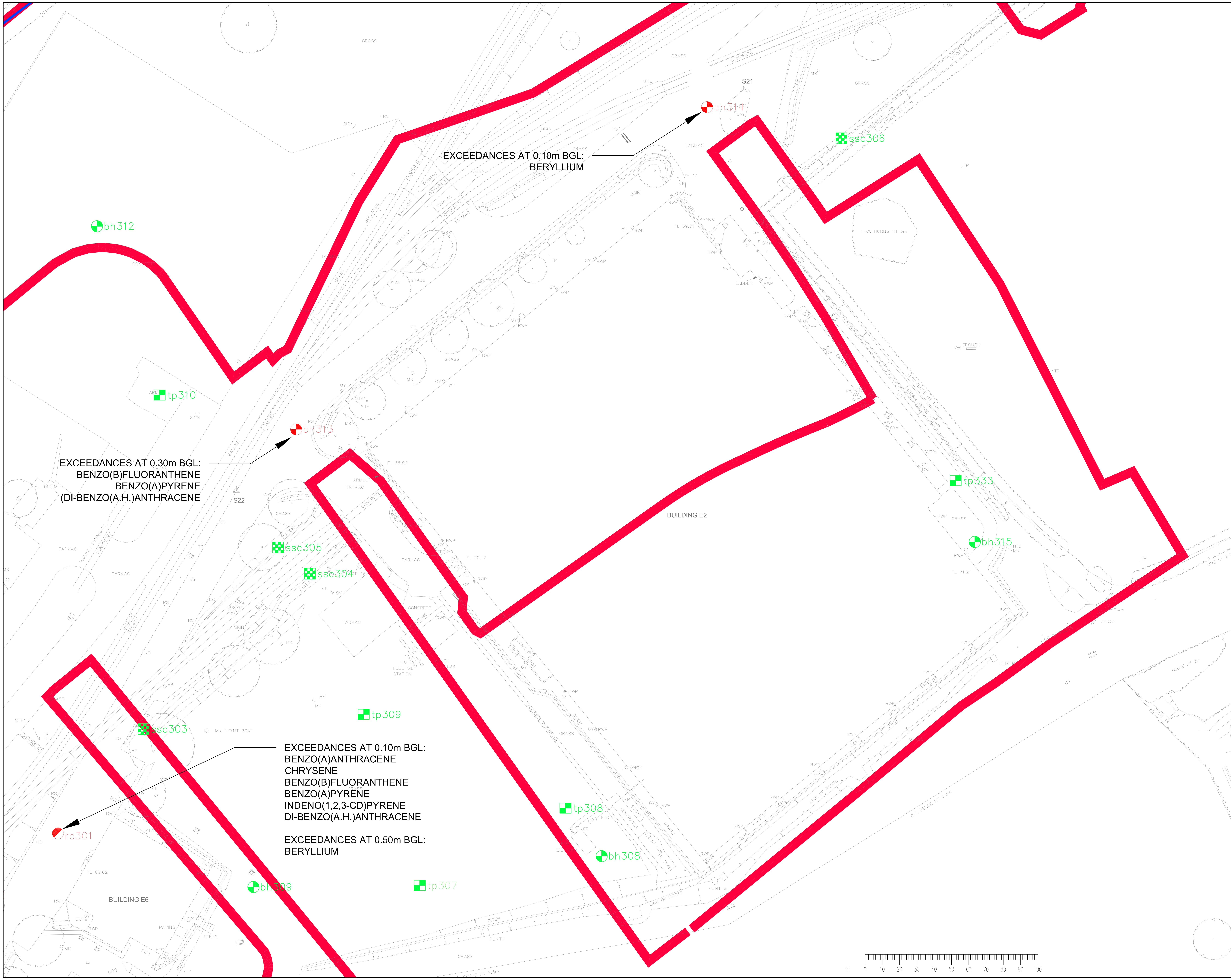


GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
3. THE CONTRACTOR MUST ENSURE AND WILL BE HELD RESPONSIBLE FOR THE OVERALL STABILITY OF THE BUILDING/STRUCTURE/EXCAVATION AT ALL STAGES OF THE WORK.
4. ALL WORK BY THE CONTRACTOR MUST BE CARRIED OUT IN SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
5. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

bh313 LOCATIONS NOT EXCEEDING RESIDENTIAL GAC

CC302 LOCATIONS EXCEEDING RESIDENTIAL GAC

Rev	Date	Description	By
A02	09.11.21	GI LOCATIONS AMENDED	TB
A01	26.08.21	GI LOCATIONS ADDED	TB

Amendments

Project
GRAVEN HILL, BICESTER

Title
HOME ZONES 3
LOCATIONS EXCEEDING RESIDENTIAL GAC
SHEET 4 OF 4

Client
Graven Hill Village Development Company Limited

Waterman

Office Address
Telephone & Fax numbers
mail@watermangroup.com www.watermangroup.com

Drawing Status
PRELIMINARY

Designed by	TB	Checked by	PE	Project No
Drawn by	TB	Date	10.11.21	WIE11386

Scales @ A1
work to figured dimensions only

Computer File No
WIE11386-147-87-300 - HZ3 resi exceedances A02.dwg

Publisher	Zone	Category	Number	Revision
WIE	147	87	304	A02

Appendix E Geotechnical Testing Results

- **Laboratory Testing Results (Home Zones 3 Geotech Results)**

LABORATORY RESULTS - Classification and Strength

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
BH301	2.00 (2.00)	D	C46301	Brown mottled grey CLAY.	CH	34 (NAT)	58	24	31.8						
BH301	4.50 (4.50)	UT	C46220	Grey slightly sandy CLAY. (See Test Remarks Sheet for further information)					15.9	SS	2.18		NST		
BH302	0.50 (0.50)	D	C46314	Brown mottled grey slightly sandy CLAY.	MV	37 (6%)	71	34	29.9						
BH302	6.30-6.75 (6.54)	UT	C45664	Dark grey CLAY.					23.9 <16.6>	SS	2.15	120	265	132	132
BH303	3.30 (3.30)	D	C46334	Dark brown mottled grey slightly sandy CLAY.	CH	38 (69%)	68	30	35.9						
BH303	3.60-4.05 (3.79)	UT	C45666	Dark grey slightly sandy CLAY.					34.5 <30.2>	SS	1.90	70	174	87	87
BH303	6.00-6.45 (6.24)	UT	C45667	Dark grey CLAY.					26.1 <18.7>	SS	2.08	120	282	141	141
BH304	2.30-2.75 (2.50)	UT	C45668	Brown mottled grey slightly sandy CLAY.					25.2 <25.6>	SS	1.99	50	172	86	86
BH305	2.30-2.75 (2.43)	UT	C45669	Brown mottled light brown and grey slightly sandy CLAY.					30.3 <28.8>	SS	1.89	50	86	43	43
BH305	4.50-4.95 (4.67)	UT	C45670	Grey CLAY.					31.1 <31.7>	SS	1.88	90	67	33	33
BH306	3.20-3.65 (3.42)	UT	C44370	Dark brownish grey slightly sandy CLAY.					31.7 <29.0>	SS	1.91	70	139	70	70
BH308	1.20-1.65 (1.43)	UT	C43738	Dark brown slightly sandy CLAY.					31.4 <31.3>	SS	1.92	30	104	52	52
BH308	3.50-3.95 (3.72)	UT	C43737	Dark brownish grey slightly sandy slightly gravelly CLAY.					31.6 <31.5>	SS	1.89	70	168	84	84
BH309	1.00-1.10 (1.00)	D	C44559	Light brown slightly sandy CLAY.	CH	42 (3%)	67	25	26.8						
BH309	1.20-1.65 (1.41)	UT	C44107	Light brown mottled grey slightly sandy CLAY.					41.6 <42.4>	SS	1.81	30	74	37	37

Remarks NST - Not suitable for Test
For Standards followed see Laboratory Test Certficate
w% - ^ = Rock water content test; x = Aggregate moisture content test
QUT Water Contents: <Failure Zone>, [After test]

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Classification and Strength

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
BH309	3.20-3.65 (3.35)	UT	C44105	Dark brownish grey slightly sandy CLAY.					29.0 <22.5>	SS	1.97	70	203	102	102
BH311	1.20-1.65 (1.41)	UT	C45673	Orangish brown mottled grey slightly sandy CLAY.					27.8 <26.7>	SS	1.99	30	94	47	47
BH311	3.00-3.45 (3.13)	UT	C45674	Dark grey slightly sandy CLAY.					24.6 <27.0>	SS	1.95	50	149	74	74
BH312	1.50 (1.50)	D	C44574	Light orangish brown slightly sandy CLAY.	CH	33 (8%)	59	26	35.4						
BH313	2.30-2.75 (2.44)	UT	C46606	Brown mottled orangish brown slightly sandy CLAY.					27.8 <28.8>	SS	1.86	50	74	37	37
BH314	1.20-1.65 (1.20)	D	C44984	Light orangish brown and grey slightly sandy CLAY.	CH	33 (NAT)	55	22	27.0						
BH314	2.40-2.85 (2.50)	UT	C43488	Light orangish brown slightly sandy CLAY.					23.6 23.6 23.6	MS	2.03 2.03 2.03	50 100 150	172 170 165	86 85 83	85
BH314	4.50-4.95 (4.50)	UT	C43487	Dark greenish grey slightly sandy CLAY.					21.1 <23.1>	SS	2.02	90	224	112	112
BH315	1.80 (1.80)	D	C44998	Dark brown slightly sandy CLAY.	CV	44 (NAT)	76	32	36.7						
BH315	3.50-3.95 (3.72)	UT	C43490	Dark grey slightly sandy CLAY.					25.7 <25.3>	SS	1.94	70	131	65	65
BH316	0.90-1.00 (0.90)	D	C44580	Light orangish brown slightly sandy CLAY.	CH	42 (1%)	66	24	33.7						
BH316	1.20-1.65 (1.30)	UT	C43495	Light orangish brown slightly sandy CLAY.					31.9 <31.6>	SS	1.97	30	118	59	59
BH316	3.80-4.25 (3.80)	UT	C43492	Dark grey slightly sandy CLAY.					27.5 <24.3>	SS	1.96	80	128	64	64
BH316	6.50-6.95 (6.50)	UT	C43493	Dark greenish grey slightly sandy CLAY.					24.5 <25.6>	SS	1.98	130	211	106	106
BH317	1.20-1.65 (1.40)	UT	C45361	Dark brown mottled grey slightly sandy CLAY.					29.1 <30.3>	SS	1.85	30	125	62	62

Remarks NST - Not suitable for Test
For Standards followed see Laboratory Test Certficate
w% - ^ = Rock water content test; x = Aggregate moisture content test
QUT Water Contents: <Failure Zone>, [After test]

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Classification and Strength

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
BH601	3.40-3.85 (3.54)	UT	C46230	Orangish grey mottled brown slightly sandy slightly gravelly CLAY.					28.4 <27.8>	SS	2.00	70	134	67	67
BH602	1.20-1.65 (1.44)	UT	C44379	Dark brown slightly sandy CLAY.					20.6 <24.0>	SS	2.10	30	98	49	49
BH602	1.65-1.70 (1.50-1.65)	D	C45067	Dark brown slightly sandy CLAY.		(13%)	25	NP	14.4						
BH602	3.20-3.65 (3.39)	UT	C44773	Brownish grey slightly sandy CLAY.					29.5 <23.7>	SS	1.89	70	156	78	78
BH603	2.50-2.95 (2.59)	UT	C46232	Brown slightly sandy CLAY.					26.1 <26.9>	SS	1.95	50	192	96	96
BH603	4.50-4.95 (4.69)	UT	C46233	Dark grey slightly sandy CLAY.					23.3 <22.5>	SS	2.06	90	217	109	109
BH604	0.50-0.60 (0.50)	D	C45073	Light orangish brown slightly sandy CLAY.	CV	43 (2%)	71	28	38.4						
BH604	2.30-2.75 (2.49)	UT	C44380	Dark brownish grey slightly sandy CLAY.					27.7 <26.1>	SS	1.93	50	134	67	67
BH605	2.30-2.75 (2.49)	UT	C46235	Light grey mottled orangish brown slightly sandy slightly gravelly CLAY.					22.3 <26.3>	SS	1.99	50	160	80	80
BH605	4.50-4.95 (4.69)	UT	C46251	Dark grey slightly sandy CLAY.					27.9 <28.3>	SS	1.96	90	98	49	49
BH606	2.50-2.95 (2.71)	UT	C46237	Grey mottled orangish brown slightly sandy CLAY.					30.4 30.4 30.4	MS	1.90 1.90 1.90	50 100 150	139 139 136	70 70 68	69
BH607	3.50-3.95 (3.74)	UT	C45865	Grey slightly sandy CLAY.					28.4 <25.4>	SS	1.88	70	194	97	97
BH608	1.50 (1.50)	D	C46435	Orangish brown slightly gravelly sandy CLAY.	CH	37 (7%)	60	23	30.1						
BH608	2.00-2.45 (2.14)	UT	C45867	Orangish brown mottled grey slightly gravelly sandy CLAY.					35.9 <36.6>	SS	1.79	40	74	37	37

Remarks NST - Not suitable for Test
For Standards followed see Laboratory Test Certficate
w% - ^ = Rock water content test; x = Aggregate moisture content test
QUT Water Contents: <Failure Zone>, [After test]

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Classification and Strength

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
TP308	1.50 (1.50)	D	C43895	Grey mottled orangish brown mottled grey slightly sandy CLAY.	CV	45 (6%)	71	26	23.8						
TP309	0.70-1.20 (0.70)	B	C43675	MADE GROUND: Grey mottled brown slightly sandy clay.					23.0						
TP309	1.50 (1.50)	D	C43903	MADE GROUND: Grey mottled brown slightly sandy clay.	CV	50 (NAT)	75	25	33.4						
TP310	1.50 (1.50)	D	C43910	Light grey mottled orange brown slightly sandy CLAY.	CH	45 (NAT)	67	22	37.7						
TP320	0.80-1.50 (0.80)	B	C43155	MADE GROUND: Dark brown mottled grey slightly sandy slightly gravelly clay.	CH	32 (7%)	58	26	21.4						
TP321	0.50 (0.50)	B	C43158	MADE GROUND: Brown slightly sandy slightly gravelly clay.	CI	26 (2%)	41	15	17.4						
TP323	1.20-1.65 (1.40)	UT	C43525	Light brown mottled grey slightly sandy slightly gravelly CLAY.					35.6 <33.1>	SS	1.84	30	48	24	24
TP324	1.50 (1.50)	D	C43920	Light grey mottled orangish brown slightly sandy CLAY.	CV	53 (NAT)	75	22	29.3						
TP325	1.20-1.65 (1.20)	UT	C43741	Orangish brown mottled grey slightly sandy CLAY.					29.5 <28.8>	SS	1.96	30	156	78	78
TP325	3.20-3.65 (3.20)	UT	C43742	Dark greenish grey slightly sandy CLAY.					24.5 <24.6>	SS	2.02	60	249	124	124
TP327	1.00 (1.00)	D	C42623	POSSIBLE MADE GROUND: Light grey slightly sandy clay.	CH	40 (5%)	67	27	28.6						
TP329	0.10 (0.10)	B	C42372	MADE GROUND: Dark grey slightly sandy slightly gravelly clay.					36.0						
TP330	1.50 (1.50)	D	C43287	MADE GROUND: Greenish grey slightly sandy slightly gravelly clay.	CI	26 (3%)	46	20	24.6						
TP331	1.30 (1.30)	D	C43927	Light grey slightly sandy CLAY.	CH	40 (NAT)	69	29	37.4						
TP331	2.00 (2.00)	D	C43929	Dark greyish brown slightly sandy CLAY.	CH	28 (6%)	55	27	38.0						
TP332	1.40 (1.40)	D	C43936	Light grey slightly sandy CLAY.	CH	42 (NAT)	67	25	38.9						
TP335	1.00 (1.00)	D	C43303	Brown mottled yellowish brown slightly sandy CLAY.	CH	26 (9%)	52	26	25.7						
TP401	0.70-1.20 (0.70)	B	C43757	Grey mottled brown slightly sandy CLAY.					25.2						

Remarks NST - Not suitable for Test
For Standards followed see Laboratory Test Certficate
w% - ^ = Rock water content test; x = Aggregate moisture content test
QUT Water Contents: <Failure Zone>, [After test]

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Classification and Strength

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) Mg/m^3	σ_3 kN/m^2	$\sigma_1-\sigma_3$ kN/m^2	c_u kN/m^2	c_{Avg} kN/m^2
TP602	1.30 (1.30)	D	C43062	POSSIBLE MADE GROUND: Orangish brown mottled light grey slightly sandy CLAY.	CH	36 (NAT)	57	21	26.8						
TP602	2.00 (2.00)	D	C43063	Dark bluish grey slightly sandy CLAY.	CH	34 (NAT)	55	21	23.2						
TP603	0.40 (0.40)	D	C43069	Orangish brown mottled grey slightly sandy CLAY.	CH	34 (NAT)	57	23	16.1						
TP603	3.00 (3.00)	D	C43074	Dark grey slightly sandy CLAY.	CI	32 (NAT)	50	18	20.4						
TP605	0.50 (0.50)	D	C43079	Orangish brown mottled grey slightly sandy CLAY.	CI	30 (NAT)	49	19	16.7						
TP605	2.10 (2.10)	D	C43081	Dark grey slightly sandy CLAY.	CH	36 (2%)	64	28	34.4						
TP606	1.50 (1.50)	D	C43957	Grey mottled orangish brown slightly sandy CLAY.	CH	39 (9%)	58	19	28.3						
TP608	0.50-1.00 (0.50)	B	C42967	Orangish brown mottled grey slightly sandy CLAY.	CI	25 (6%)	37	12	16.4						
TP609	1.50 (1.50)	D	C43096	Brown mottled grey slightly sandy CLAY	CL	20 (29%)	32	12	20.9						
TP609	2.70 (2.70)	D	C43099	Dark grey slightly sandy CLAY.	CH	35 (33%)	61	26	33.4						
TP610	1.60-2.00 (1.60)	B	C42975	Grey mottled orangish brown slightly sandy CLAY.	CH	31 (5%)	55	24	23.4						
TP613	0.50 (0.50)	D	C45999	Grey mottled orangish brown slightly sandy CLAY.	CH	31 (NAT)	54	23	30.9						
TP615	1.50 (1.50)	D	C44042	POSSIBLE MADE GROUND: Greenish grey mottled brown sandy CLAY.	CL	18 (9%)	34	16	22.7						
TP702	0.60 (0.60)	B	C45453	MADE GROUND: Light brown mottled grey slightly sandy slightly gravelly clay.					27.1						
TP703	0.60 (0.60)	B	C45458	MADE GROUND: Grey and brown slightly sandy slightly gravelly clay.	CH	38 (2%)	70	32	30.5						
TP703	1.30 (1.30)	D	C45620	Light brown mottled light grey slightly sandy CLAY.	CH	45 (NAT)	70	25	31.4						
TP704	0.30-0.80 (0.30)	B	C41970	MADE GROUND: Grey slightly sandy silty clay.	CH	39 (3%)	66	27	28.1						
TP704	1.40-1.80 (1.40)	B	C41964	PROBABLE MADE GROUND: Dark grey sandy clay.					35.4 35.4 35.4	MS-Rem	1.78 1.78 1.78	100 200 300	 117 121	 59 60	60

Remarks NST - Not suitable for Test
For Standards followed see Laboratory Test Certficate
w% - ^ = Rock water content test; x = Aggregate moisture content test
QUT Water Contents: <Failure Zone>, [After test]

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Particle Size Distribution

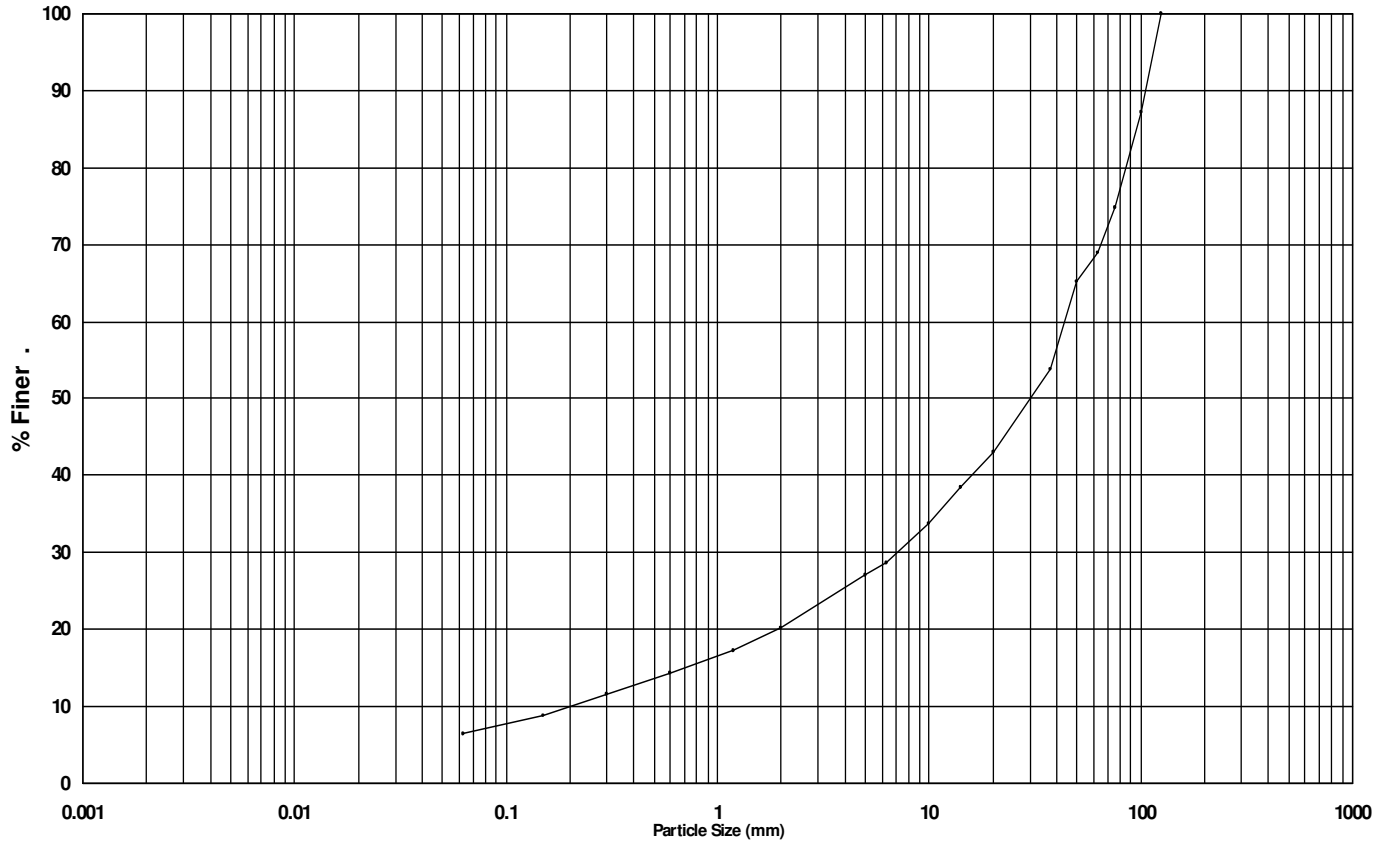
Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH314
Sample Depth	0.20-0.60m
Sample Type	B
Sample Ref	C43464

Sample Description

MADE GROUND: Light brown sandy clayey gravel with a high cobble content.



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	7
SAND	13
GRAVEL	49
COBBLES	31
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	87
75 mm	75
63 mm	69
50 mm	65
37.5 mm	54
20 mm	43
14 mm	38
10 mm	34
6.3 mm	29
5 mm	27
2 mm	20
1.18 mm	17
600 µm	14
300 µm	12
150 µm	9

Size	% Finer
63 µm	7

Uniformity Coefficient
220.99

Sieving Method
Wet sieve

Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks AGS Sieve:-Test performed as "Non Standard" due to sample mass not being in accordance with BS EN ISO 17892-4:2016

06/11/2020

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Particle Size Distribution

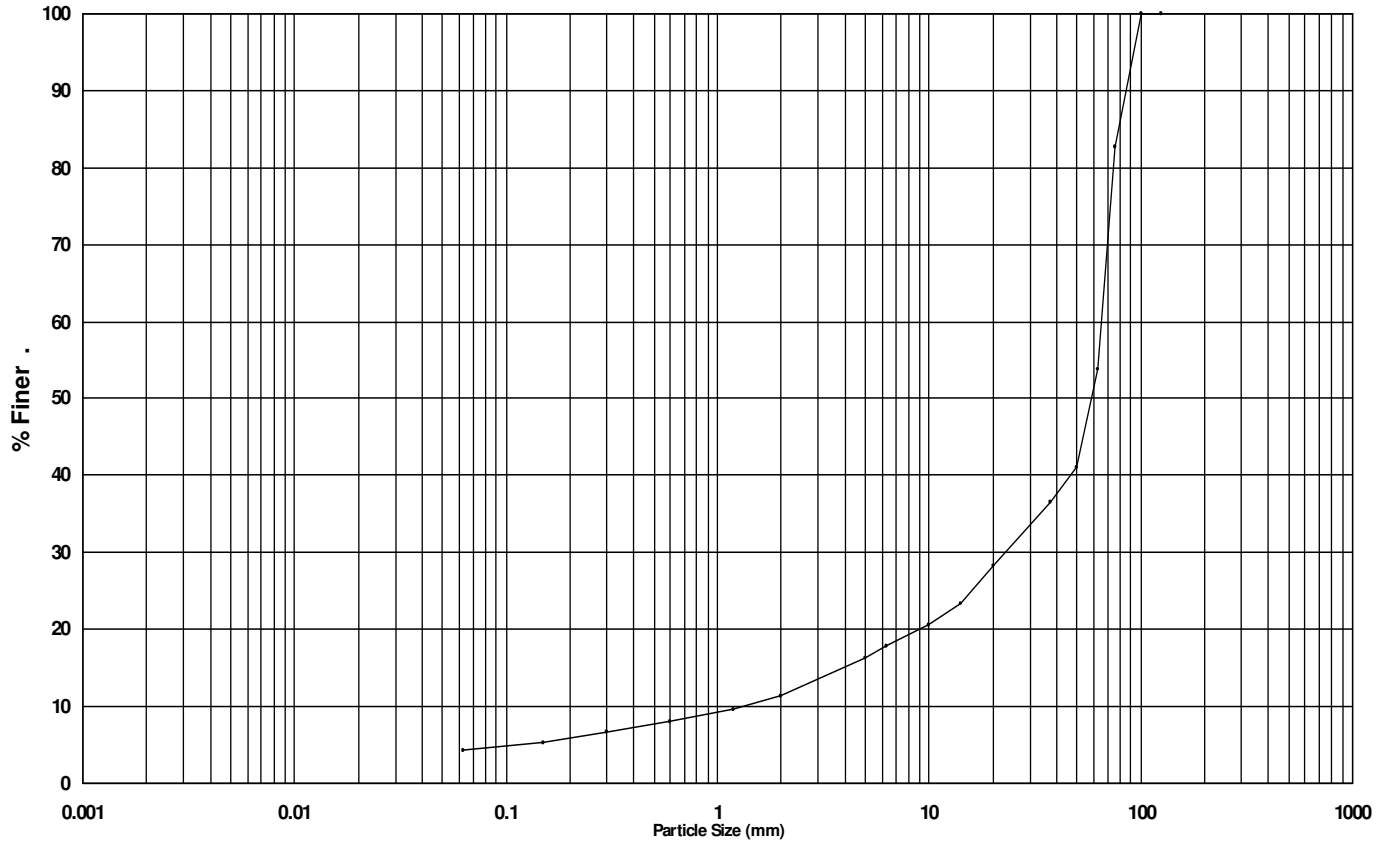
Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	CC301
Sample Depth	0.25-0.35m
Sample Type	B
Sample Ref	C42979

Sample Description

MADE GROUND: Reddish brown and dark grey sandy clayey gravel and cobbles.



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	4
SAND	7
GRAVEL	43
COBBLES	46
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	83
63 mm	54
50 mm	41
37.5 mm	36
20 mm	28
14 mm	23
10 mm	21
6.3 mm	18
5 mm	16
2 mm	11
1.18 mm	10
600 µm	8
300 µm	7
150 µm	5

Size	% Finer
63 µm	4

Uniformity Coefficient
49.52
Sieving Method
Wet sieve
Fine Particle Analysis

Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks AGS Sieve:-Test performed as "Non Standard" due to sample mass not being in accordance with BS EN ISO 17892-4:2016

06/11/2020

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Particle Size Distribution

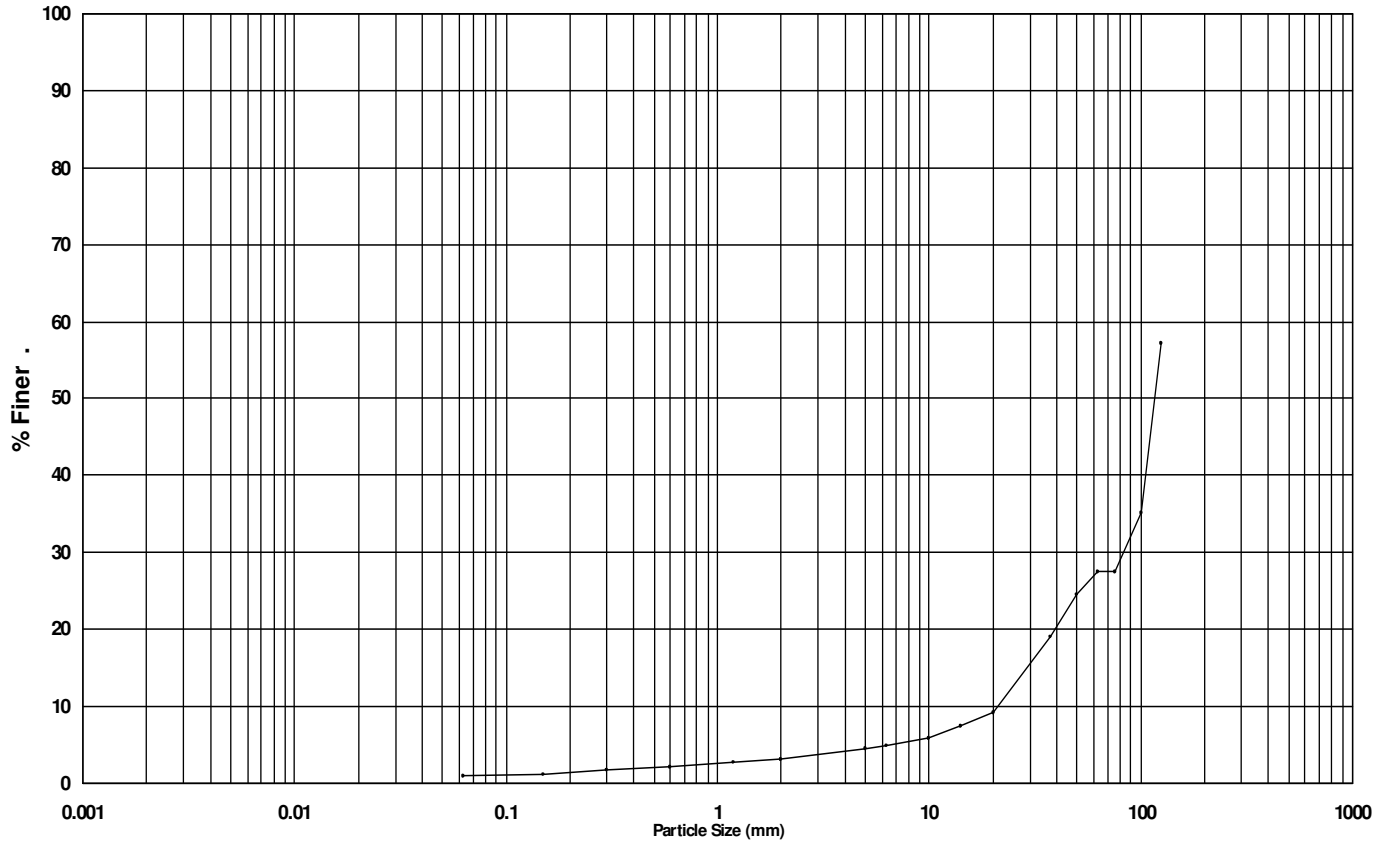
Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	RC301
Sample Depth	0.50m
Sample Type	B
Sample Ref	C43437

Sample Description

MADE GROUND: Dark grey cobbles with much sandy slightly clayey gravel.



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	1
SAND	2
GRAVEL	24
COBBLES	73
BOULDERS	0

Size	% Finer
125 mm	57
100 mm	35
75 mm	27
63 mm	27
50 mm	25
37.5 mm	19
20 mm	9
14 mm	7
10 mm	6
6.3 mm	5
5 mm	4
2 mm	3
1.18 mm	3
600 µm	2
300 µm	2
150 µm	1

Size	% Finer
63 µm	1

Uniformity Coefficient
5.96

Sieving Method
Wet sieve

Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks AGS Sieve:-Test performed as "Non Standard" due to sample mass not being in accordance with BS EN ISO 17892-4:2016

06/11/2020

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Atterberg Limit

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Results								
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data: Cone Pene.	Point Data: Water % (Factor)	Symbol	þ %	>425 sieve µm	w_L %	w_p %
BH301	2.00 (2.00)	D	C46301	Brown mottled grey CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	34	0%	58	24
BH302	0.50 (0.50)	D	C46314	Brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			MV	37	6%	71	34
BH303	3.30 (3.30)	D	C46334	Dark brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	38	69%	68	30
BH309	1.00-1.10 (1.00)	D	C44559	Light brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	42	3%	67	25
BH312	1.50 (1.50)	D	C44574	Light orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	33	8%	59	26
BH314	1.20-1.65 (1.20)	D	C44984	Light orangish brown and grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	33	0%	55	22
BH315	1.80 (1.80)	D	C44998	Dark brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	44	0%	76	32
BH316	0.90-1.00 (0.90)	D	C44580	Light orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	42	1%	66	24
BH317	2.00 (2.00)	D	C45876	Orangish brown mottled grey slightly sandy CLAY,	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	29	14%	50	21
BH318	2.40-2.85 (2.40)	D	C42519	Dark greenish grey CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	42	5%	63	21
BH319	1.00-1.10 (1.00)	D	C42534	Light brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	32	3%	54	22
BH401	1.00-1.10 (1.00)	D	C45021	Orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	45	2%	68	23

Remarks AGS

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Atterberg Limit

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Results								
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data		Symbol	þ %	>425 sieve µm	w_L %	w_p %
						Cone Pene.	Water % (Factor)					
BH430	0.50-0.60 (0.50)	D	C45515	Dark brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CV	43	3%	71	28
BH502	0.50-0.60 (0.50)	D	C42547	Light brownish grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	41	1%	63	22
BH506	1.50 (1.50)	D	C42587	Orangish brown and grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	38	8%	64	26
BH507	0.50 (0.50)	D	C42157	Brownish grey slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	43	5%	67	24
BH509	0.90-1.00 (0.90)	D	C44663	Light brownish grey slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	58	0%	83	25
BH510	1.70 (1.70)	D	C46406	Grey mottled brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	43	67%	65	22
BH512	2.00 (2.00)	D	C45959	Orangish brown and grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	42	11%	64	22
BH513	1.00-1.10 (1.00)	D	C45551	Brown mottled grey slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	38	3%	61	23
BH516	1.35-1.45 (1.35)	D	C42601	Orangish brown and light brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	35	1%	64	29
BH602	1.65-1.70 (1.65)	D	C45067	Dark brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve					13%	25	NP
BH604	0.50-0.60 (0.50)	D	C45073	Light orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CV	43	2%	71	28
BH608	1.50 (1.50)	D	C46435	Orangish brown slightly gravelly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	37	7%	60	23

Remarks

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Atterberg Limit

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Results								
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data		Symbol	þ %	>425 sieve µm	w_L %	w_p %
						Cone Pene.	Water % (Factor)					
RC809	0.50 (0.50)	D	C45248	Brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	50	0%	74	24
TP301	1.00 (1.00)	D	C43051	Brown mottled grey sandy SILT.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve					7%	25	NP
TP303	1.00 (1.00)	D	C43859	Light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	27	12%	45	18
TP305	1.00 (1.00)	D	C43876	Orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	38	0%	66	28
TP308	1.50 (1.50)	D	C43895	Grey mottled orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CV	45	6%	71	26
TP309	1.50 (1.50)	D	C43903	MADE GROUND: Grey mottled brown slightly sandy clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	50	0%	75	25
TP310	1.50 (1.50)	D	C43910	Light grey mottled orange brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	45	0%	67	22
TP320	0.80-1.50 (0.80)	B	C43155	MADE GROUND: Dark brown mottled grey slightly sandy slightly gravelly clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	32	7%	58	26
TP321	0.50 (0.50)	B	C43158	MADE GROUND: Brown slightly sandy slightly gravelly clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	26	2%	41	15
TP324	1.50 (1.50)	D	C43920	Light grey mottled orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	53	0%	75	22
TP327	1.00 (1.00)	D	C42623	POSSIBLE MADE GROUND: Light grey slightly sandy clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	40	5%	67	27
TP330	1.50 (1.50)	D	C43287	MADE GROUND: Greenish grey slightly sandy slightly gravelly clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	26	3%	46	20

Remarks AGS 4.1

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Atterberg Limit

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Results								
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data		Symbol	Ip %	>425 sieve µm	w_L %	w_p %
						Cone Pene.	Water % (Factor)					
TP331	1.30 (1.30)	D	C43927	Light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	40	0%	69	29
TP331	2.00 (2.00)	D	C43929	Dark greyish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	28	6%	55	27
TP332	1.40 (1.40)	D	C43936	Light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	42	0%	67	25
TP335	1.00 (1.00)	D	C43303	Brown mottled yellowish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	26	9%	52	26
TP401	1.00 (1.00)	D	C43991	Grey mottled brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	41	7%	66	25
TP402	0.50 (0.50)	D	C43995	MADE GROUND: Brown slightly sandy slightly gravelly clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	38	2%	62	24
TP403	1.00 (1.00)	D	C44003	Light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	38	16%	63	25
TP404	1.50 (1.50)	D	C44427	Grey mottled brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	43	0%	67	24
TP405	0.50 (0.50)	D	C45974	Brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	38	0%	60	22
TP406	1.50 (1.50)	D	C45088	Orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	25	7%	42	17
TP407	1.50 (1.50)	D	C44732	Light brown mottled light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	48	0%	71	23
TP408	1.00 (1.00)	D	C45101	Brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CV	56	0%	82	26

Remarks

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Atterberg Limit

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Results								
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data		Symbol	ρ %	>425 sieve µm	w_L %	w_p %
						Cone Pene.	Water % (Factor)					
TP523A	1.00 (1.00)	D	C45187	Light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CV	47	0%	71	24
TP602	1.30 (1.30)	D	C43062	POSSIBLE MADE GROUND: Orangish brown mottled light grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	36	0%	57	21
TP602	2.00 (2.00)	D	C43063	Dark bluish grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	34	0%	55	21
TP603	0.40 (0.40)	D	C43069	Orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CH	34	0%	57	23
TP603	3.00 (3.00)	D	C43074	Dark grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CI	32	0%	50	18
TP605	0.50 (0.50)	D	C43079	Orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, natural			CI	30	0%	49	19
TP605	2.10 (2.10)	D	C43081	Dark grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	36	2%	64	28
TP606	1.50 (1.50)	D	C43957	Grey mottled orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	39	9%	58	19
TP608	0.50-1.00 (0.50)	B	C42967	Orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	25	6%	37	12
TP609	1.50 (1.50)	D	C43096	Brown mottled grey slightly sandy CLAY	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CL	20	29%	32	12
TP609	2.70 (2.70)	D	C43099	Dark grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	35	33%	61	26
TP610	1.60-2.00 (1.60)	B	C42975	Grey mottled orangish brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	31	5%	55	24

Remarks AGS

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Atterberg Limit

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					Results								
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data		Symbol	þ %	>425 sieve µm	w_L %	w_p %
						Cone Pene.	Water % (Factor)					
BH809	3.50-3.95 (3.50)	D	C44553	Dark greenish grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	31	3%	60	29
BH813	0.70-0.80 (0.70)	D	C42790	Orangish brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	37	5%	59	22
BH815	3.90 (3.90)	D	C46453	Dark greyish brown CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	35	12%	62	27
BH818	1.00-1.10 (1.00)	D	C43621	Dark brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	33	3%	53	20
BHTP417	1.20-1.65 (1.20)	D	C46279	Grey mottled brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	37	1%	57	20
CC301	2.00-2.20 (2.00)	D	C43020	Brown mottled grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	40	1%	64	24
CC501	2.00-2.20 (2.00)	D	C43027	Dark grey slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	43	1%	68	25
CC504	1.10-1.20 (1.10)	D	C43036	MADE GROUND: Grey and brown slightly sandy clay.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CV	48	0%	73	25
CC504	2.00-2.20 (2.00)	D	C43038	Grey mottled orangish brown slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	34	1%	63	29
CC504	3.00-3.20 (3.00)	D	C43040	Grey mottled brown slightly sandy CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CH	33	5%	65	32
RC304	0.60 (0.60)	D	C45631	Brown mottled grey slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	25	6%	45	20

Remarks AGS

GEOTECHNICS
geotechnical and geoenvironmental specialists

Summary of Chemical Analysis
Soil Samples

Our Ref 20-16825
Client Ref PC207899
Contract Title Graven Hill, Bicester

			Lab No	1721235	1721236	1721237	1721238	1721239	1721240
			Sample ID	RC809	TP820	BH303	BH512	BH303	BH304
			Depth	1.00	1.30	1.20-1.65	2.00	3.30	0.50
			Other ID						
			Sample Type	D	D	D	D	D	D
			Sampling Date	01/09/2020	01/09/2020	01/09/2020	01/09/2020	01/09/2020	01/09/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Inorganics									
pH	DETSC 2008#		pH	6.4	5.9	8.4	7.3		
Organic matter	DETSC 2002#	0.1	%					7.8	0.8
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	230	1600	470	1600		
Sulphur as S, Total	DETSC 2320	0.01	%	0.04	1.6				
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.12	4.5				

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 20-16352
Client Ref PC207899
Contract Title Graven Hill, Bicester, Land

			Lab No	1718441	1718442	1718443	1718444	1718445	1718446	1718447	1718448	1718449	1718450
			Sample ID	BH315	BH512X	TP406	BH422	BH424	BH426	BH509	TP325	BH306	BH308
			Depth	1.80	2.20	3.50	0.60	0.50	1.20-1.65	0.40-0.50	0.60-0.70	0.50-0.60	0.50
			Other ID										
			Sample Type	D	D	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**										
Inorganics													
pH	DETSC 2008#		pH				8.7	8.2	7.3	8.2	7.9	7.8	7.6
Organic matter	DETSC 2002#	0.1	%	6.9	8.2	7.6							
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l				64	1900	2000	1400	1200	140	110
Sulphur as S, Total	DETSC 2320	0.01	%									0.03	0.03
Sulphate as SO4, Total	DETSC 2321#	0.01	%									0.07	0.07

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 20-16352
Client Ref PC207899
Contract Title Graven Hill, Bicester, Land

			Lab No	1718451	1718452	1718453	1718454	1718455	1718456	1718457	1718458	1718459	1718460	1718461
			Sample ID	BH309	BH312	BH422	BH423	BH423	BH504	BH509	BH509	BH512X	RC806	TP406
			Depth	0.50-0.60	1.50	1.20-1.65	1.50	3.40	1.65-1.70	1.00-1.10	3.00-3.10	0.50	1.70	0.50
			Other ID											
			Sample Type	D	D	D	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**											
Inorganics														
pH	DETSC 2008#		pH	7.5	5.4	6.3	7.5	5.7	6.0	7.4	6.3	7.3	7.3	8.5
Organic matter	DETSC 2002#	0.1	%											
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	38	1900	1900	1700	410	1500	650	2000	86	2200	88
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	4.1	2.8	0.25	0.82	0.52	0.11	0.48	0.05	2.7	0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	12	8.3	0.56	2.4	1.4	0.23	0.74	0.08	7.0	0.05

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-16433
Client Ref PC207899
Contract Title Graven Hill, Bicester

Lab No	1719169
Sample ID	BH312
Depth	0.50
Other ID	
Sample Type	D
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units	
Inorganics				
pH	DETSC 2008#		pH	11.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	390

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-16450
Client Ref PC207899
Contract Title Graven Hill, Bicester

			Lab No	1719214	1719215	1719216	1719217	1719218	1719219	1719220	1719221	1719222	1719223	1719224
			Sample ID	BH602	TP404	TP817	BH314	BH401	BH401	BH411	BH431	BH602	BH604	TP403
			Depth	0.10-0.20	0.50	0.30	2.00	0.35-0.45	1.00-1.10	1.60	0.20-0.30	2.10-2.20	1.00-1.10	1.50
			Other ID											
			Sample Type	D	D	D	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**											
Inorganics														
pH	DETSC 2008#		pH	7.7	8.2	11.9	4.8	8.5	7.6	7.1	7.9	7.5	6.0	7.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19	23	40	1700	59	510	1900	440	260	530	1800
Sulphur as S, Total	DETSC 2320	0.01	%				2.6	0.16	0.07	2.9	0.08	0.05	0.10	2.8
Sulphate as SO4, Total	DETSC 2321#	0.01	%				6.6	0.09	0.18	9.2	0.24	0.11	0.24	6.7

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 20-14585-1
Client Ref PC207899
Contract Title Graven Hill, Bicester

			Lab No	1709215	1709216	1709217	1709218	1709219	1709220	1709221	1709222	1709223	1709224	1709225
			Sample ID	BH405	CC302	TP603	CC302	CC501	CC504	TP301	TP308	TP409	TP409	TP602
			Depth	1.20-1.65	1.20-1.30	2.00	0.40-0.90	2.00-2.20	2.00-2.20	1.60	0.80	0.90-1.10	2.00-2.20	0.60
			Other ID											
			Sample Type	D	D	B	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	21/07/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**											
Inorganics														
pH	DETSC 2008#		pH	7.6	7.0	7.2	6.7	7.0	5.2	7.4	7.4	7.9	7.1	7.3
Organic matter	DETSC 2002#	0.1	%											
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	190	140	1400	170	1900	1800	1100	260	200	1600	54
Sulphur as S, Total	DETSC 2320	0.01	%	0.06	0.07	1.2								
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.11	0.14	2.6								

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied. t/f -to follow.

