REFA

CONSULTING ENGINEERS
CIVIL • STRUCTURAL
GEOTECHNICAL • ENVIRONMENTAL

MD/ST/19192

6th February 2020

Ms Christina Worswick
(On Behalf Of Broughton Parish Council)
40 Kings Drive
Fulwood
Preston
PR2 3HP

Att: Ms C Worswick

Dear Ms Worswick

RE: GROUND INVESTIGATION WORKS – BROUGHTON COMMUNITY HUB, 476 GARSTANG ROAD, BROUGHTON

We have been commissioned by Broughton Parish Council., to undertake a programme of ground investigation works to assess the ground conditions surrounding the existing property at 476 Garstang Road, Broughton and provide a detailed assessment for foundation solutions.

- Investigations

  This investigation commissioned by REFA utilised four (4 No.) window sample boreholes (WS01 – WS04) conducted by Geo-ventures UK Ltd who are a specialist ground investigation contractor. Locations of the exploratory holes are shown upon the appended exploratory hole location plan (drawing reference 19192/01).

  The investigation was conducted on 5th November 2019 and locations of the positions have been chosen by ourselves but were restricted by the presence of the existing property and utilities within the site.

- Ground Conditions

  Made ground deposits have been identified within positions WS01 – WS03 and have been proven to extend to depths ranging between 0.4 – 1.2m bgl. The made ground material comprises of reworked natural strata with anthropogenic materials such as brick and concrete.

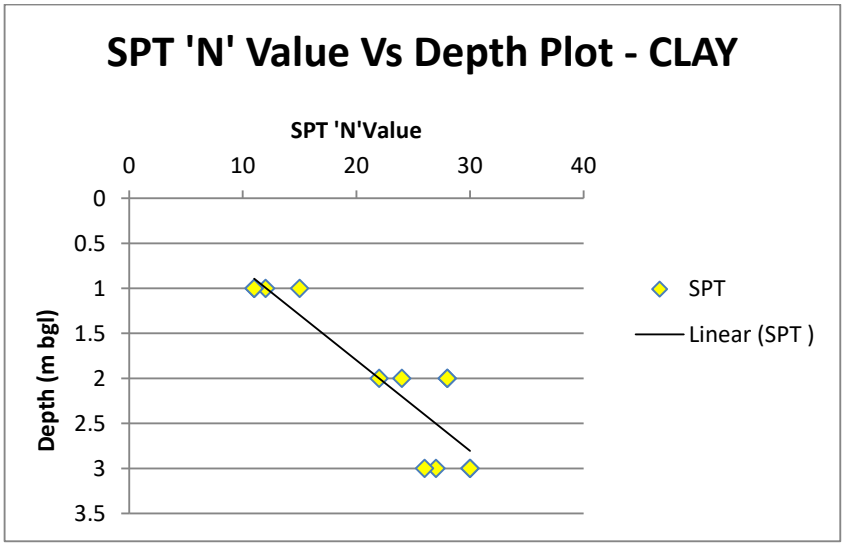
  Topsoil deposits have been identified within position WS 4 and has been proven to a maximum depth of 0.2m bgl.

  Underlying the made ground and topsoil deposits the natural strata comprises predominantly of stiff to very stiff brown sandy clay which has been proven to a maximum depth of 3.4m bgl. In-situ standard penetration tests (SPT's) have recorded "N" values of 11 – 30 blows/300mm. The SPT results are summarised in figure 1 overleaf which is a depth vs "N" value plot. Based upon this information the stiff to very stiff clays are capable of offering a safe bearing capacity of at least 150kN/m2 at a minimum depth of 0.9m bgl

