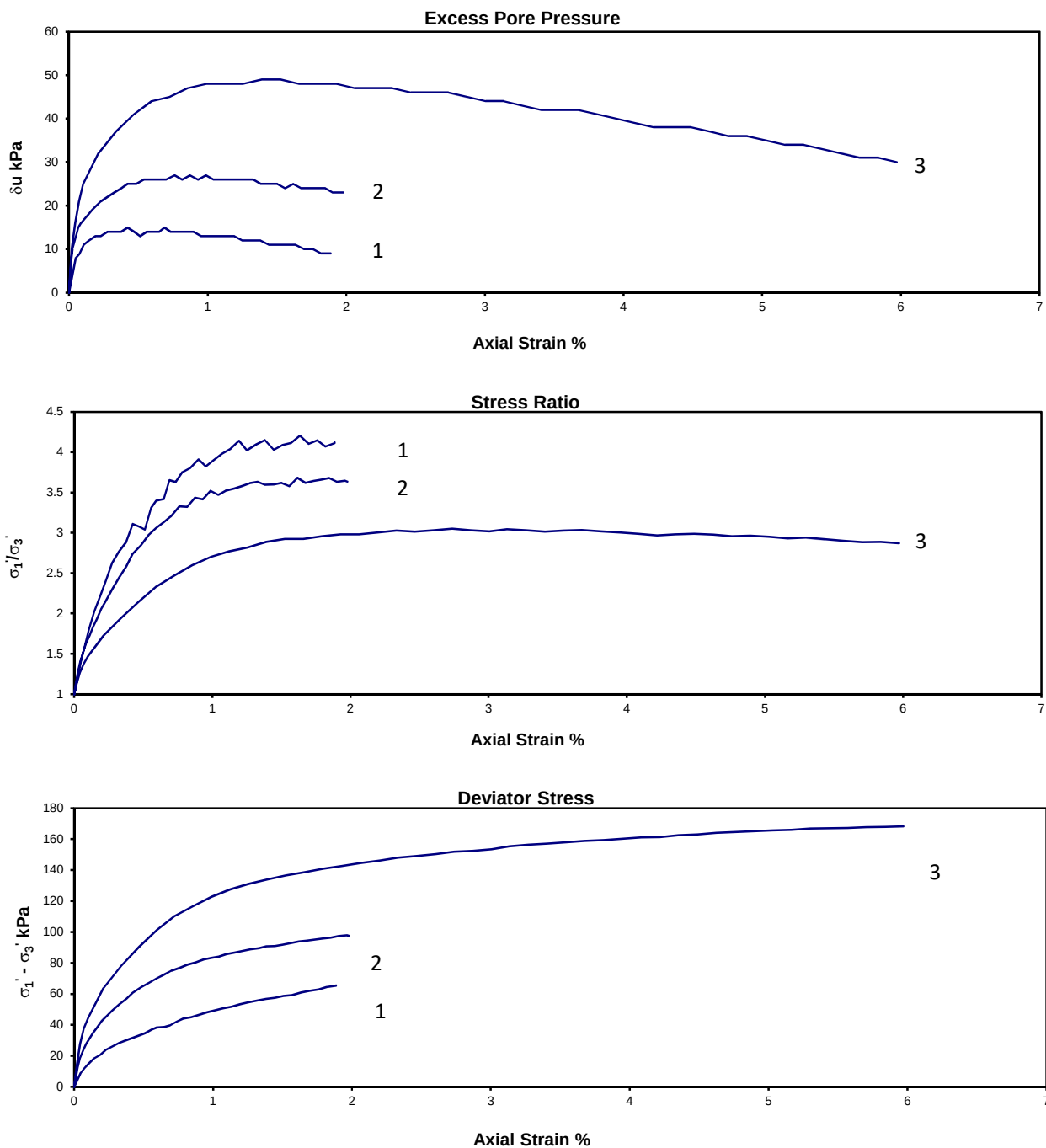
6U

SAMPLE DEPTH (m)

2.70-3.15

SPECIMEN DEPTH (m)

2.90



remarks

CONTRACT

CHECKED

31710

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT KNOWLES AND SON (OXFORD) LTD

BH/TP No.

BH04

SITE UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SAMPLE No./TYPE

6U

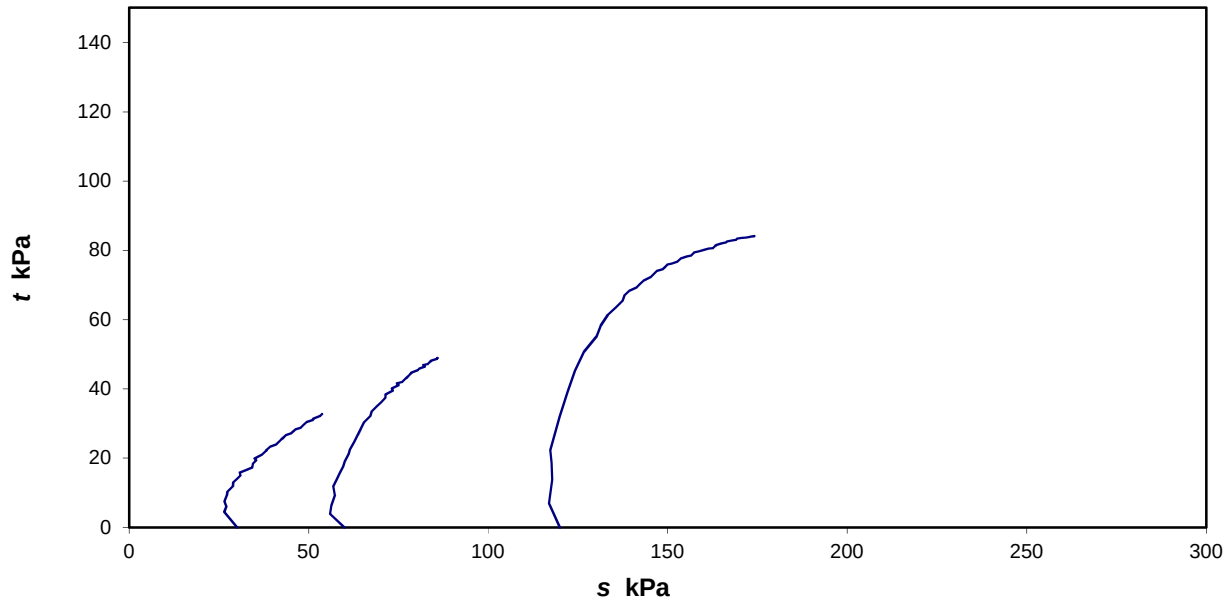
SAMPLE DEPTH (m)

2.70-3.15

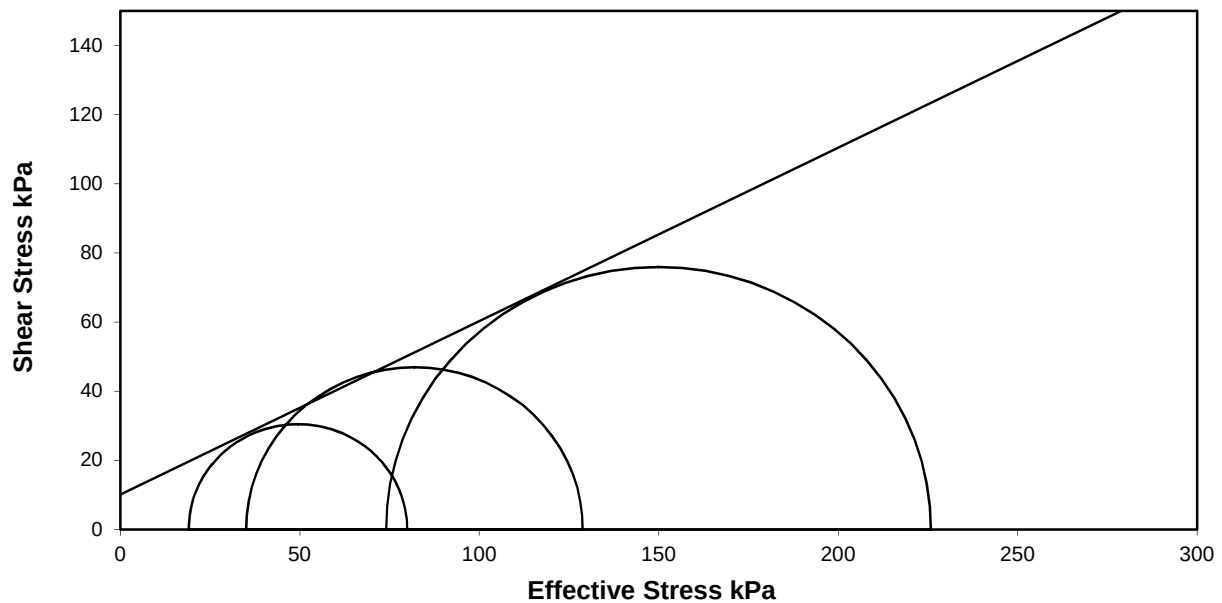
SPECIMEN DEPTH (m)

2.90

Stress Path



Mohr Circles



remarks

CONTRACT

31710

CHECKED

NP



CONSOLIDATED UNDRAINED TRIAXIAL TEST with PWP

BS1377 : Part 8 : 1990 and "Manual of Soil Laboratory Testing", Volume 3, K.H. Head

CLIENT	KNOWLES AND SON (OXFORD) LTD	BH/TP No.	BH04
SITE	UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING	SAMPLE No./TYPE	6U
		SAMPLE DEPTH (m)	2.70-3.15
		SPECIMEN DEPTH (m)	2.90



Failure Mode

INTER

remarks

Please note the photo is intended to show the mode of failure only.

CONTRACT

31710

CHECKED

NP

Geotechnical Engineering Limited

HAND VANE TEST RESULTS



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	Vane Strength (kPa)			description and remarks
	no./type	depth (m)		Top	Bottom	Average	
BH01	19U	8.00	8.00	>130			Dark grey slightly sandy silty CLAY
BH01	19U	8.00	8.20	>130			Dark grey slightly sandy silty CLAY
BH01	19U	8.00	8.45	>130			Dark grey slightly sandy silty CLAY
BH01	27U	11.00	11.00	>130			Dark grey slightly sandy silty CLAY
BH01	27U	11.00	11.21	>130			Dark grey slightly sandy silty CLAY
BH01	27U	11.00	11.45	>130			Dark grey slightly sandy silty CLAY
BH01	35U	14.00	14.00	>130			Dark grey slightly sandy silty CLAY
BH01	35U	14.00	14.20	>130			Dark grey slightly sandy silty CLAY
BH01	35U	14.00	14.40	>130			Dark grey slightly sandy silty CLAY
BH01	43U	17.00	17.00	>130			Dark grey slightly sandy silty CLAY
BH01	43U	17.00	17.25	>130			Dark grey slightly sandy silty CLAY
BH01	43U	17.00	17.45	>130			Dark grey slightly sandy silty CLAY
BH02	18U	9.50	9.50	>130			Dark grey slightly sandy silty CLAY
BH02	18U	9.50	9.70	>130			Dark grey slightly sandy silty CLAY
BH02	18U	9.50	9.90	>130			Dark grey slightly sandy silty CLAY
BH02	26U	12.50	12.50	>130			Dark grey slightly sandy silty CLAY
BH02	26U	12.50	12.70	>130			Dark grey slightly sandy silty CLAY
BH02	26U	12.50	12.90	>130			Dark grey slightly sandy silty CLAY
BH02	34U	15.50	15.50	>130			Dark grey slightly sandy silty CLAY
BH02	34U	15.50	15.73	>130			Dark grey slightly sandy silty CLAY
BH02	34U	15.50	15.95	>130			Dark grey slightly sandy silty CLAY
BH03	6UT	2.00	2.00	99			Brown and light grey slightly sandy slightly gravelly CLAY
BH03	6UT	2.00	2.20	85			Brown and light grey slightly sandy slightly gravelly CLAY
general remarks: Re - Denotes vane test refusal							
						CONTRACT 31710	CHECKED CA

Geotechnical Engineering Limited

HAND VANE TEST RESULTS



CLIENT KNOWLES & SON (OXFORD) LIMITED

SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

borehole /trial pit no.	sample		specimen depth (m)	Vane Strength (kPa)			description and remarks
	no./type	depth (m)		Top	Bottom	Average	
BH03	6UT	2.00	2.40	126			Brown and light grey slightly sandy slightly gravelly CLAY
BH03	27UT	11.50	11.50	>130			Dark grey slightly sandy silty CLAY
BH03	27UT	11.50	11.72	>130			Dark grey slightly sandy silty CLAY
BH03	27UT	11.50	11.95	>130			Dark grey slightly sandy silty CLAY
BH03	35U	14.50	14.50	>130			Dark grey slightly sandy silty CLAY
BH03	35U	14.50	14.70	>130			Dark grey slightly sandy silty CLAY
BH03	35U	14.50	14.90	>130			Dark grey slightly sandy silty CLAY
BH03	43U	17.50	17.50	>130			Dark grey slightly sandy silty CLAY
BH03	43U	17.50	17.75	>130			Dark grey slightly sandy silty CLAY
BH03	43U	17.50	17.95	>130			Dark grey slightly sandy silty CLAY
BH04	18U	8.00	8.00	112			Dark grey slightly sandy silty CLAY
BH04	18U	8.00	8.17	>130			Dark grey slightly sandy silty CLAY
BH04	18U	8.00	8.35	>130			Dark grey slightly sandy silty CLAY
BH04	26U	11.00	11.00	>130			Dark grey slightly sandy silty CLAY
BH04	26U	11.00	11.15	>130			Dark grey slightly sandy silty CLAY
BH04	26U	11.00	11.25	>130			Dark grey slightly sandy silty CLAY
BH04	34UT	14.00	14.00	>130			Dark grey slightly sandy silty CLAY
BH04	34UT	14.00	14.35	>130			Dark grey slightly sandy silty CLAY
BH04	34UT	14.00	14.45	>130			Dark grey slightly sandy silty CLAY
BH04	42UT	17.00	17.00	>130			Dark grey slightly sandy silty CLAY
BH04	42UT	17.00	17.20	>130			Dark grey slightly sandy silty CLAY
BH04	42UT	17.00	17.40	>130			Dark grey slightly sandy silty CLAY
general remarks: Re - Denotes vane test refusal							
						CONTRACT 31710	CHECKED CA



Final Report

Report No.: 16-08961-1

Initial Date of Issue: 25-Apr-2016

Client Geotechnical Engineering Ltd

Client Address: Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Contact(s): Claire Andrew

Project 31710 - University Of Reading Health
And Life Sciences

Quotation No.: **Date Received:** 19-Apr-2016

Order No.: 31710 **Date Instructed:** 19-Apr-2016

No. of Samples: 10

Turnaround (Wkdays): 5 **Results Due:** 25-Apr-2016

Date Approved: 25-Apr-2016

Approved By:



Details: Robert Monk, Technical Development
Chemist

Project: 31710 - University Of Reading Health And Life Sciences

Client: Geotechnical Engineering Ltd	Chemtest Job No.:				16-08961	16-08961	16-08961	16-08961	16-08961	16-08961	16-08961	16-08961
Quotation No.:	Chemtest Sample ID.:				282051	282052	282053	282054	282055	282056	282057	282058
Order No.: 31710	Client Sample Ref.:				TP03	TP03	BH01	BH01	BH01	BH01	BH02	BH02
	Client Sample ID.:				2B	4B	3B	7D	11B	18D	9D	17D
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.7	1.8	1.0	2.8	5.0	7.5	6.0	9.0
	Date Sampled:				15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016	15-Apr-2016
Determinand	Accred.	SOP	Units	LOD								
Moisture	N	2030	%	0.020	14	16	14	21	22	20	20	20
pH	U	2010		N/A	8.0	7.9	7.9	7.3	7.1	8.1	8.2	8.3
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.17	0.11	0.10
Total Sulphur	U	2175	%	0.010	0.040	0.020	0.010	0.020	0.010	0.52	0.32	0.51
Sulphate (Acid Soluble)	U	2430	%	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.071	0.048	0.047

Project: 31710 - University Of Reading Health And Life Sciences

Client: Geotechnical Engineering Ltd	Chemtest Job No.:				16-08961	16-08961
Quotation No.:	Chemtest Sample ID.:				282059	282060
Order No.: 31710	Client Sample Ref.:				BH02	BH02
	Client Sample ID.:				25D	35D
	Sample Type:				SOIL	SOIL
	Top Depth (m):				12.0	15.95
	Date Sampled:				15-Apr-2016	15-Apr-2016
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	19	16
pH	U	2010		N/A	8.3	8.1
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	0.096	0.24
Total Sulphur	U	2175	%	0.010	0.79	0.92
Sulphate (Acid Soluble)	U	2430	%	0.010	0.073	0.068

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



APPENDIX F

CHEMICAL TESTING



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 14 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160403-9
Your Reference:
Location: University of Reading
Report No: 357003

We received 3 samples on Saturday April 02, 2016 and 2 of these samples were scheduled for analysis which was completed on Thursday April 14, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13194124	BH03	ES	0.20 - 0.30	31/03/2016
13194125	BH03	ES	0.60 - 0.70	31/03/2016
13194126	BH03	ES	1.50	31/03/2016

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

SOLID Results Legend X Test N No Determination Possible	Lab Sample No(s)		13194124	13194125
	Customer Sample Reference		BH03	BH03
	AGS Reference		ES	ES
	Depth (m)		0.20 - 0.30	0.60 - 0.70
	Container		250g Amber Jar (AL) 1kg TUB	250g Amber Jar (AL) 1kg TUB
Anions by Kone (soil)	All	NDPs: 0 Tests: 2	X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2	X	X
Boron Water Soluble	All	NDPs: 0 Tests: 2	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 2	X	X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 1	X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 1	X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 1		X
Metals in solid samples by OES	All	NDPs: 0 Tests: 2	X	X
PAH by GCMS	All	NDPs: 0 Tests: 2	X	X
pH	All	NDPs: 0 Tests: 2	X	X
Phenols Spec MS (S)	All	NDPs: 0 Tests: 2	X	X
Sample description	All	NDPs: 0 Tests: 2	X	X
Total Organic Carbon	All	NDPs: 0 Tests: 2	X	X
Total Sulphate	All	NDPs: 0 Tests: 2	X	X
TPH CWG GC (S)	All	NDPs: 0 Tests: 1	X	



SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2		
13194124	BH03	0.20 - 0.30	Dark Brown	Sand	0.063 - 2.00 mm	Concrete/Aggre gate	Stones		
13194125	BH03	0.60 - 0.70	Light Brown	Sandy Loam	0.063 - 2.00 mm	Concrete/Aggre gate	Stones		

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Page 5 of 15

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Page 6 of 15



CERTIFICATE OF ANALYSIS

Validated

SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Phenols Spec MS (S)

Results Legend		Customer Sample R	BH03						
#	ISO17025 accredited.		BH03						
M	mCERTS accredited.								
aq	Aqueous / settled sample.								
diss.filt	Dissolved / filtered sample.								
tot.unfilt	Total / unfiltered sample.								
*	Subcontracted test.								
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery								
(F)	Trigger breach confirmed								
1-5&*\$@	Sample deviation (see appendix)								
Component		LOD/Units	Method						
4-Nitrophenol		<1 µg/kg	TM072	<50	<10				
2,4,6-Trichlorophenol		<1 µg/kg	TM072	<50	<10				
2-Nitrophenol		<1 µg/kg	TM072	<50	<10				
2,4-Dichlorophenol		<1 µg/kg	TM072	<50	<10				
Pentachlorophenol		<1 µg/kg	TM072	<50	<10				
Phenol		<1 µg/kg	TM072	<50	<10				
4-Chloro-3-methylphenol		<1 µg/kg	TM072	<50	<10				
2,4-Dimethylphenol		<1 µg/kg	TM072	<50	<10				
2-Chlorophenol		<1 µg/kg	TM072	<50	<10				
Sum of Detected Phenols		<9 µg/kg	TM072	<450	<90				
							</		



CERTIFICATE OF ANALYSIS

SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

TPH CWG (S)

Results Legend		Customer Sample R	BH03					
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.20 - 0.30 Soil/Solid 31/03/2016 02/04/2016 160403-9 13194124 ES					
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&*\$@	Sample deviation (see appendix)							
Component	LOD/Units			Method				
GRO Surrogate % recovery**	%	TM089	77					
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	86.9 M					
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #					
Benzene	<10 µg/kg	TM089	<10 M					
Toluene	<2 µg/kg	TM089	<2 M					
Ethylbenzene	<3 µg/kg	TM089	<3 M					
m,p-Xylene	<6 µg/kg	TM089	<6 M					
o-Xylene	<3 µg/kg	TM089	<3 M					
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9					
sum of detected BTEX by GC	<24 µg/kg	TM089	<24					
Aliphatics >C5-C6	<10 µg/kg	TM089	<10					
Aliphatics >C6-C8	<10 µg/kg	TM089	<10					
Aliphatics >C8-C10	<10 µg/kg	TM089	<10					
Aliphatics >C10-C12	<10 µg/kg	TM089	36.3					
Aliphatics >C12-C16	<100 µg/kg	TM173	15800					
Aliphatics >C16-C21	<100 µg/kg	TM173	39600					
Aliphatics >C21-C35	<100 µg/kg	TM173	105000					
Aliphatics >C35-C44	<100 µg/kg	TM173	90000					
Total Aliphatics >C12-C44	<100 µg/kg	TM173	250000					
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10					
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10					
Aromatics >EC8-EC10	<10 µg/kg	TM089	<10					
Aromatics >EC10-EC12	<10 µg/kg	TM089	24.2					
Aromatics >EC12-EC16	<100 µg/kg	TM173	2520					
Aromatics >EC16-EC21	<100 µg/kg	TM173	8050					
Aromatics >EC21-EC35	<100 µg/kg	TM173	76700					
Aromatics >EC35-EC44	<100 µg/kg	TM173	127000					
Aromatics >EC40-EC44	<100 µg/kg	TM173	58100					
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	214000					
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	464000					



SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH03 ES 0.20 - 0.30 SOLID 31/03/2016 00:00:00 04/04/2016 16:15:35 160403-9 13194124 TM048	05/04/16	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH03 ES 0.60 - 0.70 SOLID 31/03/2016 00:00:00 08/04/2016 00:37:22 160403-9 13194125 TM048	14/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM072	Modified: US EPA Method 8141A	Determination of Phenols by GC-MS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM221	Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd	Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	160403-9	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	357003
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	13194124	13194125
Customer Sample Ref.	BH03	BH03
AGS Ref.	ES	ES
Depth	0.20 - 0.30	0.60 - 0.70
Type	SOLID	SOLID

Anions by Kone (soil)	06-Apr-2016	06-Apr-2016
Asbestos ID in Solid Samples	07-Apr-2016	14-Apr-2016
Boron Water Soluble	05-Apr-2016	07-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	06-Apr-2016	07-Apr-2016
EPH CWG (Aliphatic) GC (S)	06-Apr-2016	
EPH CWG (Aromatic) GC (S)	06-Apr-2016	
GRO by GC-FID (S)	06-Apr-2016	
Metals in solid samples by OES	06-Apr-2016	07-Apr-2016
PAH by GCMS	06-Apr-2016	07-Apr-2016
pH	06-Apr-2016	06-Apr-2016
Phenols Spec MS (S)	08-Apr-2016	08-Apr-2016
Sample description	04-Apr-2016	05-Apr-2016
Total Organic Carbon	06-Apr-2016	08-Apr-2016
Total Sulphate	05-Apr-2016	07-Apr-2016
TPH CWG GC (S)	06-Apr-2016	



SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aliphatic) GC (S)

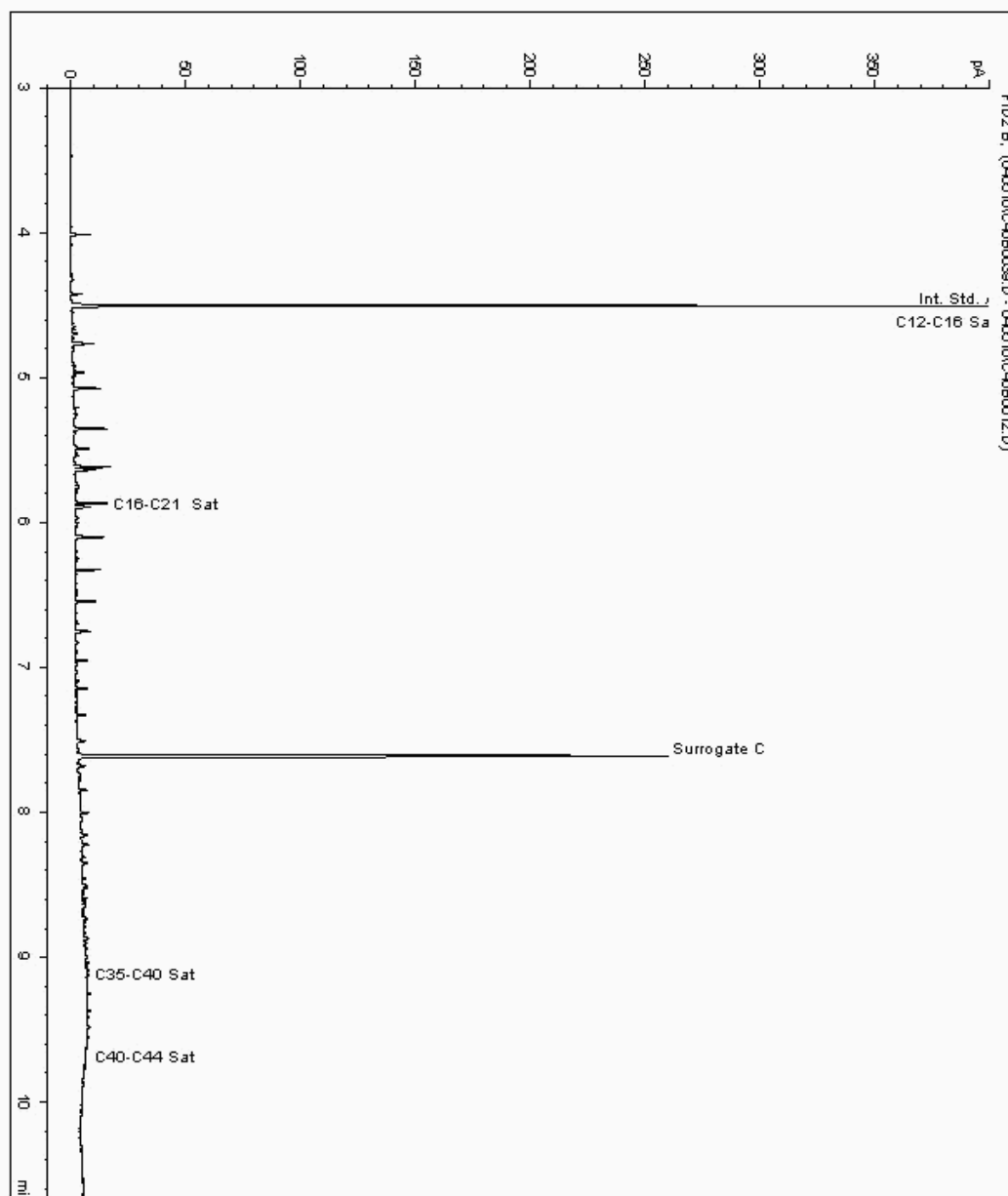
Sample No : 13199465
Sample ID : BH03

Depth : 0.20 - 0.30

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12431279-
Date Acquired : 05/04/2016 22:38:27 PM
Units : ppb
Dilution: BH03[0.20 - 0.30]