Summary of Chemical Analysis

Soil Samples

Our Ref 20-16363
Client Ref PC207899
Contract Title Graven Hill, Bicester, Land

			Lab No	1718508	1718509	1718510	1718511	1718512	1718513	1718514	1718515	1718516	1718517	1718518	1718519	1718520
			Sample ID	TP334	TP307	TP307	BH702	BH705	BH814	BH818	BH819	RC711	RC714	TP305	TP305	TP307
			Depth	1.60	3.00	4.00	0.70	0.20-0.30	0.20-0.30	0.25-0.40	0.40-0.50	0.50-0.90	0.65-0.85	0.40	0.70	0.50
			Other ID													
			Sample Type	D	D	D	D	D	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**													
Inorganics																
pH	DETSC 2008#		pH	6.0			10.3	10.3	7.7	8.0	7.3	8.1	8.1	11.5	7.2	7.6
Organic matter	DETSC 2002#	0.1	%	5.3	4.9	5.7										
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	390			2200	2200	150	170	670	1300	270	240	250	74
Sulphur as S, Total	DETSC 2320	0.01	%													
Sulphate as SO4, Total	DETSC 2321#	0.01	%													

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 20-16363
Client Ref PC207899
Contract Title Graven Hill, Bicester, Land

			Lab No	1718521	1718522	1718523	1718524	1718525	1718526	1718527	1718528	1718529	1718530	1718531	1718532
			Sample ID	TP317	TP334	BH808	BH808	BH818	BH818	BH819	TP304	TP310	TP319	TP322	TP324
			Depth	1.00	0.60	0.50	3.30	2.70-2.80	3.65-3.70	1.20-1.30	2.00	1.00	0.60	0.70	1.00
			Other ID												
			Sample Type	B	D	D	D	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**												
Inorganics															
pH	DETSC 2008#		pH	6.9	7.1	7.1	6.4	6.8	6.7	7.6	4.2	6.8	6.8	6.9	7.3
Organic matter	DETSC 2002#	0.1	%												
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	790	100	92	2000	1700	2100	820	1800	420	720	55	82
Sulphur as S, Total	DETSC 2320	0.01	%			0.03	1.6	1.7	1.1	0.09	5.5	0.08	0.12	0.05	0.03
Sulphate as SO4, Total	DETSC 2321#	0.01	%			0.08	3.6	3.9	2.5	0.28	21	0.18	0.32	0.11	0.06

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis

Soil Samples

Our Ref 20-14585-1
Client Ref PC207899
Contract Title Graven Hill, Bicester

			Lab No	1709226	1709227	1709228	1709229	1709230	1709231	1710681	1712683	1712684
			Sample ID	TP603	TP605	TP605	TP609	TP609	BH405	TP602	TP602	TP609
			Depth	1.00	1.00	2.50	1.50	2.70	2.00-2.20	0.60	1.30	3.50
			Other ID									
			Sample Type	D	D	D	D	D	D	SOIL	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	22/07/2020	n/s	13/08/2020	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**									
Inorganics												
pH	DETSC 2008#		pH	7.7	7.5	7.2	8.1		7.2	t/f	7.6	6.8
Organic matter	DETSC 2002#	0.1	%					3.3	5.9			
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	130	52	940	110		400	t/f	110	< 10
Sulphur as S, Total	DETSC 2320	0.01	%									
Sulphate as SO4, Total	DETSC 2321#	0.01	%									

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied. t/f -to follow.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-14588
Client Ref PC207899
Contract Title Graven Hill, Bicester

			Lab No	1709241	1709242	1709243	1709244	1709245	1709246	1709247	1709248	1709249	1709257	1709258
			Sample ID	TP421	TP424	TP502	TP330	TP421	TP502	TP504	TP330	TP504	RC407	TP610
			Depth	1.90	2.00	4.00	3.00	0.60	2.00	3.70	1.50	1.20	1.10	1.10
			Other ID											
			Sample Type	D	D	D	D	D	D	D	D	D	ES	D
			Sampling Date	20/07/2020	n/s	n/s	22/07/2020	20/07/2020	20/07/2020	n/s	n/s	n/s	20/07/2020	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**											
Inorganics														
pH	DETSC 2008#		pH	4.4	4.6	6.8	5.8	7.0	6.7	7.3	6.4	6.8		
Organic matter	DETSC 2002#	0.1	%	3.9									9.2	0.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1800	380	1700	1600	1100	1300	280	340	1800		
Sulphur as S, Total	DETSC 2320	0.01	%	1.8	0.06	2.3								
Sulphate as SO4, Total	DETSC 2321#	0.01	%	3.9	0.18	5.4								

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-16358
Client Ref PC207899
Contract Title Graven Hill, Bicester, Land

			Lab No	1718488	1718489
			Sample ID	TP607	TP611
			Depth	1.00	0.50
			Other ID		
			Sample Type	D	D
			Sampling Date	n/s	n/s
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Inorganics					
pH	DETSC 2008#		pH	7.9	5.5
Organic matter	DETSC 2002#	0.1	%		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	65	550
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	0.08
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.20

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

LABORATORY RESULTS - MCV, Compaction, CBR

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					MCV		Compaction					CBR				
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	MCV	w %	Type	w (Opt) %	ρ_d Mg/m³	γ_b Mg/m³	γ_d (Max) Mg/m³	Type	Top CBR %	Top w %	Bottom CBR %	Bottom w %
BH430	0.50-0.70 (0.50-0.70)	B	C44341	Dark brown slightly sandy CLAY.			4.5kg	(17.0) 27.5* 7.7 12.3 18.2 21.9	2.70a	*1.96 1.75 1.90 2.05 2.07	(1.75) *1.54 1.63 1.70 1.73 1.70					
BH812	0.10-0.50 (0.10-0.50)	B	C42456	Brownish grey slightly sandy slightly gravelly CLAY.			4.5kg	(10.5) 19.9* 22.7 3.4 7.7 14.2	2.65a	*2.04 2.00 1.75 1.93 2.04	(1.82) *1.70 1.63 1.70 1.79 1.78					
RC304	0.60 (0.60)	B	C44364	Brown mottled grey slightly sandy slightly gravelly CLAY.						1.86	1.59	4.5kg	39	17.5	55	17.3
TP307	0.20-0.80 (0.20-0.80)	B	C43644	MADE GROUND: Brown slightly sandy clay.			4.5kg	(14.0) 24.6* 6.8 11.3 13.6 20.0 17.4	2.65a	*1.96 1.78 1.94 2.03 2.04 2.04	(1.79) *1.58 1.67 1.74 1.79 1.70 1.74					
TP309	0.70-1.20 (0.70-1.20)	B	C43675	MADE GROUND: Grey mottled brown slightly sandy clay.			4.5kg	(15.5) 31.3* 18.5 27.4 13.0 22.5 9.9	2.65a	*1.91 2.06 1.96 1.92 2.02 1.78	(1.77) *1.45 1.74 1.54 1.70 1.65 1.62					
TP320	0.80-1.50 (0.80-1.50)	B	C43155	MADE GROUND: Dark brown mottled grey slightly sandy slightly gravelly clay.			4.5kg	(12.5) 22.2* 7.3 10.1 14.9 6.7	2.65a	*2.02 1.88 1.98 2.06 1.84	(1.82) *1.65 1.75 1.79 1.79 1.72					
TP321	0.50 (0.50)	B	C43158	MADE GROUND: Brown slightly sandy slightly gravelly clay.			4.5kg	(15.5) 22.2* 12.3 15.9 19.8 24.6 14.2	2.65a	*2.03 1.95 2.07 2.05 1.99 2.02	(1.80) *1.66 1.73 1.79 1.71 1.60 1.77					
TP329	0.10 (0.10)	B	C42372	MADE GROUND: Dark grey slightly sandy slightly gravelly clay.			4.5kg	(15.0) 35.2* 2.7 8.8 15.5 26.4 19.7	2.65a	*1.79 1.61 1.78 1.94 4.13 1.91	(1.69) *1.32 1.57 1.64 1.68 3.27 1.60					

Remarks AGS

Particle Density - a=assumed, m=measured
w% - * = at natural moisture content; x = aggregate moisture content
# = stabilised, see relevant test plot for details
NST = Not suitable for Test
For Standards followed see Laboratory Test Certficate

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - MCV, Compaction, CBR

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					MCV		Compaction					CBR				
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	MCV	w %	Type	w (Opt) %	ρ_d Mg/m³	γ_b Mg/m³	γ_d (Max) Mg/m³	Type	Top CBR %	Top w %	Bottom CBR %	Bottom w %
TP436	0.50-0.80 (0.50-0.80)	B	C43710	Greenish grey mottled brown sandy CLAY.			4.5kg	(12.5)	2.65a		(1.82)					
								22.2*		*2.02	*1.65					
								4.5		1.74	1.66					
								9.1		1.94	1.78					
								15.8		2.06	1.78					
								18.2		2.06	1.74					
TP503	0.30 (0.30)	B	C42670	MADE GROUND: Brown slightly sandy slightly gravelly silty clay.			4.5kg	(15.0)	2.65a		(1.73)					
								22.2*		*1.98	*1.62					
								6.0		1.78	1.68					
								10.4		1.89	1.71					
								12.9		1.95	1.73					
								17.1		2.01	1.72					
TP504	0.70 (0.70)	B	C42675	POSSIBLE MADE GROUND: Dark grey mottled orangish brown slightly sandy CLAY.			4.5kg	(12.5)	2.65a		(1.74)					
								30.5*		*1.91	*1.46					
								12.5		1.95	1.73					
								19.1		1.98	1.67					
								8.5		1.83	1.69					
								14.7		1.96	1.71					
								3.3		1.70	1.65					
TP509	0.30-0.90 (0.30-0.90)	B	C44241	MADE GROUND: Brown slightly sandy slightly gravelly clay.			4.5kg	(13.0)	2.65a		(1.77)					
								25.6*		*1.95	*1.56					
								5.2		1.70	1.62					
								11.0		1.91	1.72					
								14.4		2.01	1.75					
								22.6		1.94	1.58					
								17.9		1.99	1.68					
TP510	0.30-0.70 (0.30-0.70)	B	C44248	MADE GROUND: Brown slightly sandy slightly gravelly clay.			4.5kg	(13.0)	2.65a		(1.77)					
								11.4		1.96	1.76					
								14.3		2.01	1.76					
								19.2		2.03	1.70					
								22.4		2.02	1.65					
								24.6*		*2.00	*1.60					
								3.4		1.68	1.62					
								6.8		1.79	1.68					
TP515	0.60 (0.60)	B	C44307	Light brown mottled bluish grey slightly sandy CLAY.			4.5kg	(15.0)	2.65a		(1.74)					
								24.5*		*1.98	*1.59					
								5.9		1.74	1.64					
								10.7		1.87	1.69					
								15.0		2.00	1.74					
								18.7		2.01	1.69					
								22.1		2.01	1.65					
TP608	0.50-1.00 (0.50-1.00)	B	C42967	Orangish brown mottled grey slightly sandy CLAY.			4.5kg	(7.5)	2.70a		(2.02)					
								17.0*		*2.15	*1.83					
								2.5		1.76	1.72					
								4.0		1.91	1.83					
								5.3		2.08	1.97					
								9.3		2.19	2.00					

Remarks AGS

Particle Density - a=assumed, m=measured
w% - * = at natural moisture content; x = aggregate moisture content
# = stabilised, see relevant test plot for details
NST = Not suitable for Test
For Standards followed see Laboratory Test Certficate

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - MCV, Compaction, CBR

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2) **Project No:** PC207899

Sample					MCV		Compaction					CBR				
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	MCV	w %	Type	w (Opt) %	ρ_d Mg/m³	γ_b Mg/m³	γ_d (Max) Mg/m³	Type	Top CBR %	Top w %	Bottom CBR %	Bottom w %
TP610	1.60-2.00 (1.60-2.00)	B	C42975	Grey mottled orangish brown slightly sandy CLAY.			4.5kg	(13.0) 28.1* 7.1 17.6 22.5 10.1	2.65a	 *1.94 1.73 2.04 2.01 1.90	(1.77) *1.52 1.61 1.73 1.64 1.73					
TP702	0.60 (0.60)	B	C45453	MADE GROUND: Light brown mottled grey slightly sandy slightly gravelly clay.			4.5kg	(15.5) 26.9* 7.8 10.3 21.6 14.4	2.65a	 *1.91 1.61 1.74 1.96 1.92	(1.69) *1.51 1.49 1.58 1.61 1.68					
TP703	0.60 (0.60)	B	C45458	MADE GROUND: Grey and brown slightly sandy slightly gravelly clay.			4.5kg	(18.5) 26.3* 12.3 13.6 24.3 16.3	2.65a	 *1.95 1.68 1.82 1.92 1.91	(1.67) *1.55 1.50 1.60 1.55 1.64					
TP704	0.30-0.80 (0.30-0.80)	B	C41970	MADE GROUND: Grey slightly sandy silty clay.			4.5kg	(12.0) 25.2* 7.7 10.5 14.0 18.5	2.65a	 *2.00 1.88 2.00 2.06 2.06	(1.83) *1.60 1.75 1.81 1.81 1.74					
TP704	2.60-2.90 (2.60-2.90)	B	C41965	Brown mottled grey slightly sandy slightly gravelly CLAY.			4.5kg	(11.0) 26.8* 3.7 7.0 11.7 19.7	2.65a	 *1.90 1.70 1.86 1.99 2.03	(1.80) *1.50 1.64 1.73 1.78 1.70					
TP801	1.00-1.50 (1.00-1.50)	B	C41955	Grey slightly sandy CLAY.			4.5kg	(13.0) 29.9* 6.2 20.2 28.7 7.8 21.4 29.8	2.65a	 *1.91 1.63 1.97 1.90 1.74 1.93 1.90	(1.71) *1.47 1.54 1.64 1.48 1.61 1.59 1.46					
TP802	0.30 (0.30)	B	C45821	MADE GROUND: Brown mottled orangish brown slightly sandy slightly gravelly clay.			4.5kg	(12.5) 25.0* 6.1 10.3 15.5 20.7 23.1	2.65a	 *1.80 1.79 1.92 1.98 2.00 1.95	(1.76) *1.44 1.68 1.74 1.72 1.66 1.59					

Remarks AGS

Particle Density - a=assumed, m=measured
w% - * = at natural moisture content; x = aggregate moisture content
# = stabilised, see relevant test plot for details
NST = Not suitable for Test
For Standards followed see Laboratory Test Certficate

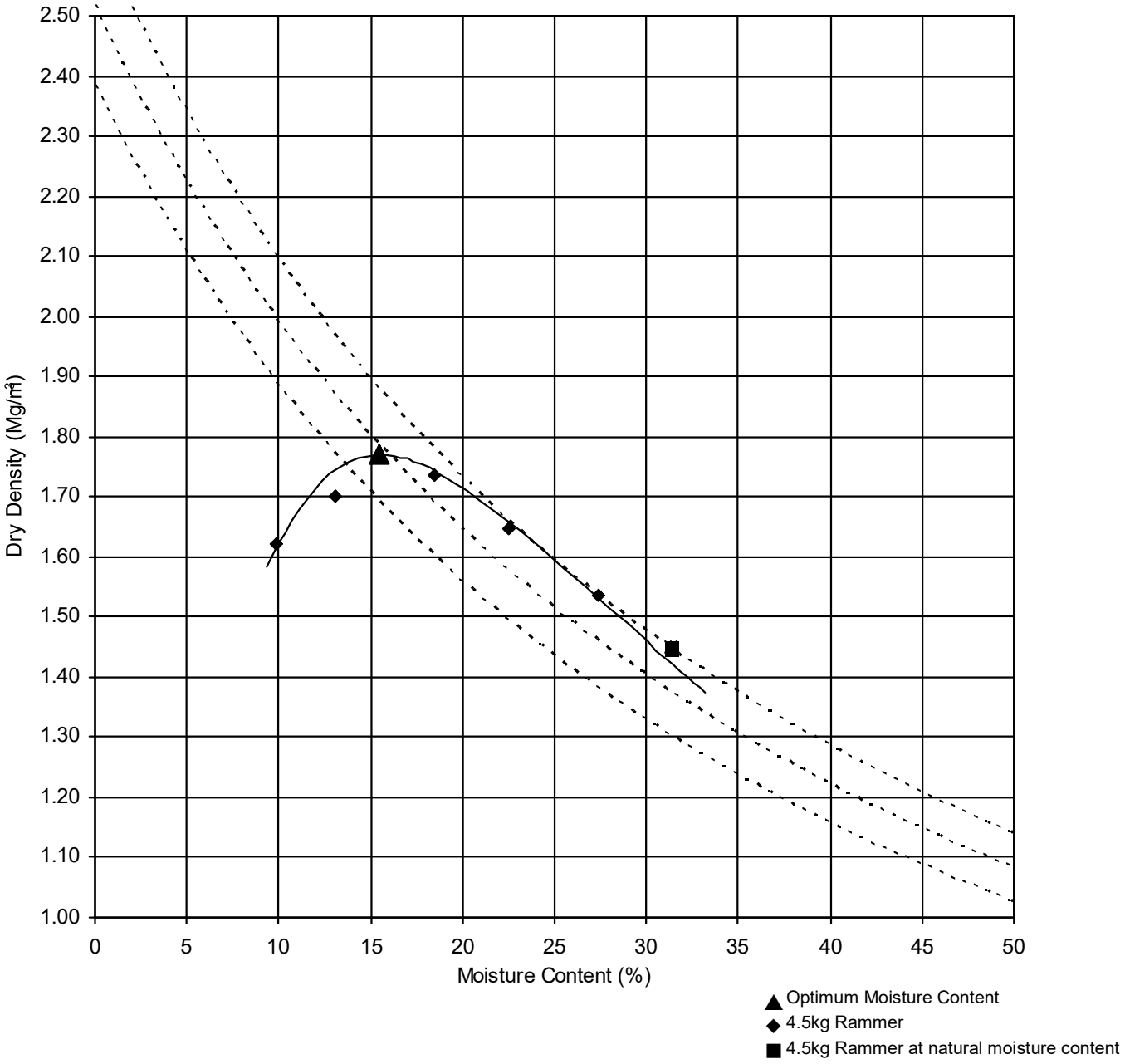
GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Compaction

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	TP309
Sample Depth	0.70-1.20m
Sample Type	B
Sample Ref	C43675



Optimum Moisture Content	15.5	
Maximum Dry Density	1.77	Mg/m^3
Particle Density	2.65 (Assumed)	Mg/m^3
Preparation	Single Sample 4.5kg Rammer	

Particles retained on	37.5mm	0 %
	20mm sieve	0 %
Description	MADE GROUND: Grey mottled brown slightly sandy clay.	

Remarks BS1377 Part 4 1990 : Clause 3.5 and 3.6

GEOTECHNICS
geotechnical and geoenvironmental specialists

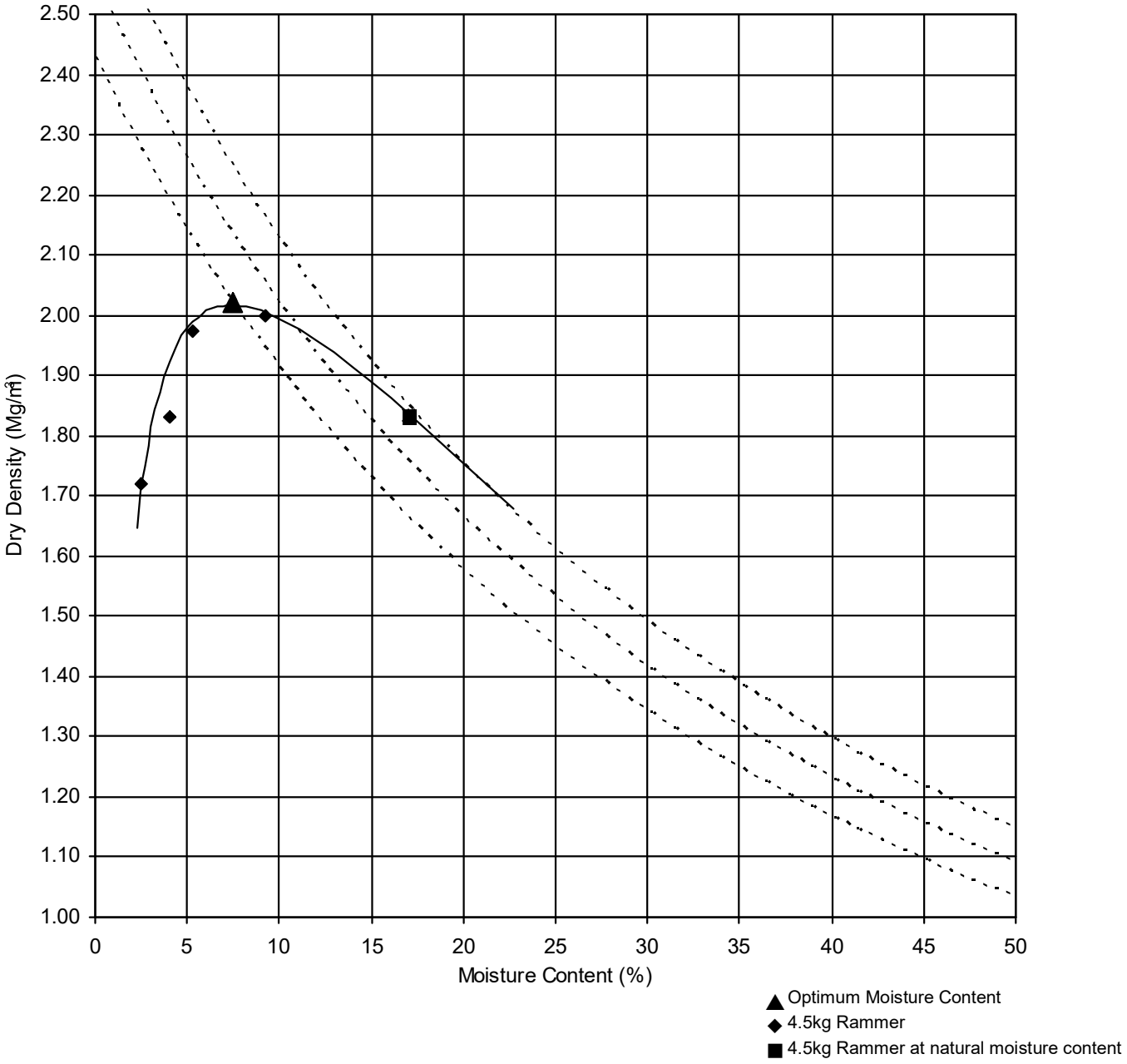
12/11/2020

LABORATORY RESULTS - Compaction

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	TP608
Sample Depth	0.50-1.00m
Sample Type	B
Sample Ref	C42967



Optimum Moisture Content	7.5	
Maximum Dry Density	2.02	Mg/m^3
Particle Density	2.70 (Ass'm)	Mg/m^3
Preparation	Single Sample 4.5kg Rammer	

Particles retained on	37.5mm	0 %
	20mm sieve	0 %
Description	Orangish brown mottled grey slightly sandy CLAY.	

Remarks AGS BS1377 Part 4 1990 : Clause 3.5 and 3.6

GEOTECHNICS
geotechnical and geoenvironmental specialists

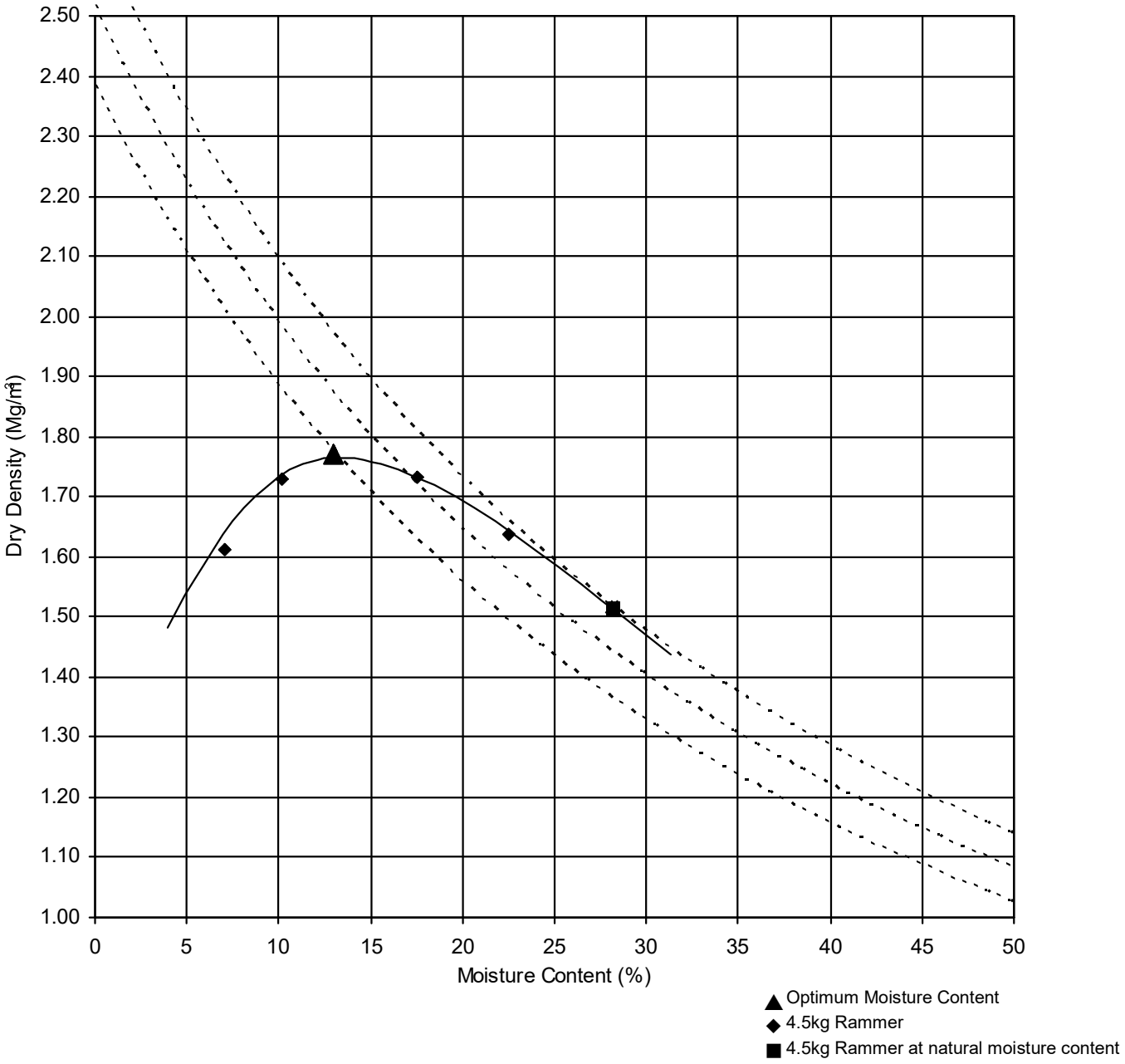
12/11/2020

LABORATORY RESULTS - Compaction

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	TP610
Sample Depth	1.60-2.00m
Sample Type	B
Sample Ref	C42975



Optimum Moisture Content	13.0	
Maximum Dry Density	1.77	Mg/m^3
Particle Density	2.65 (Assumed)	Mg/m^3
Preparation	Single Sample 4.5kg Rammer	

Particles retained on	37.5mm	0 %
	20mm sieve	0 %
Description	Grey mottled orangish brown slightly sandy CLAY.	

Remarks AGS BS1377 Part 4 1990 : Clause 3.5 and 3.6

GEOTECHNICS
geotechnical and geoenvironmental specialists

12/11/2020

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

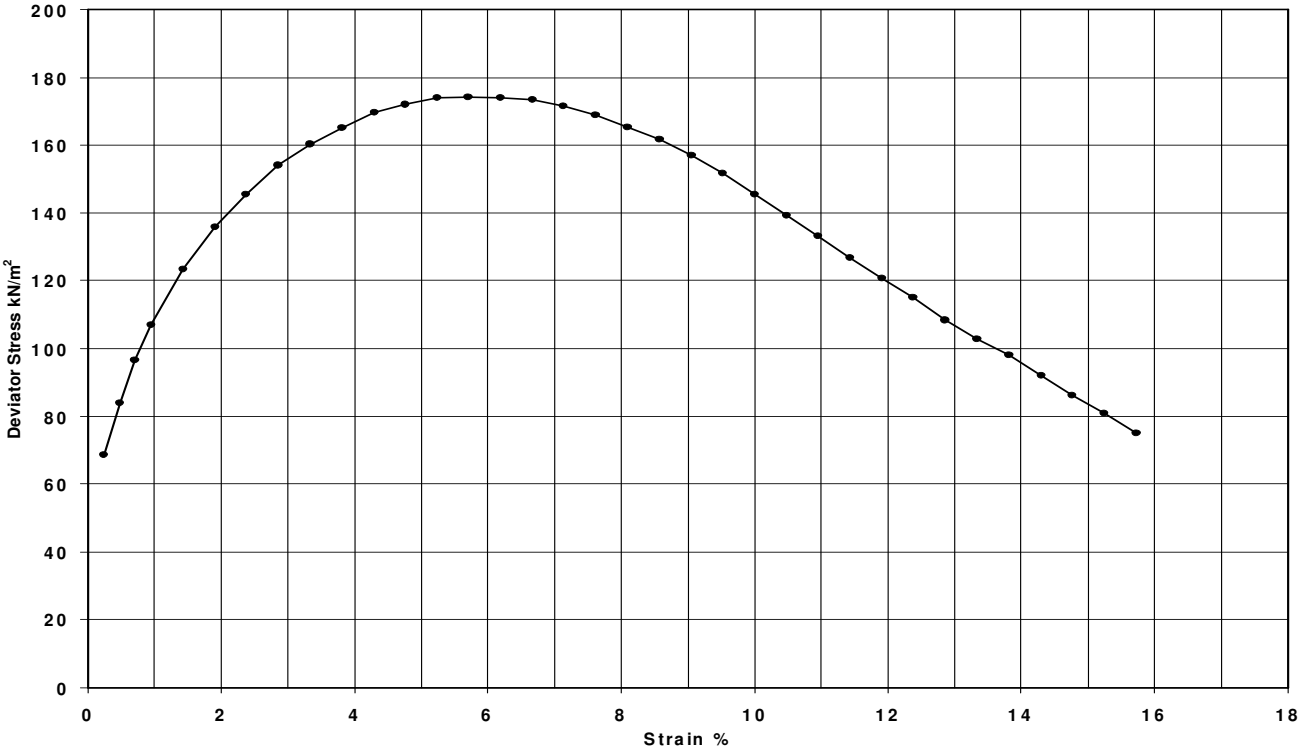
Hole	BH303
Sample Depth	3.60-4.05m
Sample Type	UT
Sample Ref	C45666

Sample Description

Dark grey slightly sandy CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	100.61		
Initial Length	(mm)	209.99		
Initial Water Content	(%)	34.5		
Initial Bulk Density	(Mg/m³)	1.90		
Initial Dry Density	(Mg/m³)	1.41		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	70		
'Specimen Height' at start of Shearing Stage	(mm)	209.81		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	174		
Undrained Shear Strength	(kPa)	87		
Strain at Failure	(%)	5.7		
Failure Zone Water Content	(%)	30.2		
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	68.6	10.0	145.5
0.5	84.0	10.5	139.4
0.7	96.7	11.0	133.2
1.0	107.0	11.4	126.9
1.4	123.5	11.9	120.7
1.9	135.9	12.4	115.0
2.4	145.6	12.9	108.4
2.9	154.1	13.3	102.8
3.3	160.4	13.8	98.1
3.8	165.1	14.3	92.0
4.3	169.6	14.8	86.2
4.8	171.9	15.2	80.8
5.2	173.9	15.7	75.2
5.7	174.2		
6.2	173.9		
6.7	173.4		
7.1	171.5		
7.6	168.9		
8.1	165.4		
8.6	161.7		
9.0	157.0		
9.5	151.7		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH303
Sample Depth	3.60-4.05m
Sample Type	UT
Sample Ref	C45666

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

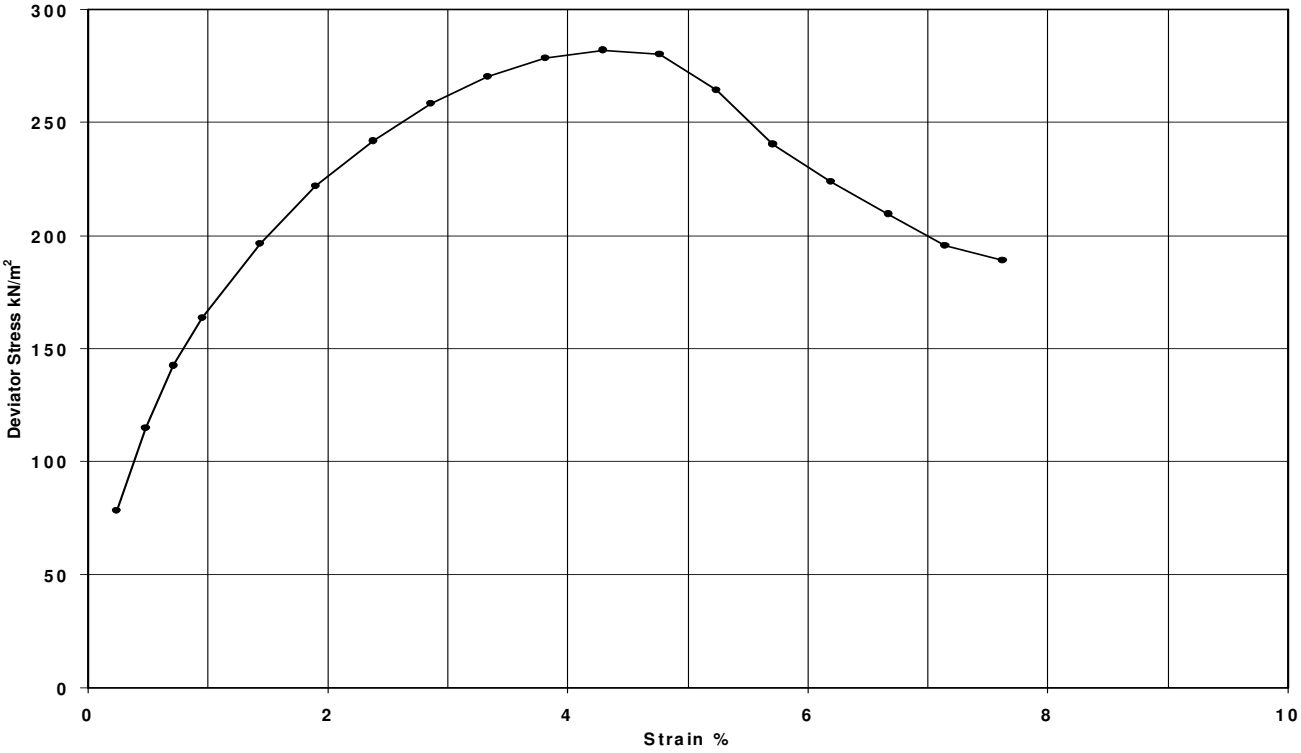
Hole	BH303
Sample Depth	6.00-6.45m
Sample Type	UT
Sample Ref	C45667