ROBERT E FRY & ASSOCIATES LTD.
45, Bridgeman Terrace
Wigan, WN1 1TT

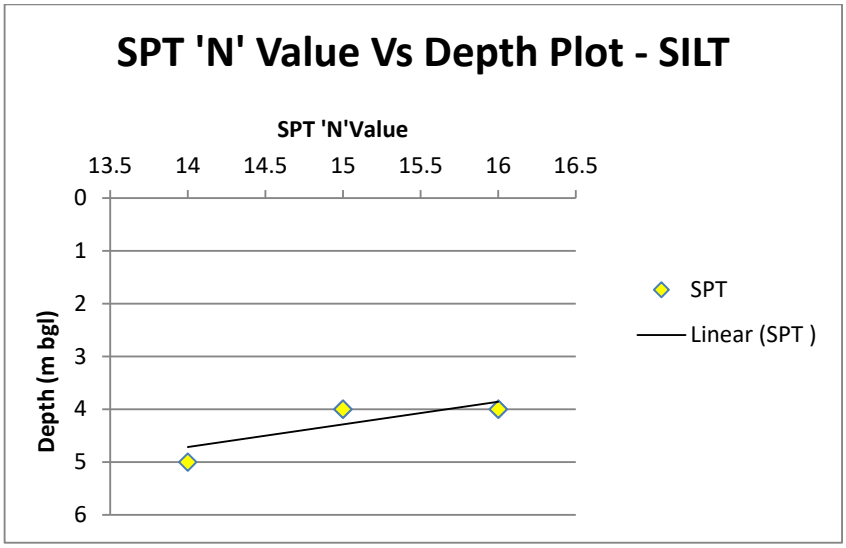
Telephone: 01942 826020
Fax: 01942 230816
Email: mail@refa.co.uk
Company Registration No. 2436911

FIGURE 1 – 'N' Value Vs Depth - CLAY



Underlying the natural clay deposits medium dense to dense silts have been identified at depths between 3.2 – 5.45m bgl. SPT testing within the silt strata has recorded N values in the range of 14-16 blows/300mm. The SPT results are summarised in figure 2 below. Based upon this information the silt material is capable of offering a safe bearing capacity of at least 150kN/m^2 at a minimum depth of 3.2m bgl.

FIGURE 2 – 'N' Value Vs Depth – SILT



Groundwater ingress has been recorded at depths ranging between 3.4 – 3.5m within the underlying silt stratum. It is anticipated that local groundwater table may be present within the underlying silt deposits and therefore any excavations continued into the underlying silts may encounter groundwater ingress. It is anticipated that the ingress may be remediated by a programme of groundwater management utilising sump pumping techniques.

- Plasticity Index Testing

  Semi mature and mature trees have been identified within and along the site boundaries and therefore it is considered that the clays within the site are capable of volume change depending on moisture content. Therefore six (6 No.) samples of the natural clays have been obtained and returned to Murray Rix laboratories for plasticity index analysis. Careful assessment of the laboratory testing confirms that the soils present within the site have a plasticity index in the range of 19 – 22% although it should be noted that sample WS04 – 1.0m is non-plastic. Modified plasticity indexes have been calculated in accordance with NHBC Handbook Chapter 4.2 and generated modified plasticity index values of 18.24 – 20.9%. Based upon this information we consider that the clays within the site should be considered to have a medium volume change potential in accordance with NHBC Handbook Chapter 4.2. Therefore, a full arboriculturist report will be required for the development of the site to determine the potential tree root effects upon foundations.

CONCLUSIONS

It is considered that the underlying natural boulder clay material is capable of offering a safe bearing capacity of at least 150kN/m^2 at a minimum depth of 0.9m bgl. However, it is anticipated that foundations may need to increase with depth due to tree root effects. The natural clays within the site are considered to have a medium volume change potential in accordance with NHBC Handbook Chapter 4.2 and therefore the foundations engineer should incorporate tree root effects into the foundation design for this development.

Groundwater ingress has been identified within the underlying silt deposits and therefore any excavations that extent into the underlying silts at depths between 3.2 – 3.4m bgl may encounter a significant groundwater ingress and there will be a requirement for a programme of groundwater management. It is also considered that during inclement weather excavations made within the impermeable clay's strata may encounter significant surface water becoming perched in excavations.