->





SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aromatic) GC (S)

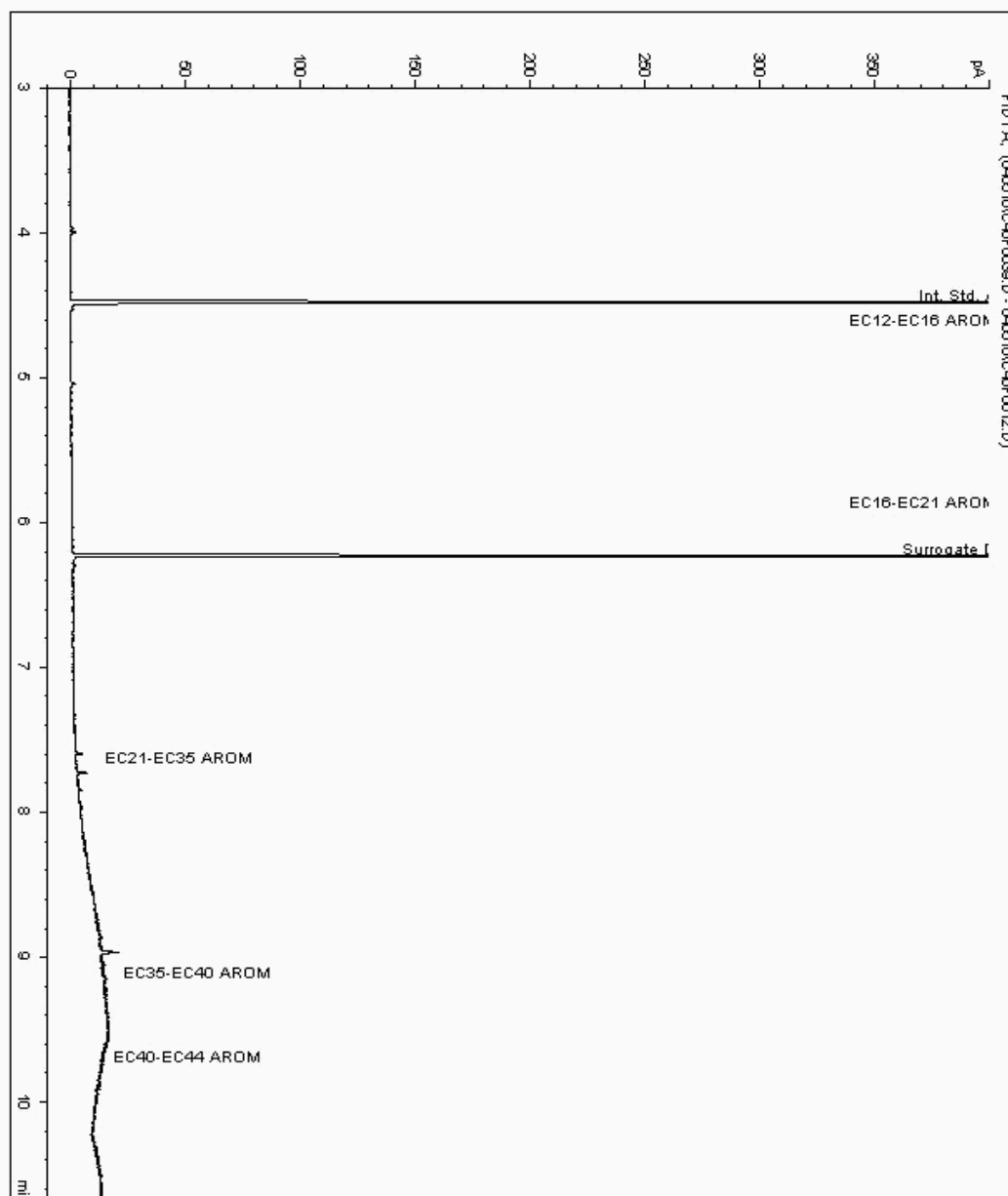
Sample No : 13199465
Sample ID : BH03

Depth : 0.20 - 0.30

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12431280-
Date Acquired : 05/04/2016 22:38:27 PM
Units : ppb
Dilution: BH03[0.20 - 0.30]

->





SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

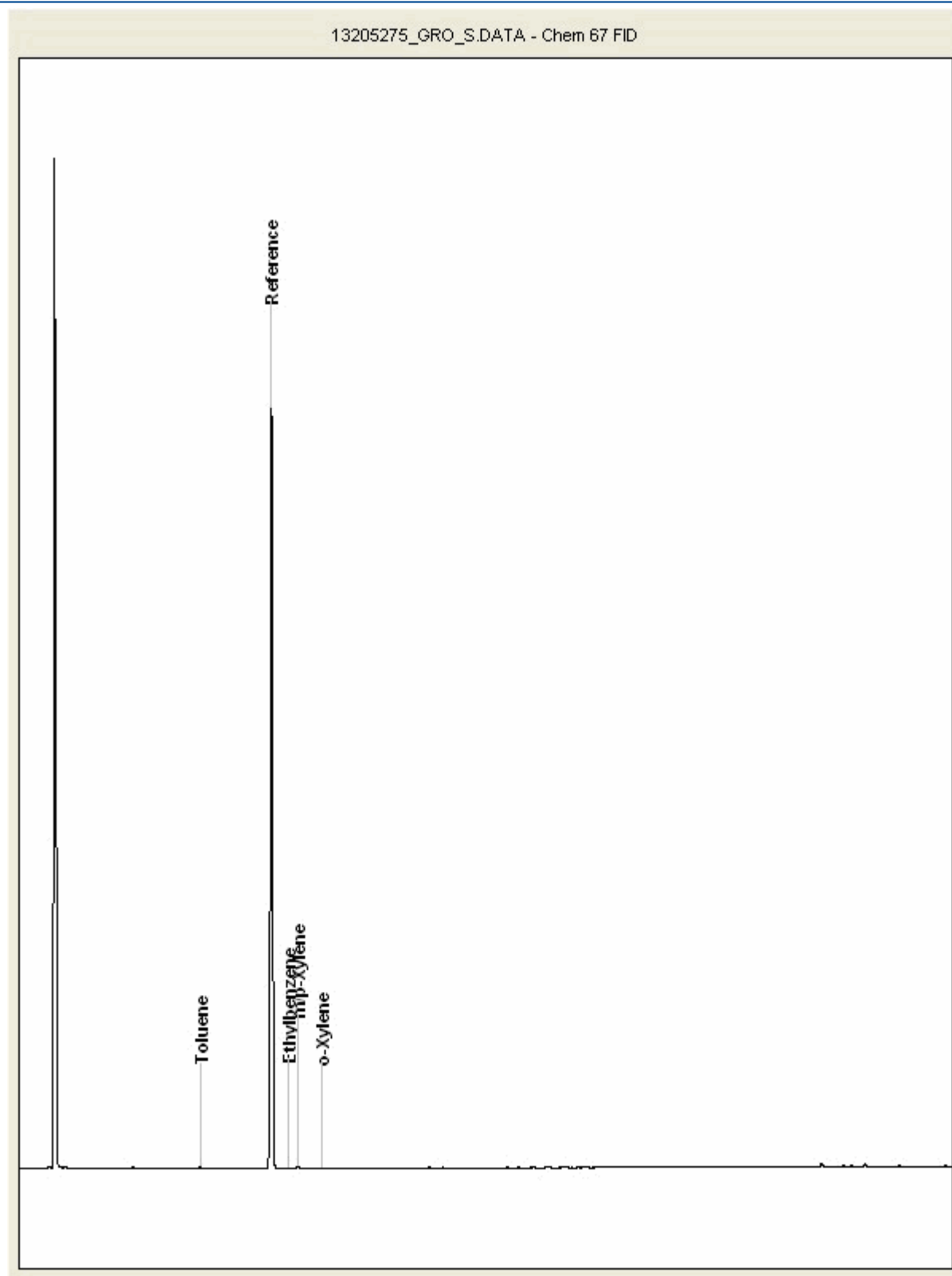
Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13205275
Sample ID : BH03

Depth : 0.20 - 0.30





SDG: 160403-9
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 357003
Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Almandine	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 14 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160406-79
Your Reference:
Location: University of Reading
Report No: 356997

We received 18 samples on Wednesday April 06, 2016 and 6 of these samples were scheduled for analysis which was completed on Thursday April 14, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13212264	BH01		0.20 - 0.40	05/04/2016
13212265	BH01		0.50 - 0.70	05/04/2016
13212248	IP01		0.20	04/04/2016
13212249	IP01		0.60	04/04/2016
13212250	IP01		0.90 - 1.00	04/04/2016
13212251	IP02		0.20	04/04/2016
13212252	IP02		0.50	04/04/2016
13212253	IP02		1.00	04/04/2016
13212254	IP03		0.20	04/04/2016
13212255	IP03		0.50	04/04/2016
13212260	TP02		0.20	04/04/2016
13212261	TP02		0.80	04/04/2016
13212262	TP02		1.60	04/04/2016
13212263	TP02		2.50	04/04/2016
13212256	TP03		0.20	04/04/2016
13212257	TP03		0.70	04/04/2016
13212258	TP03		1.30	04/04/2016
13212259	TP03		1.80	04/04/2016

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

SOLID Results Legend X Test N No Determination Possible	Lab Sample No(s)		Customer Sample Reference		AGS Reference		Depth (m)		Container	
	13212258		TP03				1.30		250g Amber Jar (AL 1kg TUB	
	13212257		TP03				0.70		60g VOC (ALE215) 250g Amber Jar (AL 1kg TUB	
	13212254		IP03				0.20		250g Amber Jar (AL 1kg TUB	
	13212253		IP02				1.00		250g Amber Jar (AL 1kg TUB	
	13212252		IP02				0.50		60g VOC (ALE215) 250g Amber Jar (AL 1kg TUB	
	13212249		IP01				0.60		60g VOC (ALE215) 250g Amber Jar (AL 1kg TUB	
Anions by Kone (soil)	All	NDPs: 0 Tests: 6								
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 5								
Boron Water Soluble	All	NDPs: 0 Tests: 6								
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 6								
Easily Liberated Sulphide	All	NDPs: 0 Tests: 6								
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 3								
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 3								
GRO by GC-FID (S)	All	NDPs: 0 Tests: 3								
Metals in solid samples by OES	All	NDPs: 0 Tests: 6								
PAH by GCMS	All	NDPs: 0 Tests: 6								
pH	All	NDPs: 0 Tests: 6								
Phenols Spec MS (S)	All	NDPs: 0 Tests: 6								
Sample description	All	NDPs: 0 Tests: 6								
Total Organic Carbon	All	NDPs: 0 Tests: 3								
TPH CWG GC (S)	All	NDPs: 0 Tests: 3								



SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
-----------	----------	------	-----------------	--------	-------------	--------	------------	-------------	-------

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
13212249	IP01	0.60	Dark Brown	Sandy Silt Loam	0.063 - 2.00 mm	Stones	None
13212252	IP02	0.50	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	None
13212253	IP02	1.00	Dark Brown	Silty Clay	0.002 - 0.063 mm	Stones	None
13212254	IP03	0.20	Dark Brown	Sandy Silt Loam	0.063 - 2.00 mm	Stones	Vegetation
13212257	TP03	0.70	Dark Brown	Sandy Silt Loam	0.063 - 2.00 mm	Stones	None
13212258	TP03	1.30	Dark Brown	Sandy Loam	0.063 - 2.00 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

SDG:	160406-79	Location:	University of Reading	Order Number:	31710/JI
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	356997
Client Reference:		Attention:	Jon Ind	Superseded Report:	

12:11:34 14/04/2016

Order Number: 31710/JL
Report Number: 356997
Superseded Report:

Page 6 of 21

Order Number: 31710/JL
Report Number: 356997
Superseded Report:

Page 7 of 21



CERTIFICATE OF ANALYSIS

SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

TPH CWG (S)

Results Legend		Customer Sample R	IP01	IP02	TP03			
#	ISO17025 accredited.							
M	mCERTS accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.60 Soil/Solid 04/04/2016 06/04/2016 160406-79 13212249	0.50 Soil/Solid 04/04/2016 06/04/2016 160406-79 13212252	0.70 Soil/Solid 04/04/2016 06/04/2016 160406-79 13212257			
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5	@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
GRO Surrogate % recovery**	%	TM089	95	83	88			
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	19500 M	107 M	<44 M			
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #	<5 #	<5 #			
Benzene	<10 µg/kg	TM089	<10 M	<10 M	<10 M			
Toluene	<2 µg/kg	TM089	<2 M	<2 M	2.34 M			
Ethylbenzene	<3 µg/kg	TM089	<3 M	<3 M	<3 M			
m,p-Xylene	<6 µg/kg	TM089	<6 M	<6 M	<6 M			
o-Xylene	<3 µg/kg	TM089	<3 M	<3 M	<3 M			
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9	<9	<9			
sum of detected BTEX by GC	<24 µg/kg	TM089	<24	<24	<24			
Aliphatics >C5-C6	<10 µg/kg	TM089	10.4	10.3	<10			
Aliphatics >C6-C8	<10 µg/kg	TM089	25.3	11.4	<10			
Aliphatics >C8-C10	<10 µg/kg	TM089	5020	23.9	<10			
Aliphatics >C10-C12	<10 µg/kg	TM089	6680	21.7	<10			
Aliphatics >C12-C16	<100 µg/kg	TM173	6070	173	<100			
Aliphatics >C16-C21	<100 µg/kg	TM173	6060	<100	<100			
Aliphatics >C21-C35	<100 µg/kg	TM173	7260	2190	2840			
Aliphatics >C35-C44	<100 µg/kg	TM173	<100	<100	<100			
Total Aliphatics >C12-C44	<100 µg/kg	TM173	19400	2360	2840			
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10	<10	<10			
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10	<10	<10			
Aromatics >EC8-EC10	<10 µg/kg	TM089	3350	23.9	<10			
Aromatics >EC10-EC12	<10 µg/kg	TM089	4450	14.8	<10			
Aromatics >EC12-EC16	<100 µg/kg	TM173	3550	538	<100			
Aromatics >EC16-EC21	<100 µg/kg	TM173	9080	2580	<100			
Aromatics >EC21-EC35	<100 µg/kg	TM173	27900	9850	2570			
Aromatics >EC35-EC44	<100 µg/kg	TM173	6350	3210	976			
Aromatics >EC40-EC44	<100 µg/kg	TM173	1600	1020	<100			
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	46900	16200	3540			
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	85800	18600	6390			



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	IP01 0.60 SOLID 04/04/2016 00:00:00 07/04/2016 13:07:00 160406-79 13212249 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	IP02 0.50 SOLID 04/04/2016 00:00:00 07/04/2016 12:58:28 160406-79 13212252 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	IP03 0.20 SOLID 04/04/2016 00:00:00 07/04/2016 20:51:46 160406-79 13212254 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP03 0.70 SOLID 04/04/2016 00:00:00 07/04/2016 20:58:45 160406-79 13212257 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP03 1.30 SOLID 04/04/2016 00:00:00 07/04/2016 15:36:45 160406-79 13212258 TM048	13/04/16	Paul Poynton	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM072	Modified: US EPA Method 8141A	Determination of Phenols by GC-MS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Test Completion Dates

Lab Sample No(s)	13212249	13212252	13212253	13212254	13212257	13212258
Customer Sample Ref.	IP01	IP02	IP02	IP03	TP03	TP03
AGS Ref.						
Depth	0.60	0.50	1.00	0.20	0.70	1.30
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Anions by Kone (soil)	13-Apr-2016	12-Apr-2016	12-Apr-2016	13-Apr-2016	13-Apr-2016	12-Apr-2016
Asbestos ID in Solid Samples	13-Apr-2016	13-Apr-2016		13-Apr-2016	13-Apr-2016	13-Apr-2016
Boron Water Soluble	11-Apr-2016	13-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016	13-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	11-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016
Easily Liberated Sulphide	13-Apr-2016	13-Apr-2016	13-Apr-2016	08-Apr-2016	08-Apr-2016	08-Apr-2016
EPH CWG (Aliphatic) GC (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	
EPH CWG (Aromatic) GC (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	
GRO by GC-FID (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	
Metals in solid samples by OES	12-Apr-2016	12-Apr-2016	11-Apr-2016	12-Apr-2016	12-Apr-2016	12-Apr-2016
PAH by GCMS	11-Apr-2016	11-Apr-2016	12-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016
pH	11-Apr-2016	11-Apr-2016	08-Apr-2016	11-Apr-2016	11-Apr-2016	11-Apr-2016
Phenols Spec MS (S)	14-Apr-2016	14-Apr-2016	14-Apr-2016	14-Apr-2016	14-Apr-2016	14-Apr-2016
Sample description	07-Apr-2016	07-Apr-2016	08-Apr-2016	07-Apr-2016	07-Apr-2016	07-Apr-2016
Total Organic Carbon			13-Apr-2016	13-Apr-2016	13-Apr-2016	
TPH CWG GC (S)	11-Apr-2016	11-Apr-2016			11-Apr-2016	



SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

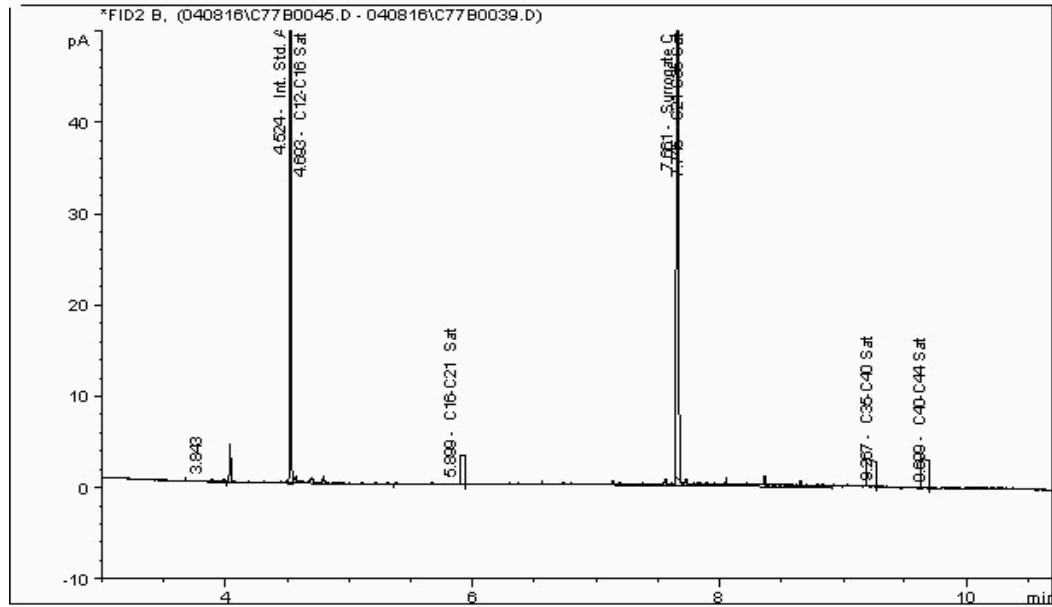
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 13221373
Sample ID : TP03

Depth : 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443920-
Date Acquired : 08/04/2016 23:46:14 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

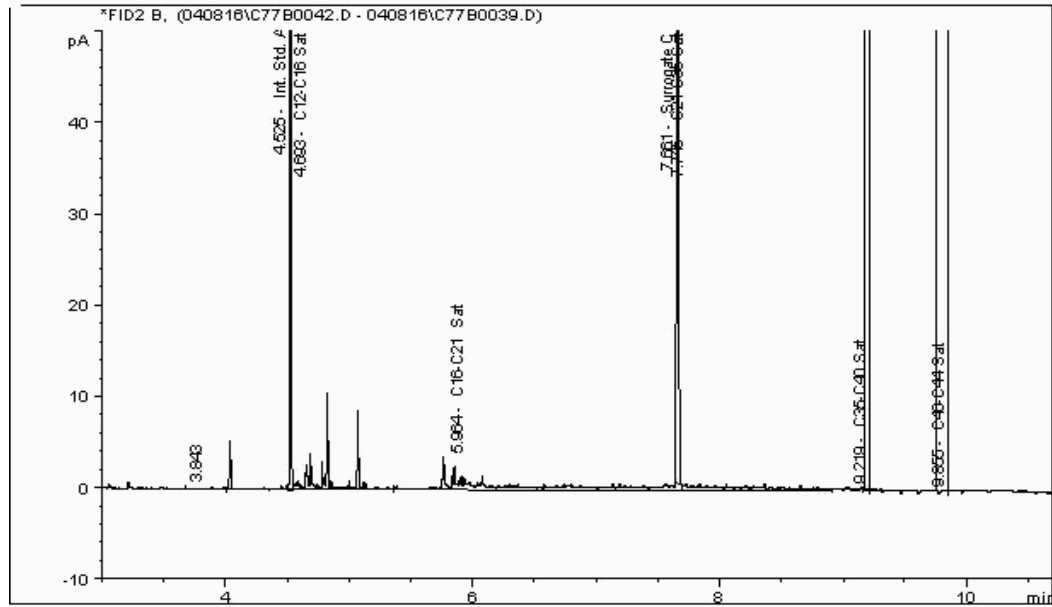
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 13221385
Sample ID : IP01

Depth : 0.60

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443793-
Date Acquired : 08/04/2016 22:53:13 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

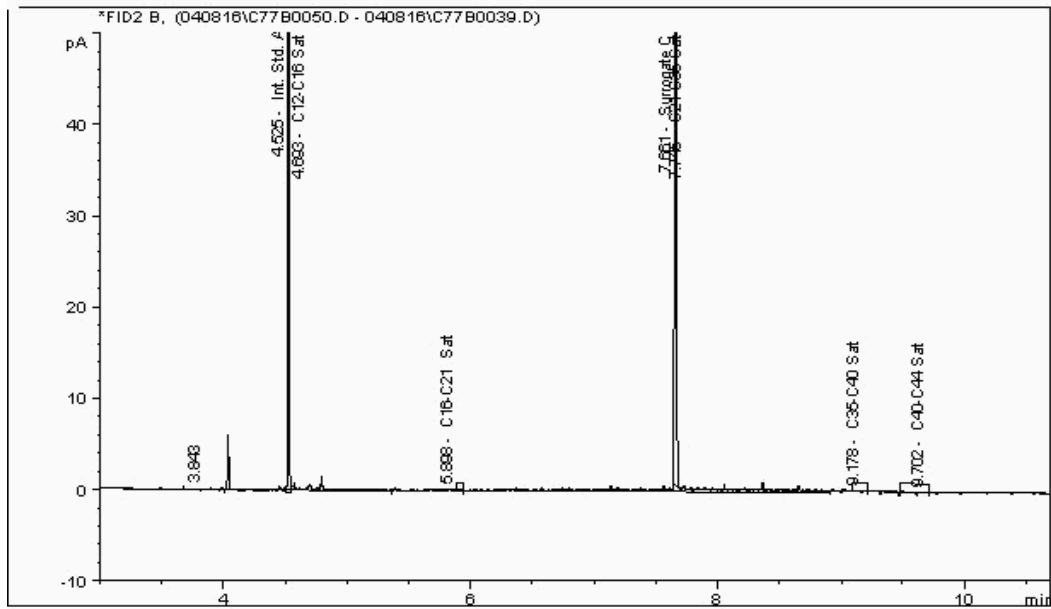
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 13221420
Sample ID : IP02

Depth : 0.50

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443833-
Date Acquired : 09/04/2016 01:11:33 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

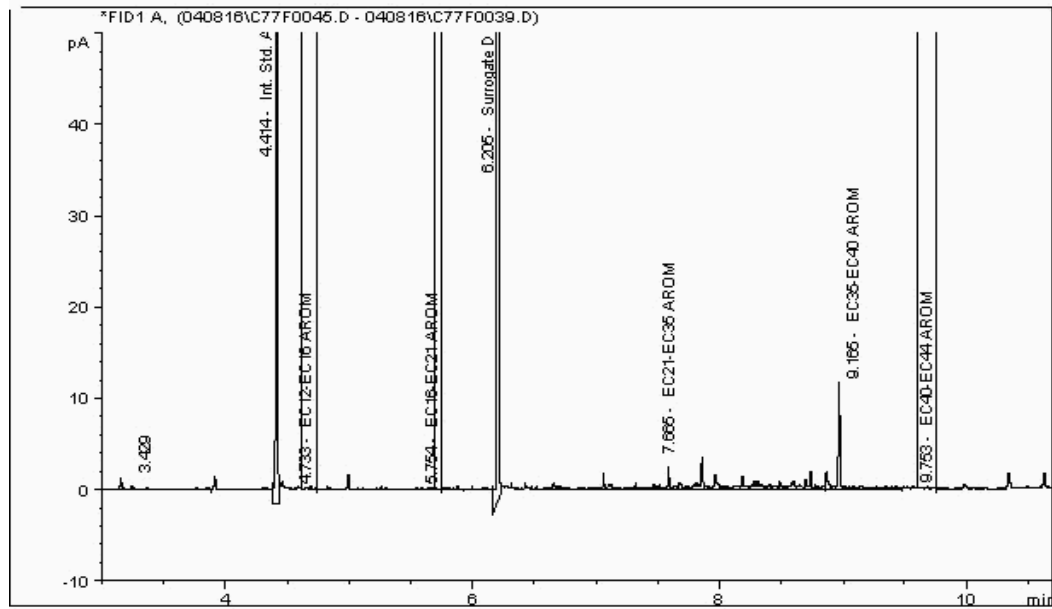
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 13221373
Sample ID : TP03