Sample Description

Dark grey CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	103.60		
Initial Length	(mm)	210.02		
Initial Water Content	(%)	26.1		
Initial Bulk Density	(Mg/m³)	2.08		
Initial Dry Density	(Mg/m³)	1.65		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	120		
'Specimen Height' at start of Shearing Stage	(mm)	209.94		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	282		
Undrained Shear Strength	(kPa)	141		
Strain at Failure	(%)	4.3		
Failure Zone Water Content	(%)	18.7		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	78.4		
0.5	115.0		
0.7	142.6		
1.0	163.5		
1.4	196.4		
1.9	221.7		
2.4	241.8		
2.9	258.2		
3.3	270.2		
3.8	278.3		
4.3	281.9		
4.8	280.3		
5.2	264.4		
5.7	240.6		
6.2	223.9		
6.7	209.4		
7.1	195.6		
7.6	189.0		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH303
Sample Depth	6.00-6.45m
Sample Type	UT
Sample Ref	C45667

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

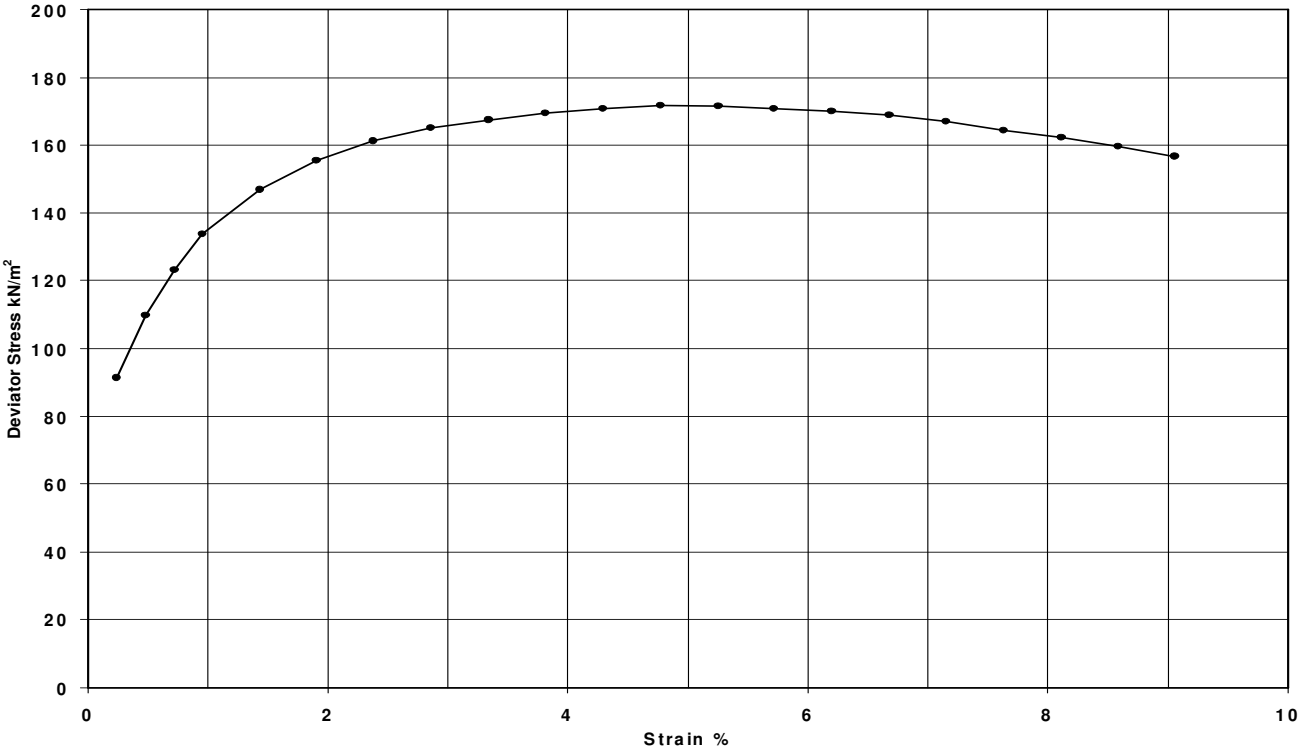
Hole BH304
Sample Depth 2.30-2.75m
Sample Type UT
Sample Ref C45668

Sample Description

Brown mottled grey slightly sandy CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	96.51		
Initial Length	(mm)	209.72		
Initial Water Content	(%)	25.2		
Initial Bulk Density	(Mg/m³)	1.99		
Initial Dry Density	(Mg/m³)	1.59		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	50		
'Specimen Height' at start of Shearing Stage	(mm)	209.63		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	172		
Undrained Shear Strength	(kPa)	86		
Strain at Failure	(%)	4.8		
Failure Zone Water Content	(%)	25.6		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	91.5		
0.5	109.9		
0.7	123.1		
1.0	133.6		
1.4	146.8		
1.9	155.4		
2.4	161.3		
2.9	165.0		
3.3	167.6		
3.8	169.4		
4.3	170.9		
4.8	171.8		
5.2	171.6		
5.7	170.8		
6.2	170.2		
6.7	168.9		
7.2	167.0		
7.6	164.4		
8.1	162.1		
8.6	159.6		
9.1	156.7		

Remarks

06/11/2020

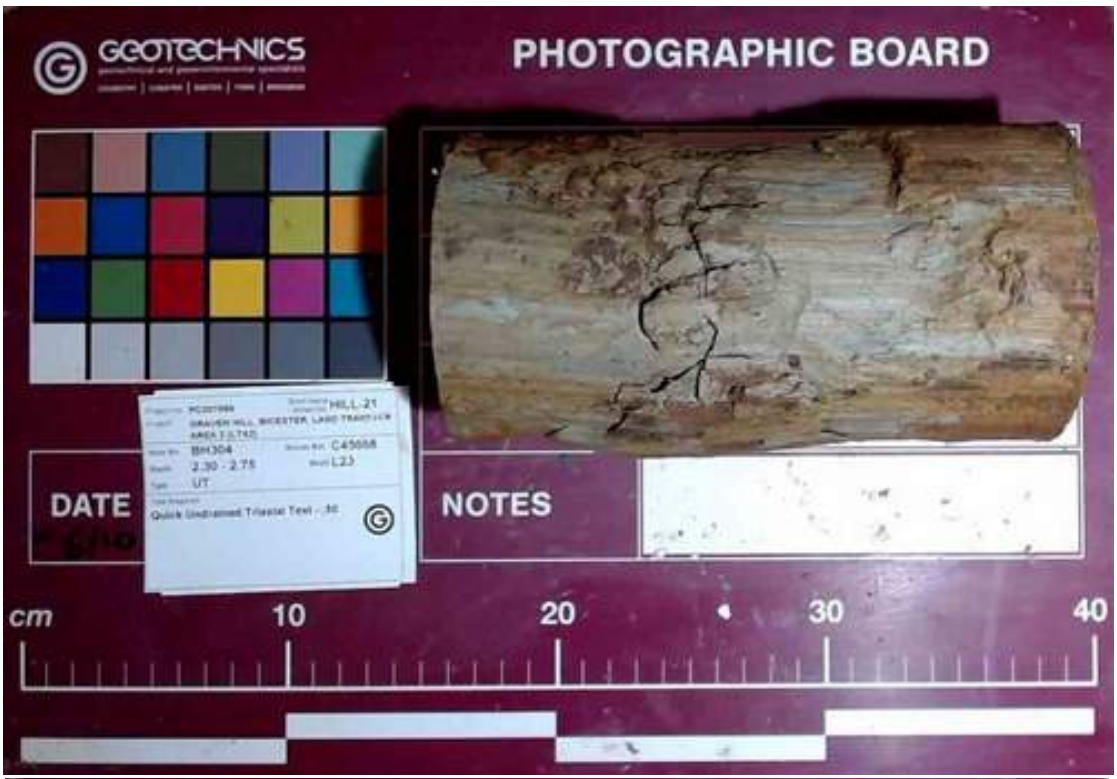
GEOTECHNICS

LABORATORY RESULTS - *Unconsolidated Undrained Triaxial Test*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH304
Sample Depth	2.30-2.75m
Sample Type	UT
Sample Ref	C45668



Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

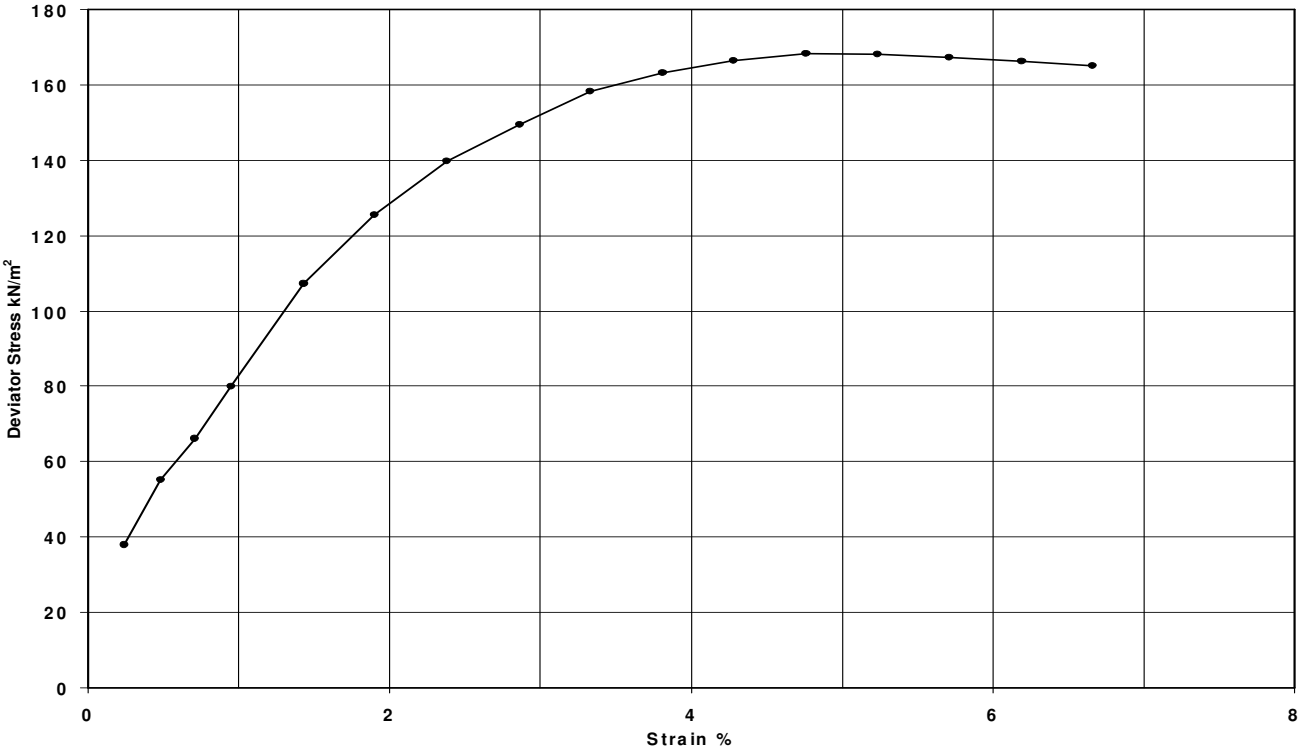
Hole BH308
Sample Depth 3.50-3.95m
Sample Type UT
Sample Ref C43737

Sample Description

The following samples were combined to perform this test:

Dark brownish grey slightly sandy slightly gravelly CLAY.

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.37		
Initial Length	(mm)	210.08		
Initial Water Content	(%)	31.6		
Initial Bulk Density	(Mg/m³)	1.89		
Initial Dry Density	(Mg/m³)	1.44		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	70		
'Specimen Height' at start of Shearing Stage	(mm)	210.06		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.9		
Corrected Deviator Stress	(kPa)	168		
Undrained Shear Strength	(kPa)	84		
Strain at Failure	(%)	4.8		
Failure Zone Water Content	(%)	31.5		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	38.0		
0.5	55.0		
0.7	66.1		
1.0	79.8		
1.4	107.2		
1.9	125.6		
2.4	139.7		
2.9	149.5		
3.3	158.2		
3.8	163.3		
4.3	166.5		
4.8	168.5		
5.2	168.2		
5.7	167.2		
6.2	166.2		
6.7	165.1		

Remarks

06/11/2020

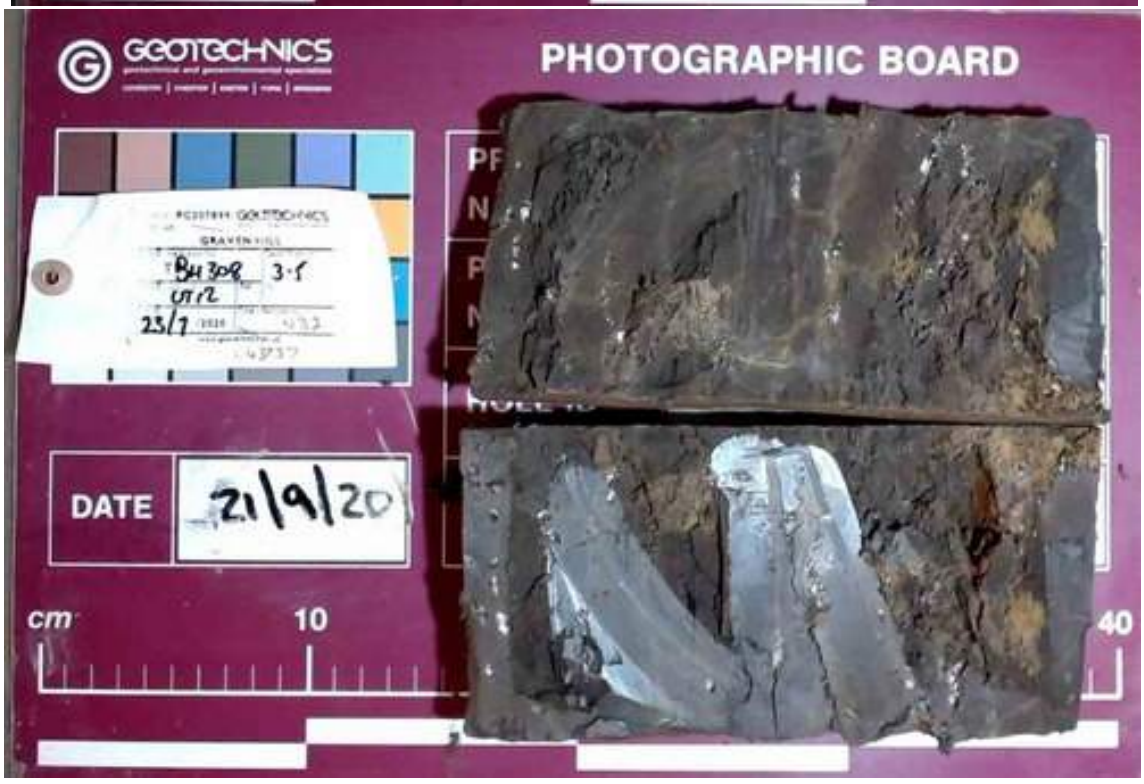
GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH308
Sample Depth	3.50-3.95m
Sample Type	UT
Sample Ref	C43737



Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

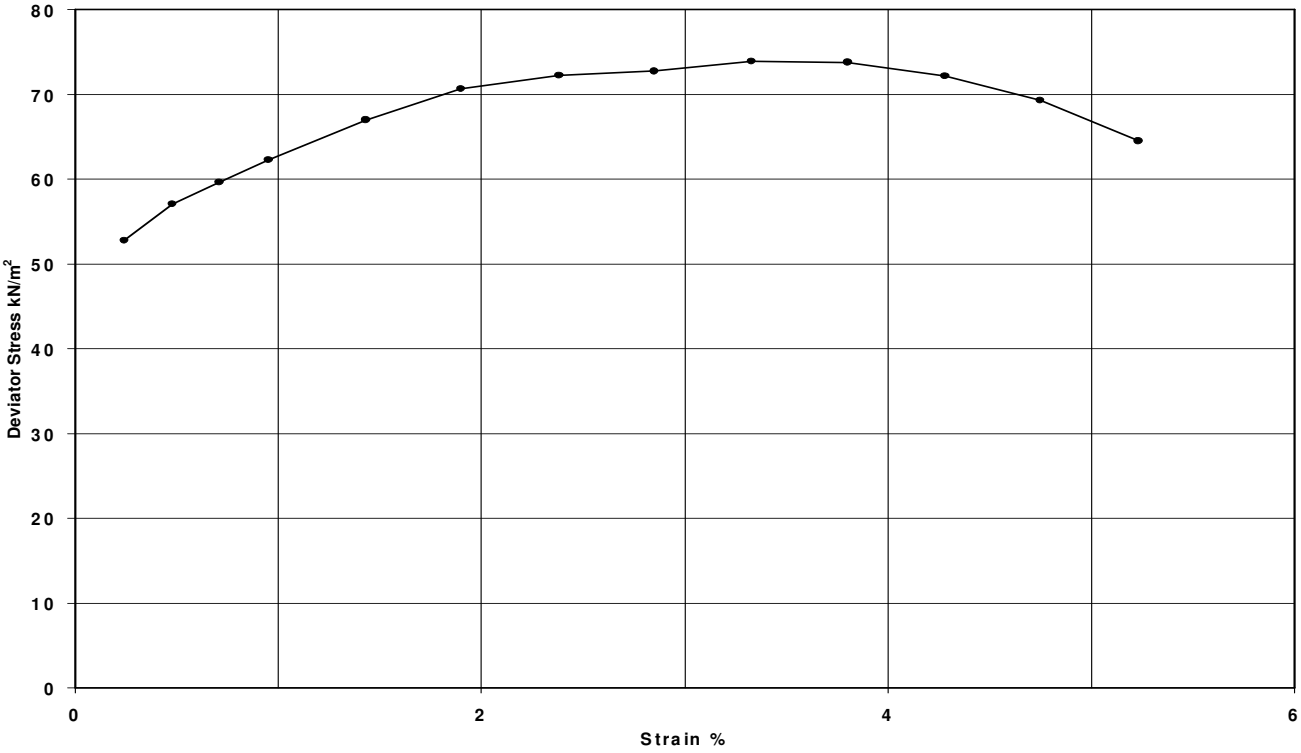
Hole BH309
Sample Depth 1.20-1.65m
Sample Type UT
Sample Ref C44107

Sample Description

The following samples were combined to perform this test:

Light brown mottled grey slightly sandy CLAY.

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.92		
Initial Length	(mm)	210.33		
Initial Water Content	(%)	41.6		
Initial Bulk Density	(Mg/m³)	1.81		
Initial Dry Density	(Mg/m³)	1.28		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	30		
'Specimen Height' at start of Shearing Stage	(mm)	210.38		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.9		
Corrected Deviator Stress	(kPa)	74		
Undrained Shear Strength	(kPa)	37		
Strain at Failure	(%)	3.3		
Failure Zone Water Content	(%)	42.4		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	52.8		
0.5	57.0		
0.7	59.6		
1.0	62.3		
1.4	67.0		
1.9	70.6		
2.4	72.3		
2.9	72.8		
3.3	73.8		
3.8	73.8		
4.3	72.2		
4.8	69.3		
5.2	64.4		

Remarks

06/11/2020

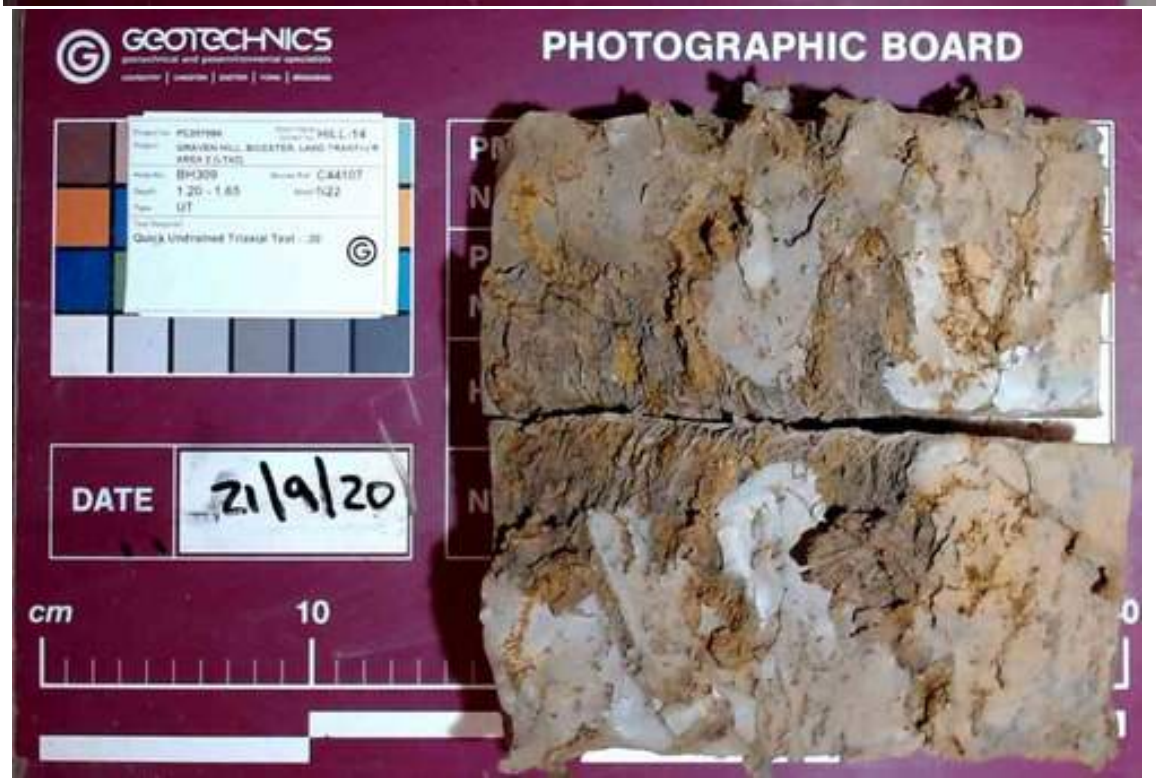
GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH309
Sample Depth	1.20-1.65m
Sample Type	UT
Sample Ref	C44107



Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

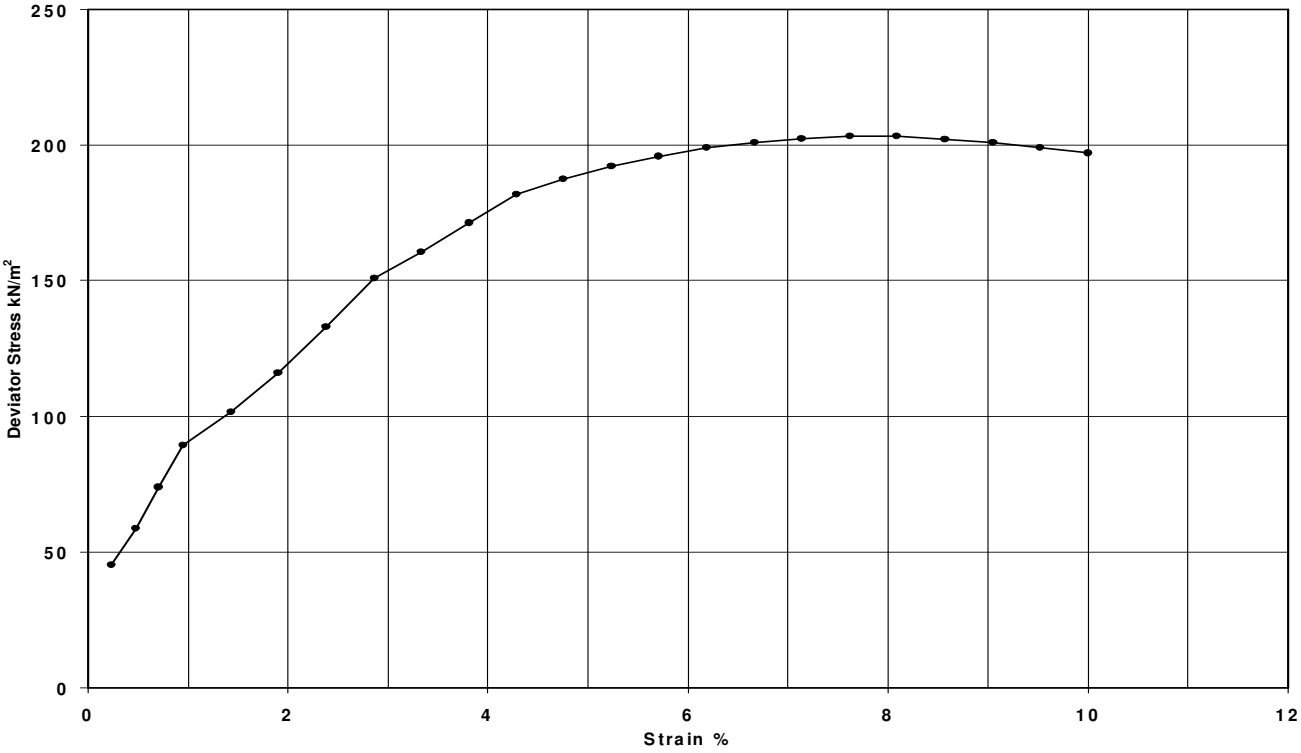
Hole BH309
Sample Depth 3.20-3.65m
Sample Type UT
Sample Ref C44105

Sample Description

The following samples were combined to perform this test:

Dark brownish grey slightly sandy CLAY.

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	103.44		
Initial Length	(mm)	210.05		
Initial Water Content	(%)	29.0		
Initial Bulk Density	(Mg/m³)	1.97		
Initial Dry Density	(Mg/m³)	1.53		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	70		
'Specimen Height' at start of Shearing Stage	(mm)	210.04		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.9		
Corrected Deviator Stress	(kPa)	203		
Undrained Shear Strength	(kPa)	102		
Strain at Failure	(%)	8.1		
Failure Zone Water Content	(%)	22.5		
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	45.2	10.0	197.1
0.5	58.6		
0.7	73.9		
1.0	89.4		
1.4	101.6		
1.9	115.9		
2.4	132.9		
2.9	151.0		
3.3	160.7		
3.8	171.3		
4.3	181.7		
4.8	187.4		
5.2	192.3		
5.7	195.7		
6.2	199.2		
6.7	201.1		
7.1	202.4		
7.6	203.2		
8.1	203.3		
8.6	202.1		
9.0	200.9		
9.5	199.1		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - *Unconsolidated Undrained Triaxial Test*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH309
Sample Depth	3.20-3.65m
Sample Type	UT
Sample Ref	C44105

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

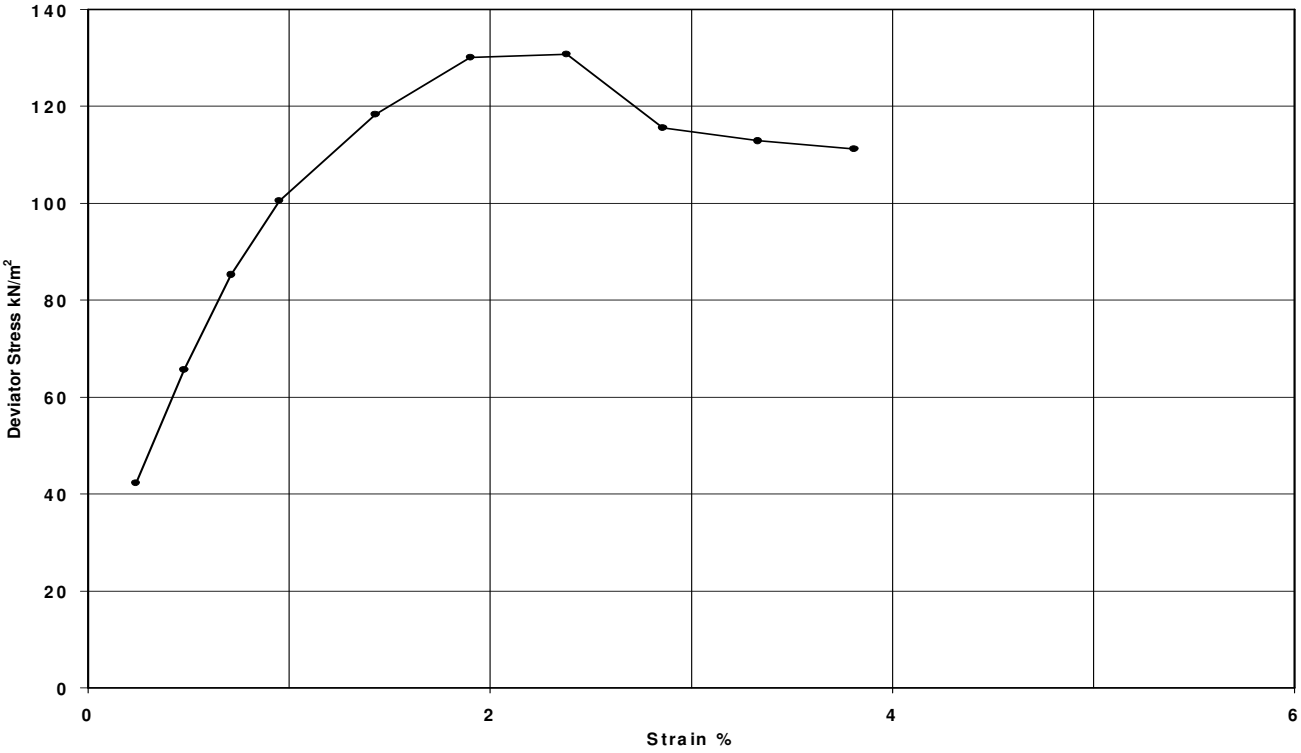
Hole	BH315
Sample Depth	3.50-3.95m
Sample Type	UT
Sample Ref	C43490

Sample Description

Dark grey slightly sandy CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.75		
Initial Length	(mm)	210.04		
Initial Water Content	(%)	25.7		
Initial Bulk Density	(Mg/m³)	1.94		
Initial Dry Density	(Mg/m³)	1.54		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	70		
'Specimen Height' at start of Shearing Stage	(mm)	210.54		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.2		
Corrected Deviator Stress	(kPa)	131		
Undrained Shear Strength	(kPa)	65		
Strain at Failure	(%)	2.4		
Failure Zone Water Content	(%)	25.3		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	42.2		
0.5	65.6		
0.7	85.3		
1.0	100.4		
1.4	118.4		
1.9	130.1		
2.4	130.7		
2.9	115.5		
3.3	112.9		
3.8	111.2		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH315
Sample Depth	3.50-3.95m
Sample Type	UT
Sample Ref	C43490

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

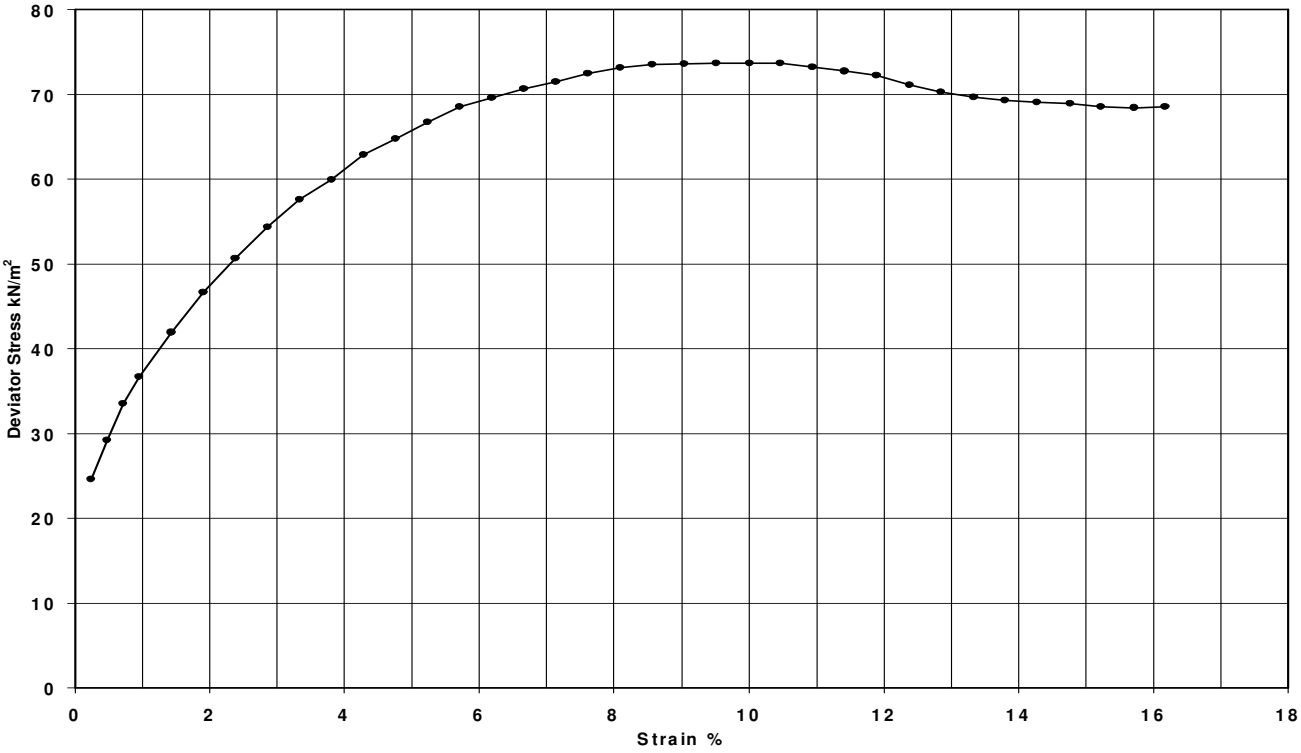
Hole	BH313
Sample Depth	2.30-2.75m
Sample Type	UT
Sample Ref	C46606

Sample Description

The following samples were combined to perform this test:

Brown mottled orangish brown slightly sandy CLAY.

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	101.76		
Initial Length	(mm)	210.08		
Initial Water Content	(%)	27.8		
Initial Bulk Density	(Mg/m³)	1.86		
Initial Dry Density	(Mg/m³)	1.46		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	50		
'Specimen Height' at start of Shearing Stage	(mm)	210.02		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	74		
Undrained Shear Strength	(kPa)	37		
Strain at Failure	(%)	10.0		
Failure Zone Water Content	(%)	28.8		
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	24.6	10.0	73.7
0.5	29.2	10.5	73.7
0.7	33.5	10.9	73.2
1.0	36.6	11.4	72.7
1.4	42.0	11.9	72.2
1.9	46.6	12.4	71.1
2.4	50.6	12.9	70.2
2.9	54.4	13.3	69.6
3.3	57.6	13.8	69.3
3.8	60.0	14.3	69.1
4.3	62.9	14.8	68.9
4.8	64.8	15.2	68.6
5.2	66.7	15.7	68.4
5.7	68.5	16.2	68.5
6.2	69.6		
6.7	70.6		
7.1	71.5		
7.6	72.5		
8.1	73.2		
8.6	73.5		
9.0	73.6		
9.5	73.6		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH313
Sample Depth	2.30-2.75m
Sample Type	UT
Sample Ref	C46606

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

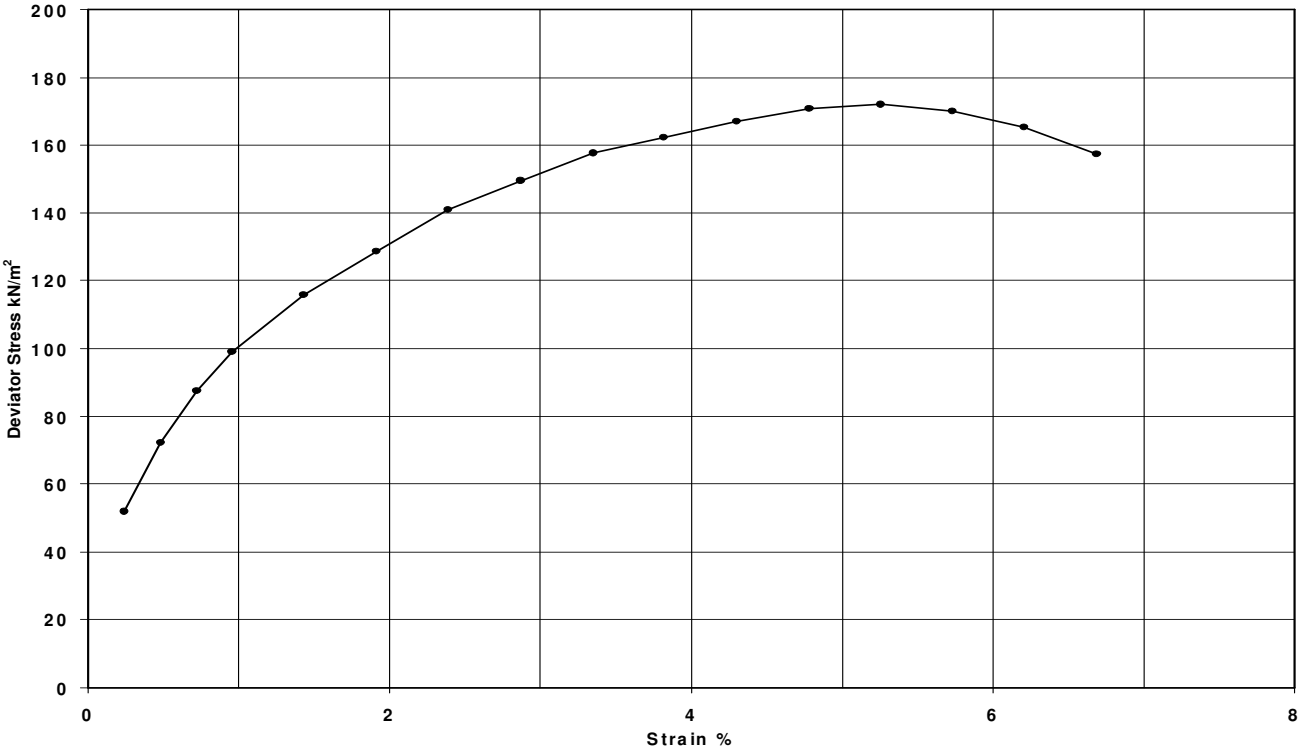
Hole BH314
Sample Depth 2.40-2.85m
Sample Type UT
Sample Ref C43488

Sample Description

Light orangish brown slightly sandy CLAY.