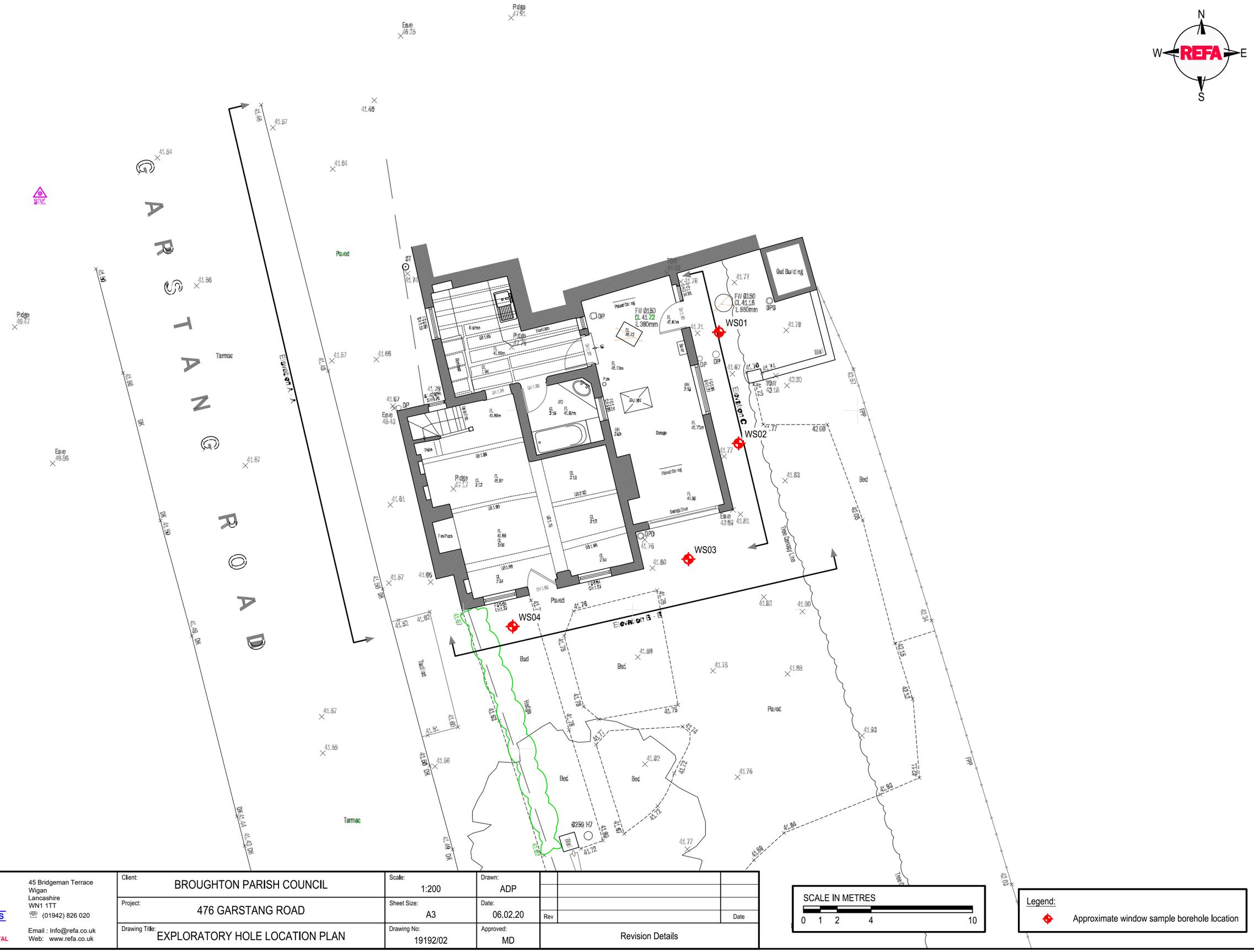
We trust that this information meets with your requirements at this time but if you do require anything further or have any queries then please do not hesitate to contact us.

Yours sincerely

M DAVIES B.Sc. (Hons), FGS
R E FRY & ASSOCIATES LTD

Enc:

Exploratory Hole Location Plan – 19192/01
Window Sample Records
Murray Rix Laboratory Analysis