Depth : 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443921-
Date Acquired : 08/04/2016 23:46:14 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

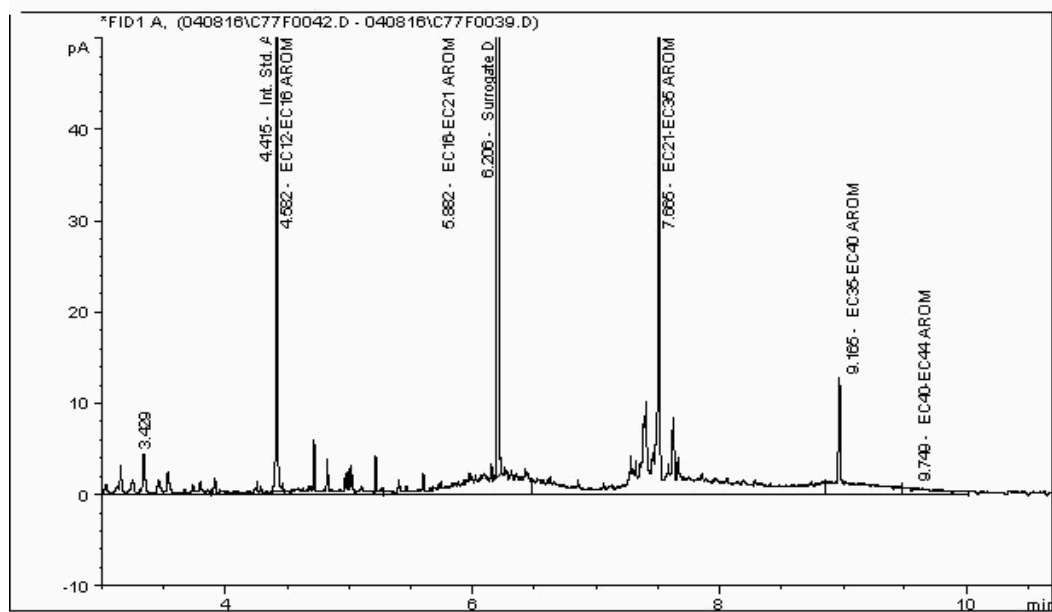
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 13221385
Sample ID : IP01

Depth : 0.60

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443794-
Date Acquired : 08/04/2016 22:53:13 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

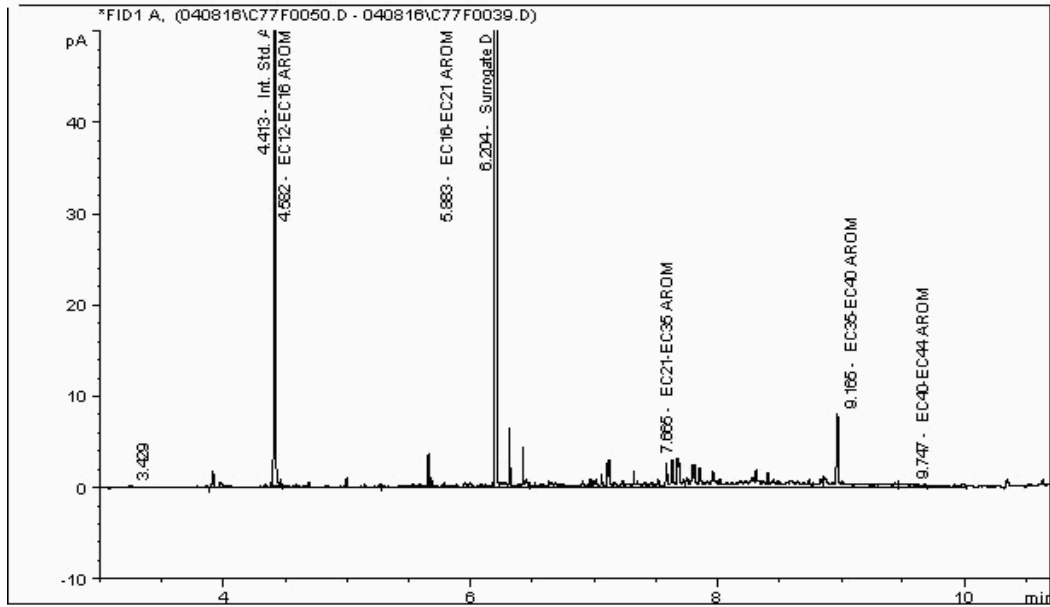
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 13221420
Sample ID : IP02

Depth : 0.50

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12443834-
Date Acquired : 09/04/2016 01:11:33 PM
Units : ppb
Dilution:





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

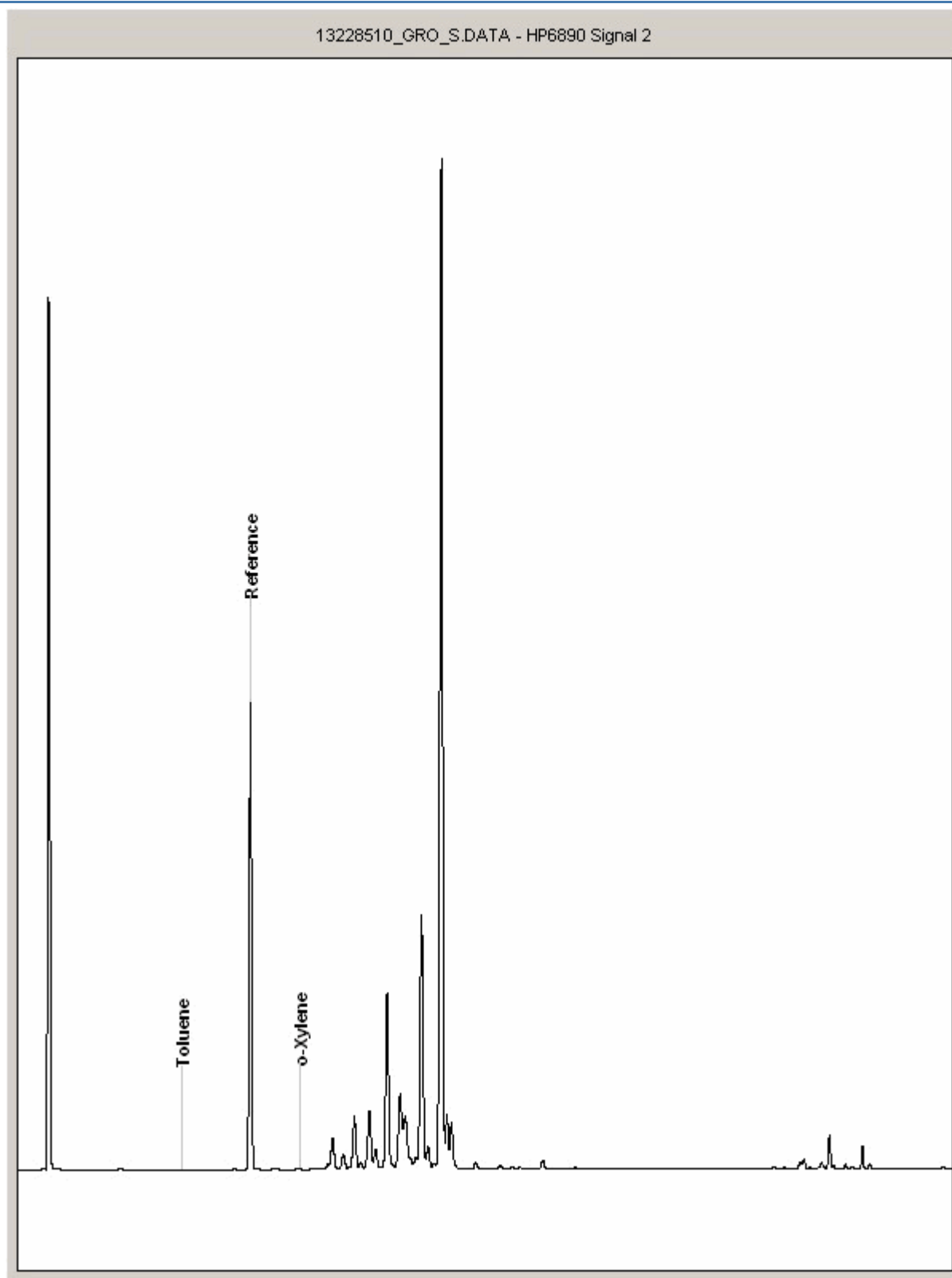
Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13228510
Sample ID : IP01

Depth : 0.60





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

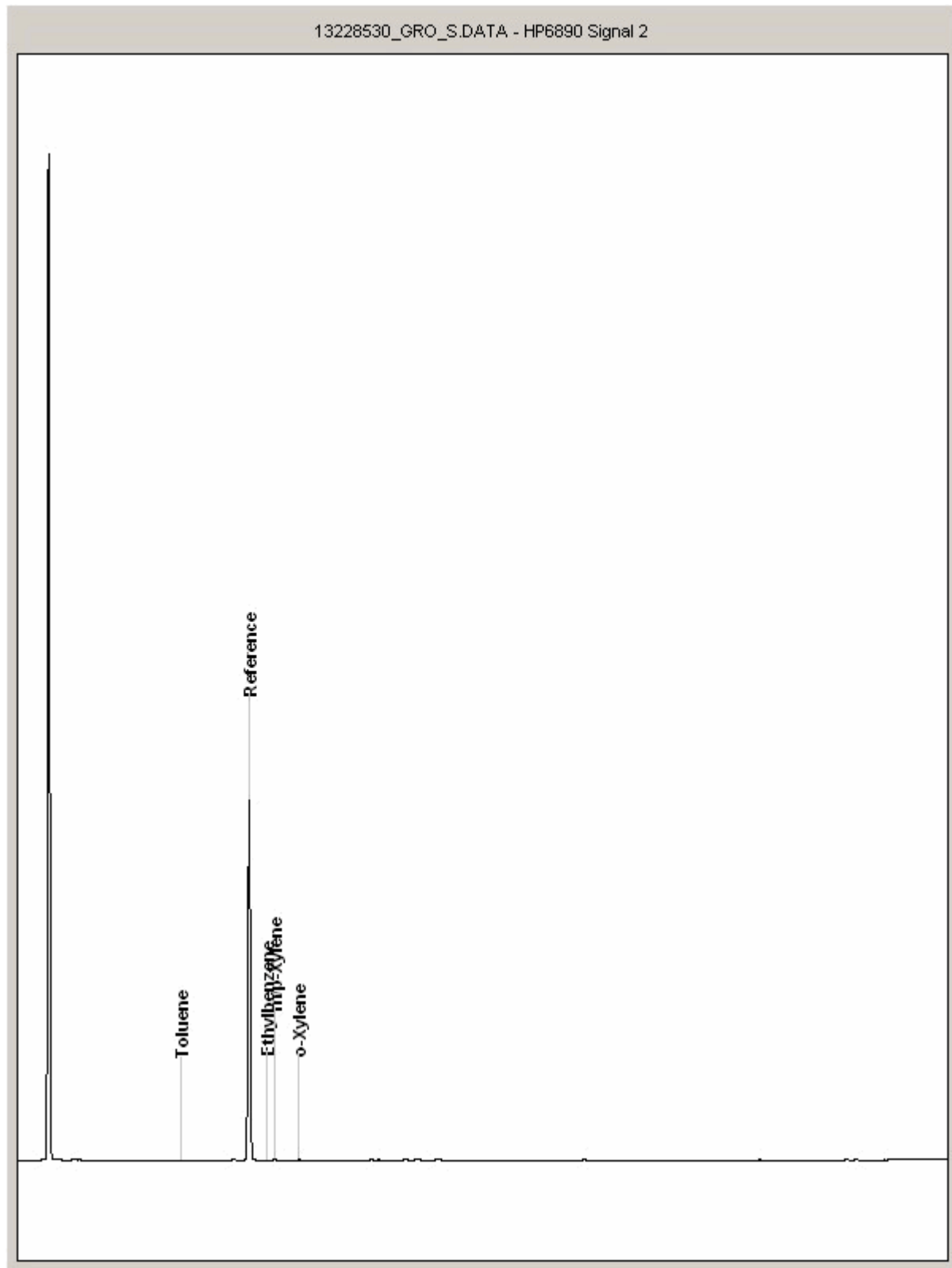
Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13228530
Sample ID : IP02

Depth : 0.50





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

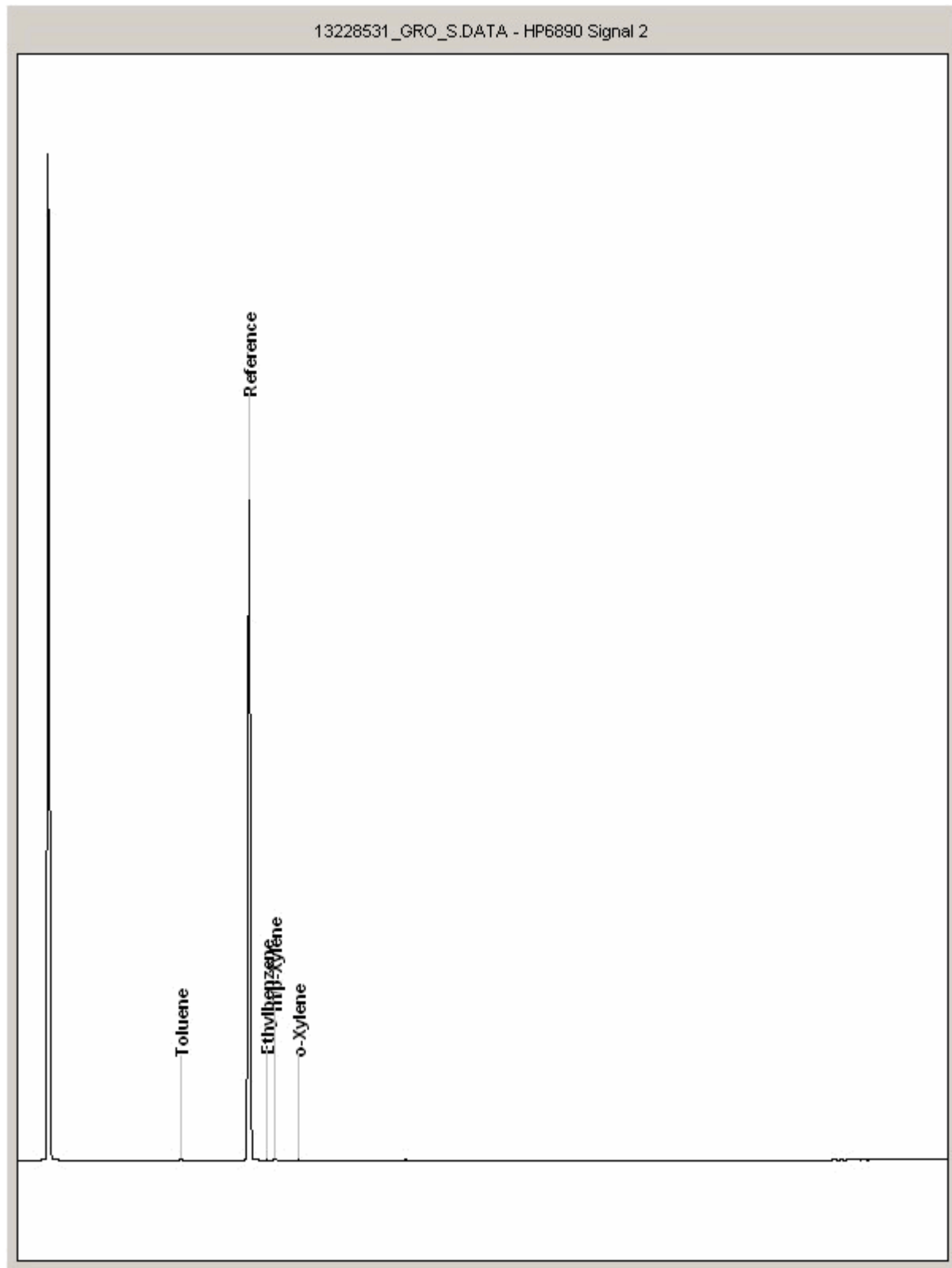
Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13228531
Sample ID : TP03

Depth : 0.70





SDG: 160406-79
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number: 31710/JI
Report Number: 356997
Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 22 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160413-30
Your Reference:
Location: University of Reading
Report No: 358159

We received 4 samples on Tuesday April 12, 2016 and 2 of these samples were scheduled for analysis which was completed on Friday April 22, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13244493	BH02		0.20 - 0.30	11/04/2016
13244494	BH02		0.50 - 0.70	11/04/2016
13244495	BH02		1.00 - 1.20	11/04/2016
13244496	BH02		2.00 - 2.20	11/04/2016

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

SOLID Results Legend X Test N No Determination Possible	Lab Sample No(s)		13244494	13244495
	Customer Sample Reference		BH02	BH02
	AGS Reference			
	Depth (m)		0.50 - 0.70	1.00 - 1.20
	Container		250g Amber Jar (AL) 1kg TUB	250g Amber Jar (AL) 1kg TUB
Anions by Kone (soil)	All	NDPs: 0 Tests: 2	X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2	X	X
Boron Water Soluble	All	NDPs: 0 Tests: 2	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 2	X	X
Easily Liberated Sulphide	All	NDPs: 0 Tests: 2	X	X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 1	X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 1	X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 1		X
Metals in solid samples by OES	All	NDPs: 0 Tests: 2	X	X
PAH by GCMS	All	NDPs: 0 Tests: 2	X	X
pH	All	NDPs: 0 Tests: 2	X	X
Phenols Spec MS (S)	All	NDPs: 0 Tests: 2	X	X
Sample description	All	NDPs: 0 Tests: 2	X	X
TPH CWG GC (S)	All	NDPs: 0 Tests: 1	X	



SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2		
13244494	BH02	0.50 - 0.70	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Vegetation	Stones		
13244495	BH02	1.00 - 1.20	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Vegetation	Stones		

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Results Legend		Customer Sample R	BH02		BH02			
#	ISO17025 accredited.							
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&*\$@	Sample deviation (see appendix)							
Component		LOD/Units	Method					
Moisture Content Ratio (% of as received sample)		%	PM024	9.2		13		
pH		1 pH Units	TM133	8.58		8.68		
Cyanide, Total		<1 mg/kg	TM153	<1		<1		
Sulphide, Easily liberated		<15 mg/kg	TM180	<15		<15		
Arsenic		<0.6 mg/kg	TM181	11.6		18.3		
Cadmium		<0.02 mg/kg	TM181	<0.02		<0.02		
Chromium		<0.9 mg/kg	TM181	15		21.5		
Copper		<1.4 mg/kg	TM181	12.7		11.8		
Lead		<0.7 mg/kg	TM181	36		34.3		
Mercury		<0.14 mg/kg	TM181	<0.14		<0.14		
Nickel		<0.2 mg/kg	TM181	12		18.1		
Selenium		<1 mg/kg	TM181	<1		<1		
Zinc		<1.9 mg/kg	TM181	53.2		49		
Boron, water soluble		<1 mg/kg	TM222	<1		<1		
Water Soluble Sulphate as SO4 2:1 Extract		<0.004 g/l	TM243	0.0112		0.054		

Order Number:
Report Number: 358159
Superseded Report:

Page 6 of 15



CERTIFICATE OF ANALYSIS

Validated

SDG: 160413-30

Job: H_GEOTECHEN_GLO-236

Client Reference:

Location: University of Reading

Customer: Geotechnical Engineering Ltd

Attention: Jon Ind

Order Number:

Report Number: 358159

Superseded Report:

Phenols Spec MS (S)

Results Legend		Customer Sample R	BH02					
#	ISO17025 accredited.		BH02					
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&*\$@	Sample deviation (see appendix)							
Component		LOD/Units	Method					
4-Nitrophenol		<1 µg/kg	TM072	<20	<20			
2,4,6-Trichlorophenol		<1 µg/kg	TM072	<20	<20			
2-Nitrophenol		<1 µg/kg	TM072	<20	<20			
2,4-Dichlorophenol		<1 µg/kg	TM072	<20	<20			
Pentachlorophenol		<1 µg/kg	TM072	<20	<20			
Phenol		<1 µg/kg	TM072	<20	<20			
4-Chloro-3-methylphenol		<1 µg/kg	TM072	<20	<20			
2,4-Dimethylphenol		<1 µg/kg	TM072	<20	<20			
2-Chlorophenol		<1 µg/kg	TM072	<20	<20			
Sum of Detected Phenols		<9 µg/kg	TM072	<180	<180			



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

TPH CWG (S)

Results Legend		Customer Sample R	BH02					
#	ISO17025 accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	0.50 - 0.70 Soil/Solid 11/04/2016 12/04/2016 160413-30 13244494					
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5&*\$@	Sample deviation (see appendix)							
Component	LOD/Units			Method				
GRO Surrogate % recovery**	%	TM089	125					
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	<44 M					
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #					
Benzene	<10 µg/kg	TM089	<10 M					
Toluene	<2 µg/kg	TM089	<2 M					
Ethylbenzene	<3 µg/kg	TM089	<3 M					
m,p-Xylene	<6 µg/kg	TM089	<6 M					
o-Xylene	<3 µg/kg	TM089	<3 M					
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9					
sum of detected BTEX by GC	<24 µg/kg	TM089	<24					
Aliphatics >C5-C6	<10 µg/kg	TM089	<10					
Aliphatics >C6-C8	<10 µg/kg	TM089	<10					
Aliphatics >C8-C10	<10 µg/kg	TM089	<10					
Aliphatics >C10-C12	<10 µg/kg	TM089	<10					
Aliphatics >C12-C16	<100 µg/kg	TM173	<100					
Aliphatics >C16-C21	<100 µg/kg	TM173	<100					
Aliphatics >C21-C35	<100 µg/kg	TM173	<100					
Aliphatics >C35-C44	<100 µg/kg	TM173	259					
Total Aliphatics >C12-C44	<100 µg/kg	TM173	259					
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10					
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10					
Aromatics >EC8-EC10	<10 µg/kg	TM089	<10					
Aromatics >EC10-EC12	<10 µg/kg	TM089	<10					
Aromatics >EC12-EC16	<100 µg/kg	TM173	1640					
Aromatics >EC16-EC21	<100 µg/kg	TM173	24900					
Aromatics >EC21-EC35	<100 µg/kg	TM173	58300					
Aromatics >EC35-EC44	<100 µg/kg	TM173	22800					
Aromatics >EC40-EC44	<100 µg/kg	TM173	9060					
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	108000					
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	108000					



SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Asbestos Identification - Soil

Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
------------------	-------------	----------	--------------------------	-----------------------------	-----------------------------	--------------------	-----------------------	-------------------	--------------------

Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH02 0.50 - 0.70 SOLID 11/04/2016 00:00:00 18/04/2016 10:06:53 160413-30 13244494 TM048	21/4/16	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
--	--	---------	--------------	---	------------------	------------------	------------------	------------------	------------------	--------------

Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH02 1.00 - 1.20 SOLID 11/04/2016 00:00:00 18/04/2016 10:12:05 160413-30 13244495 TM048	21/4/16	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
--	--	---------	--------------	---	------------------	------------------	------------------	------------------	------------------	--------------



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM072	Modified: US EPA Method 8141A	Determination of Phenols by GC-MS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished) ¹	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	160413-30	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358159
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	13244494	13244495
Customer Sample Ref.	BH02	BH02
AGS Ref.		
Depth	0.50 - 0.70	1.00 - 1.20
Type	SOLID	SOLID

Anions by Kone (soil)	21-Apr-2016	21-Apr-2016
Asbestos ID in Solid Samples	21-Apr-2016	21-Apr-2016
Boron Water Soluble	20-Apr-2016	19-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	20-Apr-2016	20-Apr-2016
Easily Liberated Sulphide	21-Apr-2016	21-Apr-2016
EPH CWG (Aliphatic) GC (S)	19-Apr-2016	
EPH CWG (Aromatic) GC (S)	19-Apr-2016	
GRO by GC-FID (S)	19-Apr-2016	
Metals in solid samples by OES	21-Apr-2016	21-Apr-2016
PAH by GCMS	21-Apr-2016	21-Apr-2016
pH	19-Apr-2016	19-Apr-2016
Phenols Spec MS (S)	22-Apr-2016	22-Apr-2016
Sample description	15-Apr-2016	15-Apr-2016
TPH CWG GC (S)	19-Apr-2016	



SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aliphatic) GC (S)