The following samples were combined to perform this test:

BS1377 Part 8 1990 : Clause 8.0



		Stage 1	Stage 2	Stage 3
Test Type		Multi-stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.27	102.27	102.27
Initial Length	(mm)	209.25	209.25	209.25
Initial Water Content	(%)	23.6	23.6	23.6
Initial Bulk Density	(Mg/m³)	2.03	2.03	2.03
Initial Dry Density	(Mg/m³)	1.64		
Particle Density	(Mg/m³)			
Cell Pressure	(kPa)	50	100	150
'Specimen Height' at start of Shearing Stage	(mm)			
Membrane Thickness/Correction	(mm/kPa)	0.30 / 0.39	0.30 / 0.39	0.30 / 0.45
Rate of Strain	(%/min)	1.86	1.86	1.86
Corrected Deviator Stress	(kPa)	172	170	165
Undrained Shear Strength	(kPa)	86	85	83
Strain at Failure	(%)	5.3	5.7	6.2
Failure Zone Water Content	(%)			
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	51.9		
0.5	72.3		
0.7	87.6		
1.0	99.0		
1.4	115.7		
1.9	128.7		
2.4	141.0		
2.9	149.5		
3.3	157.7		
3.8	162.3		
4.3	167.1		
4.8	170.8		
5.3	171.9		
5.7	170.0		
6.2	165.2		
6.7	157.3		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - *Unconsolidated Undrained Triaxial Test*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

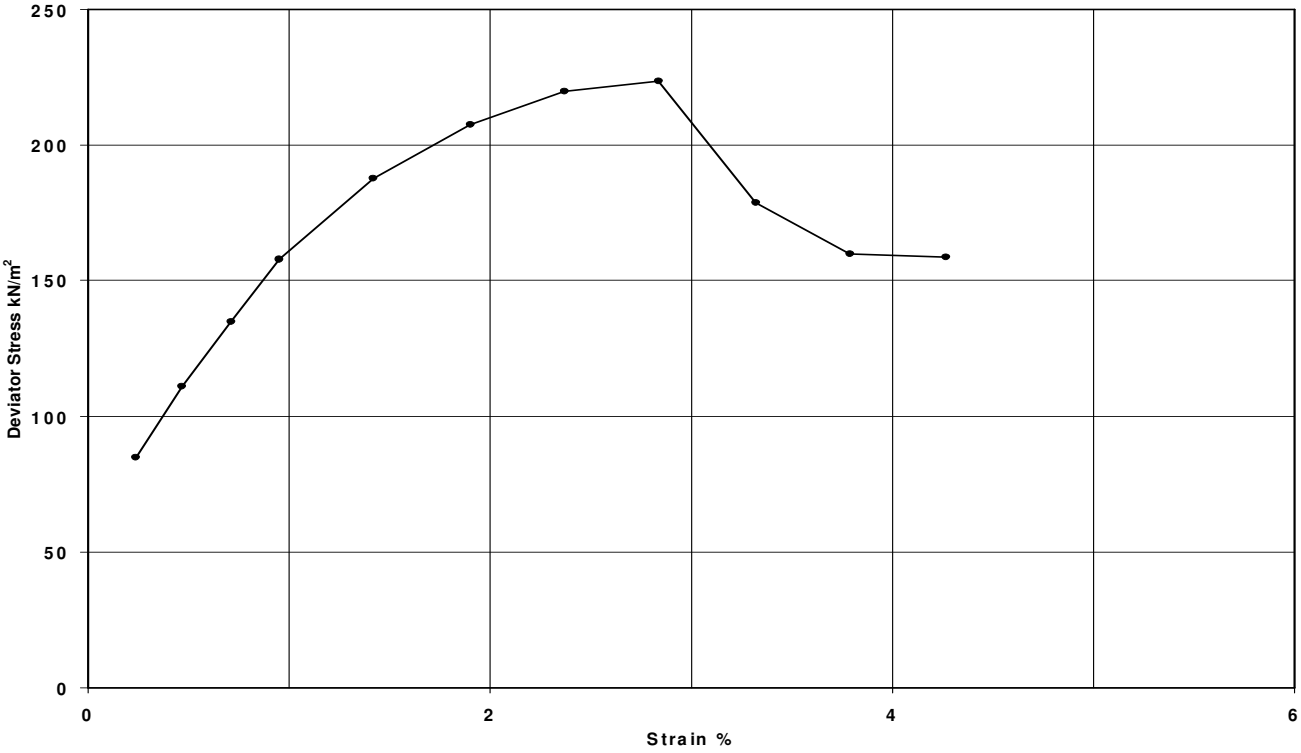
Hole BH314
Sample Depth 4.50-4.95m
Sample Type UT
Sample Ref C43487

Sample Description

Dark greenish grey slightly sandy CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.58		
Initial Length	(mm)	210.97		
Initial Water Content	(%)	21.1		
Initial Bulk Density	(Mg/m³)	2.02		
Initial Dry Density	(Mg/m³)	1.67		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	90		
'Specimen Height' at start of Shearing Stage	(mm)	211.33		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.9		
Corrected Deviator Stress	(kPa)	224		
Undrained Shear Strength	(kPa)	112		
Strain at Failure	(%)	2.8		
Failure Zone Water Content	(%)	23.1		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	84.9		
0.5	110.9		
0.7	134.9		
0.9	158.0		
1.4	187.7		
1.9	207.4		
2.4	219.8		
2.8	223.6		
3.3	178.9		
3.8	159.9		
4.3	158.8		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH314
Sample Depth	4.50-4.95m
Sample Type	UT
Sample Ref	C43487

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

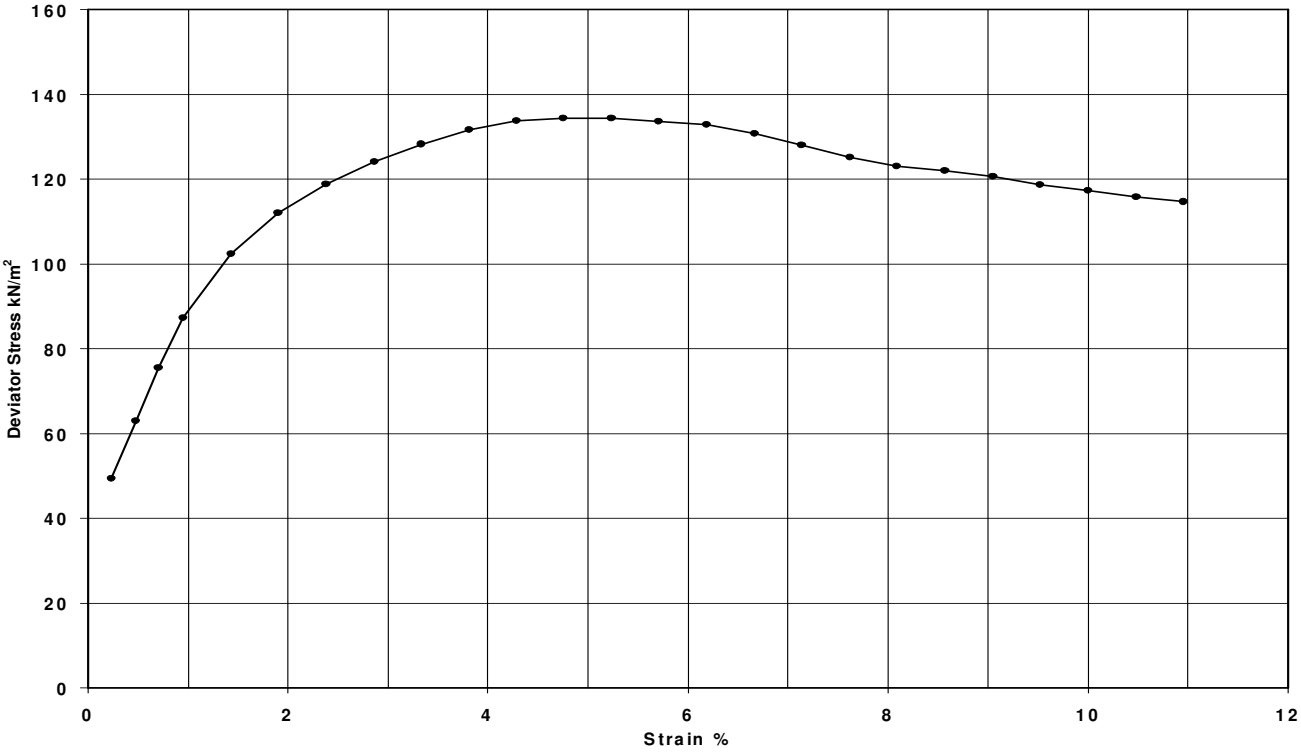
Hole	BH601
Sample Depth	3.40-3.85m
Sample Type	UT
Sample Ref	C46230

Sample Description

The following samples were combined to perform this test:

Orangish grey mottled brown slightly sandy slightly gravelly CLAY.

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.31		
Initial Length	(mm)	210.01		
Initial Water Content	(%)	28.4		
Initial Bulk Density	(Mg/m³)	2.00		
Initial Dry Density	(Mg/m³)	1.56		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	70		
'Specimen Height' at start of Shearing Stage	(mm)	209.99		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	134		
Undrained Shear Strength	(kPa)	67		
Strain at Failure	(%)	4.8		
Failure Zone Water Content	(%)	27.8		
Water Content (after test)	(%)			
Mode of Failure		Brittle		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	49.3	10.0	117.4
0.5	63.0	10.5	115.7
0.7	75.4	11.0	114.7
1.0	87.3		
1.4	102.4		
1.9	111.9		
2.4	118.9		
2.9	124.0		
3.3	128.2		
3.8	131.7		
4.3	133.7		
4.8	134.4		
5.2	134.3		
5.7	133.5		
6.2	132.9		
6.7	130.7		
7.1	128.0		
7.6	125.1		
8.1	123.2		
8.6	121.9		
9.0	120.5		
9.5	118.7		

Remarks

06/11/2020

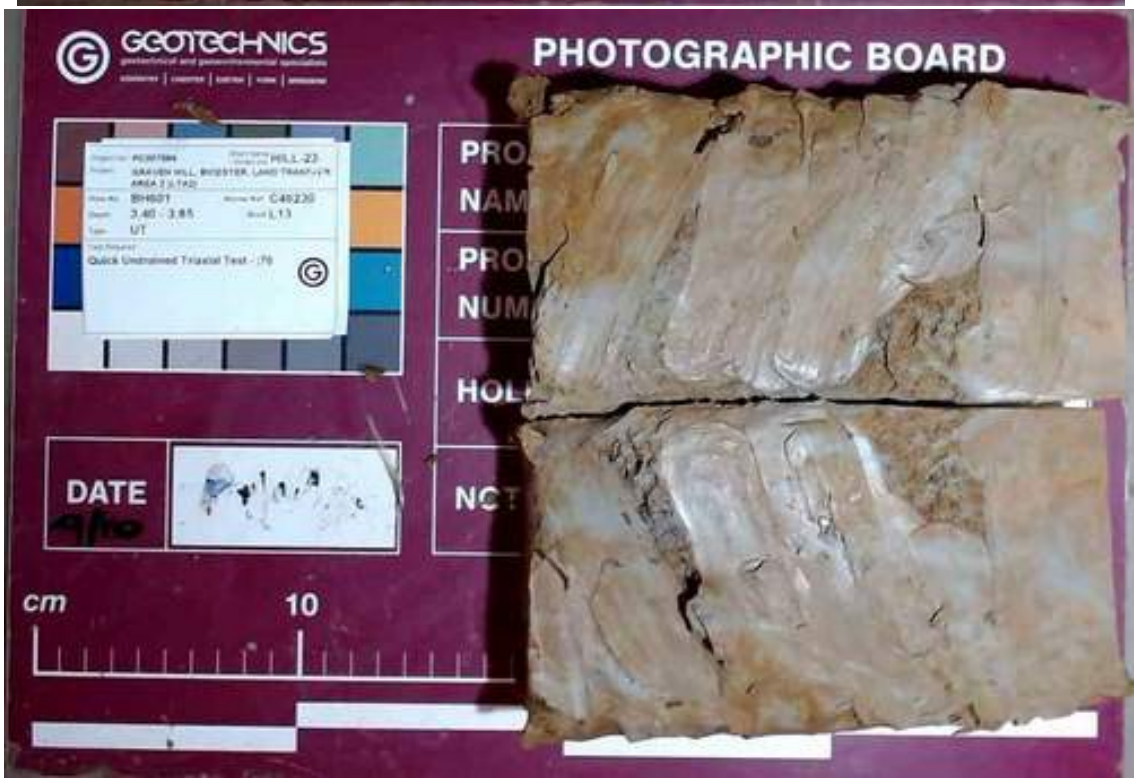
GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH601
Sample Depth	3.40-3.85m
Sample Type	UT
Sample Ref	C46230



Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

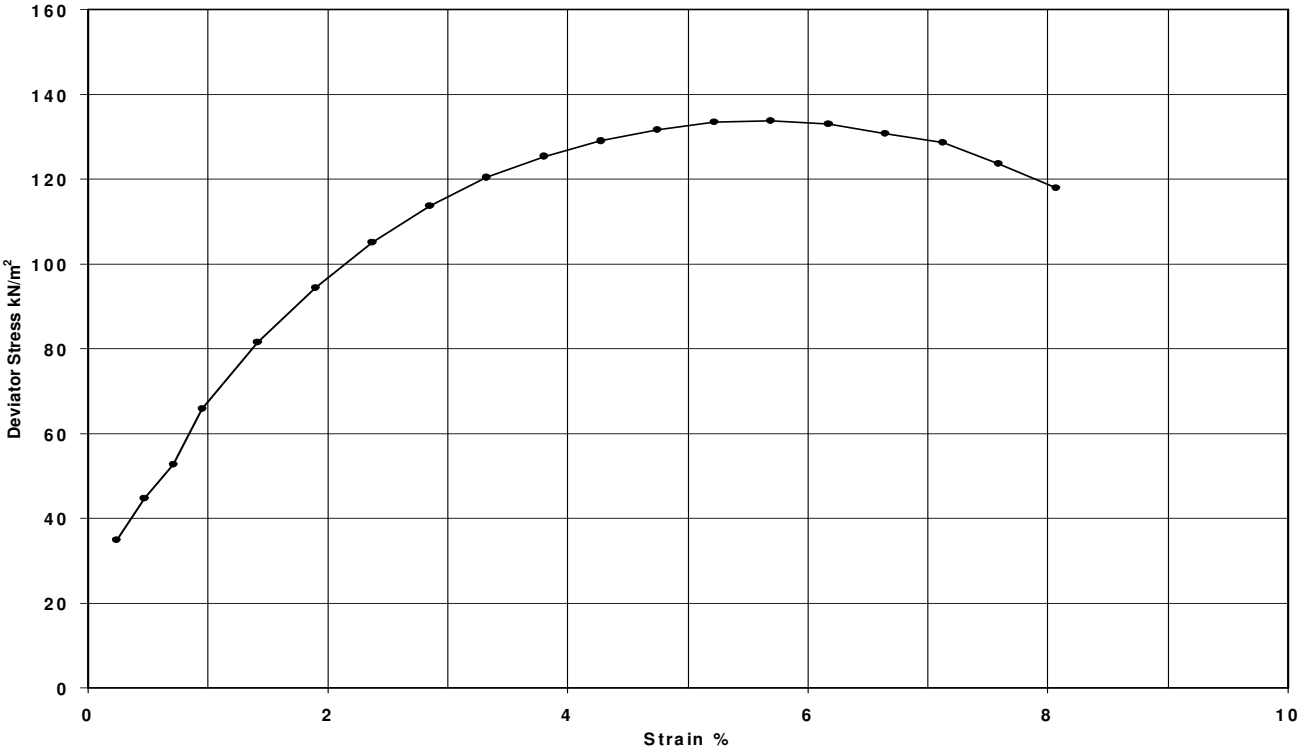
Hole BH604
Sample Depth 2.30-2.75m
Sample Type UT
Sample Ref C44380

Sample Description

Dark brownish grey slightly sandy CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	103.74		
Initial Length	(mm)	210.73		
Initial Water Content	(%)	27.7		
Initial Bulk Density	(Mg/m³)	1.93		
Initial Dry Density	(Mg/m³)	1.51		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	50		
'Specimen Height' at start of Shearing Stage	(mm)	210.61		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	134		
Undrained Shear Strength	(kPa)	67		
Strain at Failure	(%)	5.7		
Failure Zone Water Content	(%)	26.1		
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	34.9		
0.5	44.7		
0.7	52.6		
0.9	65.8		
1.4	81.6		
1.9	94.3		
2.4	105.0		
2.8	113.7		
3.3	120.3		
3.8	125.3		
4.3	129.1		
4.7	131.6		
5.2	133.4		
5.7	133.7		
6.2	132.9		
6.6	130.7		
7.1	128.6		
7.6	123.6		
8.1	117.8		

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - *Unconsolidated Undrained Triaxial Test*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH604
Sample Depth	2.30-2.75m
Sample Type	UT
Sample Ref	C44380

Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

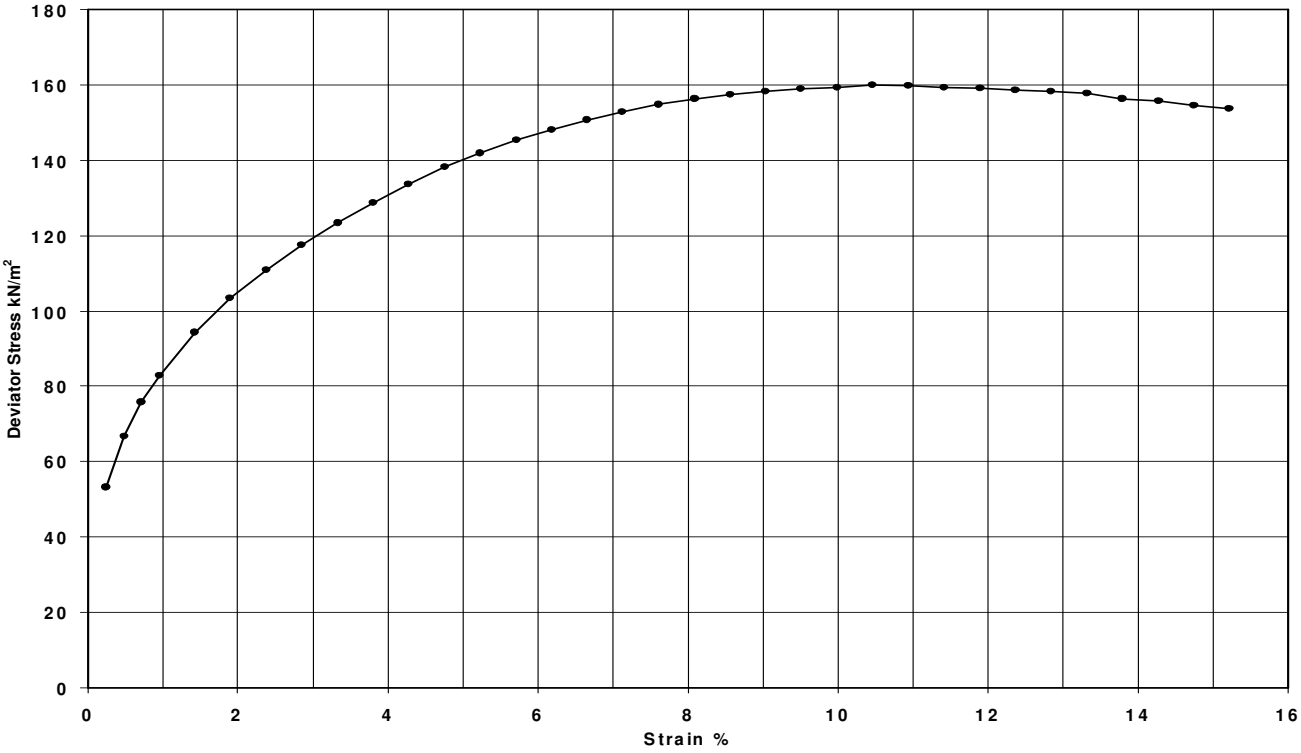
Hole BH605
Sample Depth 2.30-2.75m
Sample Type UT
Sample Ref C46235

Sample Description

The following samples were combined to perform this test:

Light grey mottled orangish brown slightly sandy slightly gravelly CLAY.

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.94		
Initial Length	(mm)	210.25		
Initial Water Content	(%)	22.3		
Initial Bulk Density	(Mg/m³)	1.99		
Initial Dry Density	(Mg/m³)	1.63		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	50		
'Specimen Height' at start of Shearing Stage	(mm)	210.24		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	160		
Undrained Shear Strength	(kPa)	80		
Strain at Failure	(%)	10.5		
Failure Zone Water Content	(%)	26.3		
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	53.1	10.0	159.4
0.5	66.7	10.5	160.0
0.7	75.8	10.9	159.7
1.0	82.8	11.4	159.3
1.4	94.3	11.9	159.2
1.9	103.3	12.4	158.7
2.4	111.0	12.8	158.3
2.9	117.6	13.3	157.8
3.3	123.4	13.8	156.4
3.8	128.7	14.3	155.8
4.3	133.7	14.7	154.5
4.8	138.2	15.2	153.6
5.2	142.0		
5.7	145.2		
6.2	148.0		
6.7	150.7		
7.1	152.9		
7.6	154.7		
8.1	156.3		
8.6	157.4		
9.0	158.2		
9.5	158.9		

Remarks

06/11/2020

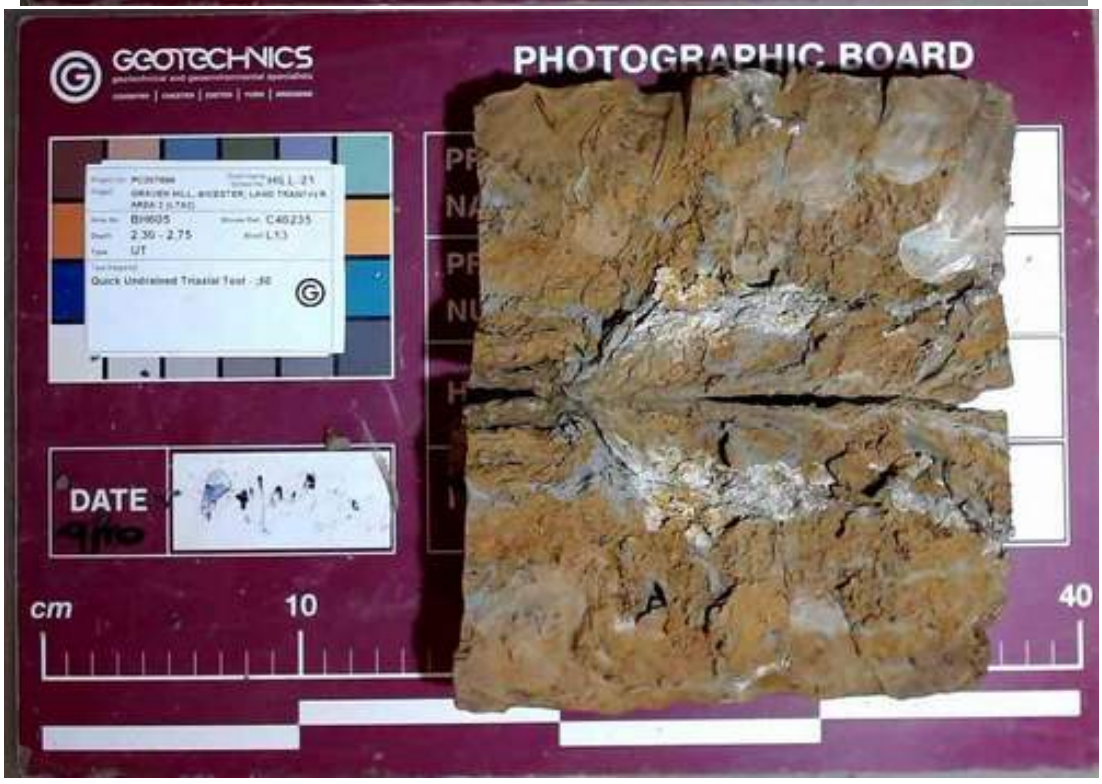
GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH605
Sample Depth	2.30-2.75m
Sample Type	UT
Sample Ref	C46235



Remarks

06/11/2020

GEOTECHNICS

LABORATORY RESULTS - Unconsolidated Undrained Triaxial Test

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

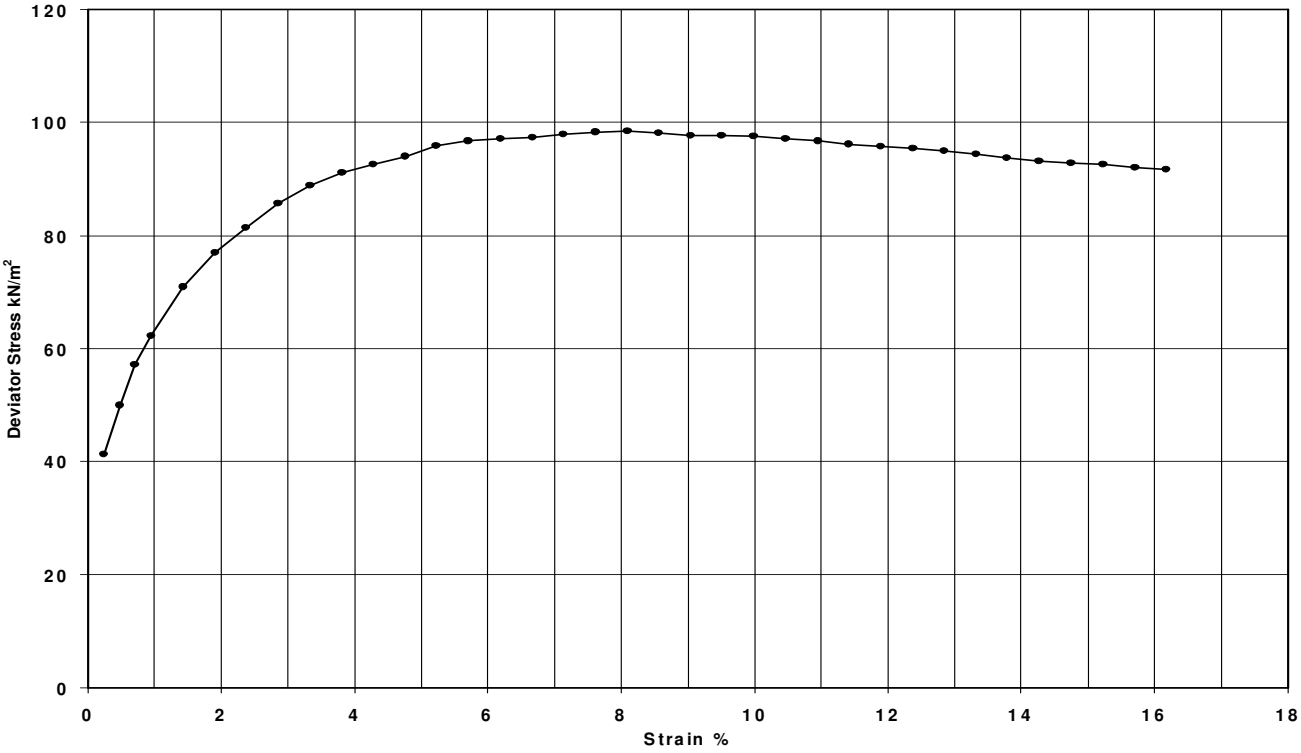
Hole BH605
Sample Depth 4.50-4.95m
Sample Type UT
Sample Ref C46251

Sample Description

Dark grey slightly sandy CLAY.

The following samples were combined to perform this test:

BS EN ISO 17892-8:2018



		Stage 1	Stage 2	Stage 3
Test Type		Single Stage		
Sample Condition		Undisturbed		
Orientation of sample		Vertical		
Initial Diameter	(mm)	102.41		
Initial Length	(mm)	210.23		
Initial Water Content	(%)	27.9		
Initial Bulk Density	(Mg/m³)	1.96		
Initial Dry Density	(Mg/m³)	1.53		
Particle Density	(Mg/m³)	2.65 Assumed		
Cell Pressure	(kPa)	90		
'Specimen Height' at start of Shearing Stage	(mm)	209.89		
Membrane Thickness/Correction	(mm/kPa)	100 / 0.0000		
Rate of Strain	(%/min)	1.4		
Corrected Deviator Stress	(kPa)	98		
Undrained Shear Strength	(kPa)	49		
Strain at Failure	(%)	8.1		
Failure Zone Water Content	(%)	28.3		
Water Content (after test)	(%)			
Mode of Failure		Intermediate		

Strain %	Corrected Deviator Stress kN/m²	Strain %	Corrected Deviator Stress kN/m²
0.2	41.4	10.0	97.6
0.5	50.0	10.5	97.2
0.7	57.1	10.9	96.7
1.0	62.3	11.4	96.1
1.4	70.9	11.9	95.7
1.9	77.0	12.4	95.4
2.4	81.4	12.8	95.0
2.9	85.8	13.3	94.4
3.3	88.8	13.8	93.7
3.8	91.2	14.3	93.2
4.3	92.5	14.7	92.9
4.8	94.1	15.2	92.6
5.2	95.9	15.7	92.0
5.7	96.8	16.2	91.7
6.2	97.2		
6.7	97.3		
7.1	97.9		
7.6	98.3		
8.1	98.5		
8.6	98.2		
9.0	97.7		
9.5	97.8		

Remarks

06/11/2020

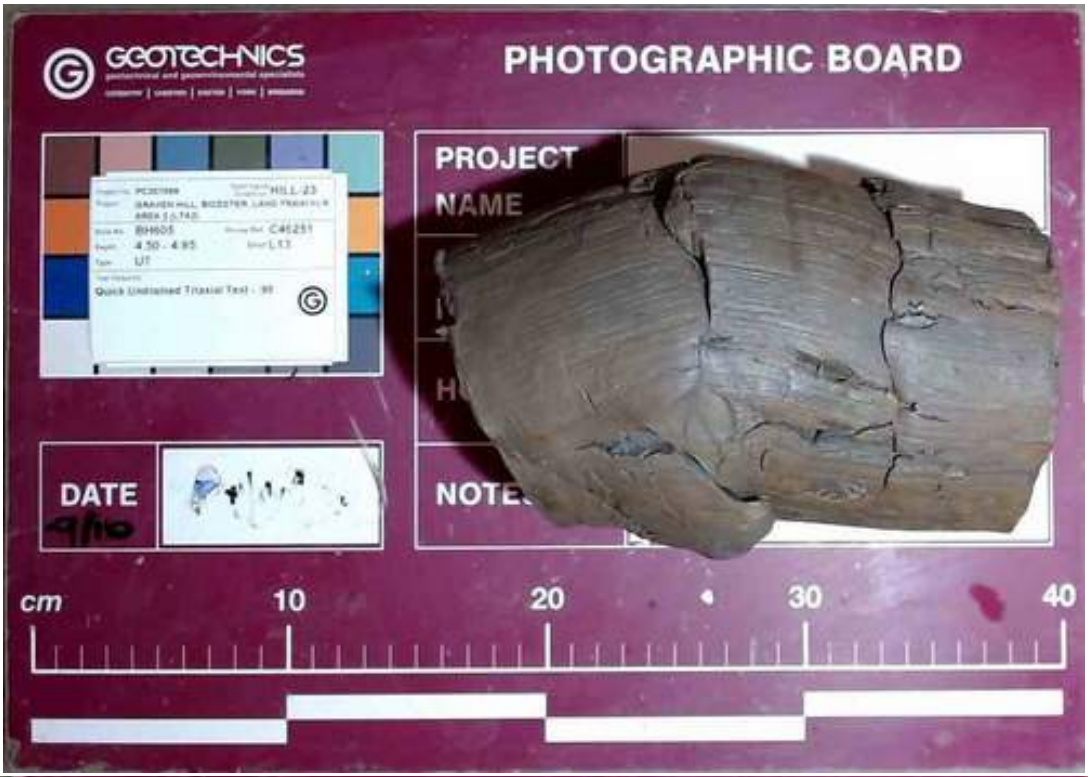
GEOTECHNICS

LABORATORY RESULTS - *Unconsolidated Undrained Triaxial Test*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Project No: PC207899

Hole	BH605
Sample Depth	4.50-4.95m
Sample Type	UT
Sample Ref	C46251



Remarks

06/11/2020

GEOTECHNICS

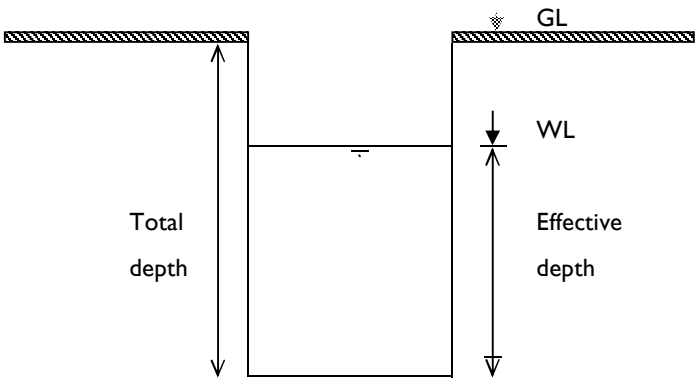
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP608
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	21/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.65	0.95	100.00
1.00	1.65	0.95	100.00
2.00	1.65	0.95	100.00
3.00	1.65	0.95	100.00
4.00	1.65	0.95	100.00
5.00	1.65	0.95	100.00
10.00	1.65	0.95	100.00
15.00	1.65	0.95	100.00
20.00	1.65	0.95	100.00
30.00	1.65	0.95	100.00
45.00	1.65	0.95	100.00
60.00	1.65	0.95	100.00
90.00	1.65	0.95	100.00
120.00	1.65	0.95	100.00
180.00	1.65	0.95	100.00
240.00	1.65	0.95	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.700	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.600	m
Effective depth (Head of Water)	=	0.950	m

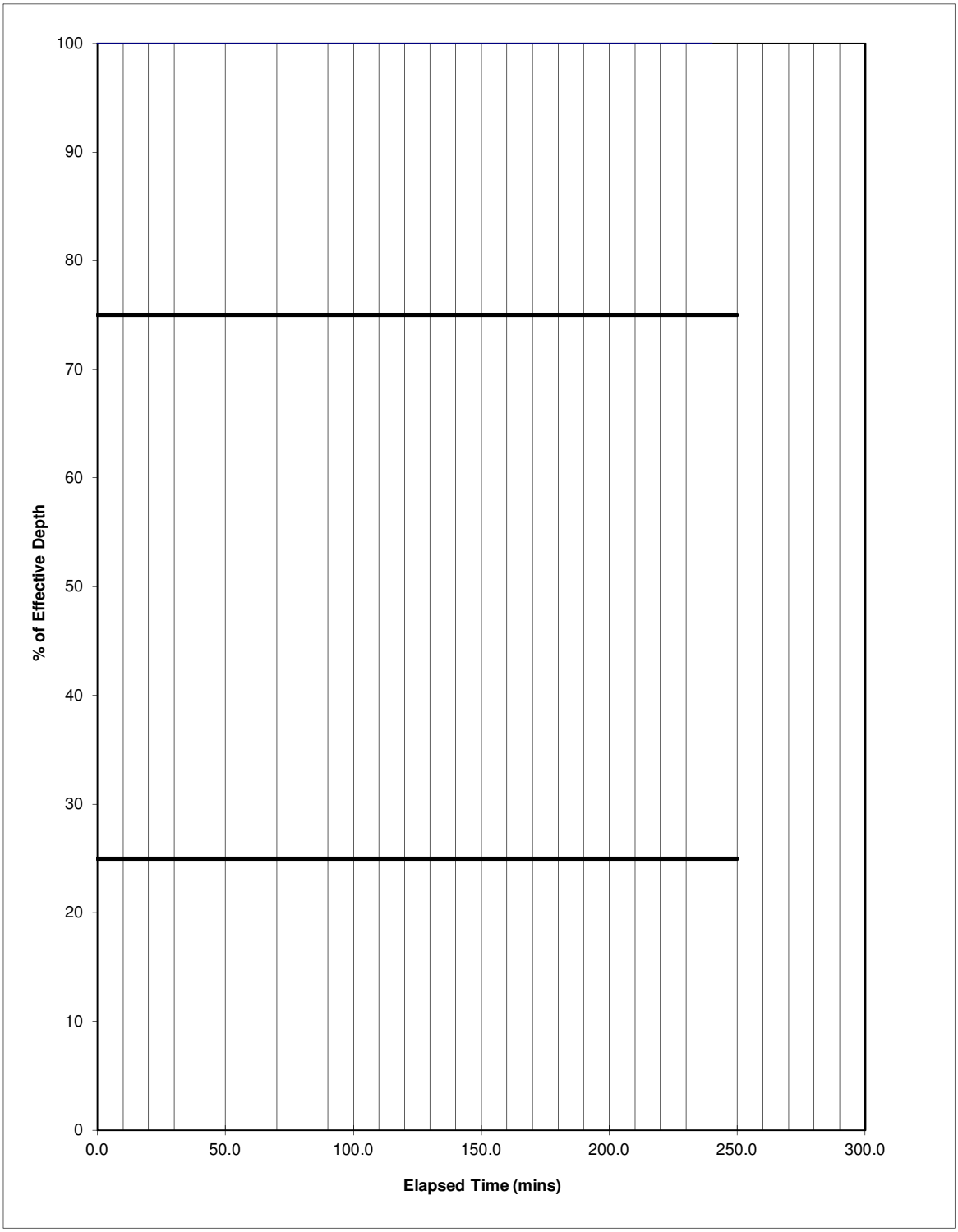
Initial depth from GL	=	1.650m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.713	1.888	
25%	0.238	2.363	
Vp75-25	=	m3	
ap50	=	m2	
tp75-25	=	min	
Soil Infiltration, f	=	*	m/sec

Remarks *No infiltration rate calculated as no fall in the water level recorded.

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP608
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	21/07/2020



tp75	=
tp25	=

Remarks *No infiltration rate calculated as no fall in the water level recorded.

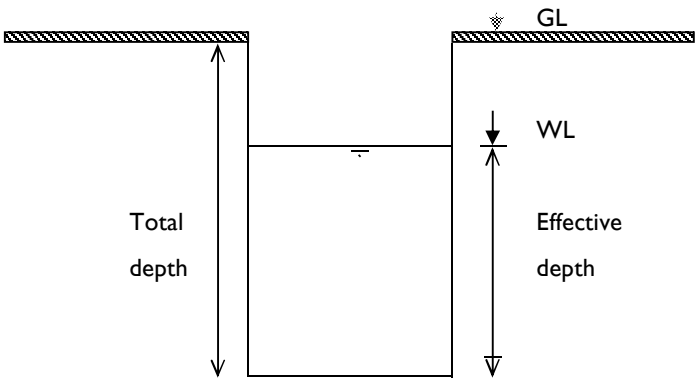
INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP610
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	21/07/2020

ELAPSED TIME (mins)	DEPTH of water below ground level (m)	HEAD (m)	HEAD (%)
0.00	1.60	0.90	100.00
1.00	1.60	0.90	100.00
2.00	1.60	0.90	100.00
3.00	1.60	0.90	100.00
4.00	1.60	0.90	100.00
5.00	1.60	0.90	100.00
10.00	1.60	0.90	100.00
15.00	1.60	0.90	100.00
20.00	1.60	0.90	100.00
30.00	1.60	0.90	100.00
45.00	1.60	0.90	100.00
60.00	1.60	0.90	100.00
90.00	1.60	0.90	100.00
120.00	1.60	0.90	100.00
180.00	1.60	0.90	100.00
240.00	1.60	0.90	100.00

TRIAL PIT SOAKAWAY



Trial pit length	=	2.500	m
Trial pit width	=	0.600	m
Trial pit depth	=	2.500	m
Effective depth (Head of Water)	=	0.900	m

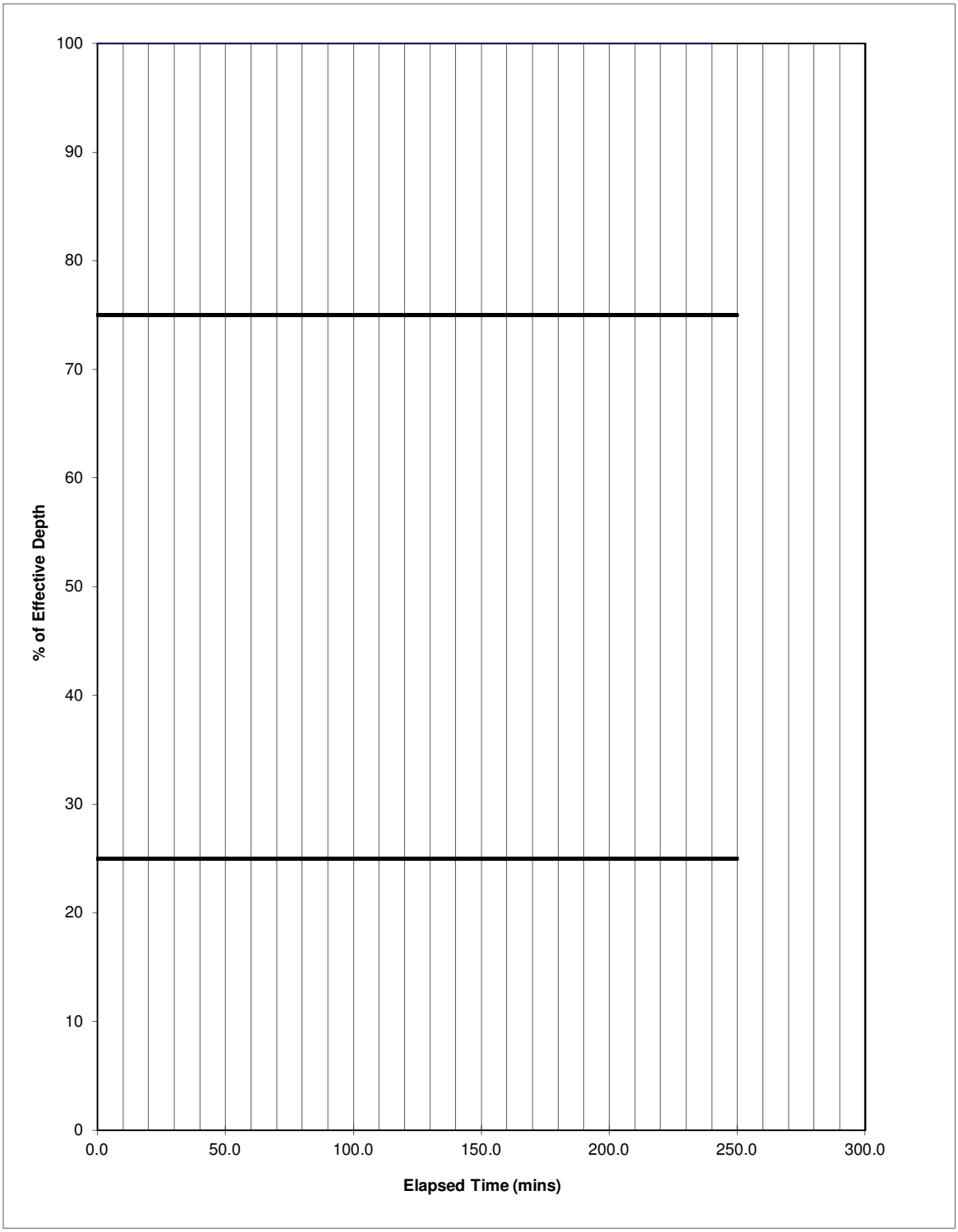
Initial depth from GL	=	1.600m	
% of effective depth	Head (m)	Depth from GL (m)	Time (mins)
75%	0.675	1.825	0.00
25%	0.225	2.275	0.00
Vp75-25	=	0.675	m3
ap50	=	4.290	m2
tp75-25	=	0.000	min
Soil Infiltration, f	=	*	m/sec

Remarks *No infiltration rate calculated as no fall in the water level recorded.