N
W
REFA
E
S
GARSTANG ROAD
Tarmac
Paved
Eaves 46.25
Ridge 47.91
41.68
41.64
41.54
41.57
41.56
Ridge 49.47
41.50
41.65
41.67
Eave 48.43
41.61
41.52
41.62
41.60
41.55
41.56
Eave 48.56
41.57
DK 41.50
41.49 DK
DK 41.44
41.43 DK
41.49 DK
STNC
Kitchen
Utility
Pantry
Plant
Shaft
WC
Garage
Fire Place
Hedge
Bed
Tree
Shrubs
Out Building
F/W Ø150
CL 41.72
I.L 390mm
F/W Ø150
CL 41.16
I.L 550mm
DP
DPD
TOW 41.52
TOW 43.18
WS01
WS02
WS03
WS04
Eaves 43.69
41.81
41.76
41.80
41.83
41.90
42.08
42.30
42.57
42.34
42.15
42.12
41.93
41.98
41.94
42.03
41.89
41.78
41.74
41.72
41.82
41.76
41.77
Ø250 H7
Manhole
Tree Canopy Line
Ridge 47.17
Ridge 47.7
Eaves 48.66
Eaves 46.56
Eaves 48.63
Eaves 48.66
Eaves 48.69
Eaves 48.72
Eaves 48.75
Eaves 48.78
Eaves 48.81
Eaves 48.84
Eaves 48.87
Eaves 48.90
Eaves 48.93
Eaves 48.96
Eaves 48.99
Eaves 49.02
Eaves 49.05
Eaves 49.08
Eaves 49.11
Eaves 49.14
Eaves 49.17
Eaves 49.20
Eaves

Geo-Ventures (UK) Limited
Geotechnical and Environmental Services

Site	Number
476 Garstang Road, Barton	WS 1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler				19-1862
	Location	**Dates** 05/11/2019	**Engineer** Robert E Fry & Associates Limited	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records
0.10	D		
0.40	D		
0.70	D		
1.00-1.45	SPT(C) N=12		2,3/3,3,3,3
1.00	D		
1.50	D		
2.00-2.45	SPT(C) N=22		3,4/4,5,5,8
2.00	D		
3.00-3.45	SPT(C) N=30		4,5/6,8,8,8
3.00	D		
			Seepage(1) at 3.40m.
3.50	D		
4.00-4.45	SPT(C) N=16		2,3/4,4,4,4
4.00	D		

Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	(0.30)	MADE GROUND : black soil, ash, sand, gravel and broken brick fill		
	0.30			
	(0.30)	MADE GROUND : soft / firm brown sandy gravelly clay fill		
	0.60			
		Firm / stiff brown CLAY		
	(0.80)			
	1.40			
		Stiff brown CLAY		
	(1.80)			
	3.20			
		Medium dense brown SILT		▽1
	(1.25)			
	4.45			
		Complete at 4.45m		

Remarks
Services inspection pit excavated by hand

Scale (approx)	Logged By
1:50	Dr J Crook

Figure No. 19-1862.WS 1

Geo-Ventures (UK) Limited
Geotechnical and Environmental Services

Site	Number
476 Garstang Road, Barton	WS 2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler				19-1862
	Location	**Dates** 05/11/2019	**Engineer** Robert E Fry & Associates Limited	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15) 0.15	MADE GROUND : brown medium coarse sand fill		
0.10	D				(0.25) 0.40	MADE GROUND : brown sand, soil and ash fill		
0.30	D							
0.50	D					Firm brown slightly sandy CLAY		
					(0.90)			
1.00-1.45	SPT(C) N=11		2,2/2,3,3,3					
1.00	D				1.30			
1.50	D					Stiff brown CLAY		
2.00-2.45	SPT(C) N=28		4,4/5,7,7,9					
2.00	D				(2.00)			
3.00-3.45	SPT(C) N=27		3,5/5,6,8,8					
3.00	D				3.30			
3.40	D		Seepage(1) at 3.40m.			Medium dense brown SILT		▽1
					(1.15)			
4.00-4.45	SPT(C) N=15		2,3/3,4,4,4					
4.00	D				4.45			
						Complete at 4.45m		

Remarks
Services inspection pit excavated by hand

Scale (approx)	Logged By
1:50	Dr J Crook

Figure No. 19-1862.WS 2

Geo-Ventures (UK) Limited
Geotechnical and Environmental Services

Site	Number
476 Garstang Road, Barton	WS 3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler				19-1862
	Location	**Dates** 05/11/2019	**Engineer** Robert E Fry & Associates Limited	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D				(0.40)	MADE GROUND : brown soil, gravel, ash and broken brick fill		
					0.40			
0.60	D				(0.80)	MADE GROUND : soft / firm brown clay fill		
1.00-1.45 1.00	SPT(C) N=11 D		2,2/2,3,3,3		1.20			
1.40	D					Stiff brown CLAY		
2.00-2.45 2.00	SPT(C) N=28 D		4,4/5,6,8,9		(2.20)			
3.00-3.45 3.00	SPT(C) N=30 D		4,5/6,6,9,9					
3.50	D		Seepage(1) at 3.50m.		3.40	Medium dense brown SILT		▽1
4.00-4.45 4.00	SPT(C) N=15 D		2,3/3,4,4,4		(2.05)			
5.00-5.45 5.00	SPT(C) N=14 D		2,3/3,3,4,4		5.45	Complete at 5.45m		