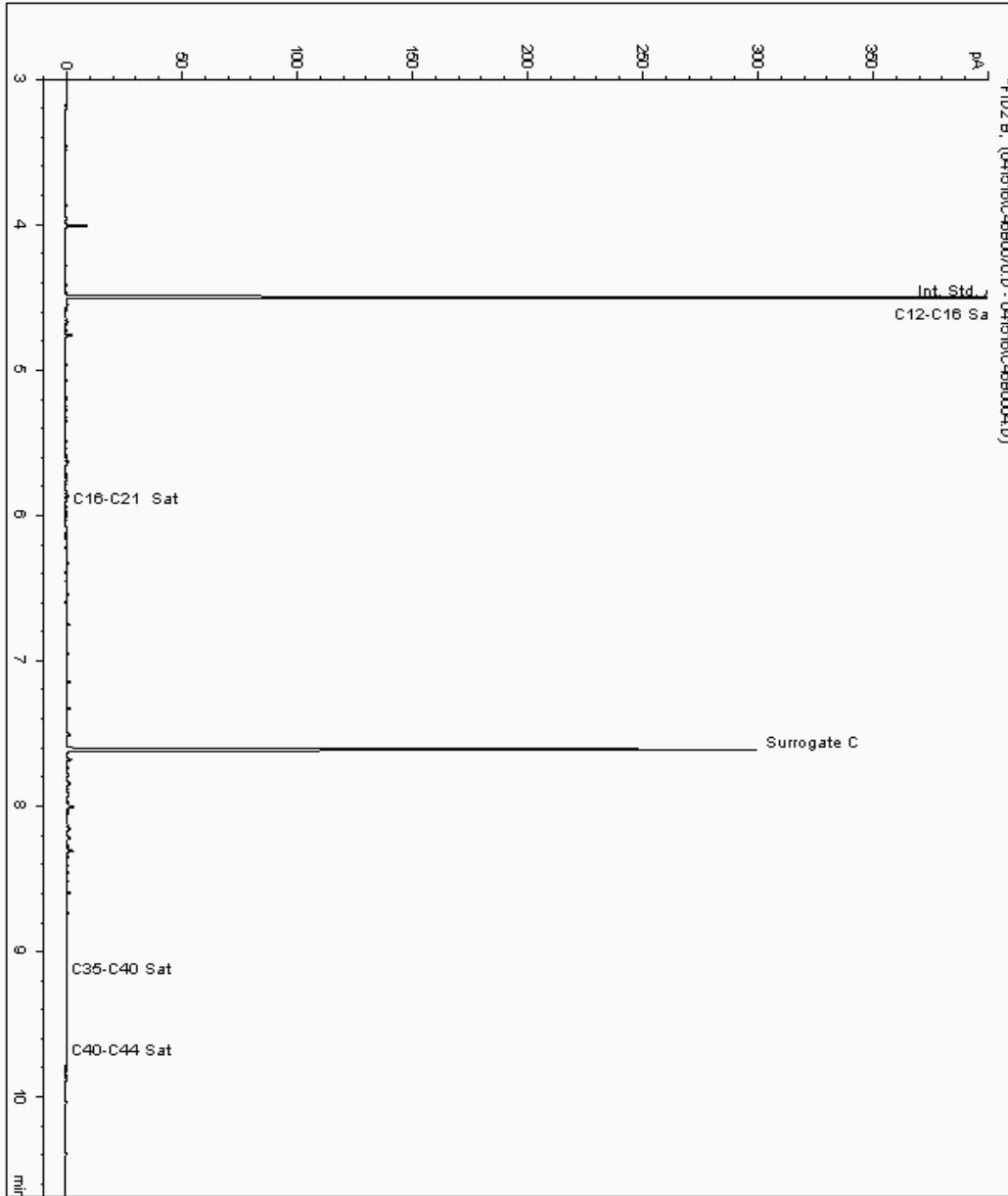
Sample No : 13261412
Sample ID : BH02

Depth : 0.50 - 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12475048-
Date Acquired : 18/04/2016 18:08:14 PM
Units : ppb
Dilution: BH02[0.50 - 0.70]

->





SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aromatic) GC (S)

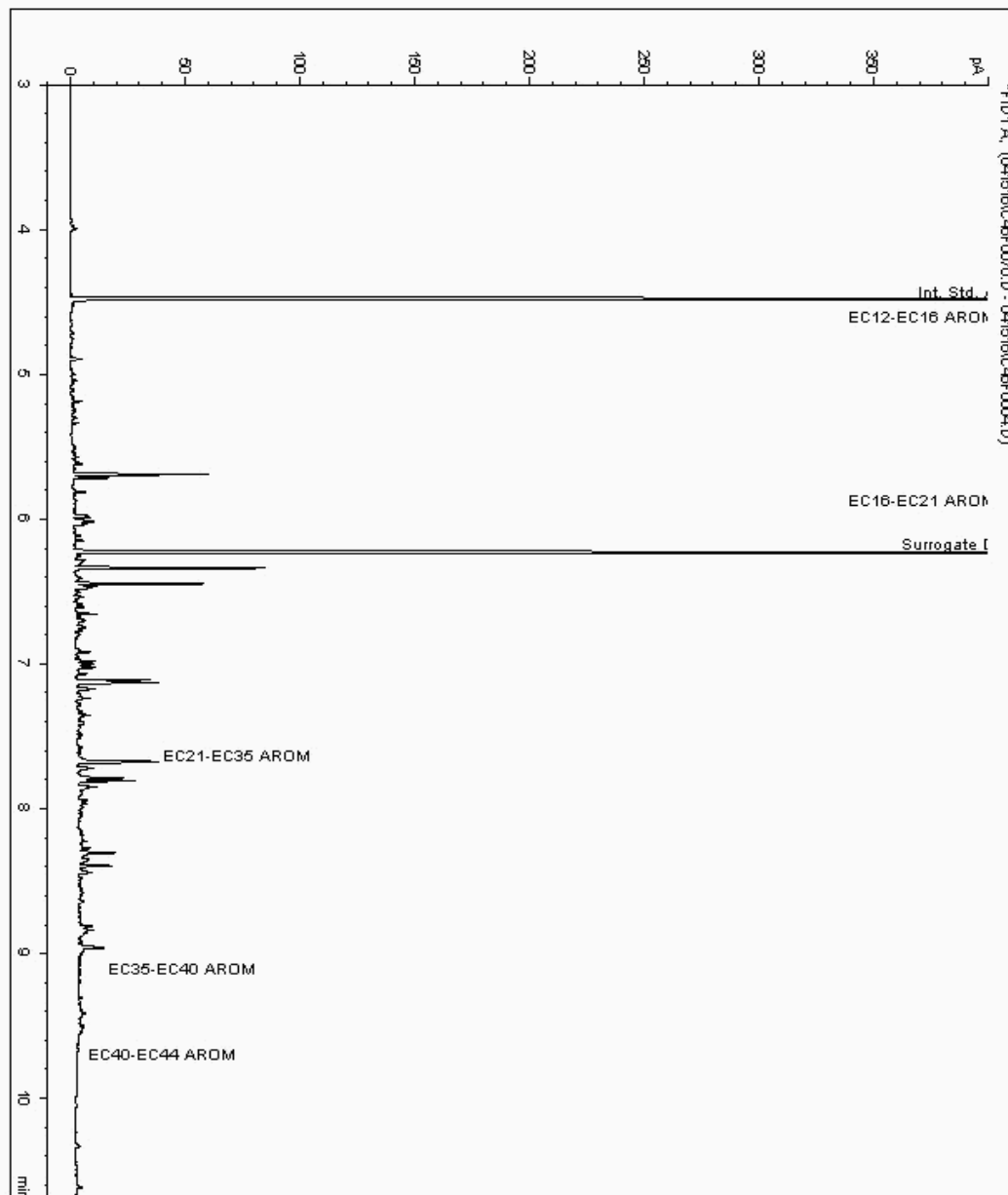
Sample No : 13261412
Sample ID : BH02

Depth : 0.50 - 0.70

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12475049-
Date Acquired : 18/04/2016 18:08:14 PM
Units : ppb
Dilution: BH02[0.50 - 0.70]

->





SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

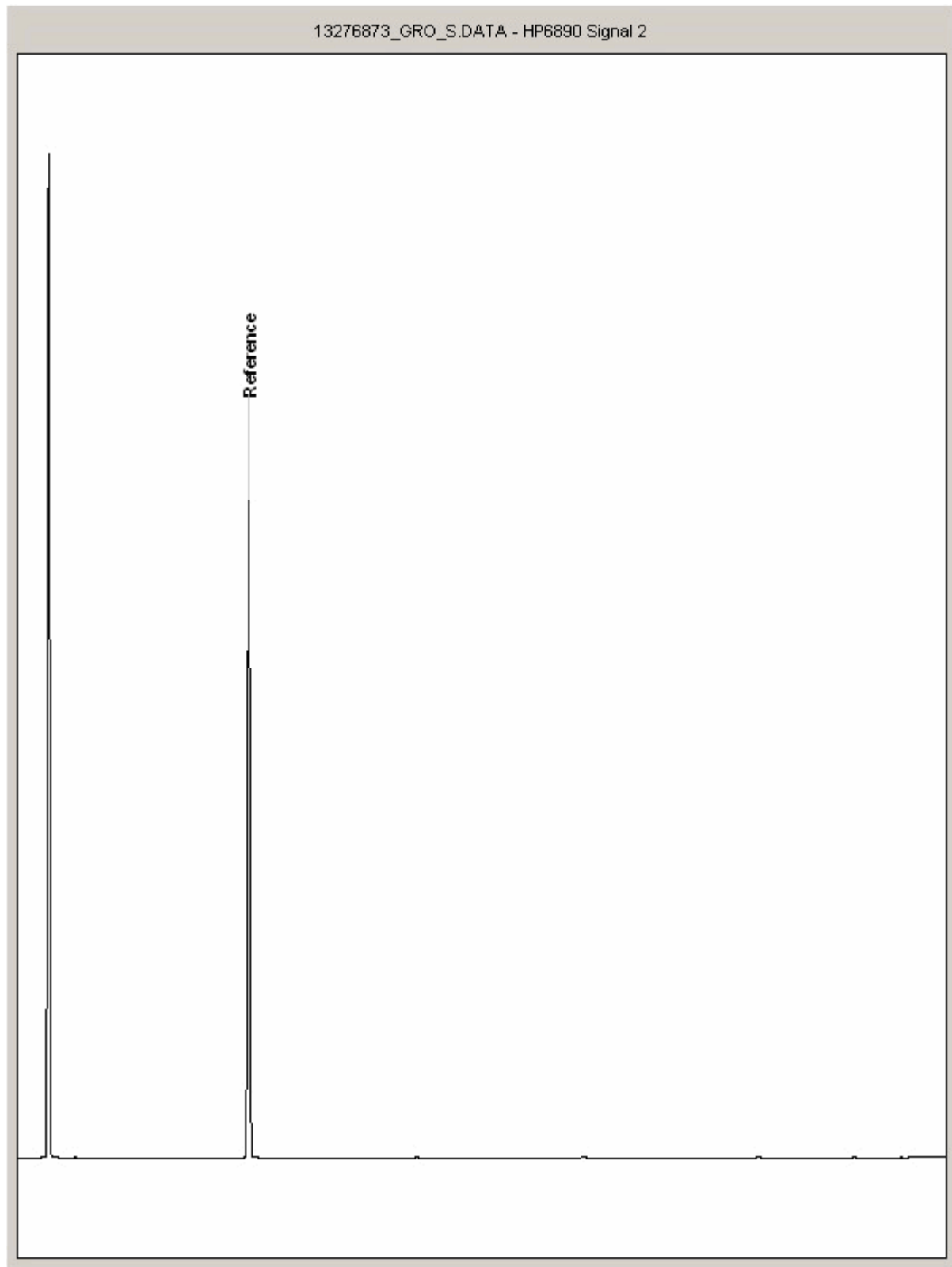
Order Number:
Report Number: 358159
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 13276873
Sample ID : BH02

Depth : 0.50 - 0.70





SDG: 160413-30
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358159
Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Crystalline	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Amosite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



Geotechnical Engineering Ltd
Centurion House
Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Attention: Jon Ind

CERTIFICATE OF ANALYSIS

Date: 27 April 2016
Customer: H_GEOTECHEN_GLO
Sample Delivery Group (SDG): 160419-67
Your Reference:
Location: University of Reading
Report No: 358783

We received 4 samples on Tuesday April 19, 2016 and 4 of these samples were scheduled for analysis which was completed on Wednesday April 27, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	160419-67	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358783
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13283521	BH01		3.91	18/04/2016
13283523	BH02		3.22	18/04/2016
13283519	BH03		3.52	18/04/2016
13283522	BH04		3.83	18/04/2016

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

LIQUID Results Legend X Test N No Determination Possible	Lab Sample No(s)					
	Customer Sample Reference					
	AGS Reference					
	Depth (m)					
	Container					
			13283521	13283523	13283519	13283522
			BH01	BH02	BH03	BH04
			3.91	3.22	3.52	3.83
			1000ml glass bottle Dissolved Metals Pr Vial (ALE297)	1000ml glass bottle Dissolved Metals Pr Vial (ALE297)	1000ml glass bottle Dissolved Metals Pr Vial (ALE297)	1000ml glass bottle Dissolved Metals Pr Vial (ALE297)
Alkalinity as CaCO ₃	All	NDPs: 0 Tests: 4	X	X	X	X
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 4	X	X	X	X
Anions by Kone (w)	All	NDPs: 0 Tests: 4	X	X	X	X
COD Unfiltered	All	NDPs: 0 Tests: 4	X	X	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4	X	X	X	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 4	X	X	X	X
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 4	X	X	X	X
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 4	X	X	X	X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 4		X	X	X
Mercury Dissolved	All	NDPs: 0 Tests: 4	X	X	X	X
Metals by iCap-OES Unfiltered (W)	All	NDPs: 0 Tests: 2	X	X		
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 4	X	X	X	X
pH Value	All	NDPs: 0 Tests: 4	X	X	X	X
Phenols by ms (w)	All	NDPs: 0 Tests: 4	X	X	X	X
Sulphide	All	NDPs: 0 Tests: 4	X	X	X	X



CERTIFICATE OF ANALYSIS

Validated

SDG:160419-67

Job:H_GEOTECHEN_GLO-236

Client Reference:

Location:University of Reading

Customer:Geotechnical Engineering Ltd

Attention:Jon Ind

Order Number:

Report Number:358783

Superseded Report:

LIQUID

Results Legend

X

Test

N

No Determination Possible

Lab Sample No(s)	13283521	13283523	13283519	13283522
Customer Sample Reference	BH01	BH02	BH03	BH04
AGS Reference				
Depth (m)	3.91	3.22	3.52	3.83
Container	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)	Disolved Metals Pr 1000ml glass bottle Vial (ALE297)
Total Metals by ICP-MS	All	NDPs: 0 Tests: 4	X	X
TPH CWG (W)	All	NDPs: 0 Tests: 4	X	X



CERTIFICATE OF ANALYSIS

SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Results Legend		Customer Sample R						
#	ISO17025 accredited.		BH01	BH02	BH03	BH04		
M	mCERTS accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	3.91	3.22	3.52	3.83		
aq	Aqueous / settled sample.		Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)		
diss.filt	Dissolved / filtered sample.		18/04/2016	18/04/2016	18/04/2016	18/04/2016		
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		19/04/2016	19/04/2016	19/04/2016	19/04/2016		
(F)	Trigger breach confirmed		160419-67	160419-67	160419-67	160419-67		
1-58*\$@	Sample deviation (see appendix)		13283521	13283523	13283519	13283522		
Component	LOD/Units	Method						
Alkalinity, Total as CaCO3	<2 mg/l	TM043	347	343	96.9	421		
			#	#	#	#		
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	<0.2	<0.2	<0.2	<0.2		
			#	#	#	#		
Sulphide	<0.01 mg/l	TM101	<0.1	<0.1	1.3	<0.1		
			#	#	#	#		
COD, unfiltered	<7 mg/l	TM107	2450	722	424	1090		
			#	#	#	#		
Arsenic (diss.filt)	<0.12 µg/l	TM152	0.46	0.383	0.369	1.18		
			#	#	#	#		
Boron (diss.filt)	<9.4 µg/l	TM152	17.7	30.3	15.7	22.5		
			#	#	#	#		
Cadmium (diss.filt)	<0.1 µg/l	TM152	0.151	<0.1	0.209	<0.1		
			#	#	#	#		
Chromium (diss.filt)	<0.22 µg/l	TM152	4.22	4.66	2.76	4.47		
			#	#	#	#		
Copper (diss.filt)	<0.85 µg/l	TM152	0.9	1.91	0.946	1.96		
			#	#	#	#		
Lead (diss.filt)	<0.02 µg/l	TM152	0.057	0.158	0.05	0.065		
			#	#	#	#		
Nickel (diss.filt)	<0.15 µg/l	TM152	9.9	5.86	30.6	4.35		
			#	#	#	#		
Selenium (diss.filt)	<0.39 µg/l	TM152	6.92	2.28	1.53	26.5		
			#	#	#	#		
Zinc (diss.filt)	<0.41 µg/l	TM152	8.09	8.74	14.6	2.7		
			#	#	#	#		
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01	<0.01	<0.01	<0.01		
			#	#	#	#		
Sulphate	<2 mg/l	TM184	65.7	37.5	59	99.4		
			#	#	#	#		
Chromium (tot.unfilt)	<3 µg/l	TM191	597	410	208	209		
			#	#	#	#		
Phenol	<0.5 µg/l	TM205	<1	<1	<1	<1		
2-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
3-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2-chlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4-dimethylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-chloro-3-methylphenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,6-dichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-Chlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4-dichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2-nitrophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4,6-trichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,4,5-trichlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
4-nitrophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,3,5,6-tetrachlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		
2,3,4,6-tetrachlorophenol	<0.5 µg/l	TM205	<0.5	<0.5	<0.5	<0.5		

Order Number:
Report Number: 358783
Superseded Report:

17:05:39 27/04/2016

Order Number:
Report Number: 358783
Superseded Report:

Page 7 of 23



CERTIFICATE OF ANALYSIS

SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

TPH CWG (W)

Results Legend		Customer Sample R	BH01	BH02	BH03	BH04		
#	ISO17025 accredited.							
M	mCERTS accredited.	Depth (m) Sample Type Date Sampled Sampled Time Date Received SDG Ref Lab Sample No.(s) AGS Reference	3.91 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283521	3.22 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283523	3.52 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283519	3.83 Water(GW/SW) 18/04/2016 19/04/2016 160419-67 13283522		
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.							
tot.unfilt	Total / unfiltered sample.							
*	Subcontracted test.							
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery							
(F)	Trigger breach confirmed							
1-5	@	Sample deviation (see appendix)							
Component	LOD/Units	Method						
GRO Surrogate % recovery**	%	TM245	93	94	92	90		
GRO >C5-C12	<50 µg/l	TM245	<50	<50	<50	<50		
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245	<3	<3	<3	<3		
Benzene	<7 µg/l	TM245	<7	<7	<7	<7		
Toluene	<4 µg/l	TM245	<4	<4	<4	<4		
Ethylbenzene	<5 µg/l	TM245	<5	<5	<5	<5		
m,p-Xylene	<8 µg/l	TM245	<8	<8	<8	<8		
o-Xylene	<3 µg/l	TM245	<3	<3	<3	<3		
Sum of detected Xylenes	<11 µg/l	TM245	<11	<11	<11	<11		
Sum of detected BTEX	<28 µg/l	TM245	<28	<28	<28	<28		
Aliphatics >C5-C6	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C6-C8	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C8-C10	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C10-C12	<10 µg/l	TM245	<10	<10	<10	<10		
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174	12	10	15	<10		
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174	273	110	313	20		
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174	1410	514	1310	141		
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174	1700	634	1640	161		
Aromatics >EC5-EC7	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC7-EC8	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC8-EC10	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC10-EC12	<10 µg/l	TM245	<10	<10	<10	<10		
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174	21	<10	11	19		
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174	165	58	80	136		
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174	902	355	453	661		
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174	1090	413	544	816		
Total Aliphatics & Aromatics >C5-35 (aq)	<10 µg/l	TM174	2790	1070	2190	977		



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
TM043	Method 2320B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part109 1984	Determination of alkalinity in aqueous samples		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM099	BS 2690: Part 7:1968 / BS 6068: Part2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser		
TM101	Method 4500B & C, AWWA/APHA, 20th Ed., 1999	Determination of Sulphide in soil and water samples using the Kone Analyser		
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM191	Standard Methods for the examination of waters and wastewaters 16th Edition, ALPHA, Washington DC, USA. ISBN 0-87553-131-8.	Determination of Unfiltered Metals in Water Matrices by ICP-MS		
TM205		Determination of Phenols in Waste Waters using Solid Phase Extraction, Acetylation, Gas Chromatography and Mass Selective Detection		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM228	US EPA Method 6010B	Determination of Major Cations in Water by iCap 6500 Duo ICP-OES		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	160419-67	Location:	University of Reading	Order Number:	
Job:	H_GEOTECHEN_GLO-236	Customer:	Geotechnical Engineering Ltd	Report Number:	358783
Client Reference:		Attention:	Jon Ind	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	13283521	13283523	13283519	13283522
Customer Sample Ref.	BH01	BH02	BH03	BH04
AGS Ref.				
Depth	3.91	3.22	3.52	3.83
Type	LIQUID	LIQUID	LIQUID	LIQUID

Alkalinity as CaCO3	25-Apr-2016	25-Apr-2016	26-Apr-2016	25-Apr-2016
Ammoniacal Nitrogen	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Anions by Kone (w)	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
COD Unfiltered	23-Apr-2016	21-Apr-2016	22-Apr-2016	22-Apr-2016
Cyanide Comp/Free/Total/Thiocyanate	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
Dissolved Metals by ICP-MS	25-Apr-2016	25-Apr-2016	25-Apr-2016	25-Apr-2016
EPH CWG (Aliphatic) Aqueous GC (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
EPH CWG (Aromatic) Aqueous GC (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
GRO by GC-FID (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016
Mercury Dissolved	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Metals by iCap-OES Unfiltered (W)	26-Apr-2016	26-Apr-2016		
PAH Spec MS - Aqueous (W)	25-Apr-2016	22-Apr-2016	25-Apr-2016	22-Apr-2016
pH Value	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Phenols by ms (w)	27-Apr-2016	27-Apr-2016	27-Apr-2016	27-Apr-2016
Sulphide	21-Apr-2016	21-Apr-2016	21-Apr-2016	21-Apr-2016
Total Metals by ICP-MS	26-Apr-2016	26-Apr-2016	26-Apr-2016	26-Apr-2016
TPH CWG (W)	22-Apr-2016	22-Apr-2016	22-Apr-2016	22-Apr-2016



SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

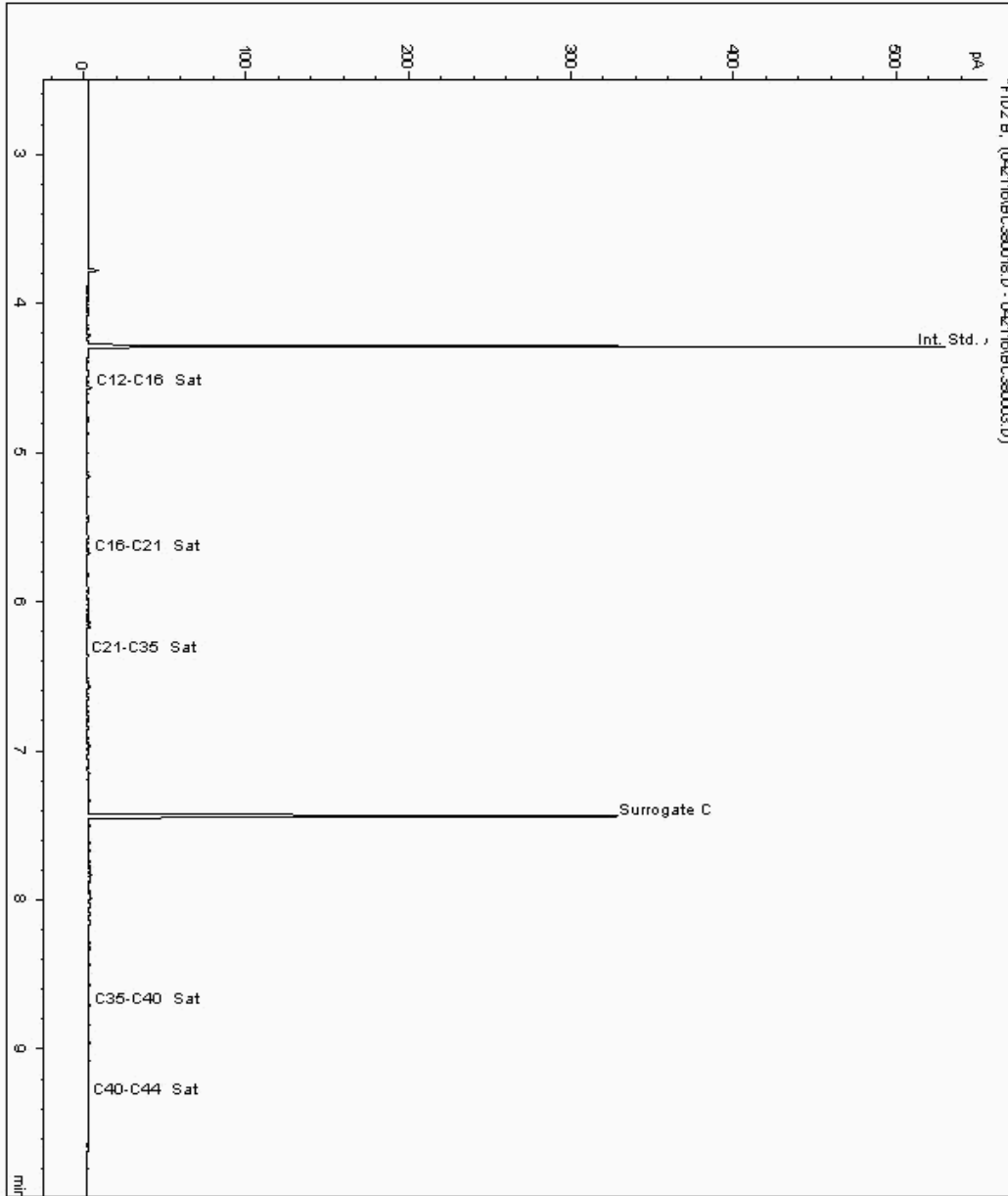
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13288596
Sample ID : BH04

Depth : 3.83

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507646-
Date Acquired : 21/04/16 20:37:01 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