INSITU TESTING - Soakaway Test

Form INS009 Rev 7

Project	Ground Investigation for Graven Hill, Bicester, Land Transfer Area 2 (LTA2)	Trial Pit	TP610
		Test No	1
		Project No	PC207899
Client	Graven Hill Village Development Company Limited	Date	21/07/2020



tp75	=
tp25	=

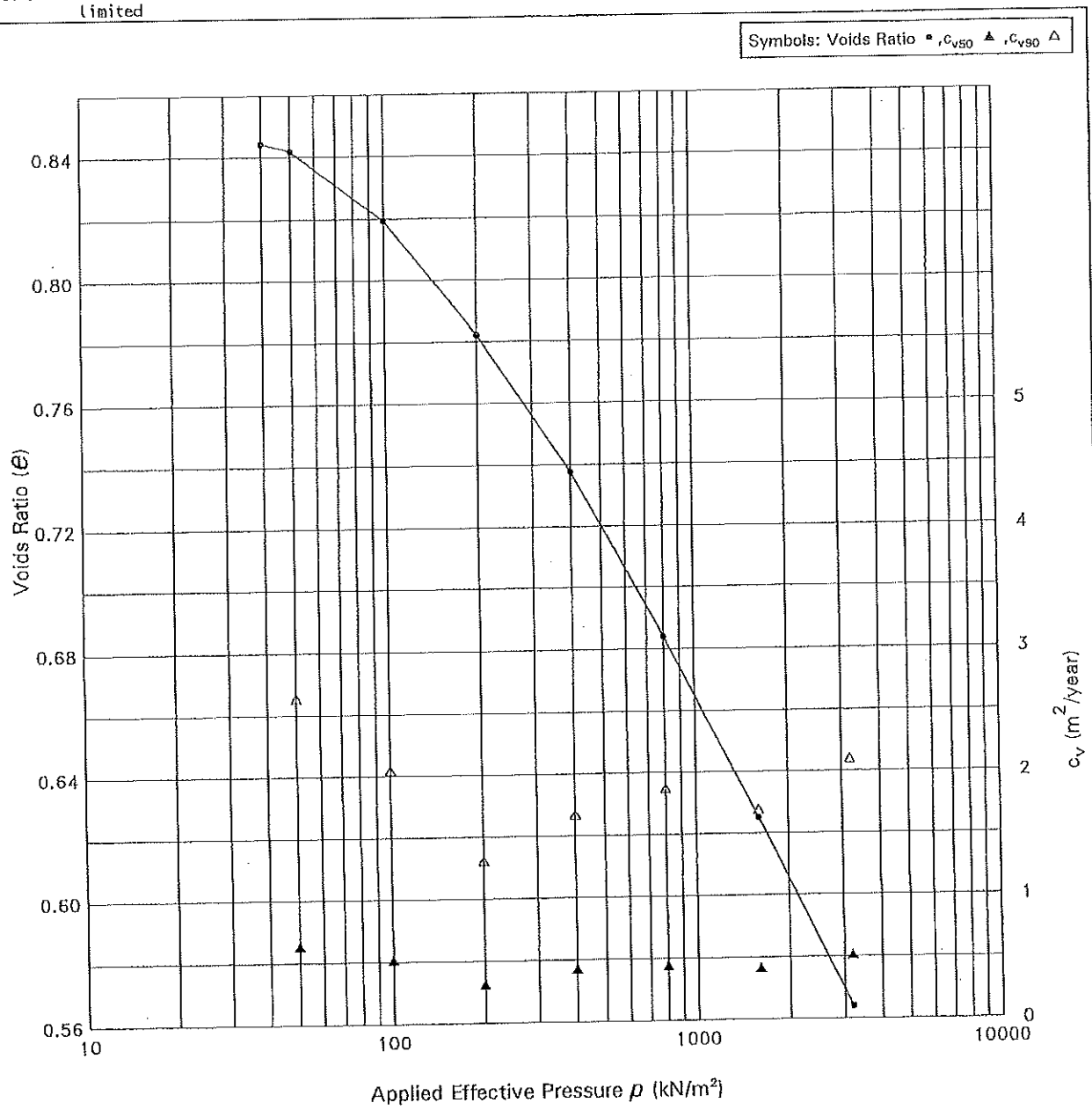
Remarks *No infiltration rate calculated as no fall in the water level recorded.

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project: Graven Hill, Bicester, Land Transfer Area 2 (LTA2)

Client: Graven Hill Village Development Company limited

Project No: PC207899
Borehole: BH303
Sample Depth: 3.60 - 4.05 m
Sample Type: UT



Applied Pressure kN/m²	0-40	40-50	50-100	100-200	200-400	400-800	800-1600	1600-3200		
m_v m²/MN	.00	0.13	0.25	0.20	0.12	0.08	0.04	0.02		
c_{v50} Log Time m²/yr	-	0.63	0.51	0.31	0.43	0.44	0.41	0.51		
c_{v90} Root Time m²/yr	-	2.64	2.04	1.30	1.67	1.87	1.69	2.10		
Voids Ratio	0.844	0.842	0.819	0.782	0.738	0.684	0.625	0.564		

Description
C45666 Dark brown mottled grey slightly sandy CLAY

Specimen Diameter	74.640	mm
Initial Height	15.900	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.844	
Swelling Pressure	40	kN/m^2

Initial Water Content	30.08	%
Final Water Content	23.53	%
Initial Saturation	94.41	%
Initial Bulk Density	1.87	Mg/m^3
Initial Dry Density	1.44	Mg/m^3

Remarks: Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

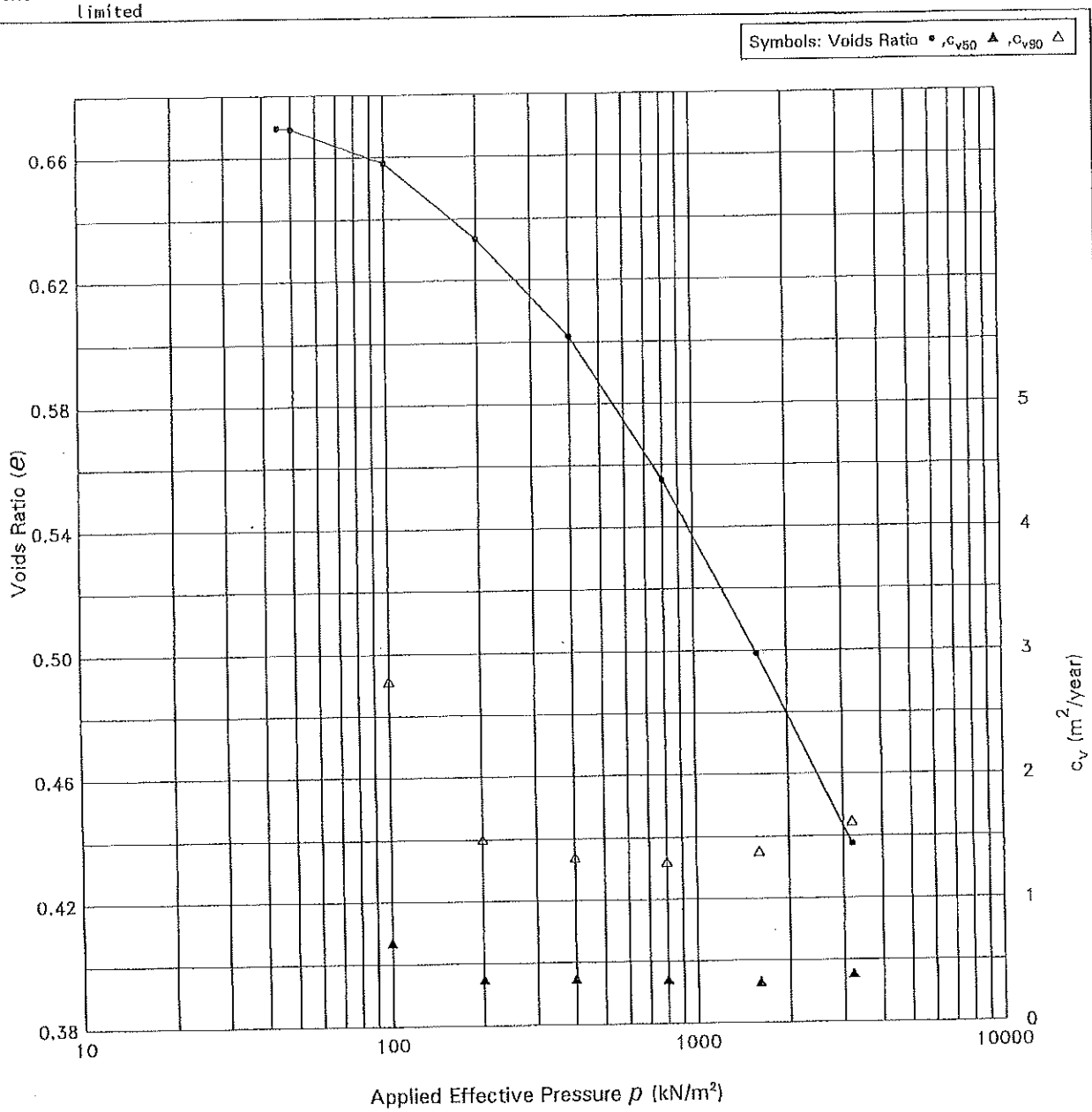
geotechnics

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project Graven Hill, Biscester, Land Transfer Area 2 (LTA2)

Client Graven Hill Village Development Company limited

Project No PC207899
Borehole BH304
Sample Depth 2.30 - 2.75 m
Sample Type UT



Applied Pressure kN/m²	0-45	45-50	50-100	100-200	200-400	400-800	800-1600	1600-3200		
m_v m²/MN	.00	0.05	0.13	0.15	0.10	0.07	0.05	0.03		
c_{v50} Log Time m²/yr	-	-	0.67	0.37	0.37	0.35	0.33	0.38		
c_{v90} Root Time m²/yr	-	-	2.78	1.50	1.34	1.30	1.38	1.62		
Voids Ratio	0.670	0.669	0.658	0.633	0.602	0.555	0.499	0.438		

Description
C45668 Brown mottled grey slightly sandy CLAY

Specimen Diameter	74.550	mm
Initial Height	15.870	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.670	
Swelling Pressure	45	kN/m²

Initial Water Content	25.94	%
Final Water Content	20.23	%
Initial Saturation	100	%
Initial Bulk Density	2.00	Mg/m³
Initial Dry Density	1.59	Mg/m³

Remarks Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

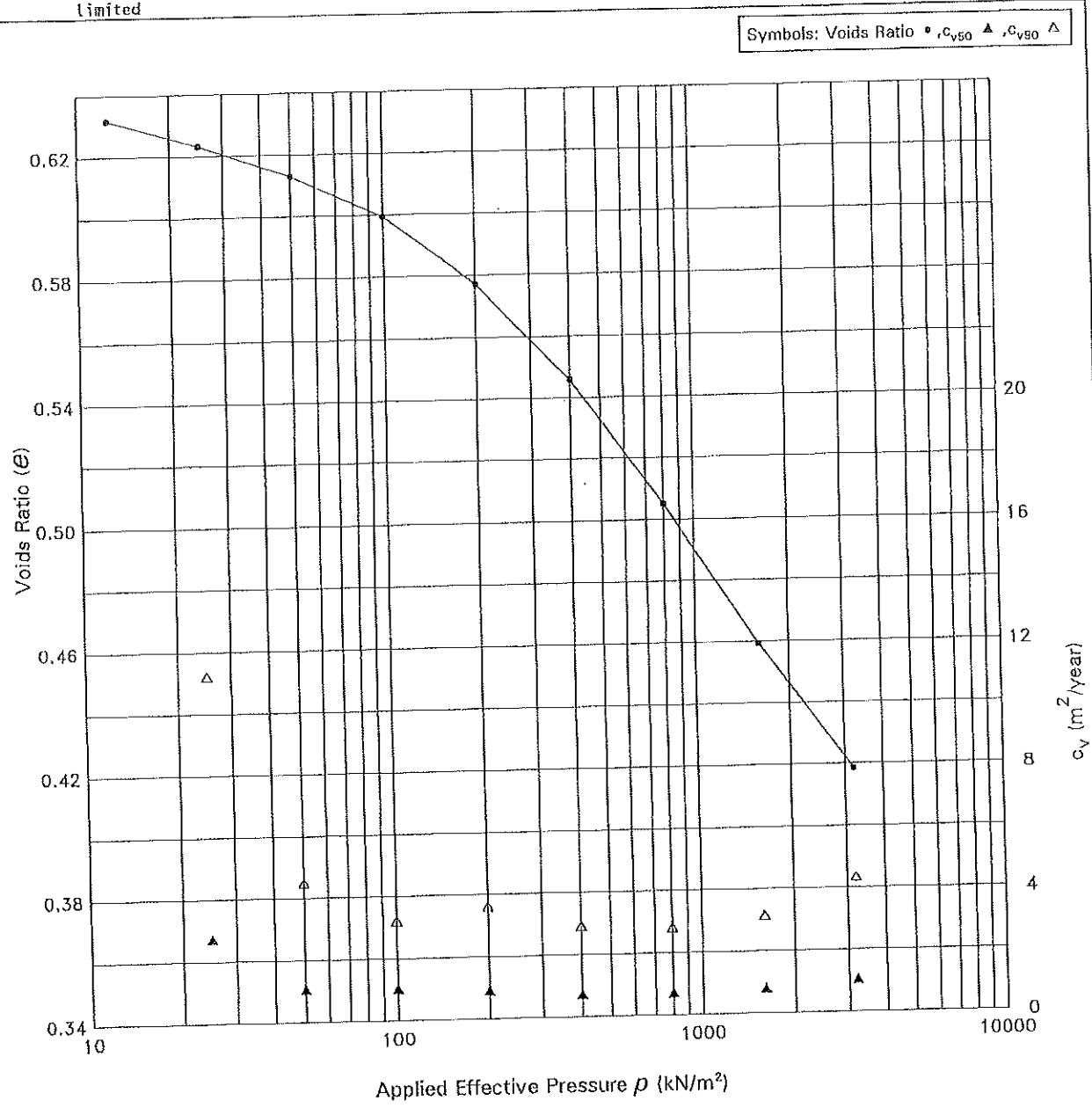
geotechnics

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project: Graven Hill, Biscester, Land Transfer Area 2 (LTA2)

Client: Graven Hill Village Development Company limited

Project No: PC207899
Borehole: BH309
Sample Depth: 3.20 - 3.65 m
Sample Type: UT



Applied Pressure kN/m²	0-12.5	12.5-25	25-50	50-100	100-200	200-400	400-800	800-1600	1600-3200	
m_v m^2/MN	.00	0.42	0.25	0.17	0.14	0.10	0.07	0.04	0.02	
c_{v50} Log Time m^2/yr	-	2.73	1.06	1.01	0.89	0.72	0.70	0.79	1.03	
c_{v90} Root Time m^2/yr	-	11.21	4.49	3.21	3.61	2.92	2.81	3.15	4.34	
Voids Ratio	0.632	0.623	0.613	0.599	0.577	0.546	0.505	0.459	0.419	

Description
C44105 Dark brownish grey slightly sandy CLAY

Specimen Diameter	74.520	mm
Initial Height	15.770	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.632	

Initial Water Content	23.03	%
Final Water Content	18.76	%
Initial Saturation	96.58	%
Initial Bulk Density	2.00	Mg/m^3
Initial Dry Density	1.62	Mg/m^3

Remarks: Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

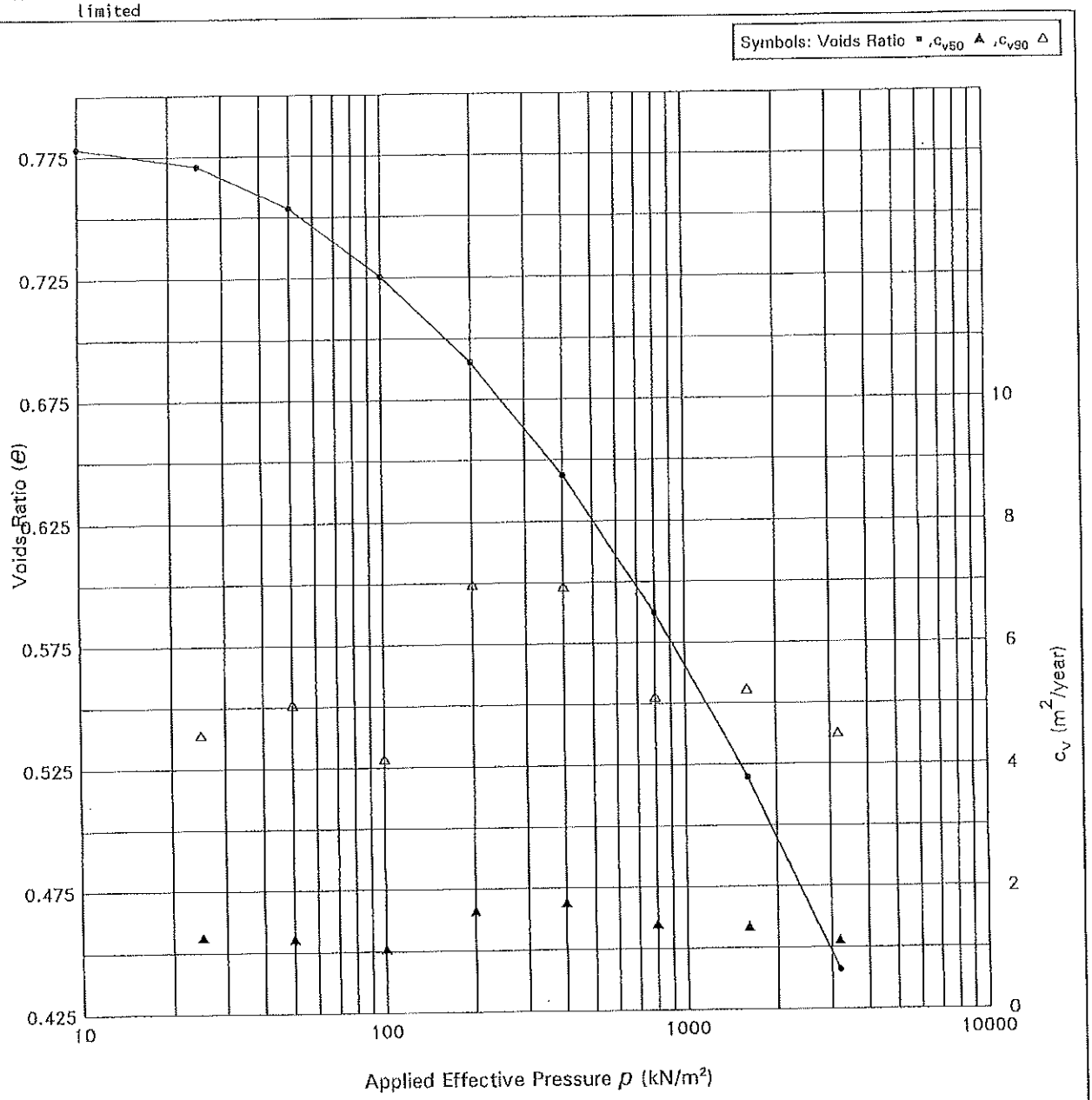
geotechnics

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project: Graven Hill, Biscester, Land Transfer Area 2 (LTA2)

Client: Graven Hill Village Development Company limited

Project No: PC207899
Borehole: BH313
Sample Depth: 2.30 - 2.75 m
Sample Type: UT



Applied Pressure kN/m²	0-10	10-25	25-50	50-100	100-200	200-400	400-800	800-1600	1600-3200	
m_v m^2/MN	.00	0.27	0.39	0.32	0.20	0.14	0.09	0.05	0.03	
c_{v50} Log Time m^2/yr	-	1.25	1.21	1.04	1.64	1.76	1.40	1.34	1.11	
c_{v90} Root Time m^2/yr	-	4.56	5.04	4.14	6.98	6.93	5.11	5.23	4.50	
Voids Ratio	0.778	0.771	0.754	0.726	0.690	0.644	0.587	0.520	0.441	

Description
C46606 Brown mottled orangish brown and grey slightly sandy CLAY

Specimen Diameter	75.010	mm
Initial Height	15.770	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.778	
Swelling Pressure	10	kN/m²

Initial Water Content	29.95	%
Final Water Content	21.00	%
Initial Saturation	100	%
Initial Bulk Density	1.94	Mg/m³
Initial Dry Density	1.49	Mg/m³

Remarks: Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

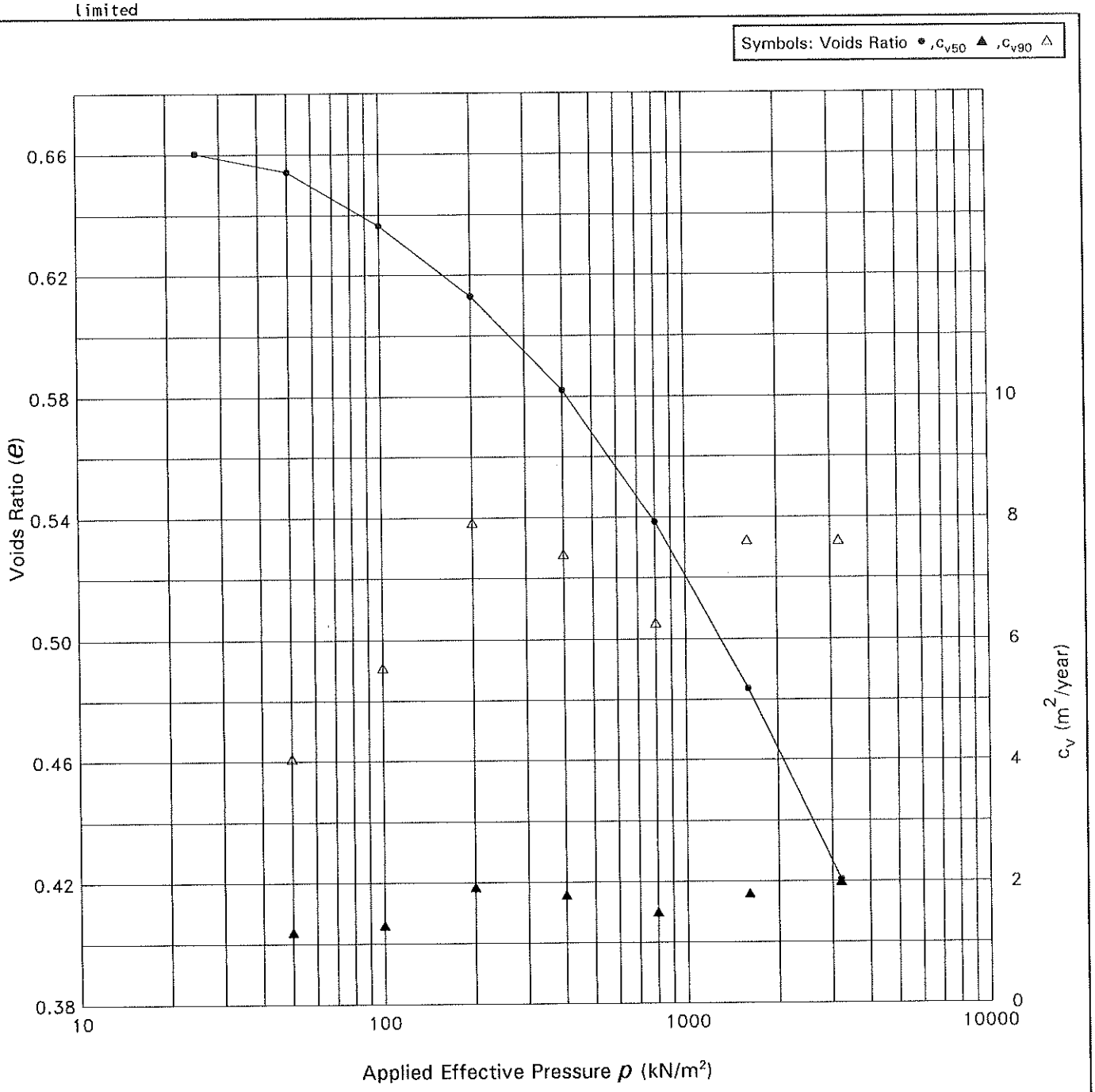
geotechnics

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project Graven Hill, Biscester, Land Transfer Area 2 (LTA2)

Client Graven Hill Village Development Company limited

Project No PC207899
Borehole BH314
Sample Depth 2.40 - 2.85 m
Sample Type UT



Applied Pressure kN/m²	0-25	25-50	50-100	100-200	200-400	400-800	800-1600	1600-3200		
m_v m^2/MN	.00	0.15	0.22	0.14	0.10	0.07	0.04	0.03		
c_{v50} Log Time m^2/yr	-	1.19	1.30	1.92	1.79	1.50	1.80	2.00		
c_{v90} Root Time m^2/yr	-	4.05	5.55	7.92	7.39	6.27	7.62	7.61		
Voids Ratio	0.660	0.654	0.636	0.613	0.582	0.538	0.484	0.421		

Description
C43488 Light orangish brown and grey slightly sandy CLAY

Specimen Diameter	74.570	mm
Initial Height	15.870	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.660	
Swelling Pressure	25	kN/m²

Initial Water Content	25.09	%
Final Water Content	19.46	%
Initial Saturation	100	%
Initial Bulk Density	2.00	Mg/m³
Initial Dry Density	1.60	Mg/m³

Remarks Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

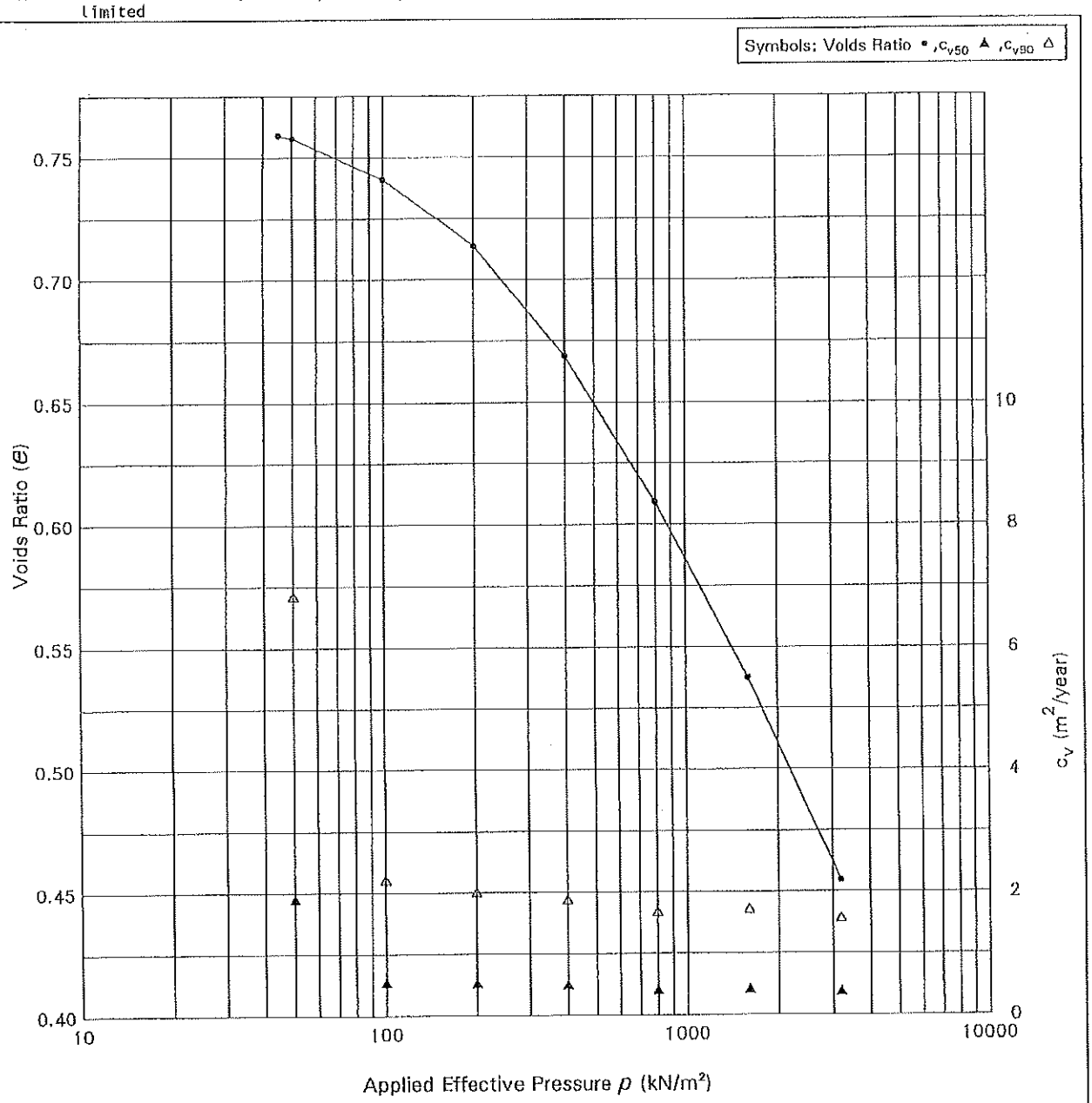
geotechnics

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project: Graven Hill, Biscester, Land Transfer Area 2 (LTA2)

Client: Graven Hill Village Development Company Limited

Project No: PC207899
Borehole: BH601
Sample Depth: 3.40 - 3.85 m
Sample Type: UT



Applied Pressure kN/m²	0-45	45-50	50-100	100-200	200-400	400-800	800-1600	1600-3200		
m_v m²/MN	.00	0.13	0.19	0.16	0.13	0.09	0.06	0.03		
c_{v50} Log Time m²/yr	-	1.90	0.54	0.53	0.50	0.41	0.42	0.38		
c_{v90} Root Time m²/yr	-	6.85	2.21	2.01	1.88	1.68	1.72	1.57		
Voids Ratio	0.759	0.758	0.741	0.714	0.669	0.609	0.537	0.455		

Description
C46230 Orangish grey mottled brown slightly sandy slightly gravelly CLAY

Specimen Diameter	74.520	mm
Initial Height	15.770	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.759	
Swelling Pressure	45	kN/m²

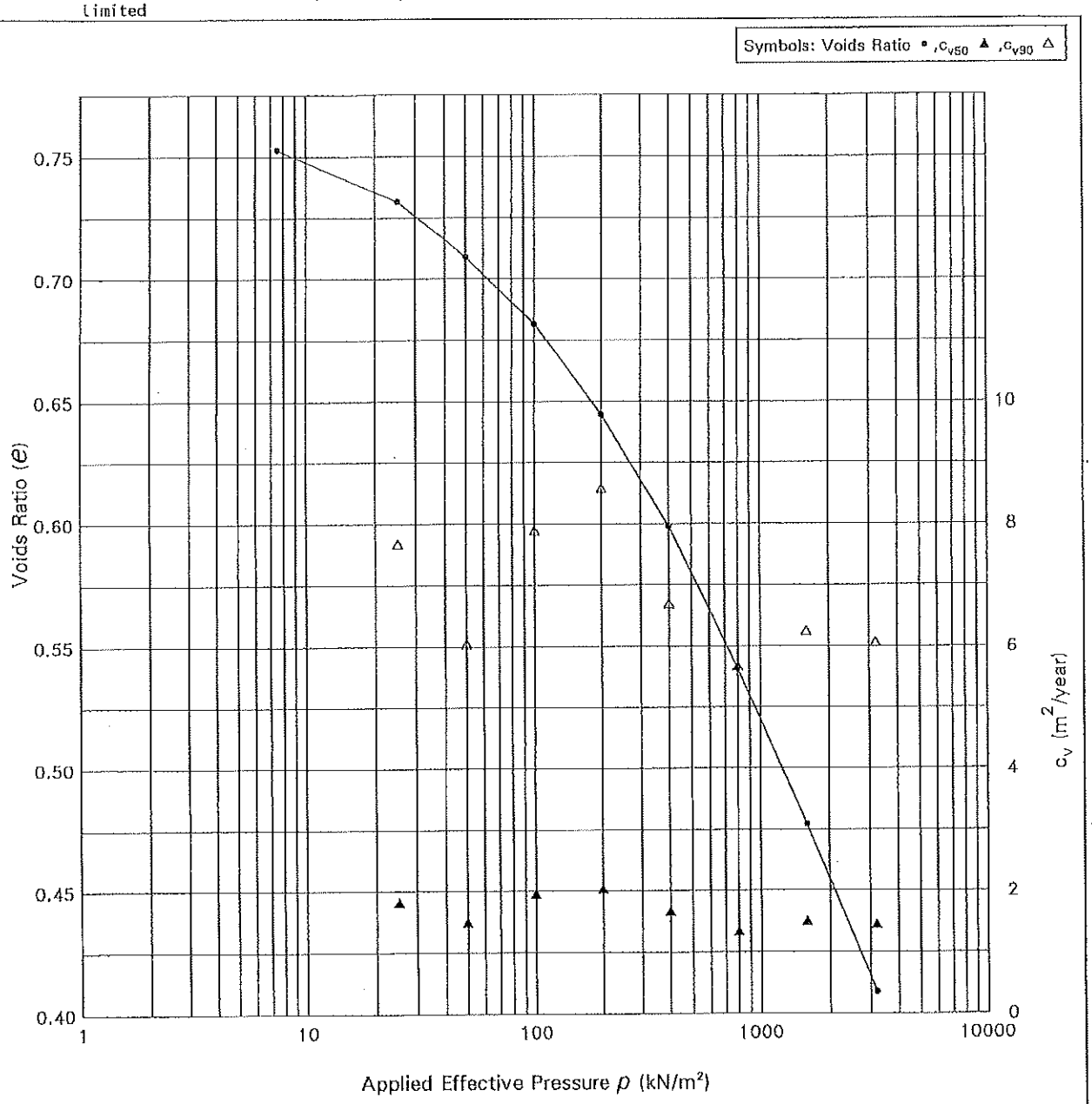
Initial Water Content	30.32	%
Final Water Content	21.72	%
Initial Saturation	100	%
Initial Bulk Density	1.96	Mg/m³
Initial Dry Density	1.51	Mg/m³

Remarks: Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

geotechnics

LABORATORY RESULTS - *Consolidation e/logp Plot*

Project	Graven Hill, Biscester, Land Transfer Area 2 (LTA2)	Project No	PC207899
		Borehole	BH604
		Sample Depth	2.30 - 2.75 m
Client	Graven Hill Village Development Company Limited	Sample Type	UT



Applied Pressure	kN/m²	0-7.5	7.5-25	25-50	50-100	100-200	200-400	400-800	800-1600	1600-3200	
m_v	m^2/MN	.00	0.69	0.52	0.32	0.22	0.14	0.09	0.05	0.03	
c_{v50} Log Time	m^2/yr	-	1.82	1.49	1.95	2.04	1.66	1.34	1.50	1.45	
c_{v90} Root Time	m^2/yr	-	7.68	6.05	7.89	8.58	6.69	5.68	6.25	6.06	
Voids Ratio		0.753	0.732	0.709	0.682	0.645	0.599	0.541	0.477	0.409	

Description
C44380 Dark brownish grey slightly sandy CLAY

Specimen Diameter	74.550	mm
Initial Height	15.830	mm
Particle Density	2.65 Assumed	
Initial Voids Ratio	0.753	
Swelling Pressure	7.5	kN/m^2

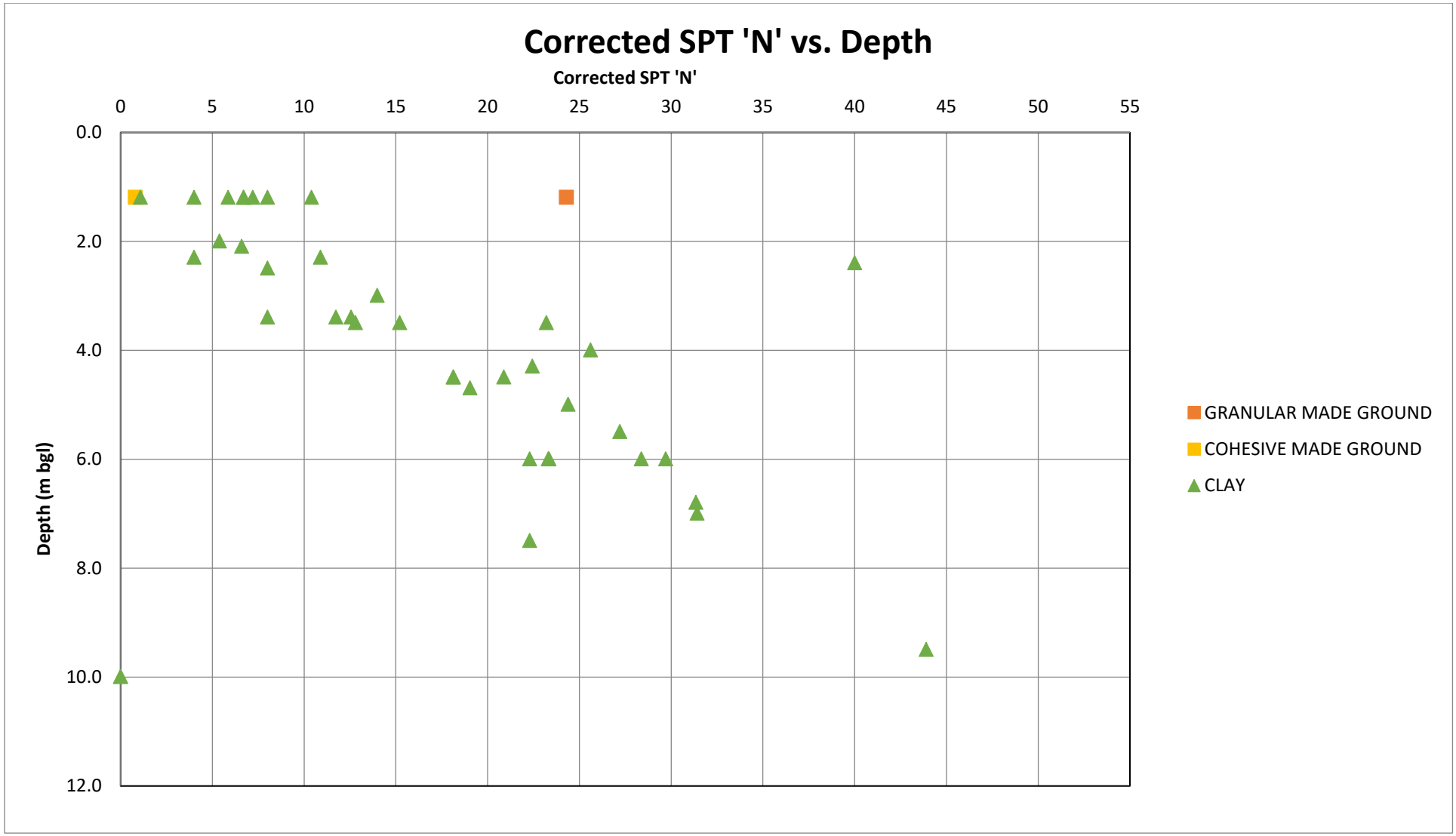
Initial Water Content	27.90	%
Final Water Content	19.98	%
Initial Saturation	98.23	%
Initial Bulk Density	1.93	Mg/m^3
Initial Dry Density	1.51	Mg/m^3

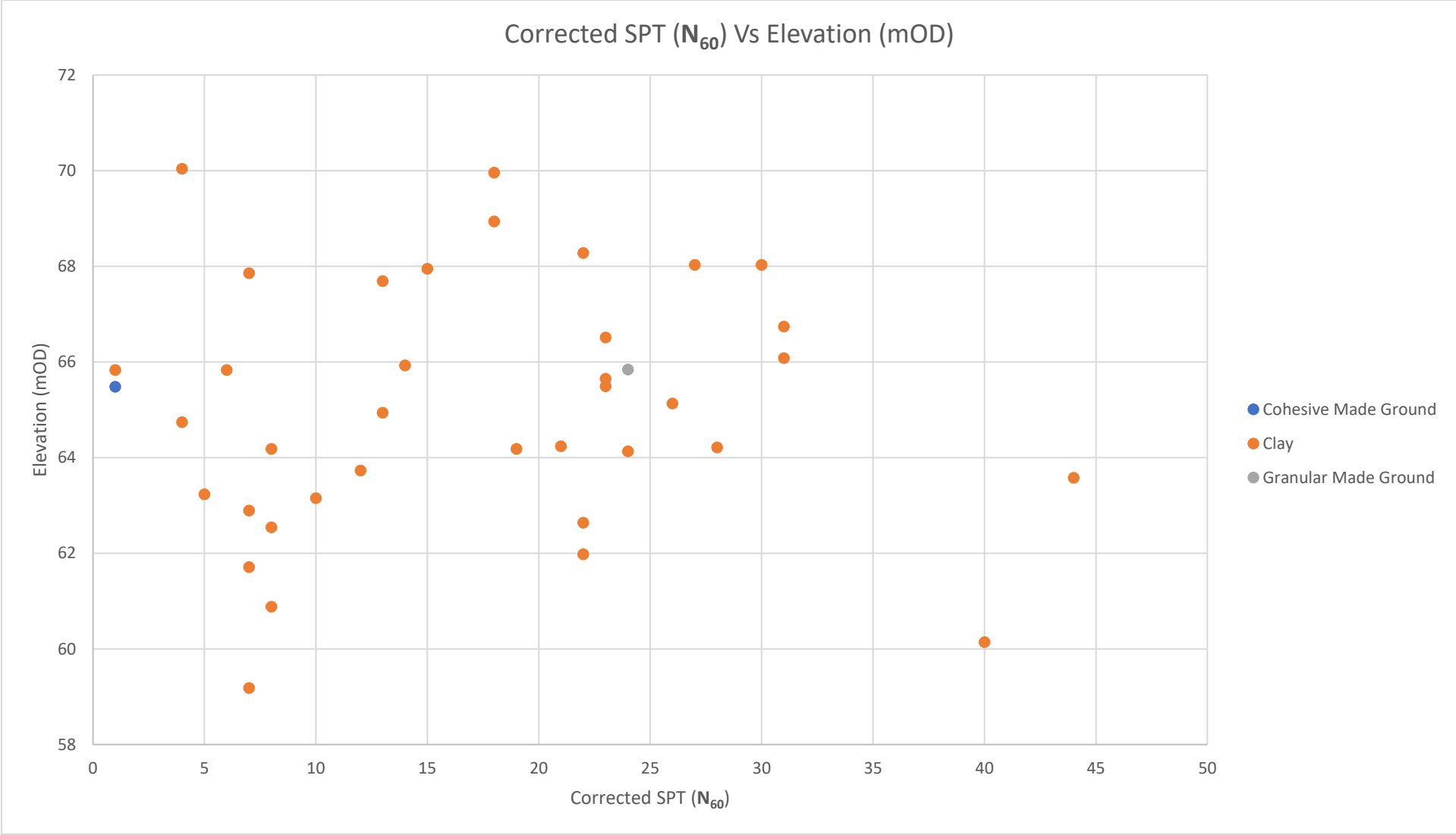
Remarks
Laboratory temperature 20°C ± 3°C
Specimen cut vertically from base of sample
Test performed in accordance with BS EN ISO 17892-5:2017

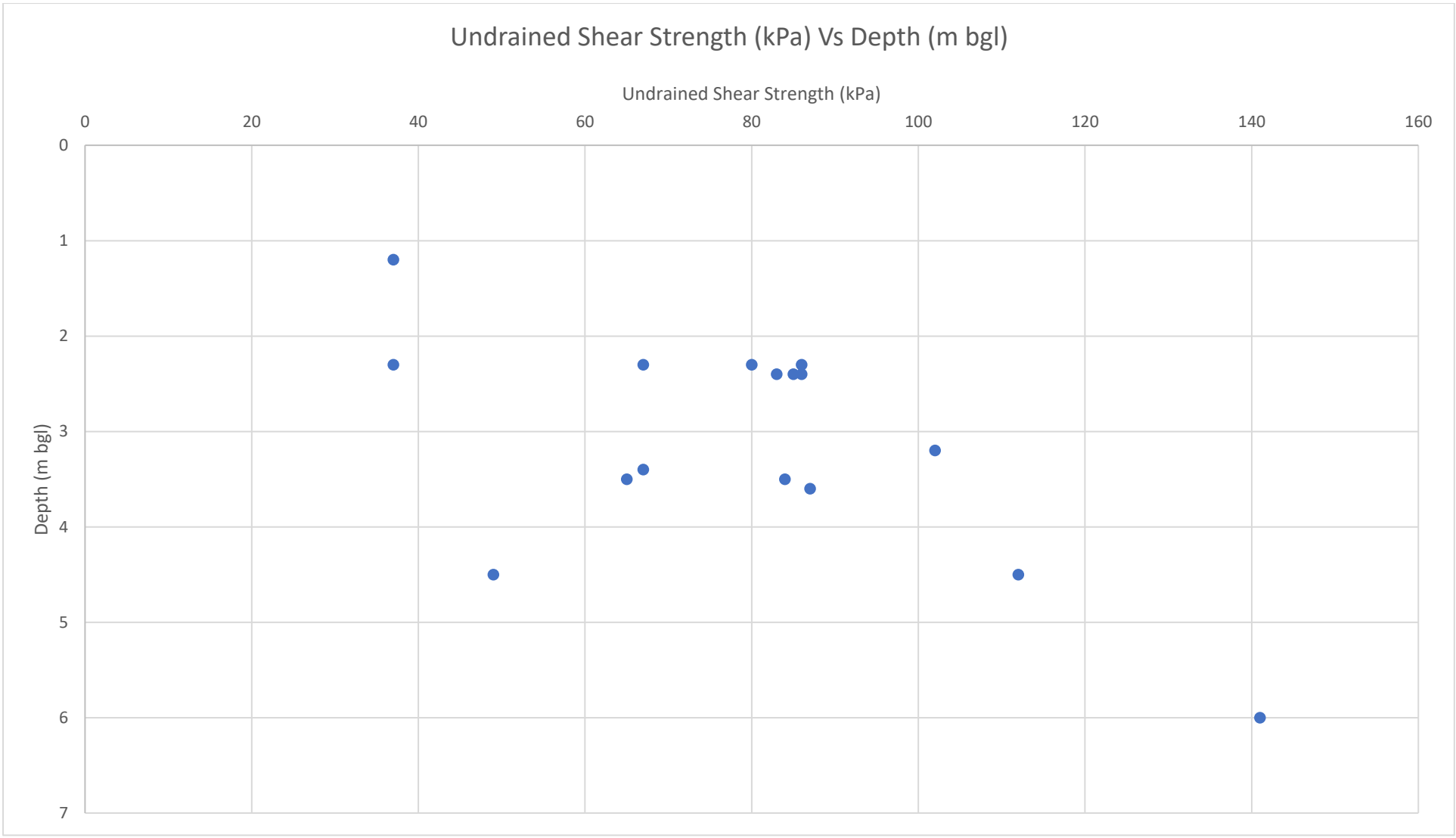
geotechnics

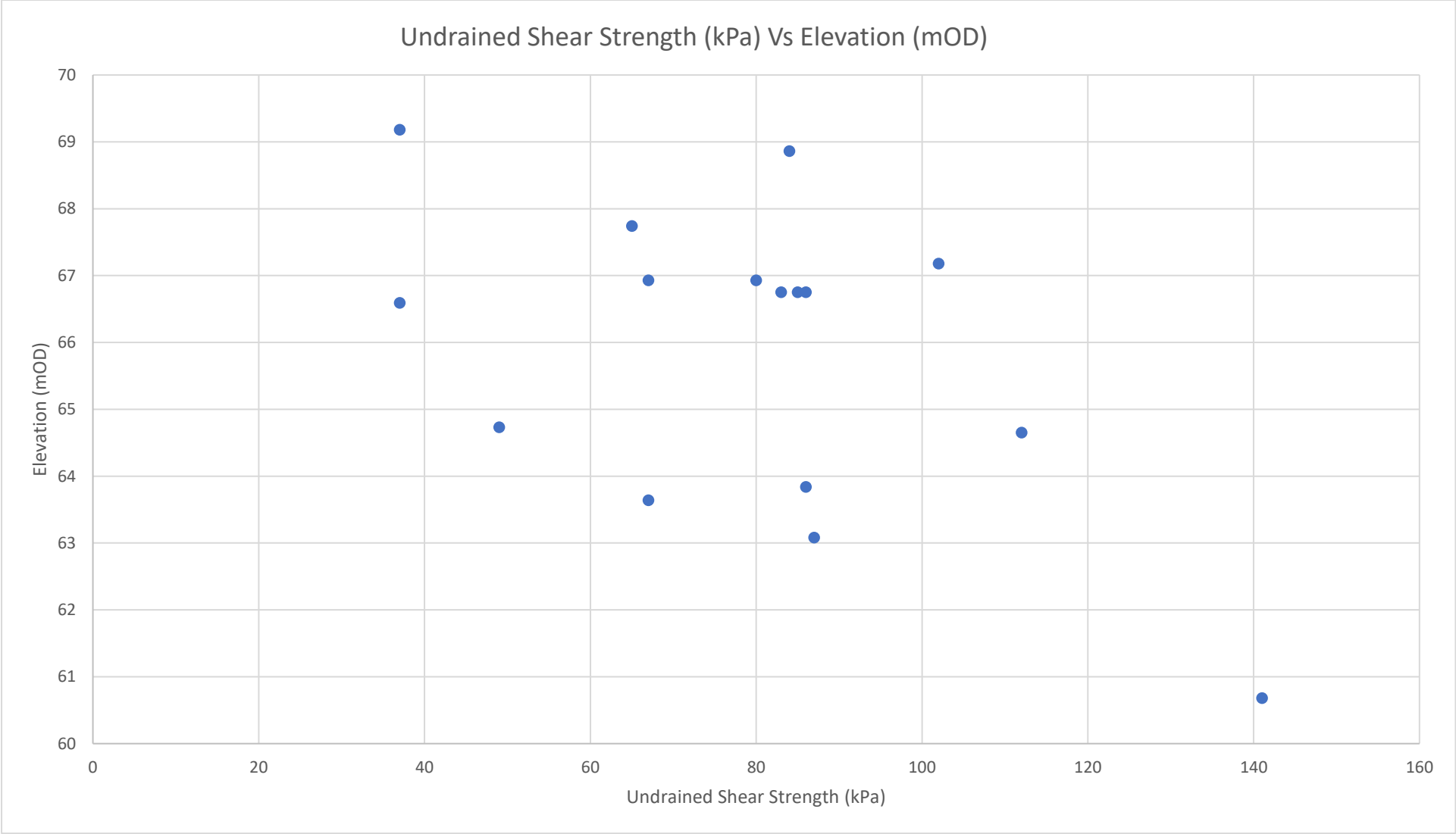
Appendix F Geotechnical Figures

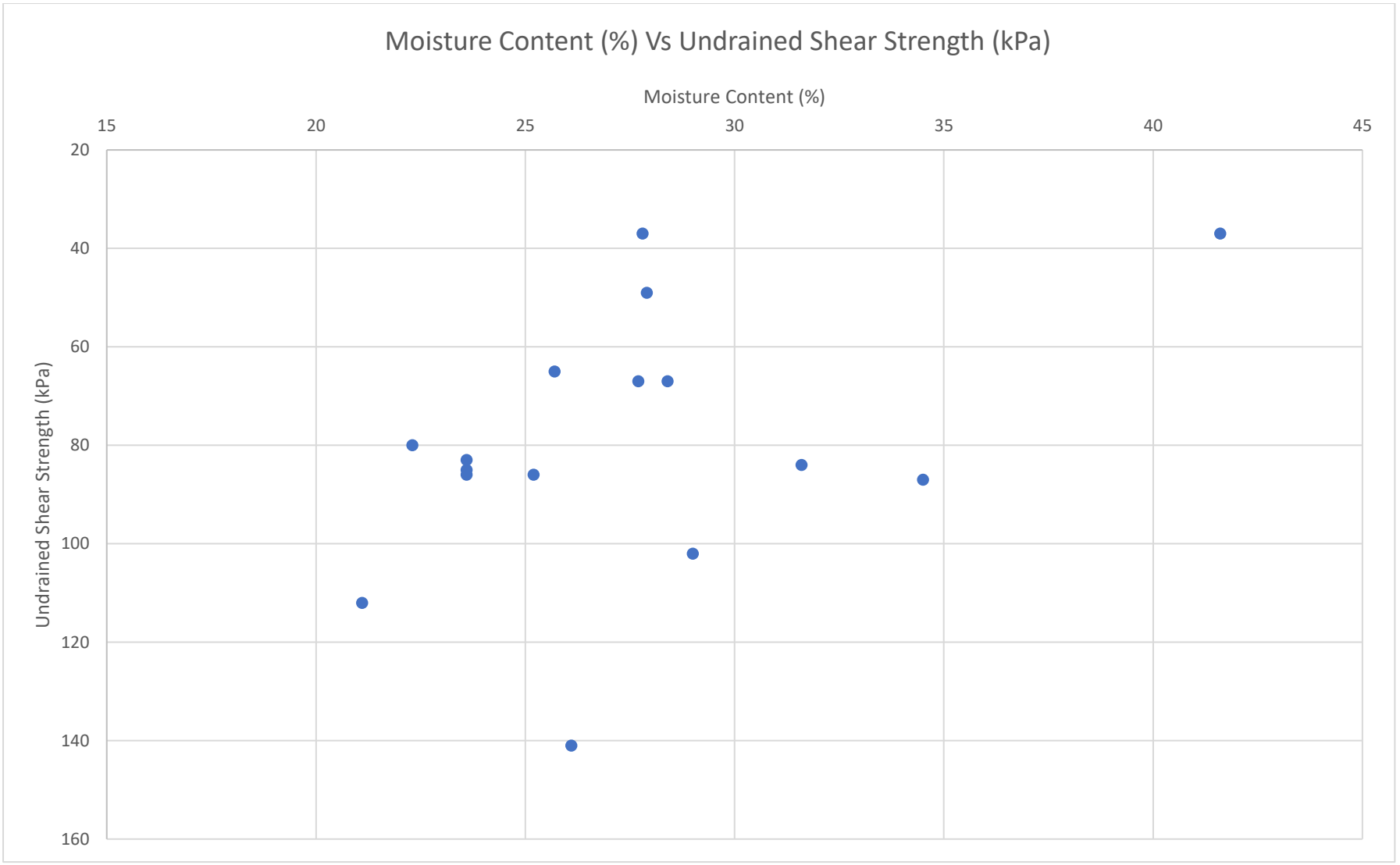
- **Corrected SPT ‘N’ Vs. Depth**
- **Corrected SPT ‘N’ Vs. Elevation**
- **Undrained Shear Strength Vs. Depth**
- **Undrained Shear Strength Vs. Elevation**
- **Undrained Shear Strength Vs. Moisture Content**


Corrected SPT 'N' vs. Depth
Corrected SPT 'N'
0
5
10
15
20
25
30
35
40
45
50
55
Depth (m bgl)
0.0
2.0
4.0
6.0
8.0
10.0
12.0
GRANULAR MADE GROUND
COHESIVE MADE GROUND
CLAY


Corrected SPT (N_{60}) Vs Elevation (mOD)
Elevation (mOD)
72
70
68
66
64
62
60
58
0
5
10
15
20
25
30
35
40
45
50
Corrected SPT (N_{60})
Cohesive Made Ground
Clay
Granular Made Ground


Undrained Shear Strength (kPa) Vs Depth (m bgl)
Undrained Shear Strength (kPa)
0
20
40
60
80
100
120
140
160
Depth (m bgl)
0
1
2
3
4
5
6
7


Undrained Shear Strength (kPa) Vs Elevation (mOD)
Elevation (mOD)
70
69
68
67
66
65
64
63
62
61
60
0
20
40
60
80
100
120
140
160
Undrained Shear Strength (kPa)


Moisture Content (%) Vs Undrained Shear Strength (kPa)
Moisture Content (%)
15
20
25
30
35
40
45
Undrained Shear Strength (kPa)
20
40
60
80
100
120
140
160

Appendix G Monitoring Results

- **Fieldwork Monitoring Results Sheet (Home Zones 3 – Monitoring Results)**

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH303

Sheet No. 1 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.50 - 6.00m

Date Installed 6 August 2020

Diameter 50mm

Cover Type Upright lockable protective cover

Ground Level 66.68 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
12-Aug-2020	00:00:00	2.71							
12-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
12-Aug-2020	00:00:30		<0.1	<2	0.2	17.4	<1	<1	
12-Aug-2020	00:01:00		<0.1	<2	0.2	17.2	<1	<1	
12-Aug-2020	00:02:00		<0.1	<2	0.2	17.2			
12-Aug-2020	00:03:00		<0.1	<2	0.2	17.2			
19-Aug-2020	00:00:00	2.29							
19-Aug-2020	00:00:05		<0.1	<2	<0.1	20.3	<1	<1	
19-Aug-2020	00:00:30		<0.1	<2	0.4	14.3	<1	<1	
19-Aug-2020	00:01:00		<0.1	<2	0.4	13.8	<1	<1	
19-Aug-2020	00:02:00		<0.1	<2	0.4	13.8	<1	<1	
19-Aug-2020	00:03:00		<0.1	<2	0.4	13.8	<1	<1	
19-Aug-2020	00:04:00		<0.1	<2	0.4	13.8	<1	<1	
3-Sep-2020	00:00:00	2.20							
3-Sep-2020	00:00:05		<0.1	<2	0.7	18.5	<1	<1	
3-Sep-2020	00:00:30		<0.1	<2	0.8	8.5	<1	<1	
3-Sep-2020	00:01:00		<0.1	<2	0.8	8.1	<1	<1	
3-Sep-2020	00:02:00		<0.1	<2	0.8	8.0	<1	<1	
3-Sep-2020	00:03:00		<0.1	<2	0.8	7.9	<1	<1	
3-Sep-2020	00:04:00		<0.1	<2	0.8	7.9	<1	<1	
16-Sep-2020	00:00:00	2.29							
16-Sep-2020	00:00:05		<0.1	<2	0.5	20.1	<1	2	
16-Sep-2020	00:00:30		<0.1	<2	1.1	21.0	<1	2	
16-Sep-2020	00:01:00		<0.1	<2	1.1	10.8	<1	<1	
16-Sep-2020	00:02:00		<0.1	<2	1.1	10.7	<1	<1	
16-Sep-2020	00:03:00		<0.1	<2	1.1	10.7	<1	<1	
16-Sep-2020	00:04:00		<0.1	<2	1.1	10.7	<1	<1	
29-Sep-2020	00:00:00	2.42							
29-Sep-2020	00:00:05		<0.1	<2	0.3	20.3	<1	<1	
29-Sep-2020	00:00:30		<0.1	<2	0.9	16.1	<1	<1	
29-Sep-2020	00:01:00		<0.1	<2	1.5	13.8	<1	<1	
29-Sep-2020	00:02:00		<0.1	<2	1.6	13.0	<1	<1	
29-Sep-2020	00:03:00		<0.1	<2	1.6	13.0	<1	<1	
29-Sep-2020	00:04:00		<0.1	<2	1.6	12.9	<1	<1	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Client Graven Hill Village Development Company

Project No PC207899
Borehole BH303
Sheet No. 1 (2 of 2)

Installation Details

Installation Type Standpipe
Depth to Base 6.00m
Filter Zone 1.50 - 6.00m
Date Installed 6 August 2020

Diameter 50mm
Cover Type Upright lockable protective cover
Ground Level 66.68 m OD

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
12-Aug-2020	00:00:00	1006	<1	<0.1	
12-Aug-2020	00:00:05				
12-Aug-2020	00:00:30				
12-Aug-2020	00:01:00				
12-Aug-2020	00:02:00				
12-Aug-2020	00:03:00				
19-Aug-2020	00:00:00	997	<1	<0.1	
19-Aug-2020	00:00:05				
19-Aug-2020	00:00:30				
19-Aug-2020	00:01:00				
19-Aug-2020	00:02:00				
19-Aug-2020	00:03:00				
19-Aug-2020	00:04:00				
3-Sep-2020	00:00:00	1003	<1	<0.1	
3-Sep-2020	00:00:05				
3-Sep-2020	00:00:30				
3-Sep-2020	00:01:00				
3-Sep-2020	00:02:00				
3-Sep-2020	00:03:00				
3-Sep-2020	00:04:00				
16-Sep-2020	00:00:00	1006	<1	<0.1	
16-Sep-2020	00:00:05				
16-Sep-2020	00:00:30				
16-Sep-2020	00:01:00				
16-Sep-2020	00:02:00				
16-Sep-2020	00:03:00				
16-Sep-2020	00:04:00				
29-Sep-2020	00:00:00	1006	<1	<0.1	
29-Sep-2020	00:00:05				
29-Sep-2020	00:00:30				
29-Sep-2020	00:01:00				
29-Sep-2020	00:02:00				
29-Sep-2020	00:03:00				
29-Sep-2020	00:04:00				

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH305

Sheet No. 1 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.50 - 6.00m

Date Installed 6 August 2020

Diameter 50mm

Cover Type Flush lockable protective cover

Ground Level 67.92 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
12-Aug-2020	00:00:00	1.19							
12-Aug-2020	00:00:05		<0.1	<2	<0.1	20.7	<1	<1	
12-Aug-2020	00:00:30		<0.1	<2	3.1	18.6	<1	1	
12-Aug-2020	00:01:00		<0.1	<2	3.0	18.5	<1	1	
12-Aug-2020	00:02:00		<0.1	<2	2.9	18.6	<1	1	
12-Aug-2020	00:03:00		<0.1	<2	3.2	18.5			
12-Aug-2020	00:04:00		<0.1	<2	3.2	18.5			
12-Aug-2020	00:05:00		<0.1	<2	3.4	18.3			
12-Aug-2020	00:06:00		<0.1	<2	3.3	18.3			
12-Aug-2020	00:07:00		<0.1	<2	3.0	18.3			
12-Aug-2020	00:08:00		<0.1	<2	2.5	18.5			
12-Aug-2020	00:09:00		<0.1	<2	2.2	18.7			
12-Aug-2020	00:10:00		<0.1	<2	2.1	18.8			
12-Aug-2020	00:11:00		<0.1	<2	2.1	18.8			
12-Aug-2020	00:12:00		<0.1	<2	2.1	18.8			
19-Aug-2020	00:00:00	0.99							
19-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
19-Aug-2020	00:00:30		<0.1	<2	0.8	19.9	<1	<1	
19-Aug-2020	00:01:00		<0.1	<2	0.8	19.9	<1	1	
19-Aug-2020	00:02:00		<0.1	<2	0.8	19.9	<1	1	
3-Sep-2020	00:00:00	1.06							
3-Sep-2020	00:00:05		<0.1	<2	0.3	20.1	<1	<1	
3-Sep-2020	00:00:30		<0.1	<2	0.2	20.5	<1	<1	
3-Sep-2020	00:01:00		<0.1	<2	0.2	20.6	<1	<1	
3-Sep-2020	00:02:00		<0.1	<2	0.1	20.7	<1	<1	
3-Sep-2020	00:03:00		<0.1	<2	0.1	20.7	<1	<1	
3-Sep-2020	00:04:00		<0.1	<2	0.1	20.7	<1	<1	
16-Sep-2020	00:00:00	1.16							
16-Sep-2020	00:00:05		<0.1	<2	0.5	19.4	<1	<1	
16-Sep-2020	00:00:30		<0.1	<2	0.2	20.9	<1	<1	
16-Sep-2020	00:01:00		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:02:00		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:03:00		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:04:00		<0.1	<2	0.1	20.9	<1	<1	
29-Sep-2020	00:00:00	1.14							
29-Sep-2020	00:00:05		<0.1	<2	0.3	20.6	<1	2	
29-Sep-2020	00:00:30		<0.1	<2	0.6	20.4	<1	5	
29-Sep-2020	00:01:00		<0.1	<2	0.7	20.3	<1	2	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Project No: PC207899
Borehole: BH305
Client: Graven Hill Village Development Company
Sheet No.: 1 (2 of 2)

Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	6.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 6.00m	Ground Level	67.92 m OD
Date Installed	6 August 2020		

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
12-Aug-2020	00:00:00	1008	<1	<0.1	
12-Aug-2020	00:00:05				
12-Aug-2020	00:00:30				
12-Aug-2020	00:01:00				
12-Aug-2020	00:02:00				
12-Aug-2020	00:03:00				
12-Aug-2020	00:04:00				
12-Aug-2020	00:05:00				
12-Aug-2020	00:06:00				
12-Aug-2020	00:07:00				
12-Aug-2020	00:08:00				
12-Aug-2020	00:09:00				
12-Aug-2020	00:10:00				
12-Aug-2020	00:11:00				
12-Aug-2020	00:12:00				
19-Aug-2020	00:00:00	996	<1	<0.1	
19-Aug-2020	00:00:05				
19-Aug-2020	00:00:30				
19-Aug-2020	00:01:00				
19-Aug-2020	00:02:00				
3-Sep-2020	00:00:00	1008	<1	<0.1	
3-Sep-2020	00:00:05				
3-Sep-2020	00:00:30				
3-Sep-2020	00:01:00				
3-Sep-2020	00:02:00				
3-Sep-2020	00:03:00				
3-Sep-2020	00:04:00				
16-Sep-2020	00:00:00	1014	<1	<0.1	
16-Sep-2020	00:00:05				
16-Sep-2020	00:00:30				
16-Sep-2020	00:01:00				
16-Sep-2020	00:02:00				
16-Sep-2020	00:03:00				
16-Sep-2020	00:04:00				
29-Sep-2020	00:00:00	1002	<1	<0.1	
29-Sep-2020	00:00:05				
29-Sep-2020	00:00:30				
29-Sep-2020	00:01:00				

Remarks

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH305

Sheet No. 2 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.50 - 6.00m

Date Installed 6 August 2020

Diameter 50mm

Cover Type Flush lockable protective cover

Ground Level 67.92 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
29-Sep-2020	00:02:00		<0.1	<2	0.6	20.4	<1	4	
29-Sep-2020	00:03:00		<0.1	<2	0.3	20.4	<1	2	
29-Sep-2020	00:04:00		<0.1	<2	0.3	20.7	<1	2	
29-Sep-2020	00:05:00		<0.1	<2	0.1	20.9	<1	2	
29-Sep-2020	00:06:00		<0.1	<2	0.1	20.9	<1	2	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Client Graven Hill Village Development Company

Project No PC207899
Borehole BH305
Sheet No. 2 (2 of 2)

Installation Details

Installation Type Standpipe
Depth to Base 6.00m
Filter Zone 1.50 - 6.00m
Date Installed 6 August 2020

Diameter 50mm
Cover Type Flush lockable protective cover
Ground Level 67.92 m OD

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
29-Sep-2020	00:02:00				
29-Sep-2020	00:03:00				
29-Sep-2020	00:04:00				
29-Sep-2020	00:05:00				
29-Sep-2020	00:06:00				

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH306

Sheet No. 1 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.00 - 6.00m

Date Installed 28 July 2020

Diameter 50mm

Cover Type Upright lockable protective cover

Ground Level 70.78 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
31-Jul-2020	00:00:00	5.06							
31-Jul-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
31-Jul-2020	00:00:30		<0.1	<2	3.2	18.7	<1	<1	
31-Jul-2020	00:01:00		<0.1	<2	3.3	18.6	<1	<1	
31-Jul-2020	00:02:00		<0.1	<2	3.3	18.6			
31-Jul-2020	00:03:00		<0.1	<2	3.3	18.6			
5-Aug-2020	00:00:00	4.02							
5-Aug-2020	00:00:05		<0.1	<2	2.0	19.7	<1	<1	
5-Aug-2020	00:00:30		<0.1	<2	2.1	19.6	<1	<1	
5-Aug-2020	00:01:00		<0.1	<2	2.2	19.4	<1	<1	
5-Aug-2020	00:02:00		<0.1	<2	2.4	19.3			
5-Aug-2020	00:03:00		<0.1	<2	2.7	19.2			
5-Aug-2020	00:04:00		<0.1	<2	3.0	19.0			
5-Aug-2020	00:05:00		<0.1	<2	3.0	19.0			
5-Aug-2020	00:06:00		<0.1	<2	3.0	19.0			
5-Aug-2020	00:07:00		<0.1	<2	3.4	18.8			
5-Aug-2020	00:08:00		<0.1	<2	3.4	18.8			
5-Aug-2020	00:09:00		<0.1	<2	3.1	19.0			
5-Aug-2020	00:10:00		<0.1	<2	3.0	19.1			
12-Aug-2020	00:00:00	3.02							
12-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
12-Aug-2020	00:00:30		<0.1	<2	2.6	19.5	<1	<1	
12-Aug-2020	00:01:00		<0.1	<2	2.6	19.3	<1	<1	
12-Aug-2020	00:02:00		<0.1	<2	2.7	19.2	<1	<1	
12-Aug-2020	00:03:00		<0.1	<2	2.7	19.2	<1	<1	
12-Aug-2020	00:04:00		<0.1	<2	2.7	19.2			
12-Aug-2020	00:05:00		<0.1	<2	2.7	19.2			
19-Aug-2020	00:00:00	0.58							
19-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
19-Aug-2020	00:00:30		<0.1	<2	3.1	18.7	<1	<1	
19-Aug-2020	00:01:00		<0.1	<2	3.1	18.1	<1	<1	
19-Aug-2020	00:02:00		<0.1	<2	3.1	18.1	<1	<1	
19-Aug-2020	00:03:00		<0.1	<2	3.1	18.1	<1	<1	
3-Sep-2020	00:00:00	1.36							
3-Sep-2020	00:00:05		<0.1	<2	0.3	18.8	<1	1	
3-Sep-2020	00:00:30		<0.1	<2	1.0	18.7	<1	1	
3-Sep-2020	00:01:00		<0.1	<2	1.5	18.0	<1	5	
3-Sep-2020	00:02:00		<0.1	<2	2.1	18.7	<1	3	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Project No PC207899
Borehole BH306
Client Graven Hill Village Development Company
Sheet No. 1 (2 of 2)

Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	6.00m	Cover Type	Upright lockable protective cover
Filter Zone	1.00 - 6.00m	Ground Level	70.78 m OD
Date Installed	28 July 2020		

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
31-Jul-2020	00:00:00	1002	<1	<0.1	
31-Jul-2020	00:00:05				
31-Jul-2020	00:00:30				
31-Jul-2020	00:01:00				
31-Jul-2020	00:02:00				
31-Jul-2020	00:03:00				
5-Aug-2020	00:00:00	1005	<1	<0.1	
5-Aug-2020	00:00:05				
5-Aug-2020	00:00:30				
5-Aug-2020	00:01:00				
5-Aug-2020	00:02:00				
5-Aug-2020	00:03:00				
5-Aug-2020	00:04:00				
5-Aug-2020	00:05:00				
5-Aug-2020	00:06:00				
5-Aug-2020	00:07:00				
5-Aug-2020	00:08:00				
5-Aug-2020	00:09:00				
5-Aug-2020	00:10:00				
12-Aug-2020	00:00:00	1006	<1	<0.1	
12-Aug-2020	00:00:05				
12-Aug-2020	00:00:30				
12-Aug-2020	00:01:00				
12-Aug-2020	00:02:00				
12-Aug-2020	00:03:00				
12-Aug-2020	00:04:00				
12-Aug-2020	00:05:00				
19-Aug-2020	00:00:00	996	<1	<0.1	
19-Aug-2020	00:00:05				
19-Aug-2020	00:00:30				
19-Aug-2020	00:01:00				
19-Aug-2020	00:02:00				
19-Aug-2020	00:03:00				
3-Sep-2020	00:00:00	1008	<1	<0.1	
3-Sep-2020	00:00:05				
3-Sep-2020	00:00:30				
3-Sep-2020	00:01:00				
3-Sep-2020	00:02:00				

Remarks

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH306

Sheet No. 2 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.00 - 6.00m

Date Installed 28 July 2020

Diameter 50mm

Cover Type Upright lockable protective cover

Ground Level 70.78 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
3-Sep-2020	00:03:00		<0.1	<2	2.4	15.7	<1	3	
3-Sep-2020	00:04:00		<0.1	<2	2.6	15.4	<1	3	
3-Sep-2020	00:05:00		<0.1	<2	2.6	15.3	<1	1	
16-Sep-2020	00:00:00	1.50							
16-Sep-2020	00:00:05		<0.1	<2	0.9	19.6	<1	<1	
16-Sep-2020	00:00:30		<0.1	<2	2.2	18.0	<1	<1	
16-Sep-2020	00:01:00		<0.1	<2	4.4	15.0	<1	<1	
16-Sep-2020	00:02:00		<0.1	<2	5.2	13.7	<1	<1	
16-Sep-2020	00:03:00		<0.1	<2	5.3	13.6	<1	<1	
16-Sep-2020	00:04:00		<0.1	<2	5.3	13.7	<1	<1	
16-Sep-2020	00:05:00		<0.1	<2	5.3	13.7	<1	<1	
29-Sep-2020	00:00:00	1.58							
29-Sep-2020	00:00:05		<0.1	<2	0.5	21.0	<1	5	
29-Sep-2020	00:00:30		<0.1	<2	1.8	19.8	<1	4	
29-Sep-2020	00:01:00		<0.1	<2	2.5	19.1	<1	5	
29-Sep-2020	00:02:00		<0.1	<2	2.8	18.8	<1	5	
29-Sep-2020	00:03:00		<0.1	<2	2.8	18.7	<1	4	
29-Sep-2020	00:04:00		<0.1	<2	2.8	18.7	<1	2	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Client Graven Hill Village Development Company

Project No PC207899
Borehole BH306
Sheet No. 2 (2 of 2)

Installation Details

Installation Type Standpipe
Depth to Base 6.00m
Filter Zone 1.00 - 6.00m
Date Installed 28 July 2020

Diameter 50mm
Cover Type Upright lockable protective cover
Ground Level 70.78 m OD

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
3-Sep-2020	00:03:00				
3-Sep-2020	00:04:00				
3-Sep-2020	00:05:00				
16-Sep-2020	00:00:00	1012	<1	<0.1	
16-Sep-2020	00:00:05				
16-Sep-2020	00:00:30				
16-Sep-2020	00:01:00				
16-Sep-2020	00:02:00				
16-Sep-2020	00:03:00				
16-Sep-2020	00:04:00				
16-Sep-2020	00:05:00				
29-Sep-2020	00:00:00	1004	<1	<0.1	
29-Sep-2020	00:00:05				
29-Sep-2020	00:00:30				
29-Sep-2020	00:01:00				
29-Sep-2020	00:02:00				
29-Sep-2020	00:03:00				
29-Sep-2020	00:04:00				

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH312

Sheet No. 1 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.50 - 6.00m

Date Installed 24 July 2020

Diameter 50mm

Cover Type Flush lockable protective cover

Ground Level 67.71 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
31-Jul-2020	00:00:00	0.59							
31-Jul-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
31-Jul-2020	00:00:30		<0.1	<2	<0.1	20.4	<1	3	
31-Jul-2020	00:01:00		<0.1	<2	<0.1	20.4	<1	3	
31-Jul-2020	00:02:00		<0.1	<2	<0.1	20.4	<1	3	
5-Aug-2020	00:00:00	0.63							
5-Aug-2020	00:00:05		<0.1	<2	<0.1	19.8	<1	<1	
5-Aug-2020	00:00:30		<0.1	<2	<0.1	19.8	<1	<1	
5-Aug-2020	00:01:00		<0.1	<2	<0.1	19.8	<1	<1	
12-Aug-2020	00:00:00	0.67							
12-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
12-Aug-2020	00:00:30		<0.1	<2	0.1	20.3	<1	1	
12-Aug-2020	00:01:00		<0.1	<2	0.1	20.1	<1	2	
12-Aug-2020	00:02:00		<0.1	<2	0.1	20.1	<1	2	
12-Aug-2020	00:03:00		<0.1	<2	0.1	20.1	<1	2	
12-Aug-2020	00:04:00		<0.1	<2	0.1	20.1			
19-Aug-2020	00:00:00	0.32							
19-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
19-Aug-2020	00:00:30		<0.1	<2	0.3	19.5	<1	<1	
19-Aug-2020	00:01:00		<0.1	<2	0.3	19.4	<1	1	
19-Aug-2020	00:02:00		<0.1	<2	0.3	19.2	<1	1	
19-Aug-2020	00:03:00		<0.1	<2	0.3	19.9	<1	<1	
19-Aug-2020	00:04:00		<0.1	<2	0.3	19.3	<1	<1	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Client Graven Hill Village Development Company

Project No PC207899
Borehole BH312
Sheet No. 1 (2 of 2)

Installation Details

Installation Type Standpipe
Depth to Base 6.00m
Filter Zone 1.50 - 6.00m
Date Installed 24 July 2020

Diameter 50mm
Cover Type Flush lockable protective cover
Ground Level 67.71 m OD

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
31-Jul-2020	00:00:00	1002	<1	<0.1	
31-Jul-2020	00:00:05				
31-Jul-2020	00:00:30				
31-Jul-2020	00:01:00				
31-Jul-2020	00:02:00				
5-Aug-2020	00:00:00	1005	<1	<0.1	
5-Aug-2020	00:00:05				
5-Aug-2020	00:00:30				
5-Aug-2020	00:01:00				
12-Aug-2020	00:00:00	1008	<1	<0.1	
12-Aug-2020	00:00:05				
12-Aug-2020	00:00:30				
12-Aug-2020	00:01:00				
12-Aug-2020	00:02:00				
12-Aug-2020	00:03:00				
12-Aug-2020	00:04:00				
19-Aug-2020	00:00:00	997	<1	<0.1	
19-Aug-2020	00:00:05				
19-Aug-2020	00:00:30				
19-Aug-2020	00:01:00				
19-Aug-2020	00:02:00				
19-Aug-2020	00:03:00				
19-Aug-2020	00:04:00				

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH315

Sheet No. 1 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 3.00m

Filter Zone 1.00 - 3.00m

Date Installed 23 July 2020

Diameter 50mm

Cover Type Upright lockable protective cover

Ground Level 71.24 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
5-Aug-2020	00:00:00	0.31							
5-Aug-2020	00:00:05		<0.1	<2	0.7	20.5	<1	<1	
5-Aug-2020	00:00:30		<0.1	<2	0.4	20.5	<1	<1	
5-Aug-2020	00:01:00		<0.1	<2	0.1	20.6	<1	<1	
5-Aug-2020	00:02:00		<0.1	<2	<0.1	20.7			
5-Aug-2020	00:03:00		<0.1	<2	<0.1	20.7			
5-Aug-2020	00:04:00		>0.1	<2	<0.1	20.7			

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Client Graven Hill Village Development Company

Project No PC207899
Borehole BH315
Sheet No. 1 (2 of 2)

Installation Details

Installation Type Standpipe
Depth to Base 3.00m
Filter Zone 1.00 - 3.00m
Date Installed 23 July 2020

Diameter 50mm
Cover Type Upright lockable protective cover
Ground Level 71.24 m OD

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
5-Aug-2020	00:00:00	1003	-15	-3.1	
5-Aug-2020	00:00:05				
5-Aug-2020	00:00:30				
5-Aug-2020	00:01:00				
5-Aug-2020	00:02:00				
5-Aug-2020	00:03:00				
5-Aug-2020	00:04:00				

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Client: Graven Hill Village Development Company

Project No: PC207899
Borehole: BH601
Sheet No.: 1 (1 of 2)

Installation Details

Installation Type: Standpipe
Depth to Base: 6.00m
Filter Zone: 1.50 - 6.00m
Date Installed: 12 August 2020