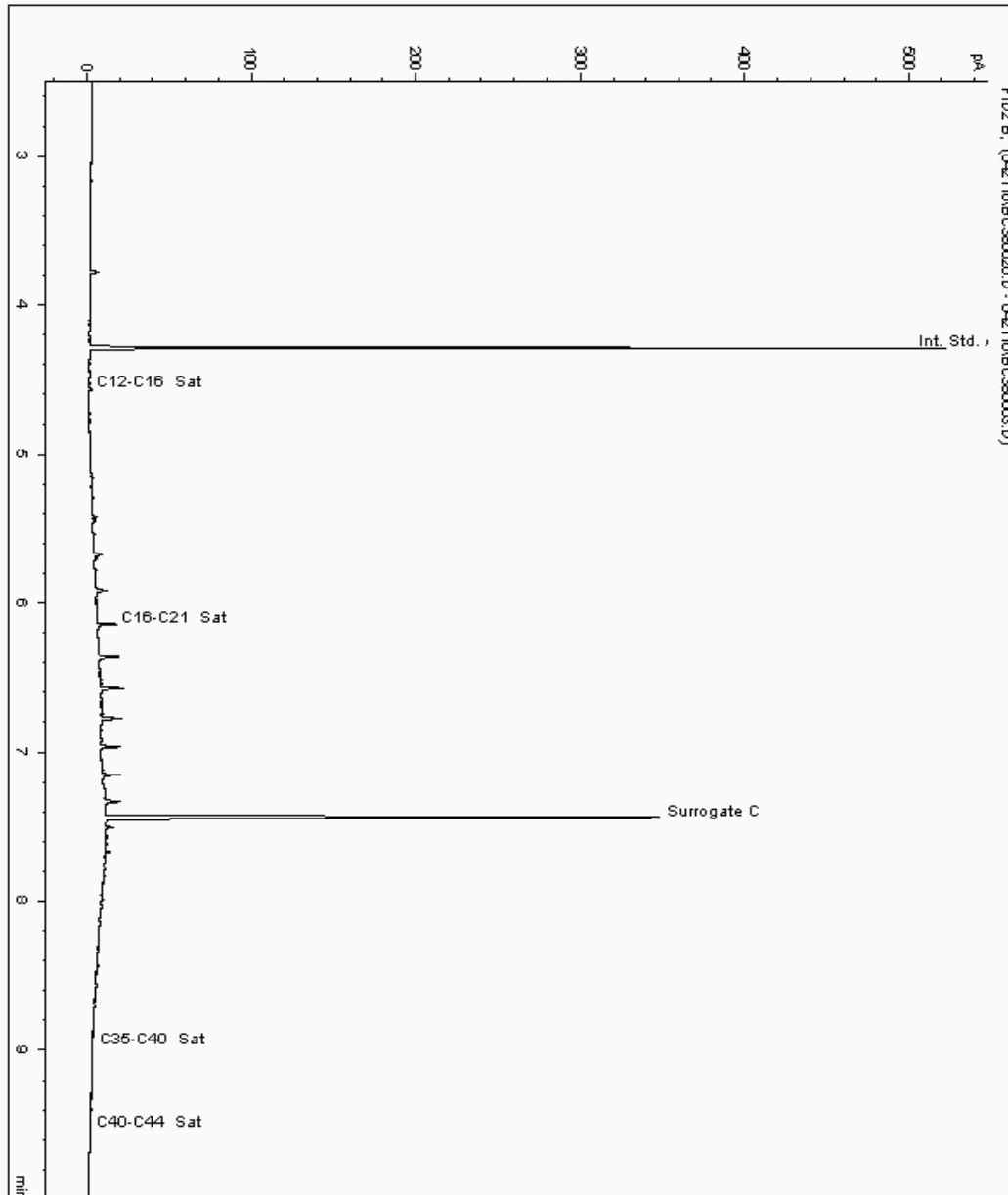
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13288841
Sample ID : BH03

Depth : 3.52

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507607-
Date Acquired : 21/04/16 21:04:37 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

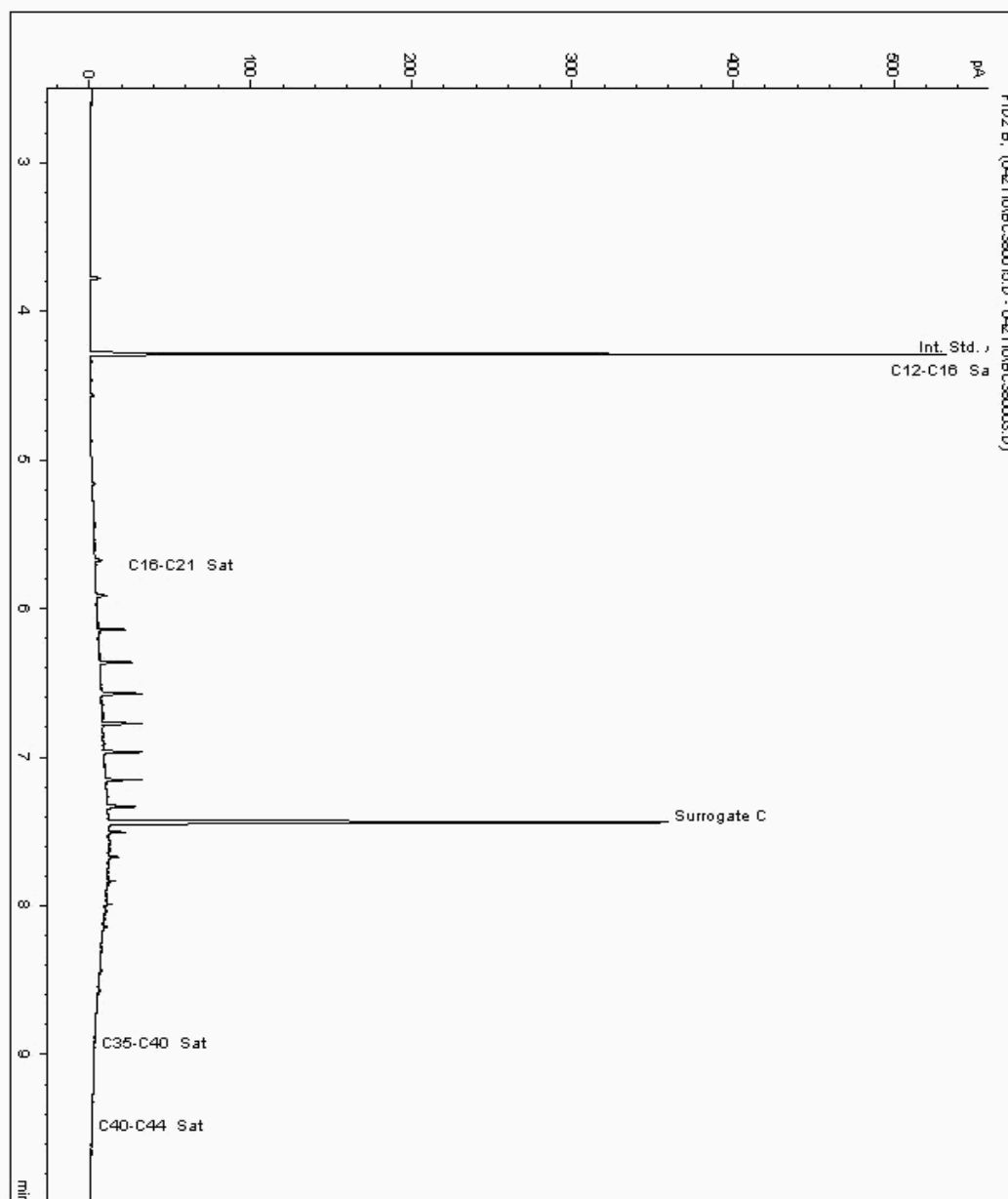
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13288917
Sample ID : BH01

Depth : 3.91

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507626-
Date Acquired : 21/04/16 19:50:40 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

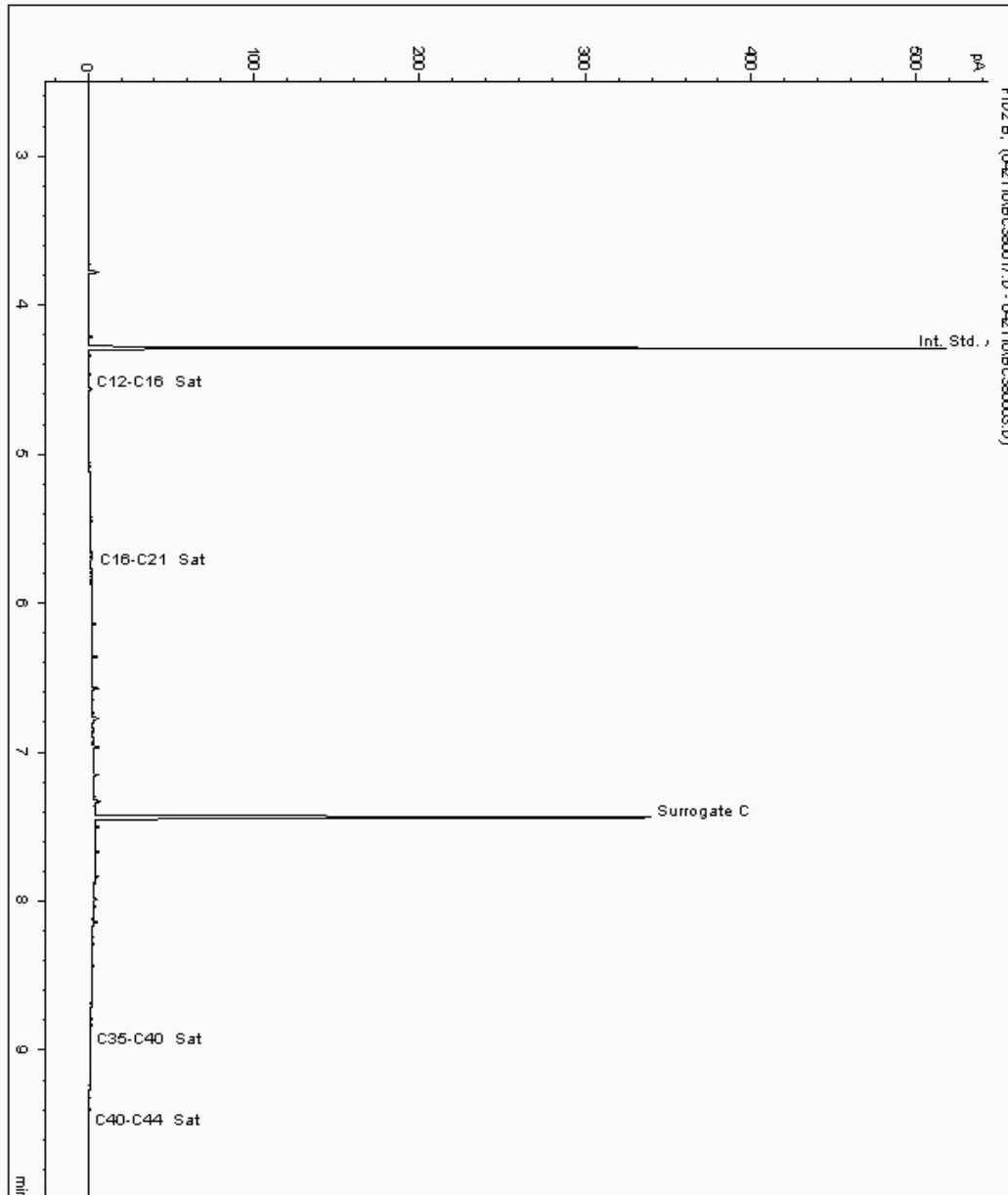
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 13289152
Sample ID : BH02

Depth : 3.22

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 12507666-
Date Acquired : 21/04/16 20:18:29 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

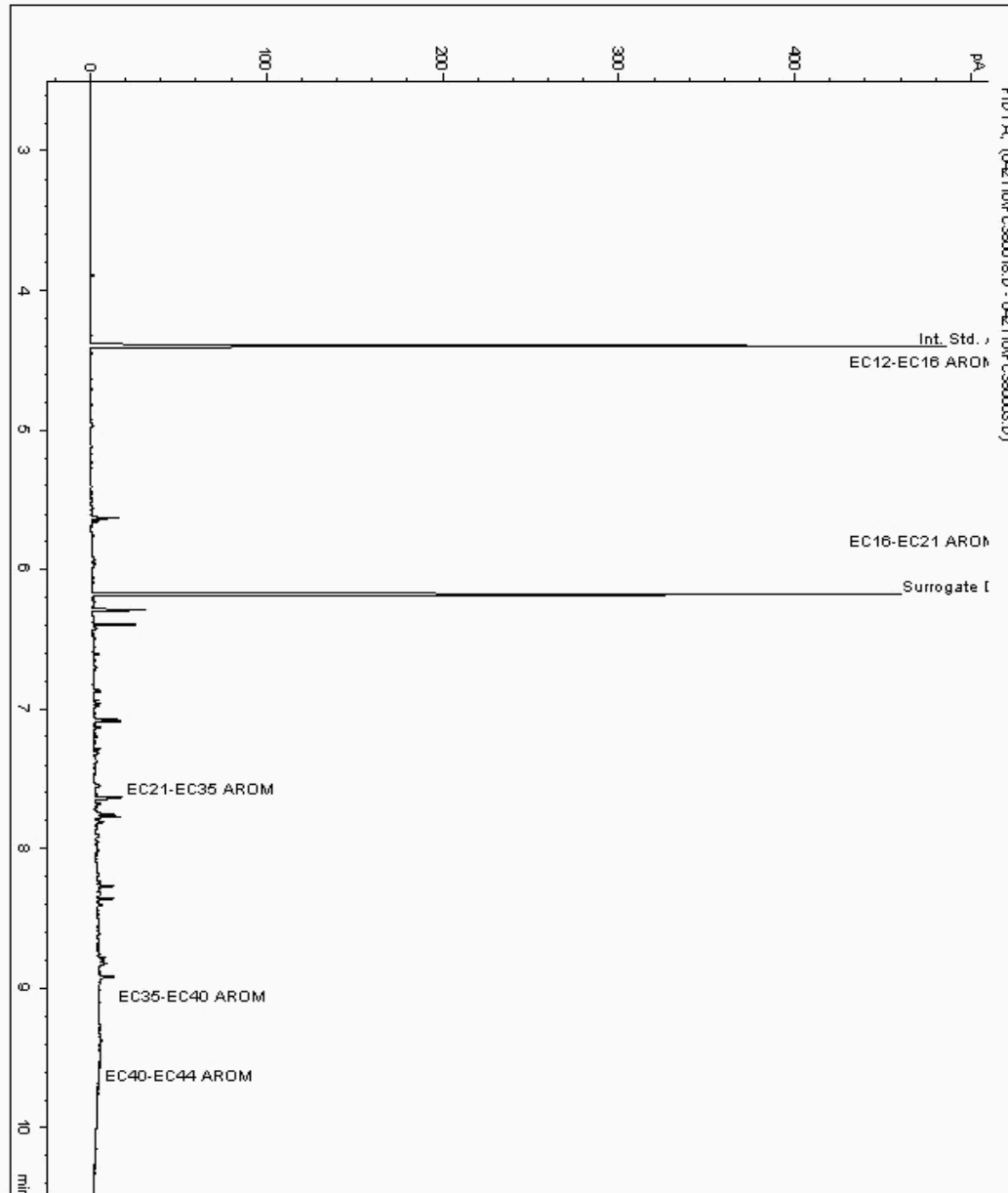
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13288596
Sample ID : BH04

Depth : 3.83

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507647-
Date Acquired : 21/04/16 20:37:01 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

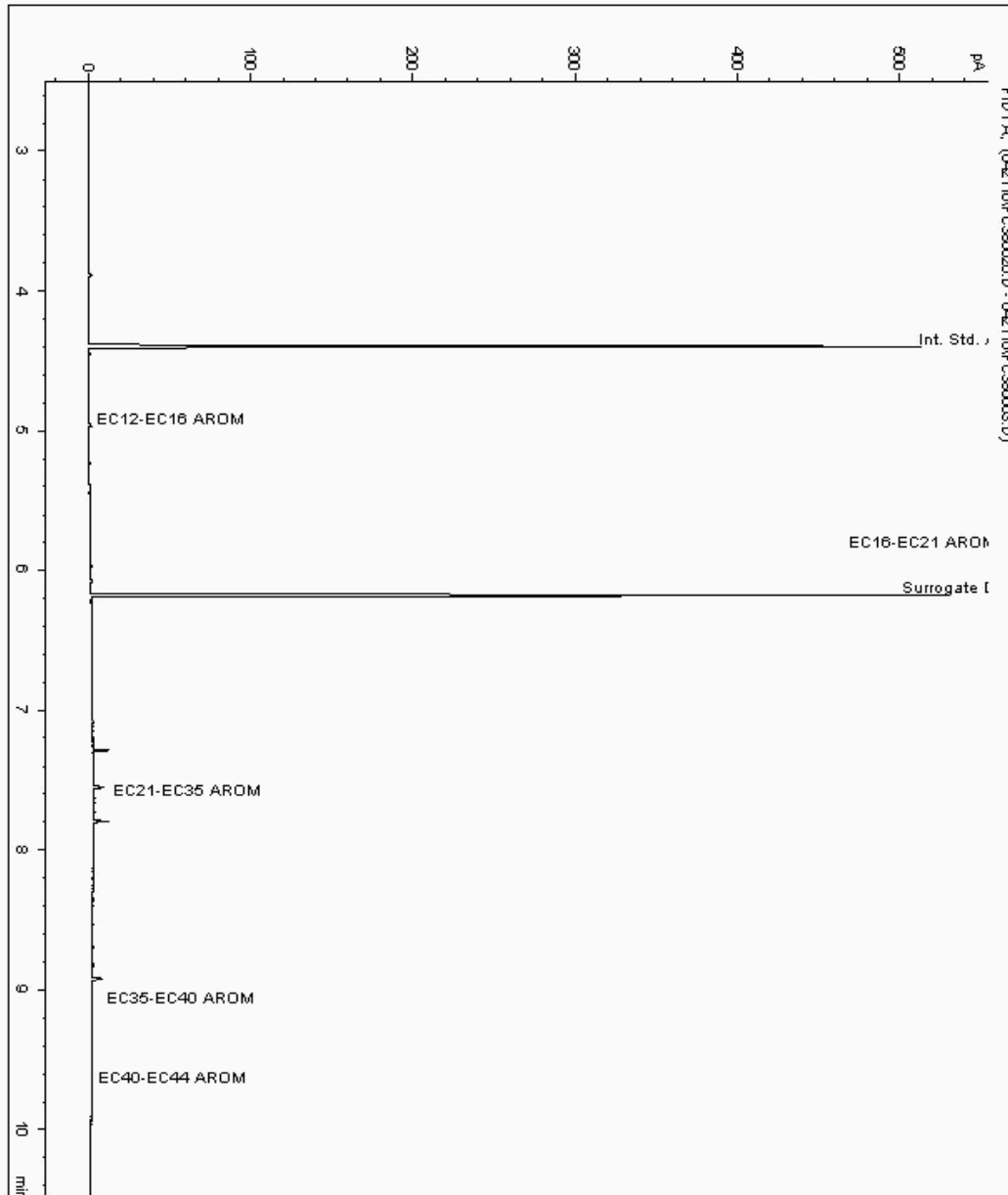
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13288841
Sample ID : BH03

Depth : 3.52

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507608-
Date Acquired : 21/04/16 21:04:38 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

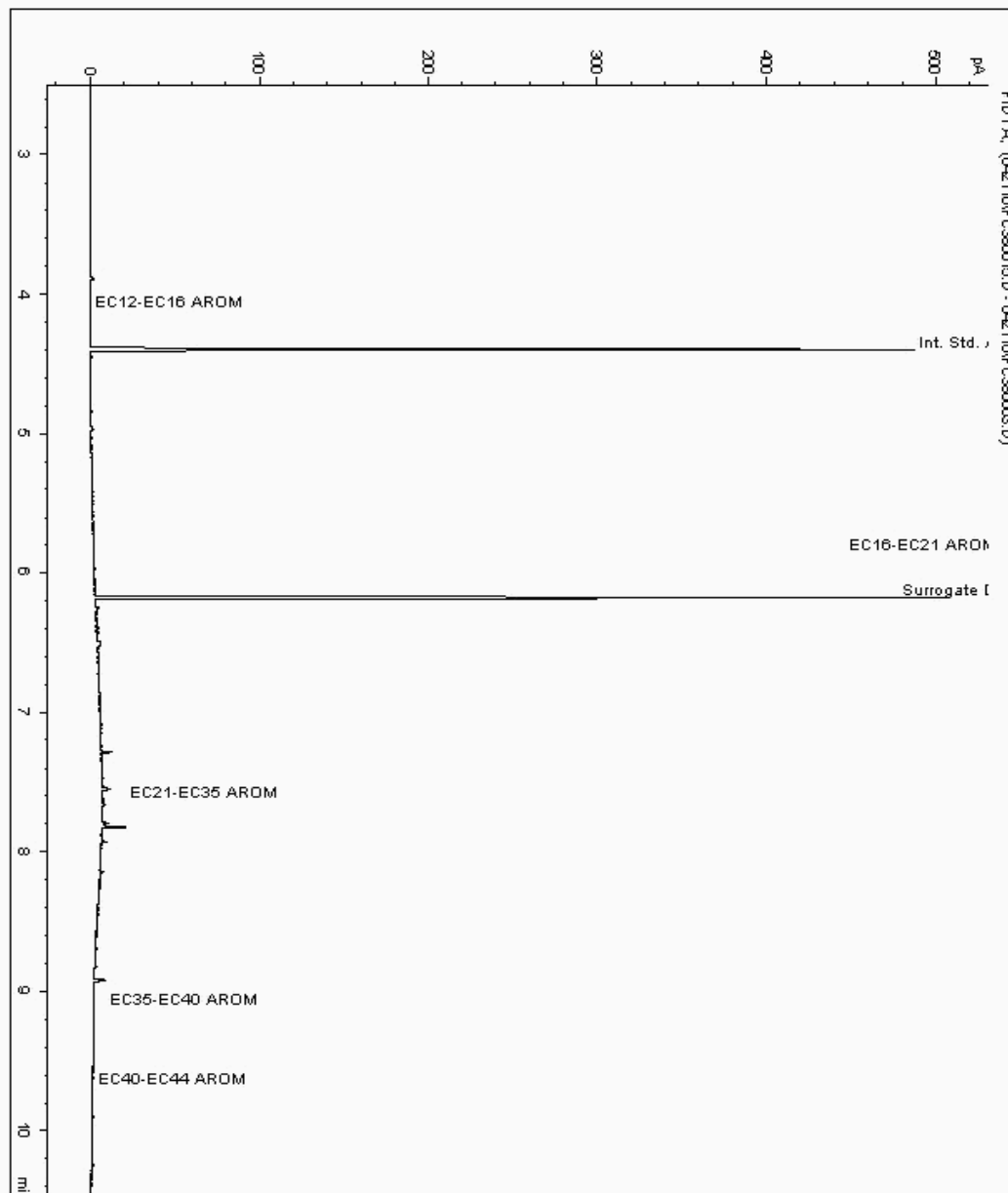
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13288917
Sample ID : BH01

Depth : 3.91

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507627-
Date Acquired : 21/04/16 19:50:40 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

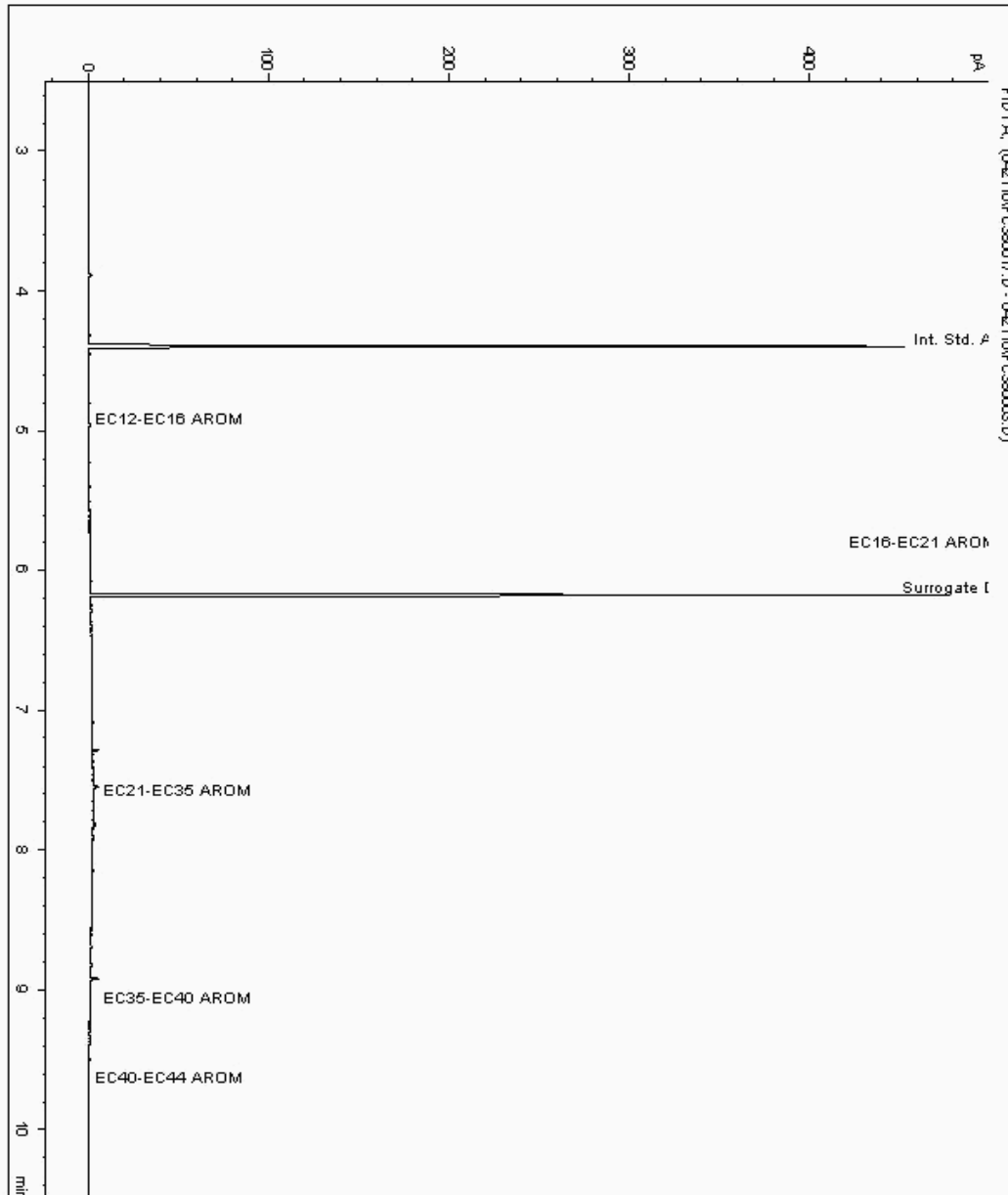
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 13289152
Sample ID : BH02