Diameter: 50mm
Cover Type: Upright lockable protective cover
Ground Level: 67.04 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
12-Aug-2020	00:00:00	DRY							
12-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
12-Aug-2020	00:00:30		<0.1	<2	0.9	19.5	<1	<1	
12-Aug-2020	00:01:00		<0.1	<2	0.9	19.4	<1	<1	
12-Aug-2020	00:02:00		<0.1	<2	0.9	19.4			
12-Aug-2020	00:03:00		<0.1	<2	0.9	19.4			
12-Aug-2020	00:04:00		<0.1	<2	0.9	19.4			
20-Aug-2020	00:00:00	1.87							
20-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
20-Aug-2020	00:00:30		<0.1	<2	<0.1	21.3	<1	<1	
20-Aug-2020	00:01:00		<0.1	<2	<0.1	21.2	<1	<1	
20-Aug-2020	00:02:00		<0.1	<2	<0.1	21.1			
20-Aug-2020	00:03:00		<0.1	<2	<0.1	21.0			
20-Aug-2020	00:04:00		<0.1	<2	<0.1	21.0			
20-Aug-2020	00:05:00		<0.1	<2	<0.1	21.0			
3-Sep-2020	00:00:00	2.14							
3-Sep-2020	00:00:05		<0.1	<2	0.4	20.5	<1	<1	
3-Sep-2020	00:00:30		<0.1	<2	1.8	19.2	<1	<1	
3-Sep-2020	00:01:00		<0.1	<2	1.9	18.9	<1	<1	
3-Sep-2020	00:02:00		<0.1	<2	2.0	18.8	<1	<1	
3-Sep-2020	00:03:00		<0.1	<2	2.0	18.8	<1	<1	
3-Sep-2020	00:04:00		<0.1	<2	2.0	18.8	<1	<1	
16-Sep-2020	00:00:00	2.44							
16-Sep-2020	00:00:05		<0.1	<2	0.7	20.3	<1	<1	
16-Sep-2020	00:00:30		<0.1	<2	2.5	18.1	<1	<1	
16-Sep-2020	00:01:00		<0.1	<2	2.5	18.0	<1	<1	
16-Sep-2020	00:02:00		<0.1	<2	2.5	18.0	<1	<1	
16-Sep-2020	00:03:00		<0.1	<2	2.5	18.0	<1	<1	
16-Sep-2020	00:04:00		<0.1	<2	2.5	18.0	<1	<1	
29-Sep-2020	00:00:00	2.94							
29-Sep-2020	00:00:05		<0.1	<2	0.6	20.7	<1	<1	
29-Sep-2020	00:00:30		<0.1	<2	2.1	18.8	<1	<1	
29-Sep-2020	00:01:00		<0.1	<2	2.6	18.3	<1	<1	
29-Sep-2020	00:02:00		<0.1	<2	3.1	17.9	<1	<1	
29-Sep-2020	00:03:00		<0.1	<2	3.1	17.8	<1	<1	
29-Sep-2020	00:04:00		<0.1	<2	3.1	17.8	<1	<1	

Remarks

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Project No PC207899
Borehole BH601
Client Graven Hill Village Development Company
Sheet No. 1 (2 of 2)

Installation Details

Installation Type Standpipe
Depth to Base 6.00m
Filter Zone 1.50 - 6.00m
Date Installed 12 August 2020
Diameter 50mm
Cover Type Upright lockable protective cover
Ground Level 67.04 m OD

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
12-Aug-2020	00:00:00	1006	<1	<0.1	
12-Aug-2020	00:00:05				
12-Aug-2020	00:00:30				
12-Aug-2020	00:01:00				
12-Aug-2020	00:02:00				
12-Aug-2020	00:03:00				
12-Aug-2020	00:04:00				
20-Aug-2020	00:00:00	994	<1	<0.1	
20-Aug-2020	00:00:05				
20-Aug-2020	00:00:30				
20-Aug-2020	00:01:00				
20-Aug-2020	00:02:00				
20-Aug-2020	00:03:00				
20-Aug-2020	00:04:00				
20-Aug-2020	00:05:00				
3-Sep-2020	00:00:00	1004	<1	<0.1	
3-Sep-2020	00:00:05				
3-Sep-2020	00:00:30				
3-Sep-2020	00:01:00				
3-Sep-2020	00:02:00				
3-Sep-2020	00:03:00				
3-Sep-2020	00:04:00				
16-Sep-2020	00:00:00	1007	<1	<0.1	
16-Sep-2020	00:00:05				
16-Sep-2020	00:00:30				
16-Sep-2020	00:01:00				
16-Sep-2020	00:02:00				
16-Sep-2020	00:03:00				
16-Sep-2020	00:04:00				
29-Sep-2020	00:00:00	1006	<1	<0.1	
29-Sep-2020	00:00:05				
29-Sep-2020	00:00:30				
29-Sep-2020	00:01:00				
29-Sep-2020	00:02:00				
29-Sep-2020	00:03:00				
29-Sep-2020	00:04:00				

Remarks

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)

Client Graven Hill Village Development Company

Project No PC207899

Borehole BH605

Sheet No. 1 (1 of 2)

Installation Details

Installation Type Standpipe

Depth to Base 6.00m

Filter Zone 1.50 - 6.00m

Date Installed 12 August 2020

Diameter 50mm

Cover Type Upright lockable protective cover

Ground Level 69.23 m OD

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Carbon Monoxide CO (ppm)	Remarks
12-Aug-2020	00:00:00	DRY							
12-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
12-Aug-2020	00:00:30		<0.1	<2	0.9	19.6	<1	5	
12-Aug-2020	00:01:00		<0.1	<2	0.9	19.5	<1	7	
12-Aug-2020	00:02:00		<0.1	<2	0.9	19.5	<1	7	
12-Aug-2020	00:03:00		<0.1	<2	0.9	19.5	<1	7	
20-Aug-2020	00:00:00	0.66							
20-Aug-2020	00:00:05		<0.1	<2	<0.1	20.2	<1	<1	
20-Aug-2020	00:00:30		<0.1	<2	<0.1	21.3	<1	<1	
20-Aug-2020	00:01:00		<0.1	<2	<0.1	21.2	<1	<1	
20-Aug-2020	00:02:00		<0.1	<2	<0.1	21.2			
20-Aug-2020	00:03:00		<0.1	<2	<0.1	21.1			
20-Aug-2020	00:04:00		<0.1	<2	<0.1	21.1			
20-Aug-2020	00:05:00		<0.1	<2	<0.1	21.1			
3-Sep-2020	00:00:00	0.89							
3-Sep-2020	00:00:05		<0.1	<2	0.1	20.4	<1	<1	
3-Sep-2020	00:00:30		<0.1	<2	0.2	20.6	<1	<1	
3-Sep-2020	00:01:00		<0.1	<2	0.2	20.7	<1	<1	
3-Sep-2020	00:02:00		<0.1	<2	0.1	20.7	<1	<1	
3-Sep-2020	00:03:00		<0.1	<2	0.1	20.7	<1	<1	
3-Sep-2020	00:04:00		<0.1	<2	0.1	20.8	<1	<1	
3-Sep-2020	00:05:00		<0.1	<2	0.1	20.8	<1	<1	
16-Sep-2020	00:00:00	1.05							
16-Sep-2020	00:00:05		<0.1	<2	0.2	20.9	<1	<1	
16-Sep-2020	00:00:30		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:01:00		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:02:00		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:03:00		<0.1	<2	0.1	20.9	<1	<1	
16-Sep-2020	00:04:00		<0.1	<2	0.1	20.9	<1	<1	
29-Sep-2020	00:00:00	1.16							
29-Sep-2020	00:00:05		<0.1	<2	0.5	19.6	<1	<1	
29-Sep-2020	00:00:30		<0.1	<2	0.1	20.5	<1	<1	
29-Sep-2020	00:01:00		<0.1	<2	0.1	20.6	<1	<1	
29-Sep-2020	00:02:00		<0.1	<2	0.1	20.6	<1	<1	
29-Sep-2020	00:03:00		<0.1	<2	0.1	20.6	<1	<1	

Remarks

geotechnics

FIELDWORK - *Insitu Gas Monitoring - Instrument Record*

Project: GRAVEN HILL, BICESTER, LAND TRANSFER AREA 2 (LTA2)
Project No: PC207899
Borehole: BH605
Client: Graven Hill Village Development Company
Sheet No.: 1 (2 of 2)

Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	6.00m	Cover Type	Upright lockable protective cover
Filter Zone	1.50 - 6.00m	Ground Level	69.23 m OD
Date Installed	12 August 2020		

Date	Time	Barometric Pressure (mBars)	Diff. Pressure (Pa)	Flow Rate (l/hr)	Remarks
12-Aug-2020	00:00:00	1005	<1	<0.1	
12-Aug-2020	00:00:05				
12-Aug-2020	00:00:30				
12-Aug-2020	00:01:00				
12-Aug-2020	00:02:00				
12-Aug-2020	00:03:00				
20-Aug-2020	00:00:00	994	<1	<0.1	
20-Aug-2020	00:00:05				
20-Aug-2020	00:00:30				
20-Aug-2020	00:01:00				
20-Aug-2020	00:02:00				
20-Aug-2020	00:03:00				
20-Aug-2020	00:04:00				
20-Aug-2020	00:05:00				
3-Sep-2020	00:00:00	1004	<1	<0.1	
3-Sep-2020	00:00:05				
3-Sep-2020	00:00:30				
3-Sep-2020	00:01:00				
3-Sep-2020	00:02:00				
3-Sep-2020	00:03:00				
3-Sep-2020	00:04:00				
3-Sep-2020	00:05:00				
16-Sep-2020	00:00:00	1007	<1	<0.1	
16-Sep-2020	00:00:05				
16-Sep-2020	00:00:30				
16-Sep-2020	00:01:00				
16-Sep-2020	00:02:00				
16-Sep-2020	00:03:00				
16-Sep-2020	00:04:00				
29-Sep-2020	00:00:00	1005	<1	<0.1	
29-Sep-2020	00:00:05				
29-Sep-2020	00:00:30				
29-Sep-2020	00:01:00				
29-Sep-2020	00:02:00				
29-Sep-2020	00:03:00				

Remarks

Appendix H Environmental Receptors

The Contaminated Land Statutory Guidance has a four category system that considers harm to human health, controlled waters, flora and fauna, property, livestock and crops. The Categories are broadly defined as follows:

1 Contaminated Land – similar to land where it is known that significant harm has been caused or significant harm is being caused

2 Contaminated Land – no significant harm being caused but there is a significant possibility for significant harm to be caused in the future

3 Not Contaminated Land – there may be harm being caused but no significant possibility for significant harm to be caused in the future

4 Not Contaminated Land – no contaminant linkage, normal levels of contaminants and no significant harm being caused and no significant possibility for significant harm to be caused in the future.

Table H.1: Significant pollution to controlled waters

Pollution of controlled waters

Under Section 78A(9) of Part 2A the term "pollution of controlled waters means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term "controlled waters" in relation to England has the same meaning as in Part 3 of the Water Resources Act 1991, except that "ground waters" does not include water contained in underground strata but above the saturation zones. (Paragraph 4.36)

Given that the Part 2A regime seeks to identify and deal with significant pollution (rather than lesser levels of pollution), the local authority should seek to focus on pollution which: (i) may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems; (ii) which may result in damage to material property; or (iii) which may impair or interfere with amenities and other legitimate uses of the environment. (Paragraph 4.37)

Significant pollution of controlled waters

Paragraph 4.38 states that "The following types of pollution should be considered to constitute significant pollution of controlled waters:

(a) Pollution equivalent to "environmental damage" to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations.

(b) Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use.

(c) A breach of a statutory surface water Environment Quality Standard, either directly or via a groundwater pathway.

(d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)5)".

Paragraph 4.39 states that “In some circumstances, the local authority may consider that the following types of pollution may constitute significant pollution: (a) significant concentrations6 of hazardous substances or non-hazardous pollutants in groundwater; or (b) significant concentrations of priority hazardous substances, priority substances or other specific polluting substances in surface water; at an appropriate, risk based compliance point. The local authority should only conclude that pollution is significant if it considers that treating the land as contaminated land would be in accordance with the broad objectives of the regime as described in Section 1 (of the Contaminated Land Statutory Guidance). This would normally mean that the authority should conclude that less serious forms of pollution are not significant. In such cases the authority should consult the Environment Agency”.

The following types of circumstance should not be considered to be contaminated land on water pollution grounds:

(a) The fact that substances are merely entering water and none of the conditions for considering that significant pollution is being caused set out in paragraphs 4.38 and 4.39 above are being met.

(b) The fact that land is causing a discharge that is not discernible at a location immediately downstream or down-gradient of the land (when compared to upstream or up-gradient concentrations).

(c) Substances entering water in compliance with a discharge authorised under the Environmental Permitting Regulations.

Significant pollution of controlled waters is being caused

In deciding whether significant pollution of controlled waters is being caused, the local authority should consider that this test is only met where it is satisfied that the substances in question are continuing to enter controlled waters; or that they have already entered the waters and are likely to do so again in such a manner that past and likely future entry in effect constitutes ongoing pollution. For these purposes, the local authority should:

(a) Regard substances as having entered controlled waters where they are dissolved or suspended in those waters, or (if they are immiscible with water) they have direct contact with those waters on or beneath the surface of the water.

(b) Take the term “continuing to enter” to mean any measurable entry of the substance(s) into controlled waters additional to any which has already occurred.

(c) Take the term “likely to do so again” to mean more likely than not to occur again.

Land should not be determined as contaminated land on grounds that significant pollution of controlled waters is being caused where: (a) the relevant substance(s) are already present in controlled waters; (b) entry into controlled waters of the substance(s) from land has ceased; and (c) it is not likely that further entry will take place.

Significant Possibility of Significant Pollution of Controlled Waters

In deciding whether or not a significant possibility of significant pollution of controlled waters exists, the local authority should first understand the possibility of significant pollution of controlled waters posed by the land, and the levels of certainty/uncertainty attached to that understanding, before it goes on to decide whether or not that possibility is significant. The term “possibility of significant pollution of controlled waters” means the estimated likelihood that significant pollution of controlled waters might occur. In assessing the possibility of significant pollution of controlled waters from land, the local authority should act in accordance with the advice on risk assessment in Section 3 and the guidance in this sub-section.

In deciding whether the possibility of significant pollution of controlled waters is significant the local authority should bear in mind that Part 2A makes the decision a positive legal test. In other words, for particular land to meet the test the authority needs reasonably to believe that there is a significant possibility of such pollution, rather than to demonstrate that there is not.

Before making its decision on whether a given possibility of significant pollution of controlled waters is significant, the local authority should consider:

(a) The estimated likelihood that the potential significant pollution of controlled waters would become manifest; the strength of evidence underlying the estimate; and the level of uncertainty underlying the estimate.

(b) The estimated impact of the potential significant pollution if it did occur. This should include consideration of whether the pollution would be likely to cause a breach of European water legislation, or make a major contribution to such a breach.

(c) The estimated timescale over which the significant pollution might become manifest.

(d) The authority's initial estimate of whether remediation is feasible, and if so what it would involve and the extent to which it might provide a solution to the problem; how long it would take; what benefit it would be likely to bring; and whether the benefits would outweigh the costs and any impacts on local society or the environment from taking action

Reproduced from DEFRA (2012) Contaminated Land Statutory Guidance pursuant to section 78YA of the Environmental Protection Act 1990 as amended by Section 57 of the Environment Act 1995.

Table H.2: Significant harm to human health, ecological systems and property

Relevant types of receptor	Significant harm	Significant possibility of significant harm
Human beings	The following health effects should always be considered to constitute significant harm to human health: death; life threatening diseases (eg cancers); other diseases likely to have serious impacts on health; serious injury; birth defects; and impairment of reproductive functions. Other health effects may be considered by the local authority to constitute significant harm. For example, a wide range of conditions may or may not constitute significant harm (alone or in combination) including: physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts. In deciding whether or not a particular form of harm is significant harm, the local authority should consider the	The risk posed by one or more relevant contaminant linkage(s) relating to the land comprises: (a) The estimated likelihood that significant harm might occur to an identified receptor, taking account of the current use of the land in question. (b) The estimated impact if the significant harm did occur – i.e. the nature of the harm, the seriousness of the harm to any person who might suffer it, and (where relevant) the extent of the harm in terms of how many people might suffer it. In estimating the likelihood that a specific form of significant harm might occur the local authority should, among other things, consider: (a) The estimated probability that

Relevant types of receptor	Significant harm	Significant possibility of significant harm
	seriousness of the harm in question: including the impact on the health, and quality of life, of any person suffering the harm; and the scale of the harm. The authority should only conclude that harm is significant if it considers that treating the land as contaminated land would be in accordance with the broad objectives of the regime as described in Section 1 of the Contaminated Land Statutory Guidance.	the significant harm might occur: (i) if the land continues to be used as it is currently being used; and (ii) where relevant, if the land were to be used in a different way (or ways) in the future having regard to the guidance on "current use" in Section 3 of the Contaminated Land Statutory Guidance. (b) The strength of evidence underlying the risk estimate. It should also consider the key assumptions on which the estimate of likelihood is based, and the level of uncertainty underlying the estimate.
Any ecological system, or living organism forming part of such a system, within a location which is: • a site of special scientific interest (under section 28 of the Wildlife and Countryside Act (WCA) 1981 (as amended) and Part 4 of the Natural Environment and Rural Communities Act 2006 (as amended)); • a national nature reserve (under Section 35 of the WCA 1981 (as amended)); • a marine nature reserve (under Section 36 of the WCA 1981 (as amended)); • an area of special protection for birds (under Section 3 of the WCA 1981 (as amended)); • a "European site" within the meaning of regulation 8 of the Conservation of Habitats and Species Regulations 2010 (as amended); • any habitat or site afforded policy protection under Section 11 of The National Planning Policy Framework (NPPF) on conserving and enhancing the natural environment (i.e. possible Special Areas of Conservation, potential Special	The following types of harm should be considered to be significant harm: • harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or • harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location. In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010 (as amended).	Conditions would exist for considering that a significant possibility of significant harm exists to a relevant ecological receptor where the local authority considers that: • significant harm of that description is more likely than not to result from the contaminant linkage in question; or • there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration. Any assessment made for these purposes should take into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.

Relevant types of receptor	Significant harm	Significant possibility of significant harm
Protection Areas and listed or proposed Ramsar sites); or • any nature reserve established under Section 21 of the National Parks and Access to the Countryside Act 1949.		
Property in the form of: • crops, including timber • produce grown domestically, or on allotments, for consumption • livestock • other owned or domesticated animals; • wild animals which are the subject of shooting or fishing rights.	For crops, a substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage. The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a diminution in yield or loss in value is caused by a contaminant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss. In the Guidance states that this description of significant harm is referred to as an "animal or crop effect".	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question, taking into account relevant information for that type of contaminant linkage, particularly in relation to the ecotoxicological effects of the contaminant.
Property in the form of buildings. For this purpose 'building' means any structure or erection and any part of a building, including any part below ground level, but does not include plant or machinery comprised in a building, or buried services such as sewers, water pipes or electricity cables.	Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended. In the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was	Conditions would exist for considering that a significant possibility of significant harm exists to the relevant types of receptor where the local authority considers that significant harm is more likely than not to result from the contaminant linkage in question during the expected economic life of the building (or in the case of a scheduled Ancient Monument the foreseeable future), taking into account relevant information for that type of contaminant linkage.

Relevant types of receptor	Significant harm	Significant possibility of significant harm
	scheduled. The Guidance states that this description of significant harm is referred to as a 'building effect'.	

Reproduced from DEFRA (2012) Contaminated Land Statutory Guidance pursuant to section 78YA of the Environmental Protection Act 1990 as amended by Section 57 of the Environment Act 1995.

Appendix I Generic Assessment Criteria

Human Health Generic Assessment Criteria

Background

In order to be able to make inference on whether the results obtained during the site investigation (e.g. chemical concentrations in soils, waters and gas) point to the presence of a potential hazard to human health, it is necessary to distinguish between the results, reflecting background and/or insignificantly elevated levels of contamination (i.e. with negligible potential to cause harm or pollution) and the results with significantly elevated concentrations (i.e. with significant potential to cause harm or pollution).

The contamination assessment has been undertaken in general accordance with the Land Contamination Risk Assessment (LCRM) 2020 (Environment Agency), and forms a decision record in relation to the assessment of the site. This sets out a tiered approach:

- Preliminary Risk Assessment (e.g. establishing potential contaminant linkages);
- Generic Quantitative Risk Assessment (GQRA) (e.g. comparison of site contaminant concentrations against generic standards and compliance criteria e.g. Soil Guideline Values (SGV) or other Generic Assessment Criteria including an assessment of risk using the source pathway target model); and
- Detailed Quantitative Risk Assessment (DQRA) (e.g. the comparison of contaminant concentrations against site specific assessment criteria).

Preliminary Risk Assessment

This typically encompasses a desk based generation of a conceptual model to establish the potential contaminant linkages associated with the site and any proposed development. Works would typically involve:

- Evaluation of the potential sources of contamination on the site and in the locality and from both a current and historical perspective
- Statutory Consultation;
- Evaluation of a sites geology, hydrology and hydrogeology;
- Site inspection;
- Additional pertinent information as necessary on a site by site basis.

Where works indicate the presence of a potential contaminant linkage further evaluation and potentially site investigation works are necessary to determine the significance of the linkage.

Generic Quantitative Risk Assessment (GQRA)

In August 2008 the Environment Agency (EA) and Department of Environment Food and Rural Affairs (DEFRA) announced the withdrawal of the Contaminated Land Reports CLR7 – 10, CLEA UK (beta) and existing SGV reports as they no-longer fully reflected the revised approach to human health risk assessment.

New partial guidance (in particular Science Reports SR2, SR3 and SR7) and new risk assessment tools (CLEA model version v1.04, v1.05 and currently v1.06) were published in 2009 and these allow environmental practitioners to derive generic and site specific Soil Assessment Criteria (GAC and SAC).

Soil Guideline Values (SGVs)

The EA and DEFRA updated the TOX reports and Soil Guideline Values (SGVs) to reflect the guidance documents published in 2009. SGVs for arsenic, cadmium, nickel, mercury, selenium, BTEX compounds (benzene, toluene, ethylbenzene and xylenes), dioxins, furans and dioxin like PCBs and phenol have been made available.

Since publishing the revised SGVs the CLEA model was updated to version v1.06. The Environment Agency has however confirmed that v1.05 has only a "minor effect on assessment criteria calculated using the CLEA software 1.04" and consequently the GACs derived are considered to remain valid. Environment Agency SGVs generated using v1.04 have also not been updated. Software version v1.06 is identical to v1.05 with some password protection enhancements that in no way affect the GAC values generated.

Owing to the scientific advances since 2009 and in particular toxicological research outputs, less significance is now placed on the SGVs in the hierarchy outlined below.

Category 4 Screening Levels (C4SLs)

Category 4 Screening Levels were generated by Contaminated Land: Applications in Real Environments (CL:AIRE) on behalf of DEFRA and made available to the public in April 2014. Category 4 Screening Levels were derived in response to policy changes outlined in the recently revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A). Part 2A was originally introduced to ensure that the risks from land contamination to human health, property and the environment are managed appropriately, with the revised SG being designed to address concerns regarding its real-world application. The revised SG presents a new four category system for classifying land under Part 2A, ranging from Category 4, where the level of risk posed is acceptably low, to Category 1, where the level of risk is clearly unacceptable.

The document SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (March 2014) states that:

The Impact Assessment that accompanied the revised Part 2A Statutory Guidance identified a potential role for new 'Category 4 Screening Levels' 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.

Suitable For Use Screening Levels (S4USLs)

In January 2015, Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have published updated screening criteria that were derived in line with UK guidance on risk assessment (SR2 and SR3). The resultant screening criteria reflect the industries greater knowledge of the relevant toxicology and further consideration of exposure scenarios as set out in SP1010.

Waterman's Generic Assessment Criteria (GACs)

Waterman have used the following hierarchy for the generic assessment of soils to evaluate Human Health.

- Published Category 4 Screening Values (C4SLs) derived by CL:AIRE on behalf of DEFRA; or in their absence;
- Suitable 4 Use Screening Levels (S4USLs) derived by LQM/CIEH; or in their absence;
- Published Soil Guideline Values (SGVs);
- GAC prepared in accordance with the CLEA v1.04 / v1.06 model by authoritative bodies (e.g. Contaminated Land Applications in Real Environments (CL:AIRE) 2009; and
- Waterman in-house GAC prepared in accordance with the CLEA V1.06 model and associated documents.

Tabulated values of the GACs used are presented overleaf. The references of the sources quoted in the table are:-

- Environment Agency, 2009. CLEA Software, version 1.06;
- DEFRA, Environment Agency, 2004. Model Procedures for the Management of Land Contamination, Contaminated Land Report 11;
- DEFRA, 2014, SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document and appendices;
- LQM / CIEH, 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment;
- Environment Agency, 2009. Human health toxicological assessment of contaminants in soil. Report SC050021/SR2;
- Environment Agency, 2009. Updated technical background to the CLEA model. Report SC050021/SR3;
- Environment Agency, 2008. Compilation of chemical data for priority organic pollutants for derivation of Soil Guideline Values. Report SC050021/SR7; and
- EIC / CL:AIRE, 2010. Soil generic assessment criteria for human health risk assessment.

Detailed Quantitative Risk Assessment (DQRA)

Detailed Quantitative Risk Assessments are undertaken on a site specific basis and full details of the alterations to the CLEA model and generic land use scenarios will be described within the specific reports.

Benzo(a)pyrene Surrogate Marker (SM) Approach

The DEFRA Category 4 Screening Level for B(a)P is based on the surrogate marker approach. In order to utilise the GAC or others based on this approach, the sample assessed must exhibit certain properties that comply with underlying assumptions.

SP1010, Appendix E states:

"The SM approach estimates the toxicity of a mixture of PAHs in an environmental matrix by using toxicity data for a PAH mixture for which the composition is known. Exposure to the SM is assumed to represent exposure to all PAHs in that matrix therefore the toxicity of the SM represents the toxicity of the mixture. In most cases, BaP is chosen as the SM due to its ubiquitous nature and the vast amount of data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food (EFSA 2008). However, RIVM considered that 'it would not be suitable to use BaP as a SM for carcinogenic risk assessment of PAH mixtures in soil due to the wide variety in composition of PAH mixtures in Dutch land contamination sites', although little data was provided in the report to support this statement (RIVM 2001). Similarly, the Canadian Council of Ministers of the Environment (CCME) also stated that contaminated soil is likely to contain a diverse range of carcinogenic and non-carcinogenic PAH of varying potency (CCME, 2008).

The SM approach relies on a number of assumptions (HPA 2010).

- *The SM (BaP) must be present in all soil samples.*
- *The profile of the different PAH relative to BaP should be similar in all samples.*
- *The PAH profile in the soil samples should be similar to that used in the pivotal toxicity study on which HBGV was based i.e. the Culp study.*

[sic] To assess the PAH profile in the test soil sample [complies with the assumptions above], the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated to ensure it is similar to the test material used in the Culp study (HPA 2010). To be considered sufficiently similar, the ratio relative to BaP should fit within the upper and lower limits (representing an order of magnitude above and below the mean ratio to BaP of test material used in the Culp study). In such cases BaP is considered an adequate SM and the LLTC for BaP may be used in the risk assessment.

If the site falls outside the order of magnitude limits, it may be appropriate to considering a LLTC for groups of surrogate markers, such as groups of 2, 4 or 8 PAHs, as used by EFSA for the evaluation of PAHs in food (EFSA 2008). Expert judgement should be sought in such situations where there is uncertainty as to whether BaP is sufficiently representative (HPA 2010)."

The ratios of the seven genotoxic PAHs relative to B(a)P can be calculated 'by hand' or using LQM's PAH profiling tool.

Generic Quantitative Risk Assessment Criteria

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Arsenic	mg/kg	37	37	37	40	40	40	49	49	49	DEFRA C4SLs
Antimony	mg/kg				550	550	550				CL:AIRE 2009
Barium	mg/kg				1300	1300	1300				CL:AIRE 2009
Beryllium	mg/kg	1.7	1.7	1.7	1.7	1.7	1.7	35	35	35	LQM S4ULs 2015
Boron (Water Soluble)	mg/kg	290	290	290	11000	11000	11000	45	45	45	LQM S4ULs 2015
Cadmium	mg/kg	22	22	22	150	150	150	3.9	3.9	3.9	DEFRA C4SLs
Chromium (Total)	mg/kg	910	910	910	910	910	910	18000	18000	18000	LQM S4ULs 2015
Chromium (VI)	mg/kg	21	21	21	21	21	21	170	170	170	DEFRA C4SLs
Copper	mg/kg	2400	2400	2400	7100	7100	7100	520	520	520	LQM S4ULs 2015
Lead	mg/kg	200	200	200	310	310	310	80	80	80	DEFRA C4SLs
Mercury	mg/kg	1.2	1.2	1.2	1.2	1.2	1.2	21	21	21	LQM S4ULs 2015
Molybdenum	mg/kg				670	670	670				CL:AIRE 2009
Nickel	mg/kg	130	130	130	180	180	180	53	53	53	LQM S4ULs 2015
Selenium	mg/kg	250	250	250	430	430	430	88	88	88	LQM S4ULs 2015
Vanadium*	mg/kg	410	410	410	1200	1200	1200	91	91	91	LQM S4ULs 2015
Zinc	mg/kg	3700	3700	3700	40000	40000	40000	620	620	620	LQM S4ULs 2015
Cyanide (Free)	mg/kg	26	26	26				4.1	4.1	4.1	Waterman GAC - CLEA v1.06

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Complex Cyanide	mg/kg	63000	63000	63000				1200	1200	1200	Waterman GAC - CLEA v1.06
Thiocyanate	mg/kg	230	230	230				46	46	46	Waterman GAC - CLEA v1.06
Aliphatic EC5 - EC6	mg/kg	42	78	160	42	78	160	730	1700	3900	LQM S4ULs 2015
Aliphatic EC6 - EC8	mg/kg	100	230	530	100	230	530	2300	5600	13000	LQM S4ULs 2015
Aliphatic EC8-EC10	mg/kg	27	65	150	27	65	150	320	770	1700	LQM S4ULs 2015
Aliphatic EC10-EC12	mg/kg	130	330	760	130	330	770	2200	4400	7300	LQM S4ULs 2015
Aliphatic EC12-EC16	mg/kg	1100	2400	4300	1100	2400	4400	11000	13000	13000	LQM S4ULs 2015
Aliphatic EC16-EC35	mg/kg	65000	92000	110000	65000	92000	110000	260000	270000	270000	LQM S4ULs 2015
Aliphatic EC35-EC44	mg/kg	65000	92000	110000	65000	92000	110000	260000	270000	270000	LQM S4ULs 2015
Aromatic C5-C7	mg/kg	70	140	300	370	690	1400	13	27	57	LQM S4ULs 2015
Aromatic C7-C8	mg/kg	130	290	660	860	1800	3900	22	51	120	LQM S4ULs 2015
Aromatic C8-C10	mg/kg	34	83	190	47	110	270	8.6	21	51	LQM S4ULs 2015
Aromatic C10-C12	mg/kg	74	180	380	250	590	1200	13	31	74	LQM S4ULs 2015
Aromatic C12-C16	mg/kg	140	330	660	1800	2300	2500	23	57	130	LQM S4ULs 2015
Aromatic C16-C21	mg/kg	260	540	930	1900	1900	1900	46	110	260	LQM S4ULs 2015
Aromatic C21-C35	mg/kg	1100	1500	1700	1900	1900	1900	370	820	1600	LQM S4ULs 2015
Aromatic C35-C44	mg/kg	1100	1500	1700	1900	1900	1900	370	820	1600	LQM S4ULs 2015
Benzene	mg/kg	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	LQM S4ULs 2015
Toluene	mg/kg	130	290	660	880	1900	3900	22	51	120	LQM S4ULs 2015

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Ethyl Benzene	mg/kg	47	110	260	83	190	440	16	39	91	LQM S4ULs 2015
Xylene - m	mg/kg	59	140	320	82	190	450	31	74	170	LQM S4ULs 2015
Xylene - o	mg/kg	60	140	330	88	210	480	28	67	160	LQM S4ULs 2015
Xylene - p	mg/kg	56	130	310	79	180	430	29	69	160	LQM S4ULs 2015
MTBE (Methyl tert-butyl ether)	mg/kg	49	84	160				23	44	90	CL:AIRE 2009
Naphthalene	mg/kg	2.3	5.6	13	2.3	5.6	13	4.1	10	24	LQM S4ULs 2015
Acenaphthylene	mg/kg	170	420	920	2900	4600	6000	28	69	160	LQM S4ULs 2015
Acenaphthene	mg/kg	210	510	1100	3000	4700	6000	34	85	200	LQM S4ULs 2015
Fluorene	mg/kg	170	400	860	2800	3800	4500	27	67	160	LQM S4ULs 2015
Phenanthrene	mg/kg	95	220	440	1300	1500	1500	15	38	90	LQM S4ULs 2015
Anthracene	mg/kg	2400	5400	11000	31000	35000	37000	380	950	2200	LQM S4ULs 2015
Fluoranthene	mg/kg	280	560	890	1500	1600	1600	52	130	290	LQM S4ULs 2015
Pyrene	mg/kg	620	1200	2000	3700	3800	3800	110	270	620	LQM S4ULs 2015
Benzo(a)anthracene	mg/kg	7.2	11	13	11	14	15	2.9	6.5	13	LQM S4ULs 2015
Chrysene	mg/kg	15	22	27	30	31	32	4.1	9.4	19	LQM S4ULs 2015
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	LQM S4ULs 2015
Benzo(k)fluoranthene	mg/kg	77	93	100	110	110	110	37	75	130	LQM S4ULs 2015
Benzo(a)pyrene	mg/kg	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	LQM S4ULs 2015
Indeno(1,2,3-cd)pyrene	mg/kg	27	36	41	45	46	46	9.5	21	39	LQM S4ULs 2015

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Di-benzo(a.h.)anthracene	mg/kg	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	LQM S4ULs 2015
Benzo(g.h.i.) Perylene	mg/kg	320	340	350	360	360	360	290	470	640	LQM S4ULs 2015
Phenol	mg/kg	280	550	1100	750	1300	2300	66	140	280	LQM S4ULs 2015
Pentachlorophenol (PCP)	mg/kg	0.22	0.52	1.2	27	29	31	0.03	0.08	0.19	LQM S4ULs 2015
1,1,2,2 Tetrachloroethane	mg/kg	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	LQM S4ULs 2015
1,1,1,2 Tetrachloroethane	mg/kg	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	LQM S4ULs 2015
1,1,1 Trichloroethane	mg/kg	8.8	18	39	9	18	40	48	110	240	LQM S4ULs 2015
Trichloroethene	mg/kg	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	LQM S4ULs 2015
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	LQM S4ULs 2015
1,2- Dichloroethane	mg/kg	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	LQM S4ULs 2015
Chloroethene (Vinyl chloride)	mg/kg	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	LQM S4ULs 2015
Trichloroethene	mg/kg	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	LQM S4ULs 2015
Tetrachloroethene	mg/kg	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	LQM S4ULs 2015
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	LQM S4ULs 2015
Sum of PCDDs, PCDFs and dioxins like PCBs	ug/kg			8						8	CLEA SGVs 2009
Isopropylbenzene	mg/kg	11	27	64	12	28	67	32	79	190	CL:AIRE 2009
Propylbenzene	mg/kg	34	82	190	40	97	230	34	83	200	CL:AIRE 2009
Styrene	mg/kg	8.1	19	43	35	78	170	1.6	3.7	8.7	CL:AIRE 2009

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Bromobenzene	mg/kg	0.87	2	4.7	0.91	2.1	4.9	3.2	7.6	18	CL:AIRE 2009
1,1,2 Trichloroethane	mg/kg	0.6	1.2	2.7	0.88	1.8	3.9	0.28	0.61	1.4	CL:AIRE 2009
1,1-Dichloroethane	mg/kg	2.4	3.9	7.4	2.5	4.1	7.7	9.2	17	35	CL:AIRE 2009
1,1-Dichloroethene	mg/kg	0.23	0.4	0.82	0.23	0.41	0.82	2.8	5.6	12	CL:AIRE 2009
1,2,4-Trimethylbenzene	mg/kg	0.35	0.85	2	0.41	0.99	2.3	0.38	0.93	2.2	CL:AIRE 2009
1,2-Dichloropropane	mg/kg	0.024	0.042	0.084	0.024	0.042	0.085	0.62	1.2	2.6	CL:AIRE 2009
2-Chloronaphthalene	mg/kg	3.7	9.2	22	3.8	9.3	22	40	98	230	CL:AIRE 2009
Bromodichloromethane	mg/kg	0.016	0.03	0.061	0.019	0.034	0.07	0.016	0.032	0.068	CL:AIRE 2009
Bromoform	mg/kg	2.8	5.9	13	5.2	11	23	0.95	2.1	4.6	CL:AIRE 2009
Chloroethane	mg/kg	8.3	11	18	8.4	11	18	110	200	380	CL:AIRE 2009
Chloromethane	mg/kg	0.0083	0.0098	0.013	0.0085	0.0099	0.013	0.066	0.13	0.23	CL:AIRE 2009
Cis 1,2 Dichloroethene	mg/kg	0.11	0.19	0.37	0.12	0.2	0.39	0.26	0.5	1	CL:AIRE 2009
Dichloromethane	mg/kg	0.58	0.98	1.7	2.1	2.8	4.5	0.1	0.19	0.34	CL:AIRE 2009
Hexachloroethane	mg/kg	0.2	0.48	1.1	0.22	0.54	1.3	0.27	0.67	1.6	CL:AIRE 2009
Trans 1,2 Dichloroethene	mg/kg	0.19	0.34	0.7	0.19	0.35	0.71	0.93	1.9	4	CL:AIRE 2009
Bis (2-ethylhexyl) phthalate	mg/kg	280	610	1100	2700	2800	2800	47	120	280	CL:AIRE 2009
Butyl benzyl phthalate	mg/kg	1400	3300	7200	42000	44000	44000	220	550	1300	CL:AIRE 2009
Diethyl Phthalate	mg/kg	120	260	570	1800	3500	6300	19	41	94	CL:AIRE 2009
Di-n-butyl phthalate	mg/kg	13	31	67	450	450	450	2	5	12	CL:AIRE 2009
Di-n-octyl phthalate	mg/kg	2300	2800	3100	3400	3400	3400	940	2100	3900	CL:AIRE 2009

Proposed End Use	units	Residential with plant uptake			Residential without plant uptake			Allotment			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Biphenyl	mg/kg	66	160	360	220	500	980	14	35	83	CL:AIRE 2009
2,4-Dinitrotoluene	mg/kg	1.5	3.2	7.2	170	170	170	0.22	0.49	1.1	CL:AIRE 2009
2,6-Dinitrotoluene	mg/kg	0.78	1.7	3.9	78	84	87	0.12	0.27	0.61	CL:AIRE 2009
Tributyl tin oxide	mg/kg	0.25	0.59	1.3	1.4	3.1	0.24	0.042	0.1	0.24	CL:AIRE 2009

Proposed End Use	units	Commercial			POS(resi)			POS (park)			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Arsenic	mg/kg	640	640	640	79	79	79	170	170	170	DEFRA C4SLs
Antimony	mg/kg	7500	7500	7500							CL:AIRE 2009
Barium	mg/kg	22000	22000	22000							CL:AIRE 2009
Beryllium	mg/kg	12	12	12	2.2	2.2	2.2	63	63	63	LQM S4ULs 2015
Boron (Water Soluble)	mg/kg	240000	240000	240000	21000	21000	21000	46000	46000	46000	LQM S4ULs 2015
Cadmium	mg/kg	410	410	410	220	220	220	880	880	880	DEFRA C4SLs
Chromium (Total)	mg/kg	8600	8600	8600	1500	1500	1500	33000	33000	33000	LQM S4ULs 2015
Chromium (VI)	mg/kg	49	49	49	21	21	21	250	250	250	DEFRA C4SLs
Copper	mg/kg	68000	68000	68000	12000	12000	12000	44000	44000	44000	LQM S4ULs 2015
Lead	mg/kg	2330	2330	2330	630	630	630	1300	1300	1300	DEFRA C4SLs
Mercury	mg/kg	58	58	58	16	16	16	30	30	30	LQM S4ULs 2015
Molybdenum	mg/kg	17000	17000	17000							CL:AIRE 2009
Nickel	mg/kg	980	980	980	230	230	230	800	800	800	LQM S4ULs 2015
Selenium	mg/kg	12000	12000	12000	1100	1100	1100	1800	1800	1800	LQM S4ULs 2015
Vanadium*	mg/kg	9000	9000	9000	2000	2000	2000	5000	5000	5000	LQM S4ULs 2015
Zinc	mg/kg	730000	730000	730000	81000	81000	81000	170000	170000	170000	LQM S4ULs 2015
Cyanide (Free)	mg/kg	16000	16000	16000							Waterman GAC - CLEA v1.06
Complex Cyanide	mg/kg	430000	430000	430000							Waterman GAC - CLEA v1.06