Depth : 3.22

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 12507667-
Date Acquired : 21/04/16 20:18:29 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





CERTIFICATE OF ANALYSIS

Validated

SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

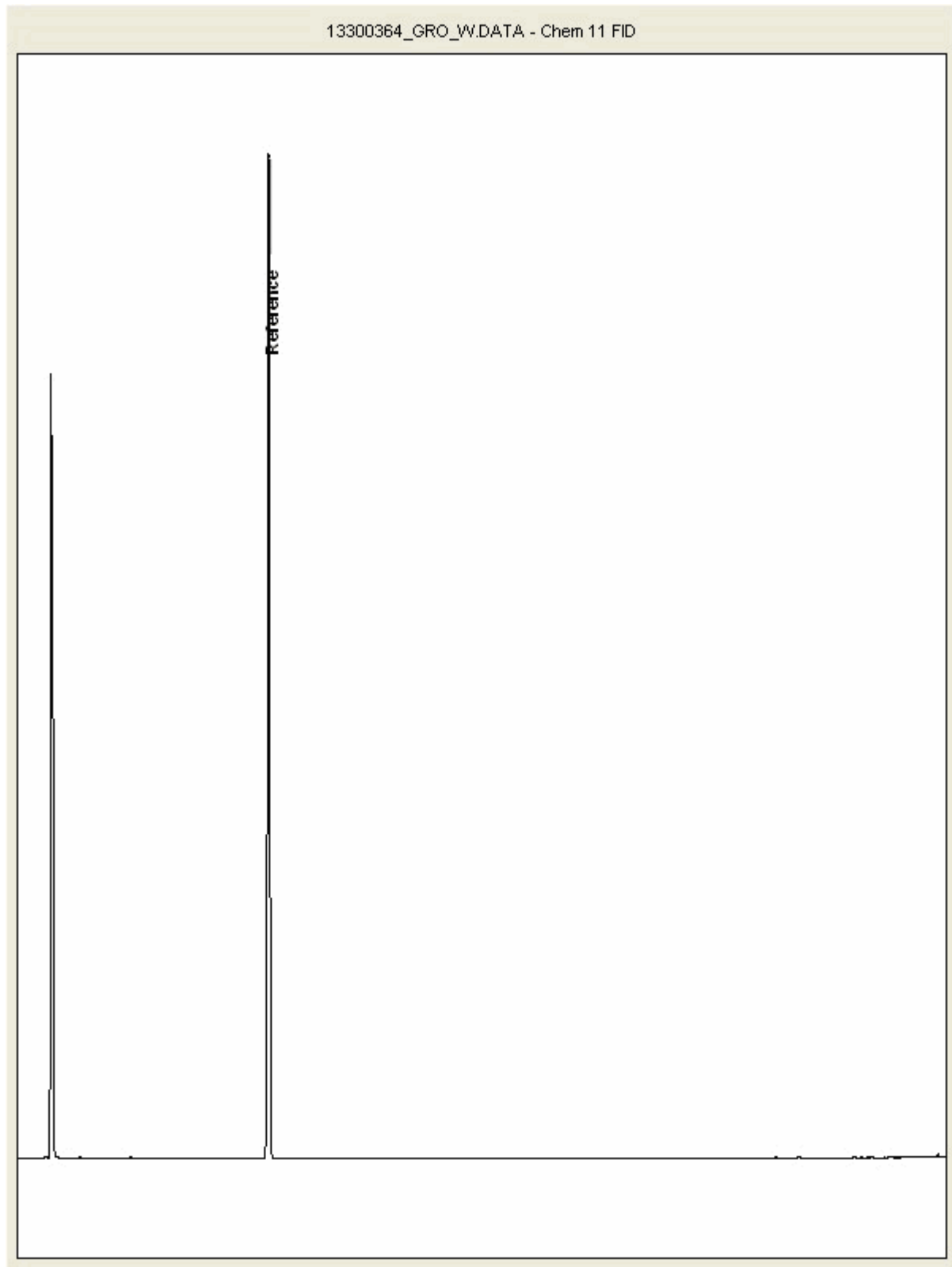
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300364
Sample ID : BH02

Depth : 3.22





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

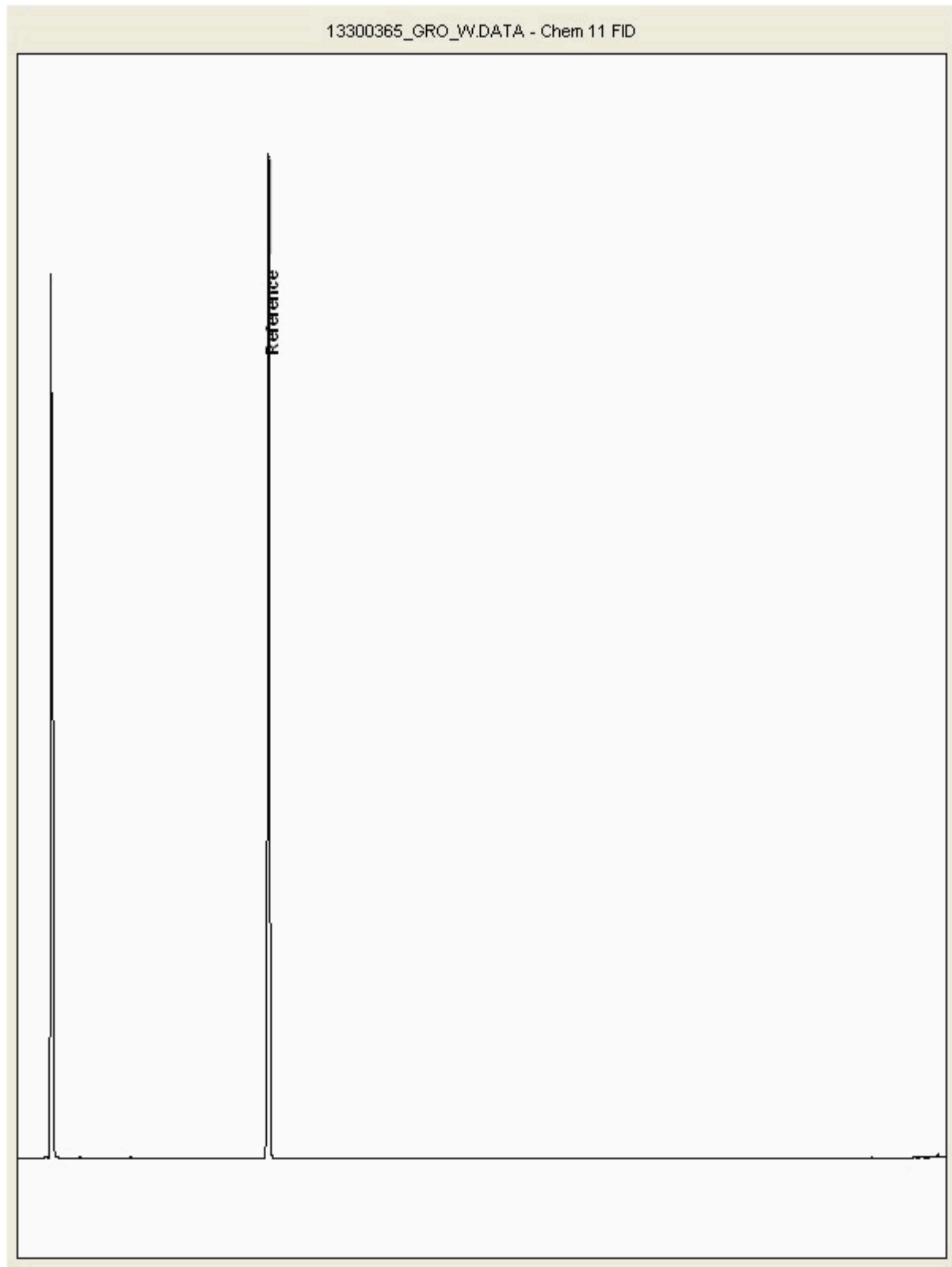
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300365
Sample ID : BH04

Depth : 3.83





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

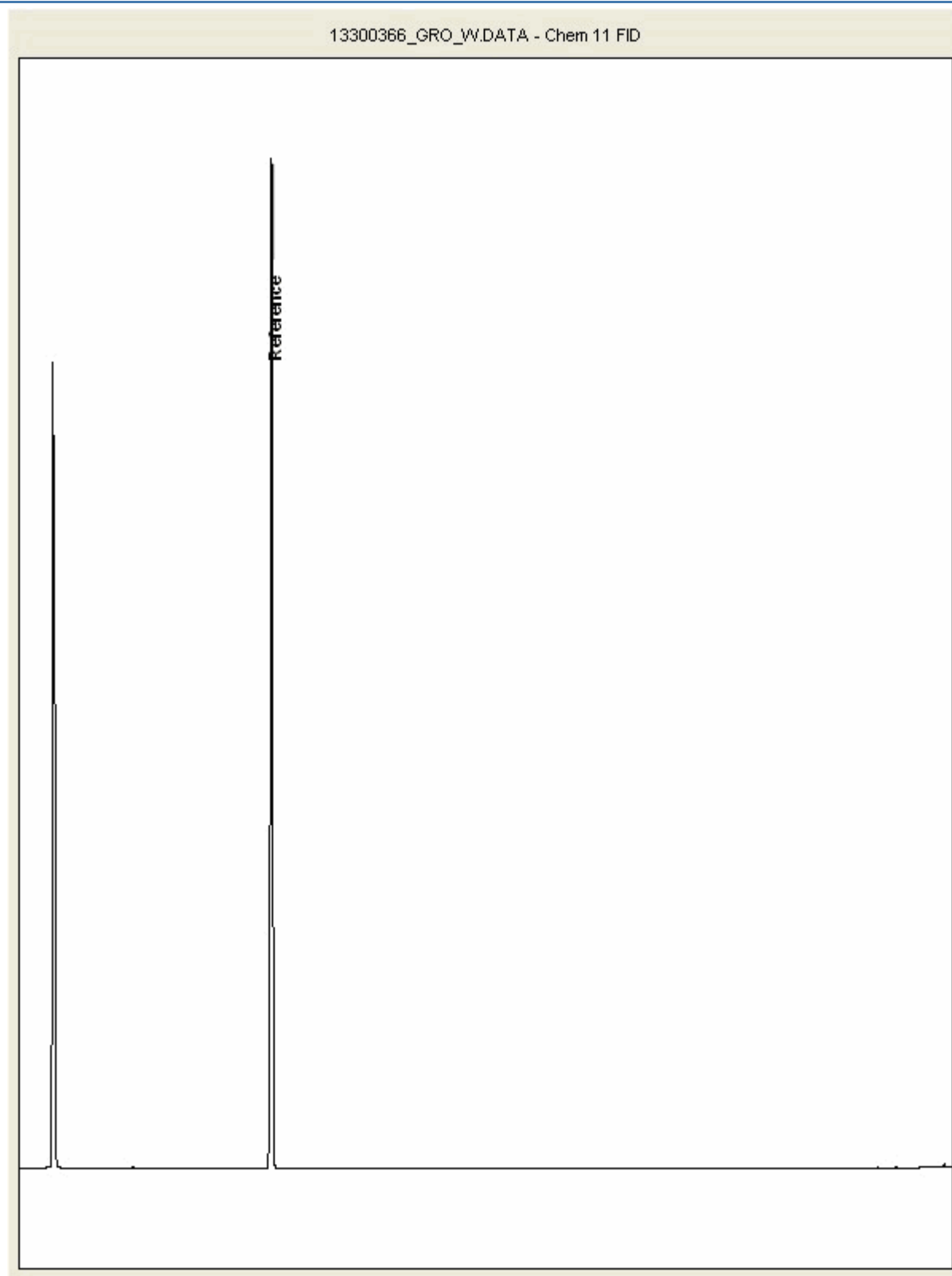
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300366
Sample ID : BH01

Depth : 3.91





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

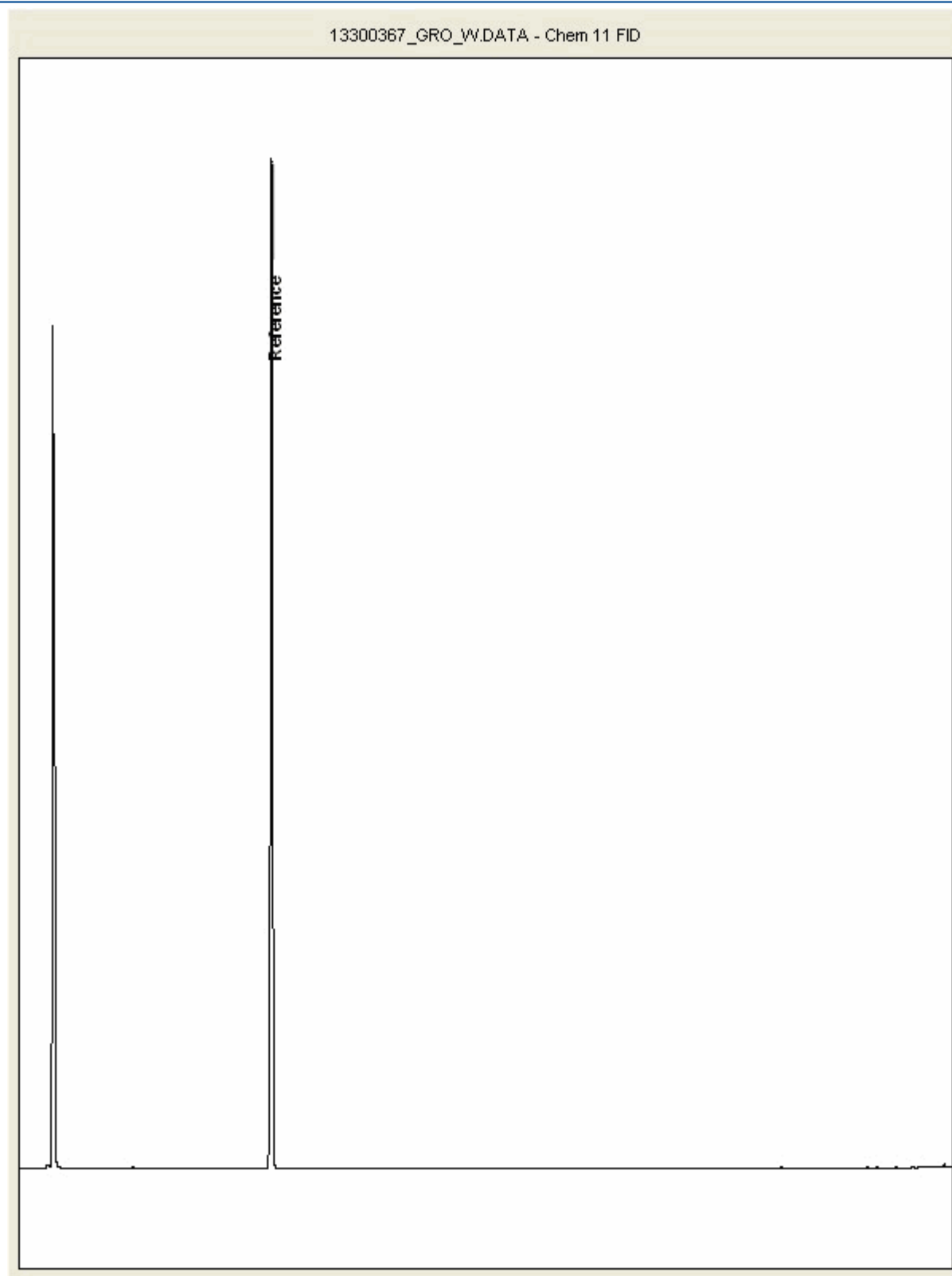
Order Number:
Report Number: 358783
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 13300367
Sample ID : BH03

Depth : 3.52





SDG: 160419-67
Job: H_GEOTECHEN_GLO-236
Client Reference:

Location: University of Reading
Customer: Geotechnical Engineering Ltd
Attention: Jon Ind

Order Number:
Report Number: 358783
Superseded Report:

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
\$	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Almandine	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.



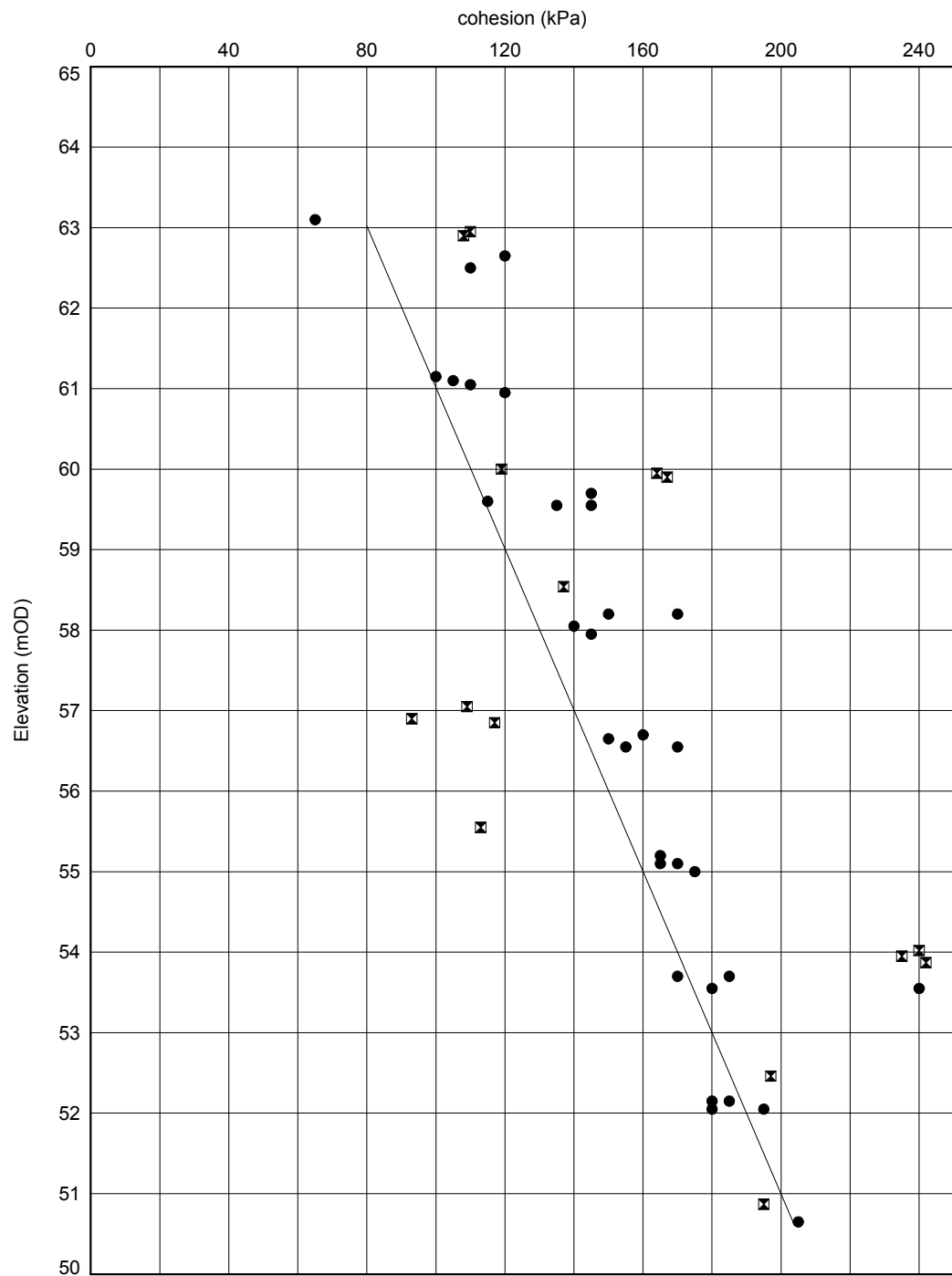
APPENDIX G

GEOTECHNICAL PLOTS

STRENGTH v ELEVATION PLOT (LONDON CLAY FORMATION)



CLIENT KNOWLES & SON (OXFORD) LIMITED
SITE UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING



- denotes a cohesion determined from SPT results using a factor of 5kPa (Stroud,1974)
- ⊠ denotes cohesion determined from triaxial test results
- ▲ denotes cohesion determined from hand shear vane test results
- denotes design line

CONTRACT	CHECKED
31710	J1



APPENDIX H

BASIS FOR ASSESSMENT OF SOILS

BASIS FOR ASSESSMENT OF SOILS

The Contaminated Land Exposure Assessment (CLEA) model

The package consists of three main reports (SR2, SR3 and SR4) and supporting toxicology reviews for individual substances. Together, they provide a coherent, consistent approach for assessing risks to human health from contaminated soil.

The development of the CLEA (2009) model was a programme of work supported by DEFRA and the EA. Future publications will include evolution of the CLEA model and individual toxicology reviews.

The three reports (SC050021) are published as part of the SR (Science Report) series of documents and are briefly introduced below.

SR2 Human Health Toxicological Assessment of Contaminants in Soil. This report incorporates the updates to how the toxicity of chemicals in soil are assessed that were introduced in *Guidance on the legal definition of contaminated land* (Defra, 2008b) together with further guidance on chemical risk assessments for soil. The report describes a framework developed by the Environment Agency (in collaboration with the Health Protection Agency and the Food Standards Agency) for the collation and review of toxicological data in order to derive Health Criteria Values (HCVs).

HCVs describe a benchmark level of exposure to a chemical at which, unless stated otherwise, long-term human exposure to chemicals in soil is tolerable or poses a minimal risk. HCVs are derived from available toxicity data. HCVs are used to derive SGVs.

SR3 Updated Technical Background to the CLEA Model. This report incorporates many of the updates to exposure assessment introduced in *Soil Guideline Values: The*

Way Forward (Defra, 2006a) together with other changes. The report describes the technical principles of the Contaminated Land Exposure Assessment (CLEA) model.

The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment, and a generic conceptual model (referred to in this report as generic land use scenarios) for site conditions and human behaviour, to estimate child and adult exposures to soil contaminants for those living, working and/or playing on contaminated sites over long time periods. The CLEA model is used to derive SGVs.

SR4 CLEA Software (Version 1.06) & Handbook (Version 1.05). The software enables assessors to derive assessment criteria (AC) to assist in the evaluation of the risks posed to human health from chronic exposure to chemicals in soil in relation to land use. Assumptions in the CLEA software apply to the derivation of generic assessment criteria (GAC), but also offer a useful starting point for the development of site-specific assessment criteria (SSAC). The introduction of version 1.05 will have only a minor effect on assessment criteria calculated using the CLEA software v1.04.

The accompanying handbook contains further information on using the CLEA software (outside the scope of the CLEA report SR3) for deriving SSAC. The CLEA software version 1.05 handbook is still relevant to version 1.06 and has not been changed. The CLEA software is used to derive SGVs.

The introduction of the new CLEA methodology now means that the SGVs and GACs derived using the old methodology will require updating. The former SGVs have been withdrawn and the Environment Agency have published revised SGV reports and associated TOX reports for the following eleven substances:

- Benzene
- Toluene
- Ethylbenzene
- Xylenes

- Mercury
- Selenium
- Arsenic
- Nickel
- Cadmium
- Phenol
- Dioxins, furans and dioxin-like PCBs

The publication of further SGVs is unlikely as HM Government and DEFRA have produced the document “Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance”. This introduces new Category 4 Screening Levels (C4SLs) where further guidance is proposed.

SGVs are scientifically based generic assessment criteria that can be used to simplify the assessment of human health risks arising from long-term and on-site exposure to chemical contamination in soil. They do not, however, consider risks to construction workers or risks from occupational exposure arising from activities in the work place.

SGVs are a screening tool for the generic quantitative risk assessment of land contamination. They are not (unless clearly stated otherwise) relevant for assessing risks to human health from short-term exposure to chemicals in soil including injury arising from direct bodily contact and do not take account of other types of risks to humans such as explosion or suffocation risks (associated with the build-up of gases such as methane and carbon dioxide) or aesthetic issues such as odour or colour.

SGVs do not take account of other non soil based sources of contamination such as contamination in groundwater, surface waters or drinking waters. They cannot be used to evaluate risks to non-human receptors such as controlled waters, ecosystems, buildings and services, domestic pets or garden plants. Where, for example, phytotoxic

effects are an important consideration in the current or future intended land use further investigation should be undertaken.

SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health. They represent an indicator to a risk assessor of when land is very unlikely to pose a significant possibility of significant harm to human health. Soil concentrations well above this level **may** pose a possibility of *significant harm* to human health. *Significance* is linked to:

- the magnitude of contamination;
- the duration and frequency of exposure;
- other site-specific factors that the enforcing authority may wish to take into account.

SGVs do not represent the threshold at which there is a *significant possibility of significant harm* (SPOSH). Nor do they automatically represent an unacceptable intake in the context of Part 2A of the Environmental Protection Act 1990. However, they are considered to be a useful starting point for such an assessment.

- SGVs can be used as a starting point for evaluating long-term risks to human health from chemicals in soil.
- SGVs can be used as an indication of chemical contamination in soil below which the long-term human health risks are considered to be tolerable or minimal.
- SGVs do not represent the “trigger” for an unacceptable intake.
- Unless specifically stated, SGVs do not cover other types of risk to humans such as fire, suffocation or explosion, or short term and acute exposures.
- SGVs cannot be used to evaluate risks to construction workers or nonhuman receptors.
- SGVs are not explicitly derived to define remediation standards.

Category 4 Screening Levels

The Impact Assessment that accompanied the revised Part 2A Statutory Guidance identified a potential role for new 'Category 4 Screening Levels' (C4SLs) in providing a simple test for deciding when land is suitable for use and definitely not contaminated land. It was envisaged that these new screening levels would allow 'low-risk' land to be dismissed from the need for further risk assessment more quickly and easily and allow regulators to focus efforts on the highest-risk land. The C4SLs were proposed to be more pragmatic (whilst still strongly precautionary) compared to existing generic screening levels. It is anticipated that, where they exist, C4SLs will be used as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the currently or previously available SGVs.

The Part 2A regime and the planning regime are inter-linked such that the National Planning Policy Framework states that "after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990" and that "Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner." The Part 2A Statutory Guidance and accompanying Impact Assessment were developed on the basis that Category 4 Screening Levels could be used under the planning regime, as they would be in Part 2A investigations directly. The estimated benefits that were expected to accrue from the changes to the Part 2A Statutory Guidance and specifically from the use of the new Category 4 Screening Levels were based on this assumption. However, policy responsibility for the National Planning Policy Framework and associated Planning Practice Guidance falls to the Department for Communities and Local Government.

The Category 4 Screening Levels consist of estimates of contaminant concentrations in soil that are considered to present an 'acceptable' level of risk, within the context of

Part 2A. The methodology for deriving both the Category 4 Screening Levels is based on CLEA methodology.

Where a valid Soil Guideline Value exists for a contaminant where a Category 4 Screening Level has also been derived, it is anticipated that risk assessors will use the Category 4 Screening Level in line with the Part 2A Statutory Guidance. In the absence of a suitable C4SL, risk assessors should identify and select appropriate generic assessment criteria in accordance with established good practice. It is for the Environment Agency to decide whether or not any of the Soil Guideline Values will be updated in the light of more recent toxicological data or whether any particular Soil Guideline Value should be withdrawn (as has already been the case with the SGV for lead).

LQM/CIEH Suitable for Use (S4UL) values

The “new” LQM/CIEH S4ULs¹ replace the 2nd edition of the LQM/CIEH Generic Assessment Criteria published in 2009. Generic values were developed by Land Quality Management Ltd (LQM) and the Chartered Institute of Environmental Health (CIEH) in 2014 to provide Generic Assessment Criteria (GACs) for a variety of land-uses, using the CLEA 1.06 (2009) model. These values are in accordance with Environment Agency publication SR4 (2009) which states that “You can derive GAC and SSAC using the CLEA software”. The properties used in the model were subject to a peer review process during a workshop in July 2014.

The LQM/CIEH S4ULs are intended for use in assessing the potential risks posed to human health by contaminants in soil and as transparently-derived and cautious “trigger values” above which further assessment of the risks or remedial action may be needed.

In the absence of LQM/CIEH S4ULS values developed by EIC/AGS/CL:AIRE and described below will be used.

¹ Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3022

EIC/AGS/CL:AIRE values

The CL:AIRE project involved the collation and review of physico-chemical data, toxicological data and information on background exposure for 44 contaminants sometimes encountered on land affected by contamination in the UK and the derivation of Generic Assessment Criteria (GACs) for 351 of these using the CLEA model (v1.06). The GAC are intended to complement soil guideline values (SGV) produced by the Environment Agency of England and Wales and the 2nd edition GAC produced by LQM and CIEH (Nathanail et al, 2009). All three sets of assessment criteria have been derived in general accordance with the Environment Agency of England and Wales Contaminated Land Exposure Assessment (CLEA) guidance and thus the combined efforts of these three groups have resulted in a useful set of screening criteria for the assessment of risks to human health from soil contamination for more than 120 potentially contaminative substances.

Definition of what EIC/AGS/CL:AIRE GAC are:

- They are scientifically based screening criteria that have been derived using the CLEA model (v1.06) in general accordance with the CLEA framework;
- They can be used as a starting point for evaluating long-term risks to human health from chemicals in soil; and
- They provide an indication of the chemical concentration in soil below which the long-term human health risks for site occupants (for various generic land-use scenarios) are considered to be tolerable or minimal;
- They are screening criteria to determine the need for further investigations and the need for a DQRA.

Definition of what EIC/AGS/CL:AIRE GAC are NOT:

- They do not represent the “trigger” for unacceptable intake, i.e. exceedance of the GAC does not necessarily imply significant possibility of significant harm (SPOSH);

- They do not cover other types of risk to humans such as fire, suffocation or explosion, risks from chemicals in groundwater or ground gas or short term and acute exposures;
- They cannot be used to evaluate risks to construction workers or non-human receptors; and
- They are not explicitly derived to define remediation standards.

CLEA and other Guidance References

CL:AIRE (2010): Soil Generic Assessment Criteria for Human Health Risk Assessment. In association with the Association of Geotechnical and Geoenvironmental Specialists and The Environmental Industries Commission.

CL:AIRE (2013): Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. PS1010 – Final Project Report. Contaminated Land: Applications in Real Environments (CL:AIRE) dated 20th December 2013.

Department for Environment, Food and Rural Affairs (2012). Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance.

Department for Environment, Food and Rural Affairs (2014). SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. March 2014.

Environment Agency. (2008), Science Report – SC050021/SR7 Compilation of data for priority organic pollutants for derivation of Soil Guideline Values. Science Report. Bristol.

Environment Agency. (2009), Science Report – SC050021/ SGV introduction Using Soil Guideline Values Science Report. Bristol: Environment Agency.

Environment Agency. (2009), Science Report – SC050021/SR3. Updated technical background to the CLEA model. Bristol: Environment Agency.

Environment Agency. (2009), Science Report – SC050021/SR2. Human health toxicological assessment of contaminants in soil. Science Report Final. Bristol: Environment Agency.

Environment Agency. (2009). CLEA software version 1.06. Bristol: Environment Agency.

Environment Agency. (2009). CLEA software (version 1.05) handbook. Science Report SC050021/SR4. Bristol: Environment Agency.

Jeffries, J., (2009). A review of body weight and height data used within the Contaminated Land Exposure Assessment model (CLEA). Project SC050021/ Technical Review 1. Bristol: Environment Agency.

Land Quality Management Ltd (2009): LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition.

Nathanail, C P, McCaffrey C, Gillett AG, Ogden RC and Nathanail JF (2014) The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

SGV Reports References

Environment Agency. (2009), Science Report - SC050021/Arsenic SGV. Soil Guideline Values for Inorganic Arsenic in Soil.

Environment Agency. (2009), Science Report - SC050021/Mercury SGV. Soil Guideline Values for Mercury in Soil.

Environment Agency. (2009), Science Report - SC050021/Nickel SGV. Soil Guideline Values for Inorganic Nickel in Soil.

Environment Agency. (2009), Science Report - SC050021/Cadmium SGV. Soil Guideline Values for Cadmium in Soil.

Environment Agency. (2009), Science Report - SC050021/Selenium SGV. Soil Guideline Values for Selenium in Soil.

Environment Agency. (2009), Science Report - SC050021/Benzene SGV. Soil Guideline Values for Benzene in Soil.

Environment Agency. (2009), Science Report - SC050021/Toluene SGV. Soil Guideline Values for Toluene in Soil.

Environment Agency. (2009), Science Report - SC050021/Ethylbenzene SGV. Soil Guideline Values for Ethylbenzene in Soil.

Environment Agency. (2009), Science Report - SC050021/Xylenes SGV. Soil Guideline Values for Xylenes in Soil.

Environment Agency. (2009), Science Report - SC050021/Dioxins SGV. Soil Guideline Values for dioxins, furans and dioxin-like PCBs in soil. Bristol: Environment Agency.

Environment Agency. (2009), Science Report - SC050021/Phenol SGV. Soil Guideline Values for Phenol in Soil.

Toxicological reports published under the new approach

Environment Agency. (2009), Science Report - SC050021/TOX1 Contaminants in soil: updated collation of toxicological data and intake values for humans Inorganic Arsenic.

Environment Agency. (2009), Science Report - SC050021//TOX8 Contaminants in soil: updated collation of toxicological data and intake values for humans Nickel.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Mercury.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Selenium.

Environment Agency. (2009), Science Report - SC050021/TOX3 Contaminants in soil: updated collation of toxicological data and intake values for humans. Cadmium

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Benzene.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Toluene.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Ethylbenzene.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Xylene.

Environment Agency. (2009), Science Report - SC050021/ Contaminants in soil: updated collation of toxicological data and intake values for humans Dioxins, furans and dioxin-like PCBs.

Environment Agency. (2009), Science Report - SC050021/ TOX9 Contaminants in soil: updated collation of toxicological data and intake values for humans Cadmium.

Toxicological reports published under the old approach

Environment Agency. (2002), Science Report – R&D Publication/ TOX4 Contaminants in soil: collation of toxicological data and intake values for humans. Chromium.

Environment Agency. (2002), Science Report - R&D Publication / TOX5 Contaminants in soil: collation of toxicological data and intake values for humans. Inorganic Cyanide.

Environment Agency. (2002), Science Report - R&D Publication / TOX6 Contaminants in soil: collation of toxicological data and intake values for humans. Lead.

Environment Agency. (2002), Science Report - R&D Publication / TOX2 Contaminants in soil: collation of toxicological data and intake values for humans. Benzo(a)Pyrene.

Environment Agency. (2003), Science Report - R&D Publication / TOX20 Contaminants in soil: collation of toxicological data and intake values for humans. Naphthalene.

Environment Agency. (2004), Science Report - R&D Publication / TOX22 Contaminants in soil: collation of toxicological data and intake values for humans. 1,2-Dichloroethane.

Environment Agency. (2004), Science Report - R&D Publication / TOX16 Contaminants in soil: collation of toxicological data and intake values for humans. Tetrachloroethane.

Environment Agency. (2004), Science Report - R&D Publication / TOX24 Contaminants in soil: collation of toxicological data and intake values for humans. Trichloroethene.

Environment Agency. (2004), Science Report - R&D Publication / TOX18 Contaminants in soil: collation of toxicological data and intake values for humans. Vinyl Chloride.

Environment Agency. (2004), Science Report - R&D Publication / TOX21 Contaminants in soil: collation of toxicological data and intake values for humans. Carbon Tetrachloride.

Environment Agency. (2004), Science Report - R&D Publication / TOX23 Contaminants in soil: collation of toxicological data and intake values for humans. Tetrachloroethene.

Environment Agency. (2004), Science Report - R&D Publication / TOX25 Contaminants in soil: collation of toxicological data and intake values for humans. 1,1,1-Trichloroethane.

Appendix C GEL 2016 Supplementary Gas Monitoring Report



UNIVERSITY OF READING - HEALTH AND LIFE
SCIENCES BUILDING

SUPPLEMENTARY GROUND GAS RISK ASSESSMENT

Prepared for UNIVERSITY OF READING

Report Ref: 32362

Geotechnical Engineering Ltd
Centurion House, Olympus Park
Quedgeley, Gloucester. GL2 4NF

01452 527743
www.geoeng.co.uk





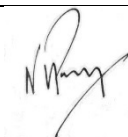
UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

SUPPLEMENTARY GROUND GAS RISK ASSESSMENT

Prepared for UNIVERSITY OF READING

Report Ref: 32362

PROJECT: Proposed development
PROJECT MANAGER: WSP / Parsons Brinckerhoff
CONSULTANT: AECOM

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 – A	FINAL	JI	NP	NP	10/10/16
ORIGINATOR			APPROVER		
					
Jonathan Ind BSc (Hons) MSc FGS Geotechnical Consultant			N Parry BEng MSc CEng MICE MCIHT SiLC Director		

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

The report has been prepared for the sole use and reliance by the University of Reading. GEL accepts no liability as a result of the use or reliance of this report by any other parties.



CONTENTS

REPORT	PAGE
1. INTRODUCTION	1
2. BACKGROUND SETTING	2
2.1 Site Location and Description	2
2.2 Radon	2
3. CONCEPTUAL SITE MODEL.....	3
4. GROUD GAS RISK ASSESSMENT	3
4.1 Basis of Assessment	3
4.2 Comparison of Results.....	4
4.3 Ground Gas Protection Measures.....	5
5. REFERENCES	7

FIGURES	Nos.
LOCATION PLAN	1
EXPLORATORY HOLE LOCATION PLAN	2

APPENDICES

APPENDIX A	GAS MONITORING RESULTS
------------	------------------------



1. INTRODUCTION

It is proposed to replace the existing Engineering Building at the University of Reading with a new purpose-built facility. Geotechnical Engineering Limited (GEL) previously carried out a ground investigation to provide a geotechnical and geoenvironmental assessment to assist in the development of the site (GEL Report Ref: 31710 Rev B, dated 24th May 2016). As recommended in Report 31710, GEL was instructed by WSP/Parsons Brinckerhoff (acting on behalf of the University of Reading), to carry out further ground gas risk assessment and provide recommendations for precautionary measures, in accordance with CIRIA C665 (Wilson et al, 2007) and BS8485:2015. This report presents the results of additional gas monitoring and comments accordingly; it should be read in conjunction with Report 31710 (2016).

The scope of work and terms and conditions of appointment were defined in correspondence by GEL, reference T24652 dated 16th September 2016.

This report describes the investigation, presents the findings and comments accordingly.

The comments given in this report and the opinions expressed assume that ground conditions do not vary beyond the range revealed by this investigation. There may however, be conditions at or adjacent to the site, which have not been disclosed by the investigation and which, therefore, have not been considered in this report. Accordingly, a careful watch should be maintained during any future groundworks and the recommendations of this report reviewed as necessary.

The recommendations given in this report should not be used for any other schemes on or adjacent to this site without further reference to GEL.



2. BACKGROUND SETTING

The site setting is recorded in detail within the Report 31710 (GEL, 2016), with a summary of key information taken from this report presented below.

2.1 Site Location and Description

The site is situated at the University of Reading Whiteknights Campus and may be located by its National Grid co-ordinates SU 7352, 7151 or the post code RG6 6UR. A location plan is presented as Figure 1.

The existing Engineering Building was roughly T-shaped in plan, comprising a four-storey brick structure at the northern end with a single-storey element extending to the south. The ground level fell gradually from southwest to northeast, up to around 2.5m. The building was bound by a tarmacadam-surfaced car park to the east with the entrance at its southern end. The area to the north and south was mainly surfaced with grass with pedestrian pathways and a number of semi-mature/mature trees. A block-paved pathway was located west of the building. The building was bound by various buried services which are highlighted on Figure 2.

2.2 Radon

The Building Research Establishment (BRE) indicates that no radon protective measures are necessary for the area (BR 211, 2007). It is advised that the local Building Control body is contacted to determine their minimum requirements in respect of radon protection.



3. CONCEPTUAL SITE MODEL

Notwithstanding the limitations of the desk study carried out as part of Report 31710 (2016) (and recommendations for further assessment to suitably establish the environmental setting), a significant thickness of Made Ground was recorded within the vicinity of the existing Engineering Building, up to 1.90m thick. Despite the material not containing any obvious putrescible material, the Made Ground is considered to represent a potential source of ground gases.

4. GROUD GAS RISK ASSESSMENT

4.1 Basis of Assessment

Approved Document Part C2 of the Building Regulations (DoE) recommends a tiered risk assessment approach in respect of “methane and other gases” (used to define hazardous soil gases which originate either from waste deposited in landfill sites or are generated naturally). Approved Document C does not include radon (which is dealt with separately) but does include volatile organic compounds (VOC’s). The methodology for the semi-quantitative risk assessment is defined in BS 8485:2015, which provides a framework in line with CLR 11 (Environment Agency, 2004). For gases not covered by BS8485:2015, a risk assessment basis is considered appropriate with standards taken from occupational exposure limits or other accepted data. Reference should also be made to CIRIA Report C665 (Wilson et al, 2007).

For the determination of the acceptability of volatile vapours (VOCs) in soils, values derived from Soil Gas Acceptance Criteria for the Protection of Indoor Air Quality for a commercial end-use, documented in the New Zealand Guidelines (1999) shall be used. A “trigger” value



of 100ppm was used for the determination of acceptability of soils based on the New Zealand Guidelines.

4.2 Comparison of Results

In order to address the risk of hazardous ground gases to the proposed development, four observation wells were installed in the boreholes, referenced BH01 to BH04, as part of the previous investigation (GEL, 2016). An exploratory hole location plan is presented as Figure 2. The standpipes were monitored on four occasions following completion of the ground investigation in order to provide a comprehensive data set in accordance with CIRIA guidance. The results are included in Appendix A and summarised in Table 4.1 below.



Borehole	Response Zone/Strata (m bgl)	Evidence of Contamination	No. of Monitoring Visits	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Flow (l/hr)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	Volatile Organic Compounds (ppm)	Water Level (m bgl)	Atmospheric Pressure (Mb)
BH01	1.00 – 6.20/ HD & BHG	No	4	0.0-0.1	1.4-4.1	9.9-20.5	0.0	0-14	0	0.0-1.8	3.50-4.34	1003-1019
BH02	1.00-4.30/ MG, HD & BHG	No	4	0.0	0.6-5.1	11.2-20.0	0.0	0-20	0	0.0-1.7	3.22-3.85	1003-1018
BH03	1.00 – 6.30/ HD & BHG	No	4	0.0-0.1	0.0-9.2	0.0-20.5	-0.2 - 0.0	0-1	0-2	0.0—6.7	3.25-3.79	1004-1020
BH04	1.00 – 6.20/ HD & BHG	No	4	0.0	1.1-4.6	12.7-20.4	0.0	0-14	0	0.0-1.7	3.83-4.3	1003-1014

Notes: MG – Made Ground; HD – Head deposits; BHG – Boyn Hill Gravel Member

Table 4.1: Summary of Gas Monitoring Data

4.3 Ground Gas Protection Measures

The risk posed by gassing sites can be determined from a semi-quantitative assessment of the risk, as proposed by Wilson and Card (1999), following development of the system as detailed in BS8485:2015. The method uses both gas concentrations and borehole flow rates to define a characteristic situation (CS) for a site based on the limiting borehole gas volume-flow or “Gas Screening Value” (GSV) for methane and carbon dioxide. The GSV (litres of gas per hour) can be calculated from the borehole flow rate (litres per hour) and gas



concentration (%). The calculation is carried out for both methane and carbon dioxide and the worst case GSV value is generally adopted for comparison with the Classification Situation.

The results in Table 4.1 indicate a maximum concentration of carbon dioxide (CO₂) at 9.2% and methane (CH₄) at 0.1%. Carbon monoxide and hydrogen sulphide was recorded at a maximum concentration of 20ppm and 2ppm respectively. Oxygen concentrations varied between 0.0% and 20.5%. No positive gas flow was detected during the four visits, with a maximum negative flow of -0.2l/hr.

In accordance with the guidance in BS8485:2015, the GSV would indicate a Characteristic Gas Situation 1 (CS1), with a very low hazard, however since that the maximum recorded concentration of carbon dioxide is nearly twice the maximum “five percent” threshold, it is recommended that ground gas precautionary measures be adopted in accordance with Characteristic Situation 2 (CS2).

Once the proposed scheme has been finalised, details of the protection measures should be designed in accordance with BS8485:2015.

A maximum soil vapour concentration (VOCs) of 6.7ppm was recorded using the PID during the monitoring visits. Based on these results, vapour protection measures are not considered necessary for the site.

The requirements for radon protection (if any) should be agreed with the Local Authority.

GEOTECHNICAL ENGINEERING LIMITED



5. REFERENCES

British Standards Institution (2015): Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS 8485.

Building Research Establishment (2007): Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment). BRE Report BR211.

Environment Agency (2004): Model Procedures for the Management of Land Contamination (CLR 11).

Geotechnical Engineering Ltd (2016): Interpretative Report on Ground investigation: University of Reading – Health and Life Sciences Building. Report No. 31710 Rev B, dated 24th May 2016.

New Zealand Ministry for the Environment (1999): Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. August 1999.

Wilson S and Card G (1999): Reliability and Risk in Gas Protection Design. Ground Engineering.

Wilson S, Oliver S, Mallett H, Hutchings H & Card G. (2007). Assessing risks posed by hazardous gases to buildings. CIRIA Report C665 (London)



Geotechnical Engineering Limited

LOCATION PLAN



CLIENT UNIVERSITY OF READING
SITE UNIVERSITY OF READING - HEALTH & LIFE SCIENCES BUILDING
SCALE Approximately 1:50,000

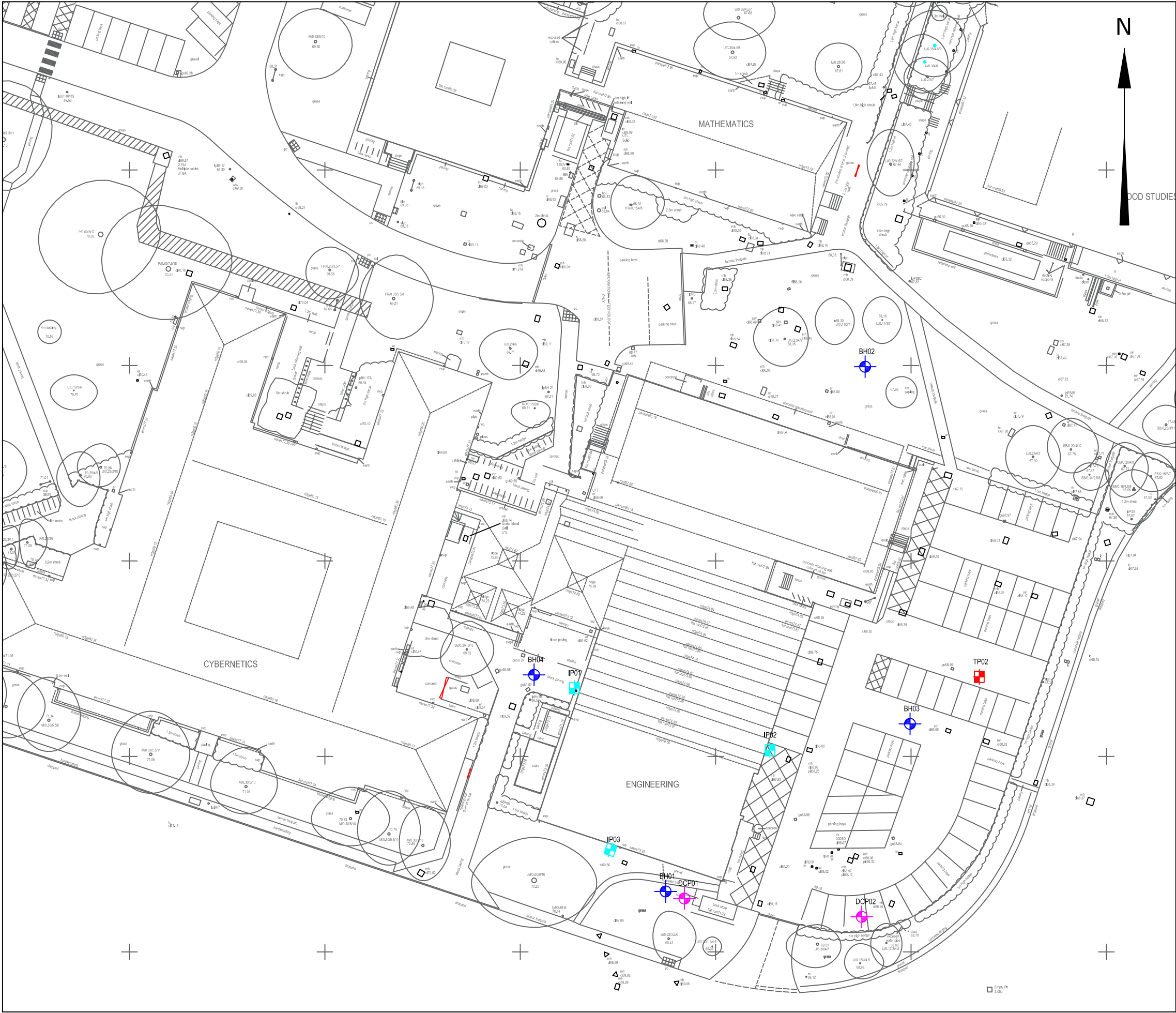
Reproduced from the 2012, 1:50,000 Ordnance Survey Map (Sheet 175 Reading & Windsor) with the permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office, Crown Copyright. Geotechnical Engineering Limited, Gloucester. AL100002447.