Proposed End Use	units	Commercial			POS(resi)			POS (park)			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Thiocyanate	mg/kg	22000	22000	22000							Waterman GAC - CLEA v1.06
Aliphatic EC5 - EC6	mg/kg	3200	5900	12000	570000	59000	60000	95000	130000	180000	LQM S4ULs 2015
Aliphatic EC6 - EC8	mg/kg	7800	17000	40000	600000	610000	620000	150000	220000	32000	LQM S4ULs 2015
Aliphatic EC8-EC10	mg/kg	2000	4800	11000	13000	13000	13000	14000	18000	21000	LQM S4ULs 2015
Aliphatic EC10-EC12	mg/kg	9700	23000	47000	13000	13000	13000	21000	23000	24000	LQM S4ULs 2015
Aliphatic EC12-EC16	mg/kg	59000	8200	90000	13000	13000	13000	25000	25000	26000	LQM S4ULs 2015
Aliphatic EC16-EC35	mg/kg	1000000	1000000	1000000	250000	250000	250000	450000	480000	490000	LQM S4ULs 2015
Aliphatic EC35-EC44	mg/kg	1000000	1000000	1000000	250000	270000	250000	450000	480000	490000	LQM S4ULs 2015
Aromatic C5-C7	mg/kg	26000	46000	86000	56000	56000	56000	76000	84000	92000	LQM S4ULs 2015
Aromatic C7-C8	mg/kg	56000	110000	180000	56000	56000	56000	87000	95000	100000	LQM S4ULs 2015
Aromatic C8-C10	mg/kg	3500	8100	17000	5000	5000	5000	7200	8500	9300	LQM S4ULs 2015
Aromatic C10-C12	mg/kg	16000	28000	34000	5000	5000	5000	9200	9700	10000	LQM S4ULs 2015
Aromatic C12-C16	mg/kg	36000	37000	38000	5100	5100	5000	10000	10000	10000	LQM S4ULs 2015
Aromatic C16-C21	mg/kg	28000	28000	28000	3800	3800	3800	7600	7700	7800	LQM S4ULs 2015
Aromatic C21-C35	mg/kg	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM S4ULs 2015
Aromatic C35-C44	mg/kg	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM S4ULs 2015
Benzene	mg/kg	27	47	90	72	72	73	90	100	110	LQM S4ULs 2015
Toluene	mg/kg	56000	110000	180000	56000	56000	56000	87000	95000	100000	LQM S4ULs 2015
Ethyl Benzene	mg/kg	5700	13000	27000	24000	24000	25000	17000	22000	27000	LQM S4ULs 2015
Xylene - m	mg/kg	6200	14000	31000	41000	42000	43000	17000	24000	32000	LQM S4ULs 2015

Proposed End Use	units	Commercial			POS(resi)			POS (park)			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Xylene - o	mg/kg	6600	15000	33000	41000	42000	43000	17000	24000	33000	LQM S4ULs 2015
Xylene - p	mg/kg	5900	14000	30000	41000	42000	43000	17000	23000	31000	LQM S4ULs 2015
MTBE (Methyl tert-butyl ether)	mg/kg	7900	13000	24000							CL:AIRE 2009
Naphthalene	mg/kg	190	460	1100	4900	4900	4900	1200	1900	3000	LQM S4ULs 2015
Acenaphthylene	mg/kg	83000	97000	100000	15000	15000	15000	29000	30000	30000	LQM S4ULs 2015
Acenaphthene	mg/kg	84000	97000	100000	15000	15000	15000	29000	30000	30000	LQM S4ULs 2015
Fluorene	mg/kg	63000	68000	71000	9900	9900	9900	20000	20000	20000	LQM S4ULs 2015
Phenanthrene	mg/kg	22000	22000	23000	3100	3100	3100	6200	6200	6300	LQM S4ULs 2015
Anthracene	mg/kg	520000	540000	540000	74000	74000	74000	150000	150000	150000	LQM S4ULs 2015
Fluoranthene	mg/kg	23000	23000	23000	3100	3100	3100	6300	6300	6400	LQM S4ULs 2015
Pyrene	mg/kg	54000	54000	54000	7400	7400	7400	15000	15000	15000	LQM S4ULs 2015
Benzo(a)anthracene	mg/kg	170	170	180	29	29	29	49	56	62	LQM S4ULs 2015
Chrysene	mg/kg	350	350	350	57	57	57	93	110	120	LQM S4ULs 2015
Benzo(b)fluoranthene	mg/kg	44	44	45	7.1	7.2	7.2	13	15	16	LQM S4ULs 2015
Benzo(k)fluoranthene	mg/kg	1200	1200	1200	190	190	190	370	410	440	LQM S4ULs 2015
Benzo(a)pyrene	mg/kg	35	35	36	5.7	5.7	5.7	11	12	13	LQM S4ULs 2015
Indeno(1,2,3-cd)pyrene	mg/kg	500	510	510	82	82	82	150	170	180	LQM S4ULs 2015
Di-benzo(a.h.)anthracene	mg/kg	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	LQM S4ULs 2015
Benzo(g.h.i.) Perylene	mg/kg	3900	4000	4000	640	640	640	1400	1500	1600	LQM S4ULs 2015
Phenol	mg/kg	760	1500	3200	760	1500	3200	760	1500	3200	LQM S4ULs 2015

Proposed End Use	units	Commercial			POS(resi)			POS (park)			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
Pentachlorophenol (PCP)	mg/kg	400	400	400	60	60	60	110	120	120	LQM S4ULs 2015
1,1,2,2 Tetrachloroethane	mg/kg	270	550	1100	1400	1400	1400	1800	2100	2300	LQM S4ULs 2015
1,1,1,2 Tetrachloroethane	mg/kg	110	250	560	1400	1400	1400	1500	1800	2100	LQM S4ULs 2015
1,1,1 Trichloroethane	mg/kg	660	1300	3000	140000	140000	140000	57000	76000	100000	LQM S4ULs 2015
Trichloroethene	mg/kg	1.2	2.6	5.7	120	120	120	70	91	120	LQM S4ULs 2015
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	2.9	6.3	14	890	920	950	190	270	400	LQM S4ULs 2015
1,2- Dichloroethane	mg/kg	0.67	0.97	1.7	29	29	29	21	24	28	LQM S4ULs 2015
Chloroethene (Vinyl chloride)	mg/kg	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	LQM S4ULs 2015
Trichloroethene	mg/kg	1.2	2.6	5.7	120	120	120	70	91	120	LQM S4ULs 2015
Tetrachloroethene	mg/kg	19	42	95	1400	1400	1400	810	1100	1500	LQM S4ULs 2015
Trichloromethane (Chloroform)	mg/kg	99	170	350	2500	2500	2500	2600	2800	3100	LQM S4ULs 2015
Sum of PCDDs, PCDFs and dioxins like PCBs	ug/kg			240							CLEA SGVs 2009
Isopropylbenzene	mg/kg	1400	3300	7700							CL:AIRE 2009
Propylbenzene	mg/kg	4100	9700	21000							CL:AIRE 2009
Styrene	mg/kg	3300	6500	11000							CL:AIRE 2009
Bromobenzene	mg/kg	97	220	520							CL:AIRE 2009
1,1,2 Trichloroethane	mg/kg	94	190	400							CL:AIRE 2009
1,1-Dichloroethane	mg/kg	280	450	850							CL:AIRE 2009
1,1-Dichloroethene	mg/kg	26	46	92							CL:AIRE 2009

Proposed End Use	units	Commercial			POS(resi)			POS (park)			Source
Soil Organic Matter Content	%	1	2.5	6	1	2.5	6	1	2.5	6	
1,2,4-Trimethylbenzene	mg/kg	42	99	220							CL:AIRE 2009
1,2-Dichloropropane	mg/kg	3.3	5.9	12							CL:AIRE 2009
2-Chloronaphthalene	mg/kg	390	960	2200							CL:AIRE 2009
Bromodichloromethane	mg/kg	2.1	3.7	7.6							CL:AIRE 2009
Bromoform	mg/kg	760	1500	3100							CL:AIRE 2009
Chloroethane	mg/kg	960	1300	2100							CL:AIRE 2009
Chloromethane	mg/kg	1	1.2	1.6							CL:AIRE 2009
Cis 1,2 Dichloroethene	mg/kg	14	24	47							CL:AIRE 2009
Dichloromethane	mg/kg	270	360	560							CL:AIRE 2009
Hexachloroethane	mg/kg	22	53	120							CL:AIRE 2009
Trans 1,2 Dichloroethene	mg/kg	22	40	81							CL:AIRE 2009
Bis (2-ethylhexyl) phthalate	mg/kg	85000	86000	86000							CL:AIRE 2009
Butyl benzyl phthalate	mg/kg	940000	940000	950000							CL:AIRE 2009
Diethyl Phthalate	mg/kg	150000	220000	290000							CL:AIRE 2009
Di-n-butyl phthalate	mg/kg	15000	15000	15000							CL:AIRE 2009
Di-n-octyl phthalate	mg/kg	89000	89000	89000							CL:AIRE 2009
Biphenyl	mg/kg	18000	33000	48000							CL:AIRE 2009
2,4-Dinitrotoluene	mg/kg	3700	3700	3800							CL:AIRE 2009
2,6-Dinitrotoluene	mg/kg	1900	1900	1900							CL:AIRE 2009
Tributyl tin oxide	mg/kg	130	180	200							CL:AIRE 2009

Soil Contamination – Risk of Harm to Property

Structures and Underground Services

Buried Concrete

BRE Special Digest 1 (2005), 3rd Edition, entitled *Concrete in aggressive ground*, provides guidance on the specification for concrete for installation in natural ground and in brownfield locations. The procedures given for the ground assessment and concrete specification cover the fairly common occurrences of sulfates, sulphides and acids, and the more rarely occurring aggressive carbon dioxide found in some ground and surface waters, which affects concrete foundations and sub-structures. It gives procedures for specification of concrete and applies to both buildings and civil engineering construction.

Water Supply Pipes

Guidance is provided in the UK Water Industry Research (UKWIR) report entitled *"Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites"* Report Ref. No. 10/WM/03/21, 2010.

Guidance is provided in the November 2010 Q&A Update and the Questions and Answers Sheet dated 4 May 2011 included at the back of the UKWIR report. Item 3 has been reproduced here:

Item	Question	Answer
3	Following the flow chart in Figure 1.1, **would it be acceptable to not undertake a site investigation and specify the use of barrier pipes** (these seem to be suitable for all conditions)? Would it be acceptable to adopt the blanket approach of always using barrier pipes at Brownfield sites, negating the need for a desk study or intrusive investigation?	The UKWIR project steering group decided that barrier pipes would provide sufficient protection for the supply of drinking water in all Brownfield site conditions. It is therefore reasonable to expect that water companies will accept the use of barrier pipe in all situations as a blanket approach

Soil Contamination – Risk of Combustion

The combustibility of soils is a complex function of soil type, energy content, and availability of oxygen. The Building Research Establishment (BRE) has published guidance based on Calorific Value (i.e. energy content, alone), namely *IP 2/87, Fire and explosion hazards associated with the redevelopment of contaminated land*. This document provides a level below which combustibility is unlikely (2MJ/kg) and a level above which combustibility is likely (10MJ/kg). In the range between these two values combustibility is uncertain. Therefore, where the lower value is exceeded, the other key factors mentioned above need to be considered.

Soil Contamination – Risk of Harm to Vegetation

Where there is topsoil present on Site and it is being considered for reuse in landscaped areas then it needs to be assessed for its suitability for use by an appropriately qualified specialist. Topsoil can be both naturally-occurring and manufactured. The requirements for topsoil that is to be reused on site are specified in BS3882:2007 and cover a range of properties including texture, organic matter content, grading, pH, nutrients and phytotoxic contaminants. The specification for phytotoxic contaminants is reproduced in the table below:

Phytotoxic Contaminants (by soil pH) for Topsoil

Contaminant*	pH		
	<6	6.0 to 7.0	>7
Zinc (Nitric acid extractable**)	<200mg/kg	<200mg/kg	<300mg/kg
Copper (Nitric acid extractable**)	<100mg/kg	<135mg/kg	<200mg/kg
Nickel (Nitric acid extractable**)	<60mg/kg	<75mg/kg	<110mg.kg

Footnotes: * The lower of the Generic Assessment Criteria for chemical contaminants (human health and the environment) and phytotoxicity shall be used for topsoil

** The method of testing is given in Annex D to BS3882:2007 Specification for topsoil and requirements for use.

The risk to human health and the environment needs to be considered as well as phytotoxicity and this will be carried out using the Generic Assessment Criteria selected for these risks as described elsewhere in this appendix and this report.

In order to assess the suitability of topsoil to be reused the full range of testing specified needs to be carried out and assessed by an appropriately qualified specialist.

Controlled Waters Generic Assessment Criteria

The Screening Values adopted by Waterman for ground and surface water quality have been selected on the basis of the water quality standards that apply at the controlled water receptor considered to be at potential risk of harm.

Surface Waters

The Water Framework Directive (WFD) (2000/60/EC) was originally introduced in 2000, however a raft of Daughter Directives have been brought in to address the objectives the WFD originally set out. Over time the WFD and its Daughter Directives have gradually replaced number of the existing Directives including the Dangerous Substances Directive (DSD) and Surface Water Directive (SWD).

The WFD identifies 'Priority' and 'Priority Hazardous Substances', to which Environmental Quality Standards (EQS) have been determined. The WFD EQS do not provide a full complement of applicable values to adopt. In the absence of an EQS, values under the replaced Surface Water Directive have been used as a guide.

Groundwater

The EU Drinking Water Directive (DWD) (98/83/EC) lays out the standards for drinking water EU wide. The UK have followed the EU regulations and translated the Directive into the Water Supply (Water Quality) Regulations England 2000. The UK Drinking Water Standards are the most relevant criteria to use for the assessment of risks to water destined for potable sources.

The WFD, to date, have not set threshold values for groundwater on a river basin basis.

TPH and PAHs

A suitable risk based assessment criteria for risks from TPH in both surface waters and groundwater are not available in the UK. The WHO have produced a health based risk assessment for drinking waters with regard to TPH “Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123”.

The WHO Guideline values have been amended for the UK standard body weight and behaviour to derive a UK guideline for DWS of TPH (70kg body weight and 2l of water consumed per day).

A complete list of assessment criteria for PAHs is absent from the UK (benzo(a)pyrene is available). However, the risk from PAHs should be considered. The theory presented in the WHO document "Petroleum Products in Drinking Waters, Background document for development of WHO Guidelines for Drinking-water Quality. Ref. WHO/SDE/WSH/05.08/123" has been applied to provide indicative screening values for PAHS with regard to drinking water. Published TDI and ID effects have been amended for the UK standard body weight and behaviour to derive a UK guideline for DWS of PAHs (70kg body weight and 2l of water consumed per day).

The derived TPH and PAH screening values are used as an indication of the risks from TPH and PAHs to human health through drinking water only.

The standards for the substances tested for in this investigation are provided in Table D3 and D4 below.

Table J3 - Screening Values – Water Quality Standards

	Concentration (µg/l)		
Determinand	**Surface Water - EQS Freshwater (DEFRA Directions 2015)**	**UK Drinking Water Standard (DWS)**	**WHO Drinking Water Standard**
Metals			
Arsenic	50	10	-
Barium	-	-	700
Beryllium	-	-	12
Boron	-	1000	-
Cadmium	0.25*	5	-
Copper	1 (bioavailable)	2000	-
Chromium (total)	4.7	50	-
Chromium (VI)	3.4	-	-
Chromium (III)	4.7	-	-
Iron	1000	200	-
Lead	1.2 (partial bioavailable)	10	-
Manganese	123 (bioavailable)	50	-
Mercury	0.07	1	-
Nickel	4 (bioavailable)	20	-
Selenium	-	10	-
Zinc	10.9+X** (bioavailable X is catchment related)	-	-
Non-Metals			
Cyanide	1	50	-

Chloride	-	250,000	-
Nitrate	-	50,000	-
Sulphate	-	250,000	-
Ammonia (total)	-	500	-
Nitrite	-	500	-
BTEX			
Benzene	10	1	-
Ethyl Benzene	-	-	300
Toluene	74	-	-
Xylene (p+m)	30	-	500
MTBE	-	-	15***
Phenol	7.7	-	-
Petroleum Hydrocarbons			
Aliphatic EC5 - EC6	-	-	15,000
Aliphatic EC6 - EC8	-	-	15,000
Aliphatic EC8-EC10	-	-	300
Aliphatic EC10-EC12	-	-	300
Aliphatic EC12-EC16	-	-	300
Aromatic EC6-EC7 (Benzene)	10	1	
Aromatic EC7-EC8 (Toluene)	74	-	700
Aromatic EC8-EC10	-	-	300****
Aromatic EC10-EC12	-	-	90
Aromatic EC12-EC16	-	-	90
Aromatic EC16-EC21	-	-	90
Aromatic EC21-EC35	-	-	90
Polycyclic Aromatic Hydrocarbons			
Anthracene	0.1	-	1050
Acenaphthene	-	-	210*****
Acenaphthylene	-	-	210*****
Chrysene	-	-	1.085*****
Di-benzo(a.h.)anthracene	-	-	0.01085*****
Phenanthrene	-	-	43.75*****
Benzo(a)pyrene	0.00017	0.01	-
Benzo(b)fluoranthene	0.00017	0.1b	-
Benzo(g.h.i.) Perylene	0.00017	0.1	-

Benzo(k)fluoranthene	0.00017	0.1	-
Fluoranthene	0.0063	-	-
Indeno(1,2,3-cd)pyrene	0.00017	0.1	-
Naphthalene	2	-	70
Fluorene	-	-	140*****
Benzo(a)anthracene	-	-	0.543*****
Pyrene	-	-	105*****
Volatile Organic Compounds			
Vinyl Chloride	-	0.5	-
1,1-dichloroethene	-	-	30
Trans 1,2-Dichloroethene	-	-	0.3
Chloroform	-	100c	-
1,2-Dichloroethane	10	3	-
Trichloroethene (TCE)	-	10	-
Bromodichloromethane	-	100	-
Tetrachloroethene (PCE)	-	10	-
1,3-Dichloropropane	-	100	40
Bromoform	-	100	-
1,4-Dichlorobenzene	-	-	300
1,2-Dichlorobenzene	-	-	1000
1,2-Dibromo-3-chloropropane	-	-	1

* Value for Class 5 water, assumes >200mg$CaCO_3$/L
** 10.9 + 2.9 (ambient background concentration for Humber catchment)
*** Odour and taste threshold
**** Value for ethylbenzene
***** Waterman-derived criteria based on guidance in WHO document and UK background data
b - Sum of 4 PAHs
c - sum of 4 trichlorohalides – Chloroform, bromoform, dibromoform and bromodichloromethane

Bioavailability based Environmental Quality Standards

Under the Water Framework Directive, originally introduced in 2000, and transposed into the UK regulatory framework via the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015, we are now required take account of the bioavailability when assessing the toxicity of heavy metal contamination in the freshwater environment.

What is Bioavailability and Why Account for it?

It is widely accepted that the total concentration of certain metals in freshwater often has limited relevance to potential environmental risk, but it is the 'bioavailable' fraction that is likely to result in toxic effects to aquatic organisms. Effectively, it's the bioavailability of a metal which reflects the actual metal concentration that the organism will be exposed to, and thus is the relevant concentration that we are interested in when assessing risk.

EQS developed under previous legislation (including the Dangerous Substances Directive (76/464/EEC)) were expressed as total concentration relative to hardness bandings to reflect the indications that toxicity to aquatic life was influenced by water hardness. Scientific knowledge and understanding on the impact of metals has since developed, and metal bioavailability in aquatic systems is now understood to be influenced by several site-specific physio-chemical factors including the pH, calcium content and the level of dissolved organic carbon (DOC) present within the water body under consideration.

Taking bioavailability into account as part of the risk assessment process is now considered best practice and will enable more accurate estimation of metal toxicity and the risks posed to the freshwater environment.

How to Account for Metal Bioavailability

The increased understanding of the impact of certain metals on the aquatic environment has enabled EQSs to be published by the UK Secretary of State for a number of metals based on their bioavailable concentration. These are referred to as EQS bioavailable and are listed in the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

It is very difficult to measure the bioavailable concentration of a metal directly. We therefore have to rely on models to predict the bioavailable concentration from dissolved concentrations. In the UK, a simple predictive tool has been developed that can take account of water quality parameters such as pH, and calcium to determine the amount of bioavailable metal present in the freshwater environment.

The tool is called the Metal Bioavailability Assessment Tool (M-BAT) and is acceptable for use under the UK regulatory framework.

Use of Background Concentrations for the Assessment of Zinc.

Metals occur naturally in the aquatic environment due to weathering of surface geology, and under the EQS Directive (2008/105/EEC) background concentrations for metals can be considered when assessing compliance against the respective EQS.

The situation for Zinc is now slightly different, and consideration of background concentration is now an explicit part of the zinc EQS released under the WFD and needs to be taken into account as part of the initial compliance assessment.

Using this approach, a local background concentration should be subtracted from the monitoring data before the bioavailability estimate is performed using M-BAT. Under the WFD, catchment specific background values have been defined for England and Wales to be used in conjunction with the EQS bioavailable. The background values are listed within the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 Schedule 3, Part 2, Table 2, and also reproduced in Appendix A of the M-BAT user guide available here.

Lead

Lead is not included in the M-BAT tool (referred to above) as it is not a full bioavailable EQS. The EQS for lead is an EU standard under WFD. It takes into account the influence of DOC on the toxicity of lead but, unlike the full bioavailable standards for zinc, copper, manganese and nickel which are included in M-BAT, it only considered the influence of DOC, and does not require the consideration of calcium or pH.

Ground Gas and Volatile Organic Compounds Generic Assessment Criteria

Ground Gas

Current UK guidance has been produced by CIRIA, the British Standards Institution (BSI) and CL:AIRE. The following relevant documents have been prepared to date:

- CIRIA C665 – Assessing the risks posed by hazardous ground gases to buildings, 2007;

- Aims to consolidate good practice in investigation, facilitate the collection of relevant data, instigate appropriate monitoring programmes, all in a risk based approach to gas contaminated land.

- BS 8576 – Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs), 2013;
    - Provides guidance on the monitoring and sampling of ground gases, including methane, carbon dioxide, oxygen, and VOCs. Guidance is not provided on the risk evaluation and characterisation of site's, the selection and design of protective measures, verification of protective measures, sampling of atmospheric gases, and the monitoring and sampling of radon.
- CIRIA C735 – Good practice on the testing and verification of protection systems for buildings against hazardous ground gases, 2014; and
    - Sets out the good practice guidance for the designer, installer, verifier, and regulator on the verification and integrity testing of gas protection systems.
- BS 8485 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, 2015.
    - Provides guidance on the appropriate ground gas parameters that can be used to identify a range of possible design solutions for protection against methane and carbon dioxide on a development.
- CL:AIRE - Technical Bulletin (TB 17), August 2018
    - The bulletin provides guidance on assessing ground gas monitoring data to ensure that sufficient data has been collected to cover critical variations in barometric pressure

Both the CIRIA and BSI publications have been prepared to be generally consistent with CLR11, *Model Procedures for the management of land contamination,* (Defra and the Environment Agency, 2004a) and follow a step by step approach summarised below:

1. Desk Study and Site Walkover.
2. Development of a Preliminary Conceptual Model and Risk Assessment.
3. Site Investigation (If deemed necessary from stage 2).
4. Risk Assessment and Site Characterisation.
5. Recommendation and Mitigation.

Where the preliminary conceptual model has deemed further investigation necessary to characterise the ground gas regime, an appropriate site investigation and monitoring regime should be designed and undertaken. In-depth guidance to assist in the design of the investigation is provided within C665 and BS 8576, which describes intrusive investigation techniques and provides guidance on selecting the number and location of monitoring wells based on the site specific conceptual model.

Waterman has generally followed the approach recommended in CIRIA C665, BS 8576, and BS 8485 with respect to characterising a site and determining the levels of gas protection methods required. Where deviations from the methodology detailed within above guidance occurs, the reasoning behind the deviation and implication of the analysis of the results has been included within the report.

Risk Assessment

In accordance with C665, to assess the ground gas regime at a site, the ground gas monitoring data should be assessed by determining the Gas Screening Value (GSV) (ℓ/hr). BS 8485 details further guidance on which GSV can be adopted based on a number of modifiers.

GSV = (Measured Maximum CO_2 or CH_4 Gas Concentration (%) / 100) x Maximum Measured Gas Flow Rate from boreholes (ℓ/hr).

Both C665 and BS 8485 dictate where the gas flow has been measured as less than the detection limit of the instrument used (typically <0.1ℓ/hr), the limit of detection of the instrumented should be used as the gas flow rate.

As per the guidance given in BS 8485 where a negative flow has been recorded, and there is an absence of a positive flow, a qualitative assessment has been undertaken into whether under different temporal conditions, a similar positive flow could occur. When the cause for negative flow is reasonably understood, it has been possible to rule out a corresponding credible positive flow and discount the negative flow.

The Gas Screening Value is used to classify the site, subject to the proposed end use of the site.

The Modified Wilson and Card classification system is used to attribute a Characteristic Situation (CS) value to the site/zone depending upon the calculated GSV. When attributing a CS, additional factors including the maximum recorded gas concentration and the maximum recorded gas flow rate should also be taken into account and may result in an increase in the CS value. Table I.2 below, outlines the CS values associated GSV's and additional factors which must be taken into account.

Table J5 Modified Wilson and Card Classification

Characteristic Situation (CIRIA 149)	Risk Classification	Gas screening value (CH_4 CO_2) l/hr	Additional Factors	Typical source of generation
1	**Very low risk**	**<0.07**	Typically methane ≤1% and / or carbon dioxide ≤5%. Otherwise consider increase to CS 2.	Natural soils with low organic content 'Typical' made ground
2	**Low risk**	**<0.7**	Borehole air flow rate not to exceed 70 l/hr. Otherwise consider increase to CS 3.	Natural soil, high peat/organic content. 'Typical' made ground
3	**Moderate risk**	**<3.5**		Old landfill, inert waste, mineworking flooded
4	**Moderate to high risk**	**<15**	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria)

5	**High risk**	**<70**	Mineworking unflooded inactive with shallow workings near surface
6	**Very High risk**	**>70**	Recent landfill site

Notes:

1) Gas screening value: litres of gas / hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/hr)
2) Source of gas and generation potential/performance must be identified.
3) If there is no detectable flow use the limit of detection of the instrument.

Following determination of the site's CS, the requirements and scope of gas protection measures can be prescribed based on the guidance given in BS 8485:2015.

BS 8485 details the required ground gas protection measures for a development using a points-based system, whereby a certain number of points must be accumulated through the installation of various protection measures to mitigate the risk to structures or buildings from the accumulation of methane or carbon dioxide. The number of points assigned will be dependent on the building type and the CS.

Table J6 Building types are separated into four distinct scenarios.

Kj,f Modifier	**Building Type**			
	Type A	**Type B**	**Type C**	**Type D**
Ownership	Private	Private or commercial / public, possible multiple	Commercial / public	Commercial / industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small / medium	Small to large	Large industrial / retail park style

Further details on the description of the building types, along with examples are included in BS 8485.

Following identification of the appropriate Building Type and CS, the minimum gas protection score can be determined through the use of the following table.

Table J7 Gas Protection Score

Characteristic Situation	**Minimum Gas Protection Score**			
	Type A	**Type B**	**Type C**	**Type D**
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5[A]	5.5[A]	4.5	3.5

5	N/A[B]	6[A]	5.5	4.5
6	N/A[B]	N/A[B]	N/A[B]	6

[A]Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system e.g. in Institutional and / or fully serviced contractual situations.

[B]The gas hazard is too high for this empirical method to be used to define the gas protection measures.

Post determination of the minimum gas protection score, a combination of two or more of the following three types of protection measures should be used to achieve the score:

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present;
- Ventilation measures; and
- Gas resistant measures.

Through combining at least two ground gas protection measures, the lack of redundancy in the use of a single protection measure approach is negated. The ground gas protection measures should work independently and collaboratively.

The tables below detail the specific ground gas protection measures and their associated scores.

Structural Barrier

Table J8

Floor and substructure design	Score[A]
Precast suspended segmental subfloor (I.e. beam and block)	0
Cast in-situ ground bearing floor slab (with only nominal mesh reinforcement)	0.5
Cast in-situ monolithic ground bearing raft or reinforced cast in-situ suspended floor slab with minimal penetrations	1 or 1.5[B]
Basement floor and slab conforming to BS 8102:2009, Grade 2 waterproofing[C, D]	2
Basement floor and walls conforming to BS 1802:2009, Grade 3 waterproofing[C, D]	2.5

[A]The scores are conditional on breaches of floor slabs, etc., being effectively sealed.

[B]To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast.

[C]The score is conditional on the waterproofing not being based on the use of a geosynthetic clay liner waterproofing product.

Ventilation Measures

Table J9

Protection element / system	Score	Comments
Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket	0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measure systems.

or strips terminating in a gravel trench external to the building.		If the layer has a low permeability and / or is not terminated in a venting trench or similar, then the score is zero.
Passive sub floor dispersal layer: Very good performance: Good performance: Media used to provide the dispersal layer are; • Clear void; • Polystyrene void former blanket; • Geocomposite void former blanket • No-fines gravel layer with gas drains; • No-fines gravel layer.	 2.5 1.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing, and type and thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 2015. Passive ventilation should be designed to meet at least good performance, see in Annex B of BS 8485 2015.
Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may compromise a clear void or be formed of geocomposite or polystyrene void formers.	1.5 to 2.5	This system relies on continues serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system including pumps and vents. Active ventilation should always be designed to meet at least good performance as described in in Annex B of BS 8485 2015.
Active positive pressurization by the creation of a blanket of external fresh air beneath the floor slabs by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.	1.5 to 2.5	This system relies on continues serviceability of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient coverage of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least good performance.
Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park).	4	Assumes that the car fumes is vented to deal with exhaust fumes designed to *Buildings Regulations 2000, Approved Document F.*

It should be noted that for Type A Buildings active ventilation systems are inappropriate.

Membrane

Table J10

Protection element / system	Score	Comments
Gas resistant membrane meeting all of the following criteria; Sufficiently impervious both in the sheet material [A] and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and / or carbon dioxide through the membrane; Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet the all the criteria in column 1 then the score is zero.

Sufficiently strong [B] to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc.); and to withstand in-service stresses (e.g settlement if placed below a floor slab); Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and Verified in accordance with CIRIA C735.

A gas protection score should only be assigned to a membrane which is formed of a material with suitably low gas permeability and which has been installed so it completely seals the foundation (including effective seals around all penetrations) and does not sustain damage from in-service stresses.

Volatile Organic Compounds (VOCs)

The Building Regulations 2000 Approved Document C (2004 Edition) also refers to volatile organic carbons (VOCs). These are primarily assessed by examination of the VOC content of site soils. Further guidance on VOCs is provided in *"The VOCs Handbook; Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination"*, CIRIA Report C682, 2009.

For former landfill sites the risk from a wider range of trace gases are considered on a site specific basis when appropriate.

VOCs in groundwater

Under the Environmental Protect Act 1990, Building Regulations Approved Document C 2004 and the National Planning Policy Framework there is a requirement to ensure that Volatile Organic Compounds (VOC) are considered on a risk assessment basis.

VOCs are organic compounds that are volatile under normal atmospheric conditions. However, they may be found in the solid, liquid, and the dissolved phase as well as in the gaseous phase. VOCs are typically found in the following contaminants:

- Petroleum (non-halogenated) hydrocarbons (e.g. benzene, toluene, and butylbenzenes);
- Halogenated hydrocarbons (e.g. chlorinated ethenes and ethanes (dry cleaning fluids or degreasers) or chlorofluorocarbons (freons)); and
- Organic compounds containing nitrogen, sulphur, and oxygen (e.g. tetrahydrofuran).

The likely sources of the above contaminants include:

- Spills, leaks, and discharges from industries;
- Landfills;
- Buildings, furnishings, and common household products;
- Vehicle emissions;
- Marshland; and
- Uncontrolled waste disposal.

The risk to receptors from VOC occur from inhalation (acute and chronic), and a flammable / explosive risk when present at high concentrations in confined spaces.

Current UK guidance for VOCs are limited in comparison to ground gas, and is primarily given in the *"The VOCs Handbook; Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination"*, CIRIA Report C682, 2009.

Additional guidance was published in 2017 by the Society of Brownfield Risk Assessments (SoBRA) *'Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile contaminants in Groundwater*', February 2017. The 2017 SoBRA document provided a set of Generic Assessment Criteria (GAC) to allow the risk to a residential/commercial premise to be assessed quantitatively using the contamination concentrations recorded in the groundwater. The GAC were generated using the CLEA model, with each GAC being the theoretical concentration in groundwater/perched water beneath a property that is modelled as resulting in estimated average daily exposure (ADE) to the critical receptor that is equal to the Health Criteria Value (HCV).

The GAC were designed to incorporate several precautionary assumptions, these conservatisms include;

- The assumption that the impacted groundwater/perched water is directly beneath the building, when it may instead be offset from the receptor;
- The assumption that there is an infinite source term, when in fact the source may be finite;
- The assumption that there is no biodegradation between the source term and the receptor;
- The assumption that the groundwater source is at a depth of 0.65m bgl;
- The use of sand soil type for both the saturated and unsaturated zone.
- The omission of a capillary zone between the saturated and unsaturated zone.

These GAC are detailed in the Tables below.

Table J11 Petroleum Hydrocarbons

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
1,2,4-Trimethylbenzene	95-63-6	24	2,200	559,000
Benzene 3	71-43-2	210	20,000	1,780,000
Ethylbenzene 3	100-41-4	10,000	*960,000 (sol)*	180,000
Isopropylbenzene	98-82-8	850	*86,000 (sol)*	56,000
Propylbenzene	103-65-1	2,700	*240,000 (sol)*	54,100
Styrene	100-42-5	8,800	*810,000 (sol)*	290,000
Toluene 3	108-88-3	230,000	*21,000,000 (sol)*	590,000
TPH Aliphatic EC5-EC6 3		1,900	*190,000 (sol)*	35,900
TPH Aliphatic >EC6-EC8 3		1,500	*150,000 (sol)*	5,370
TPH Aliphatic >EC8-EC10 3		57	*5,700 (sol)*	427
TPH Aliphatic >EC10-EC12 3		37	*3,600 (sol)*	34

TPH Aromatic >EC5-EC7 2,3		210,000	*20,000,000 (sol)*	1,780,000
TPH Aromatic >EC7-EC8 3		220,000	*21,000,000 (sol)*	590,000
TPH Aromatic >EC8-EC10 3		1,900	*190,000 (sol)*	64,600
TPH Aromatic >EC10-EC 12 3		6,800	*660,000 (sol)*	24,500
TPH Aromatic >EC12-EC16 3		39,000	*3,700,000 (sol)*	5,750
meta-Xylene 3,5	108-38-3	9,500	*940,000 (sol)*	200,000
ortho-Xylene 3,5	95-47-6	12,000	*1,100,000 (sol)*	173,000
para-Xylene 3,5	106-42-3	9,900	*980,000 (sol)*	200,000

Table J12 Polycyclic Aromatic Hydrocarbons

Chemical	CAS	GAC gw vap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
Acenaphthene	83-32-9	*170,000 (sol)*	*15,000,000 (sol)*	4,110
Acenaphthylene	208-96-8	*220,000 (sol)*	*20,000,000 (sol)*	7,950
Fluorene	86-73-7	*210,000 (sol)*	*18,000,000 (sol)*	1,860
Naphthalene	91-20-3	220	*23,000 (sol)*	19,000

Table J13 Pesticides

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
Aldrin	309-00-2	*47 (sol)*	*3,700 (sol)*	20
alpha-Endosulfan	959-98-8	*7,400 (sol)*	*590,000 (sol)*	530
beta-Endosulfan	33213-65-9	*7,500 (sol)*	*600,000 (sol)*	280

Table J14 Halogenated Organics

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
1,1,1,2-Tetrachloroethane	79-34-5	240	22,000	1,110,000
1,1,1-Trichloroethane	71-55-6	3,000	290,000	1,300,000

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
1,1,2,2-Tetrachloroethane	79-35-4	1,600	150,000	2,930,000
1,1,2-Trichloroethane	79-00-5	520	49,000	4,491,000
1,1-Dichloroethane	75-34-3	2,700	260,000	3,666,000
1,1-Dichloroethene	75-35-4	160	16,000	3,100,000
1,2,3,4-Tetrachlorobenzene	634-66-2	240	*31,000 (sol)*	7,800
1,2,3,5-Tetrachlorobenzene	634-90-2	7.0	600	3,500
1,2,3-Trichlorobenzene	87-61-7	35	3,100	21,000
1,2,4,5-Tetrachlorobenzene	95-94-3	8.1	*700 (sol)*	600
1,2,4-Trichlorobenzene	120-82-1	68	7,200	41,400
1,2-Dichlorobenzene	95-50-1	2,000	*220,000 (sol)*	133,000
1,2-Dichloroethane	107-06-2	8.9	850	8,680,000
1,2-Dichloropropane	78-87-5	22	2,600	2,050,000
1,3,5-Trichlorobenzene	108-70-3	7.4	660	6,000
1,3-Dichlorobenzene	541-73-1	31	2,800	103,000
1,4-Dichlorobenzene	106-46-7	5,000	460,000 (sol)	51,200
Bromobenzene	108-86-1	220	20,000	388,040
Bromodichloromethane	75-27-4	17	1,600	3,000,000
Bromoform (Tribromomethane)	75-25-2	3,100	400,000	3,000,000
Chlorobenzene	108-90-7	98	15,000	387,000
Chloroethane	75-00-3	10,000	1,000,000	5,742,000
Chloroethene (Vinyl Chloride)	75-01-4	0.62	63	2,760,000
Chloromethane	74-87-3	14	1,400	5,350,000
cis-1,2-Dichloroethene	156-59-2	130	13,000	7,550,000
Dichloromethane	75-09-2	3,300	370,000	20,080,000
Hexachlorobenzene	118-74-1	16 (sol)	1,400 (sol)	10
Hexachlorobutadiene	87-68-3	1.7	230	4,800
Hexachloroethane	67-72-1	8.5	740	49,900
Pentachlorobenzene	608-93-5	140	12,000 (sol)	500
Tetrachloroethene	127-18-4	34	4,600	225,000
Tetrachloromethane (Carbon Tetrachloride)	56-23-5	5.3	770	846,000
trans-1,2-Dichloroethene	156-60-5	160	16,000	5,250,000
Trichloroethene	79-01-6	5.7	530	1,370,000
Trichloromethane (Chloroform)	67-66-3	790	85,000	8,950,000

Table J15 Others (Organic and Inorganic)

Chemical	CAS	GACgwvap (µg/l) 1,2		Aqueous Solubility (µg/l)
		Residential	Commercial	
2-Chloronaphthalene	91-58-7	160	*14,000 (sol)*	11,700
Biphenyl (Lemonene)	92-52-4	*15,000 (sol)*	*1,300,000 (sol)*	4,060
Carbon disulphide	75-15-0	56	5,600	2,100,000
Mercury, elemental	7439-97-6	1.1	*95 (sol)*	56
Methyl tertiary butyl ether (MTBE)	1634-04-4	83,000	7,800,000	48,000,000

The risks to receptors from vapours will be assessed through assessment of the volatile contaminant concentrations recorded in groundwater samples against the SoBRA derived GAC. Where an exceedance is recorded, a qualitative assessment will be made, given the conservative approach of the SoBRA derived GAC as to whether a significant vapour regime is present on-site and possible risk to receptors exists. The vapour concentration recorded during headspace analysis of soils, SVOC / VOC contaminant concentration within soil samples, and the vapour concentration within installed boreholes will also be considered qualitatively during this assessment.

Where a significant vapour regime is present and a risk to receptors exists, further assessment will be required, this may include, vapour sampling, further intrusive investigations, or a Detailed Quantitative Risk Assessment (DQRA). Dependent on the results of the further assessment, remedial measures will be required to mitigate the risk to receptors.

UK and Ireland Office Locations