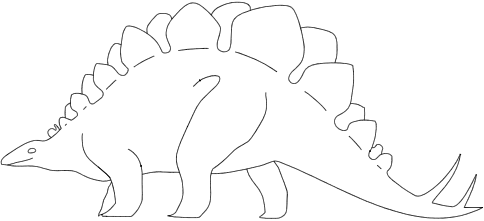
CONTRACT

FIGURE

32362

1



Key. Borehole Location DCP Location Trial Pit Location Inspection Pit Location		
Notes: Drawing supplied by client.		
 geotechnical Geotechnical Engineering Ltd Centurion House, Olympus Park, Quedgeley, Gloucester GL2 4NF Telephone: (01452) 527743 Facsimile: (01452) 729314 E-mail: geotech@geoeng.co.uk Web: www.geoeng.co.uk		
Client: UNIVERSITY OF READING		
Engineer: AECOM		
Site: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING		
Title: EXPLORATORY HOLE LOCATION PLAN		
Drawn By:	GJS	Checked By: JI
Paper Size:	A3	
Scale:	1:500	Date: October 2016
Contract:	32362	Figure: 02



APPENDIX A

GROUND GAS MONITORING RESULTS

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH01	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH01	18/04/16 09:50:00	1017	-0.52								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH01	18/04/16 09:51:00										0.0			
BH01	18/04/16 09:52:00										0.0			
BH01	18/04/16 09:53:00										0.0			
BH01	18/04/16 09:54:00										0.0			
BH01	18/04/16 09:55:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:56:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:57:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:58:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 09:59:00			3.4	0.0	13.0	0.0	0	0	1.8				
BH01	18/04/16 10:00:00			3.4	0.0	13.0	0.0	0	0	1.7				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	18/04/16 10:01:00			3.3	0.0	13.0	0.0	0	0	1.7				
BH01	18/04/16 10:02:00			3.2	0.0	13.0	0.0	0	1	1.7				
BH01	18/04/16 10:03:00			3.1	0.0	13.0	0.0	0	1	1.6				
BH01	18/04/16 10:04:00			3.1	0.0	13.1	0.0	0	1	1.5				
BH01	18/04/16 10:05:00												3.91	
BH01	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH01	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:00:00	1003	0.38								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH01	25/04/16 10:01:00										0.0			
BH01	25/04/16 10:02:00										0.0			
BH01	25/04/16 10:03:00										0.0			
BH01	25/04/16 10:04:00										0.0			
BH01	25/04/16 10:05:00			2.8	0.1	11.2	2.0	0	0	1.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	25/04/16 10:06:00			2.8	0.1	11.1	2.0	0	0	1.8				
BH01	25/04/16 10:07:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:08:00			2.9	0.1	11.0	2.0	0	0	1.8				
BH01	25/04/16 10:09:00			3.2	0.1	10.7	2.0	0	0	1.8				
BH01	25/04/16 10:10:00			3.5	0.1	10.5	2.0	0	0	1.8				
BH01	25/04/16 10:11:00			3.7	0.1	10.3	2.0	0	0	1.8				
BH01	25/04/16 10:12:00			3.9	0.1	10.1	2.0	0	0	1.8				
BH01	25/04/16 10:13:00			4.0	0.1	10.0	2.0	0	0	1.8				
BH01	25/04/16 10:14:00			4.1	0.1	9.9	2.0	0	0	1.8				
BH01	25/04/16 10:15:00												3.50	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH02	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH02	18/04/16 11:30:00	1010	-0.51								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH02	18/04/16 11:31:00										0.0			
BH02	18/04/16 11:32:00										0.0			
BH02	18/04/16 11:33:00										0.0			
BH02	18/04/16 11:34:00										0.0			
BH02	18/04/16 11:35:00			4.3	0.0	11.9	0.0	0	1	1.4				
BH02	18/04/16 11:36:00			4.3	0.0	11.8	0.0	0	0	1.4				
BH02	18/04/16 11:37:00			4.6	0.0	11.6	0.0	0	0	1.3				
BH02	18/04/16 11:38:00			4.8	0.0	11.4	0.0	0	0	1.3				
BH02	18/04/16 11:39:00			5.0	0.0	11.3	0.0	0	0	0.2				
BH02	18/04/16 11:40:00			5.1	0.0	11.2	0.0	0	0	1.1				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	18/04/16 11:41:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:42:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:43:00			5.1	0.0	11.2	0.0	0	0	1.1				
BH02	18/04/16 11:44:00			5.0	0.0	11.3	0.0	0	0	1.1				
BH02	18/04/16 11:45:00												3.22	
BH02	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH02	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:00:00	1003	0.33								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH02	25/04/16 11:01:00										0.0			
BH02	25/04/16 11:02:00										0.0			
BH02	25/04/16 11:03:00										0.0			
BH02	25/04/16 11:04:00										0.0			
BH02	25/04/16 11:05:00			2.2	0.0	17.7	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	25/04/16 11:06:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:07:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:08:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:09:00			2.2	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:10:00			2.1	0.0	17.9	0.0	0	0	0.6				
BH02	25/04/16 11:11:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:12:00			2.1	0.0	17.8	0.0	0	0	0.6				
BH02	25/04/16 11:13:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:14:00			2.2	0.0	17.7	0.0	0	0	0.6				
BH02	25/04/16 11:15:00												3.82	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH03	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH03	18/04/16 09:00:00	1019	-0.81								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH03	18/04/16 09:01:00										0.0			
BH03	18/04/16 09:02:00										0.0			
BH03	18/04/16 09:03:00										0.0			
BH03	18/04/16 09:04:00										0.0			
BH03	18/04/16 09:05:00			0.2	0.0	19.8	0.0	0	0	0.9				
BH03	18/04/16 09:06:00			0.2	0.0	19.9	0.0	0	0	0.8				
BH03	18/04/16 09:07:00			0.3	0.0	19.7	0.0	0	0	0.8				
BH03	18/04/16 09:08:00			0.3	0.0	19.5	0.0	0	0	0.8				
BH03	18/04/16 09:09:00			0.4	0.0	19.2	1.0	0	0	0.8				
BH03	18/04/16 09:10:00			0.5	0.0	18.7	1.0	0	0	0.9				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	18/04/16 09:11:00			0.7	0.1	18.2	1.0	0	0	0.9				
BH03	18/04/16 09:12:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:13:00			0.9	0.1	17.9	1.0	0	1	0.9				
BH03	18/04/16 09:14:00			0.9	0.1	18.0	1.0	0	1	0.9				
BH03	18/04/16 09:15:00												3.52	
BH03	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH03	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:00:00	1004									0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH03	25/04/16 10:01:00										0.0			
BH03	25/04/16 10:02:00										0.0			
BH03	25/04/16 10:03:00										0.0			
BH03	25/04/16 10:04:00										0.0			
BH03	25/04/16 10:05:00			3.4	0.0	16.1	0.0	0	0	0.8				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	25/04/16 10:06:00			3.8	0.1	15.6	1.0	0	0	0.8				
BH03	25/04/16 10:07:00			4.3	0.1	15.0	1.0	0	0	0.7				
BH03	25/04/16 10:08:00			5.0	0.1	14.2	1.0	0	0	0.6				
BH03	25/04/16 10:09:00			5.2	0.1	14.0	1.0	0	0	0.5				
BH03	25/04/16 10:10:00			5.0	0.1	14.3	1.0	0	0	0.5				
BH03	25/04/16 10:11:00			5.0	0.1	14.3	1.0	0	0	0.5				
BH03	25/04/16 10:12:00			4.7	0.1	14.6	1.0	0	0	0.5				
BH03	25/04/16 10:13:00			4.7	0.1	14.7	1.0	0	0	0.5				
BH03	25/04/16 10:14:00			4.7	0.1	14.8	1.0	0	0	0.5				
BH03	25/04/16 10:15:00												3.25	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	15/04/16 12:00:00	1001										10		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH04	16/04/16 12:00:00	1005										5		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	17/04/16 12:00:00	1016										9		Weather Underground data (Farnborough): rising barometric pressure, mostly cloudy.
BH04	18/04/16 10:20:00	1016	-0.29								0.0	8		Weather Underground data (Farnborough): rising barometric pressure, partly cloudy.
BH04	18/04/16 10:21:00										0.0			
BH04	18/04/16 10:22:00										0.0			
BH04	18/04/16 10:23:00										0.0			
BH04	18/04/16 10:24:00										0.0			
BH04	18/04/16 10:25:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:26:00			1.3	0.0	18.5	0.0	0	0	0.7				
BH04	18/04/16 10:27:00			1.3	0.0	18.4	0.0	0	1	0.7				
BH04	18/04/16 10:28:00			1.1	0.0	18.7	0.0	0	0	0.6				
BH04	18/04/16 10:29:00			1.1	0.0	18.8	0.0	0	0	0.6				
BH04	18/04/16 10:30:00			1.3	0.0	18.6	0.0	0	0	0.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	18/04/16 10:31:00			1.4	0.0	18.4	0.0	0	0	0.6				
BH04	18/04/16 10:32:00			1.4	0.0	18.5	0.0	0	0	0.6				
BH04	18/04/16 10:33:00			1.6	0.0	18.2	0.0	0	0	0.6				
BH04	18/04/16 10:34:00			1.7	0.0	18.1	0.0	0	0	0.6				
BH04	18/04/16 10:35:00												3.83	
BH04	22/04/16 12:00:00	1021										10		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	23/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH04	24/04/16 12:00:00	1021										8		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:40:00	1003	0.68								0.0	9		Weather Underground data (Farnborough): falling barometric pressure, partly cloudy.
BH04	25/04/16 10:41:00										0.0			
BH04	25/04/16 10:42:00										0.0			
BH04	25/04/16 10:43:00										0.0			
BH04	25/04/16 10:44:00										0.0			
BH04	25/04/16 10:45:00			2.6	0.0	16.1	0.0	0	1	1.6				
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: KNOWLES & SON (OXFORD) LIMITED

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	25/04/16 10:46:00			2.7	0.0	16.0	0.0	0	0	1.7				
BH04	25/04/16 10:47:00			2.7	0.0	15.9	0.0	0	0	1.7				
BH04	25/04/16 10:48:00			2.8	0.0	15.8	0.0	0	0	1.6				
BH04	25/04/16 10:49:00			2.9	0.0	15.7	0.0	0	0	1.6				
BH04	25/04/16 10:50:00			3.0	0.0	15.6	0.0	0	0	1.5				
BH04	25/04/16 10:51:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:52:00			3.0	0.0	15.5	0.0	0	0	1.4				
BH04	25/04/16 10:53:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:54:00			3.0	0.0	15.6	0.0	0	0	1.4				
BH04	25/04/16 10:55:00												3.91	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 31710	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH01	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH01	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH01	23/09/16 12:02:00	1013	0									20		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH01	23/09/16 12:03:00										0.0			
BH01	23/09/16 12:04:00										0.0			
BH01	23/09/16 12:05:00										0.0			
BH01	23/09/16 12:06:00										0.0			
BH01	23/09/16 12:07:00										0.0			
BH01	23/09/16 12:08:00										0.0			
BH01	23/09/16 12:09:00										0.0			
BH01	23/09/16 12:10:00										0.0			
BH01	23/09/16 12:11:00										0.0			
BH01	23/09/16 12:12:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH01	23/09/16 12:13:00			1.4	0.0	19.6	0.0	0	0	0.6					
BH01	23/09/16 12:14:00			1.5	0.0	19.6	0.0	0	0	0.6					
BH01	23/09/16 12:15:00			1.5	0.0	19.7	0.0	0	10	0.6					
BH01	23/09/16 12:16:00			1.6	0.0	19.6	0.0	0	10	0.4					
BH01	23/09/16 12:17:00			1.6	0.0	19.6	0.0	0	10	0.2					
BH01	23/09/16 12:18:00			1.6	0.0	19.6	0.0	0	10	0.2					
BH01	23/09/16 12:19:00			1.6	0.0	19.6	0.0	0	11	0.2					
BH01	23/09/16 12:20:00			1.6	0.0	19.6	0.0	0	11	0.2					
BH01	23/09/16 12:21:00			1.6	0.0	19.6	0.0	0	14	0.2					
BH01	23/09/16 12:22:00			1.6	0.0	19.6	0.0	0	0	0.2					
BH01	23/09/16 12:23:00												4.34		
BH01	30/09/16 12:00:00	1013										17		Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.	
BH01	01/10/16 12:00:00	1005										12		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.	
BH01	02/10/16 11:50:00	1017										13		Weather Underground data (Farnborough): rising barometric pressure, scattered clouds.	
BH01	03/10/16 11:00:00	1019	0								0.0	18		Weather Underground data (Farnborough): steady barometric	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362	CHECKED JI

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH01	03/10/16 11:01:00										0.0			pressure.
BH01	03/10/16 11:02:00										0.0			
BH01	03/10/16 11:03:00										0.0			
BH01	03/10/16 11:04:00										0.0			
BH01	03/10/16 11:05:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:06:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:07:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:08:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:09:00			0.0	0.0	20.5	0.0	0	0	0.0				
BH01	03/10/16 11:15:00												4.34	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH02	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH02	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH02	23/09/16 10:52:00	1014	0									20		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH02	23/09/16 10:53:00										0.0			
BH02	23/09/16 10:54:00										0.0			
BH02	23/09/16 10:55:00										0.0			
BH02	23/09/16 10:56:00										0.0			
BH02	23/09/16 10:57:00										0.0			
BH02	23/09/16 10:58:00										0.0			
BH02	23/09/16 10:59:00										0.0			
BH02	23/09/16 11:00:00										0.0			
BH02	23/09/16 11:01:00										0.0			
BH02	23/09/16 11:02:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH02	23/09/16 11:03:00			4.4	0.0	15.6	0.0	0	0	1.7					
BH02	23/09/16 11:04:00			4.8	0.0	15.2	0.0	0	0	1.6					
BH02	23/09/16 11:05:00			5.0	0.0	15.1	0.0	0	0	1.2					
BH02	23/09/16 11:06:00			5.1	0.0	15.1	0.0	0	0	1.0					
BH02	23/09/16 11:07:00			5.1	0.0	15.1	0.0	0	0	0.9					
BH02	23/09/16 11:08:00			5.0	0.0	15.1	0.0	0	0	0.7					
BH02	23/09/16 11:09:00			5.0	0.0	15.1	0.0	0	0	0.6					
BH02	23/09/16 11:10:00			4.9	0.0	15.1	0.0	0	0	0.6					
BH02	23/09/16 11:11:00			5.0	0.0	15.4	0.0	0	0	0.5					
BH02	23/09/16 11:12:00			5.0	0.0	15.1	0.0	0	0	0.4					
BH02	23/09/16 11:13:00												3.45		
BH02	30/09/16 12:00:00	1013										17		Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.	
BH02	01/10/16 12:00:00	1005										12		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.	
BH02	02/10/16 11:50:00	1017										13		Weather Underground data (Farnborough): rising barometric pressure, scattered clouds.	
BH02	03/10/16 11:40:00	1018	0								0.0	18		Weather Underground data (Farnborough): steady barometric	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362	CHECKED JI

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH02	03/10/16 11:41:00										0.0			pressure.
BH02	03/10/16 11:42:00										0.0			
BH02	03/10/16 11:43:00										0.0			
BH02	03/10/16 11:44:00										0.0			
BH02	03/10/16 11:45:00			0.6	0.0	20.0	0.0	0	0	0.0				
BH02	03/10/16 11:46:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:47:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:48:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:49:00			0.7	0.0	20.0	0.0	0	0	0.0				
BH02	03/10/16 11:50:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:51:00			0.7	0.0	19.9	0.0	0	0	0.0				
BH02	03/10/16 11:52:00			0.7	0.0	20.0	0.0	0	0	0.0				
BH02	03/10/16 11:53:00			0.7	0.0	19.8	0.0	0	10	0.0				
BH02	03/10/16 11:54:00			0.7	0.0	19.9	0.0	0	20	0.0				
BH02	03/10/16 11:55:00												3.44	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH03	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH03	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH03	23/09/16 10:14:00	1015	0									20		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH03	23/09/16 10:15:00										-0.2			
BH03	23/09/16 10:16:00										-0.1			
BH03	23/09/16 10:17:00										0.0			
BH03	23/09/16 10:18:00										0.0			
BH03	23/09/16 10:19:00										0.0			
BH03	23/09/16 10:20:00										0.0			
BH03	23/09/16 10:21:00										0.0			
BH03	23/09/16 10:22:00										0.0			
BH03	23/09/16 10:23:00										0.0			
BH03	23/09/16 10:24:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks		
BH03	23/09/16 10:25:00			8.0	0.0	0.0	2.6	0	0	4.2						
BH03	23/09/16 10:26:00			8.3	0.0	0.0	1.6	0	0	5.8						
BH03	23/09/16 10:27:00			8.6	0.0	0.0	0.9	0	0	6.3						
BH03	23/09/16 10:28:00			8.9	0.0	0.0	0.4	0	0	6.6						
BH03	23/09/16 10:29:00			9.0	0.0	0.0	0.4	1	0	6.7						
BH03	23/09/16 10:30:00			9.0	0.0	0.0	0.6	0	0	6.4						
BH03	23/09/16 10:31:00			9.1	0.0	0.0	0.2	0	0	6.6						
BH03	23/09/16 10:32:00			9.1	0.0	0.1	0.3	2	0	6.7						
BH03	23/09/16 10:33:00			9.2	0.0	0.0	0.3	0	0	6.7						
BH03	23/09/16 10:34:00			9.2	0.0	0.0	0.3	0	0	6.7						
BH03	23/09/16 10:35:00												3.77			
BH03	30/09/16 12:00:00	1013										17		Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.		
BH03	01/10/16 12:00:00	1005										12		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.		
BH03	02/10/16 11:50:00	1017										13		Weather Underground data (Farnborough): rising barometric pressure, scattered clouds.		
BH03	03/10/16 10:45:00	1020	0								0.0	17		Weather Underground data (Farnborough): steady barometric		
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362		CHECKED JI

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH03	03/10/16 10:46:00										0.0			pressure.
BH03	03/10/16 10:47:00										0.0			
BH03	03/10/16 10:48:00										0.0			
BH03	03/10/16 10:49:00										0.0			
BH03	03/10/16 10:50:00			0.2	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 10:51:00			0.2	0.0	20.5	0.0	0	0	0.0				
BH03	03/10/16 10:52:00			0.1	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 10:53:00			0.0	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 10:54:00			0.0	0.0	20.4	0.0	0	0	0.0				
BH03	03/10/16 11:00:00												3.79	
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks
BH04	20/09/16 12:00:00	1021										15		Weather Underground data (Farnborough): steady barometric pressure, overcast.
BH04	21/09/16 12:00:00	1018										19		Weather Underground data (Farnborough): steady barometric pressure, partly cloudy.
BH04	22/09/16 12:00:00	1019										17		Weather Underground data (Farnborough): steady barometric pressure, mostly cloudy.
BH04	23/09/16 11:25:00	1014	0									18		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.
BH04	23/09/16 11:26:00										0.0			
BH04	23/09/16 11:27:00										0.0			
BH04	23/09/16 11:28:00										0.0			
BH04	23/09/16 11:29:00										0.0			
BH04	23/09/16 11:30:00										0.0			
BH04	23/09/16 11:31:00										0.0			
BH04	23/09/16 11:32:00										0.0			
BH04	23/09/16 11:33:00										0.0			
BH04	23/09/16 11:34:00										0.0			
BH04	23/09/16 11:35:00										0.0			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.													CONTRACT 32362	CHECKED Jl

GAS AND GROUNDWATER LEVELS

CLIENT: UNIVERSITY OF READING

SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (litr/hr)	temperature (°C)	water level (m - bgl)	remarks		
BH04	23/09/16 11:36:00			4.2	0.0	14.4	0.0	0	14	0.2						
BH04	23/09/16 11:37:00			4.3	0.0	13.3	0.0	0	0	0.5						
BH04	23/09/16 11:38:00			4.0	0.0	12.7	0.0	0	0	0.5						
BH04	23/09/16 11:39:00			4.5	0.0	13.0	0.0	0	0	0.4						
BH04	23/09/16 11:40:00			4.5	0.0	13.0	0.0	0	0	0.3						
BH04	23/09/16 11:41:00			4.6	0.0	13.0	0.0	0	0	0.4						
BH04	23/09/16 11:42:00			4.6	0.0	13.0	0.0	0	0	0.4						
BH04	23/09/16 11:43:00			4.6	0.0	13.0	0.0	0	0	0.4						
BH04	23/09/16 11:44:00			4.6	0.0	12.9	0.0	0	0	0.2						
BH04	23/09/16 11:45:00			4.6	0.0	12.8	0.0	0	0	0.2						
BH04	23/09/16 11:46:00	1013										17	4.29	Weather Underground data (Farnborough): falling barometric pressure, scattered clouds.		
BH04	30/09/16 12:00:00															
BH04	01/10/16 12:00:00															
BH04	02/10/16 11:50:00															
BH04	03/10/16 11:20:00	1005										12		Weather Underground data (Farnborough): falling barometric pressure, mostly cloudy.		
BH04	02/10/16 11:50:00	1017										13		Weather Underground data (Farnborough): rising barometric pressure, scattered clouds.		
BH04	03/10/16 11:20:00	1013									0.0	14		Weather Underground data (Farnborough): steady barometric		
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362		CHECKED JI



SITE: UNIVERSITY OF READING - HEALTH AND LIFE SCIENCES BUILDING

Borehole /trial pit no.	date and time	barometric pressure (mb)	pressure differentiation (mm H ₂ O)	carbon dioxide (%)	methane (%)	oxygen (%)	LEL (%)	hydrogen sulphide (ppm)	carbon monoxide (ppm)	VOC (ppm)	gas flow (ltr/hr)	temperature (°C)	water level (m - bgl)	remarks	
BH04	03/10/16 11:21:00										0.0			pressure.	
BH04	03/10/16 11:22:00										0.0				
BH04	03/10/16 11:23:00										0.0				
BH04	03/10/16 11:24:00										0.0				
BH04	03/10/16 11:25:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:26:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:27:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:28:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:29:00			0.0	0.0	20.4	0.0	0	0	0.0					
BH04	03/10/16 11:30:00											4.30			
remarks # denotes result exceeding capacity of gas monitoring equipment VOC - Photoionisation Detector Mini RAE 2000 measures VOC vapours with 10.6eV lamp calibrated against isobutylene.														CONTRACT 32362	CHECKED JI

Appendix D – Site Reconnaissance Photographs

University of Reading – Engineering Building Walkover and Gas Monitoring

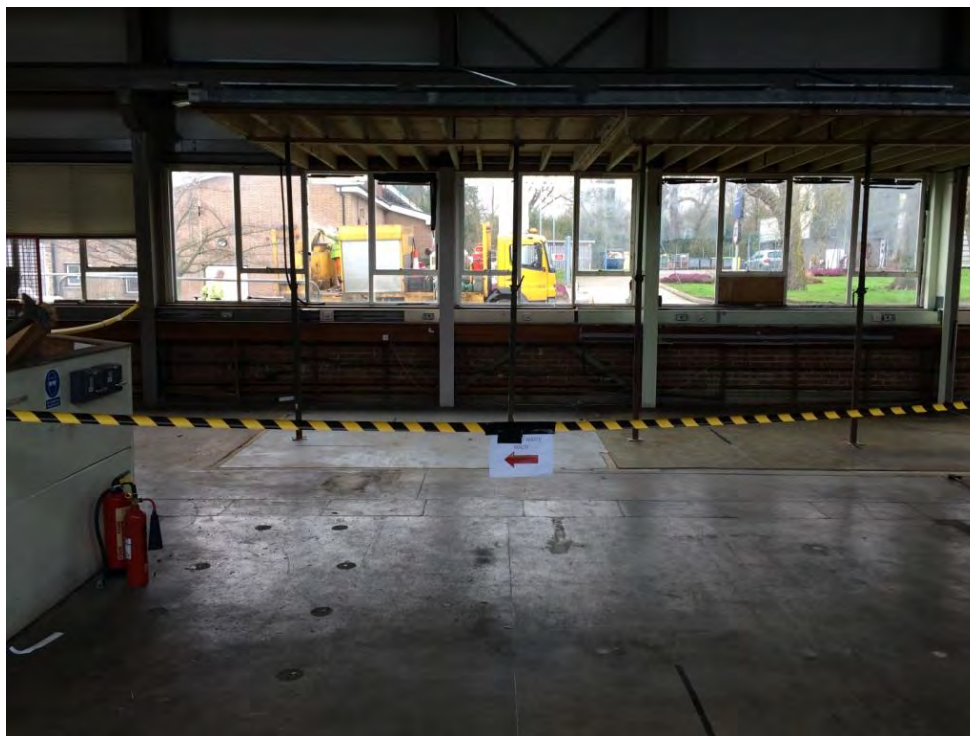


Photo 1 – Engineering workshop – cleared of all machinery, no visual olfactory evidence of contamination.



Photo 2 – Service ducts on ground floor of single storey south section. Asbestos removed from ducts, no visual olfactory evidence of contamination.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)			Draft	Ref: Walkover
Client	University of Reading			Scale: N/A	Job No: 60441574
				Drg. Size: A4	PLATES



Photo 3 – Redundant fuse board in Engineering building. No transformer was noted in the accessible parts of the building. Site management confirms no transformer was present in the building.



Photo 4 – Plant room in basement. All machinery on raised plinths. Some water on floor, no visual or olfactory evidence of contamination.

Title	Photolog		App'd:	Drawn	Date:
Location	Engineering Building (HLS Project)		JC		March 2017
Client	University of Reading		Draft	Ref:	Walkover
			Scale:	Job No:	60441574
			N/A		
			Drg. Size:		PLATES
			A4		



Photo 5 – Site of BH01 to the south of the Engineering building.



Photo 6 – Site of BH02 to the north of the Engineering building. Contractor confirmed excavation of this well during subsurface utility re-routing/installations.

Title	Photolog		App'd:	Drawn	Date:
				JC	March 2017
Location	Engineering Building (HLS Project)		Draft		Ref: Walkover
			Scale:		Job No: 60441574
Client	University of Reading		Drg. Size:	A4	PLATES



Photo 7 – Site of BH03 in former car park. Currently a contractor compound. Despite scraping away spoil piles the well could not be located.



Photo 8 – Site of BH04, at right, to the west of the single storey element of the Engineering building.

Title	Photolog		App'd:	Drawn	Date:
Location	Engineering Building (HLS Project)			JC	March 2017
Client	University of Reading			Draft	Ref: Walkover
				Scale:	Job No: 60441574
				N/A	
				Drg. Size:	PLATES
				A4	



Photo 9 – View north to Engineering building from remediated Energy Centre site 30m to south.



Photo 10 – View west to Engineering building from campus road to east.

Title	Photolog		App'd:	Drawn JC	Date: March 2017
Location	Engineering Building (HLS Project)			Draft	Ref: Walkover
Client	University of Reading			Scale: N/A	Job No: 60441574
				Drg. Size: A4	PLATES



Photo 11 – View south-west to Engineering building from pathway to north.



Photo 12 – Pond in 'Harris Gardens' 210m east of the site.

Title	Photolog		App'd:	Drawn: JC	Date: March 2017	
Location	Engineering Building (HLS Project)		Draft	Ref: Walkover		
Client	University of Reading		Scale: N/A	Job No: 60441574		
			Drg. Size: A4	PLATES		