Remarks
Services inspection pit excavated by hand

Scale (approx)	Logged By
1:50	Dr J Crook

Figure No. 19-1862.WS 3

Geo-Ventures (UK) Limited
Geotechnical and Environmental Services

Site	Number
476 Garstang Road, Barton	WS 4

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler				19-1862
	Location	**Dates** 05/11/2019	**Engineer** Robert E Fry & Associates Limited	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown TOPSOIL with rootlets		
0.10	D				0.20	Firm / stiff brown slightly sandy C:LAY		
0.40	D				(0.80)			
1.00-1.45	SPT(C) N=15		2,2/3,4,4,4		1.00	Stiff brown CLAY		
1.00	D							
1.50	D							
2.00-2.45	SPT(C) N=24		3,4/5,5,6,8		(2.40)			
2.00	D							
3.00-3.45	SPT(C) N=26		4,4/5,6,7,8					
3.00	D							
					3.40	Medium dense brown SILT		▽1
3.50	D		Seepage(1) at 3.50m.		(1.05)			
4.00-4.45	SPT(C) N=16		3,3/4,4,4,4					
4.00	D				4.45	Complete at 4.45m		

Remarks
Services inspection pit excavated by hand

Scale (approx)	Logged By
1:50	Dr J Crook

Figure No. 19-1862.WS 4

Geo-Ventures (UK) Limited
Geotechnical and Environmental Services

Standard Penetration Test Results

Site : 476 Garstang Road, Barton

Client :

Engineer : Robert E Fry & Associates Limited

Job Number 19-1862

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
WS 1	1.00	1.15	1.45	CPT	2	3	3	3	3	3	N=12	
WS 1	2.00	2.15	2.45	CPT	3	4	4	5	5	8	N=22	
WS 1	3.00	3.15	3.45	CPT	4	5	6	8	8	8	N=30	
WS 1	4.00	4.15	4.45	CPT	2	3	4	4	4	4	N=16	
WS 2	1.00	1.15	1.45	CPT	2	2	2	3	3	3	N=11	
WS 2	2.00	2.15	2.45	CPT	4	4	5	7	7	9	N=28	
WS 2	3.00	3.15	3.45	CPT	3	5	5	6	8	8	N=27	
WS 2	4.00	4.15	4.45	CPT	2	3	3	4	4	4	N=15	
WS 3	1.00	1.15	1.45	CPT	2	2	2	3	3	3	N=11	
WS 3	2.00	2.15	2.45	CPT	4	4	5	6	8	9	N=28	
WS 3	3.00	3.15	3.45	CPT	4	5	6	6	9	9	N=30	
WS 3	4.00	4.15	4.45	CPT	2	3	3	4	4	4	N=15	
WS 3	5.00	5.15	5.45	CPT	2	3	3	3	4	4	N=14	
WS 4	1.00	1.15	1.45	CPT	2	2	3	4	4	4	N=15	
WS 4	2.00	2.15	2.45	CPT	3	4	5	5	6	8	N=24	
WS 4	3.00	3.15	3.45	CPT	4	4	5	6	7	8	N=26	
WS 4	4.00	4.15	4.45	CPT	3	3	4	4	4	4	N=16	

MURRAY RIX
CONSULTANCY, SITE INVESTIGATION
CONSTRUCTION MATERIALS TESTING

TEST REPORT

Client	Robert E Fry & Associates Ltd (REFA)
Address	45 Bridgeman Terrace Wigan WN1 1TT
Contract	19192 - Garstang Road, Barton
Job Number	MRN 3541/35
Date of Issue	04 December 2019
Page	**1 of 7**

Approved Signatories

S J Hutchings, O P Davies

Notes

1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.

2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.

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

4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING
1580

TEST CERTIFICATE

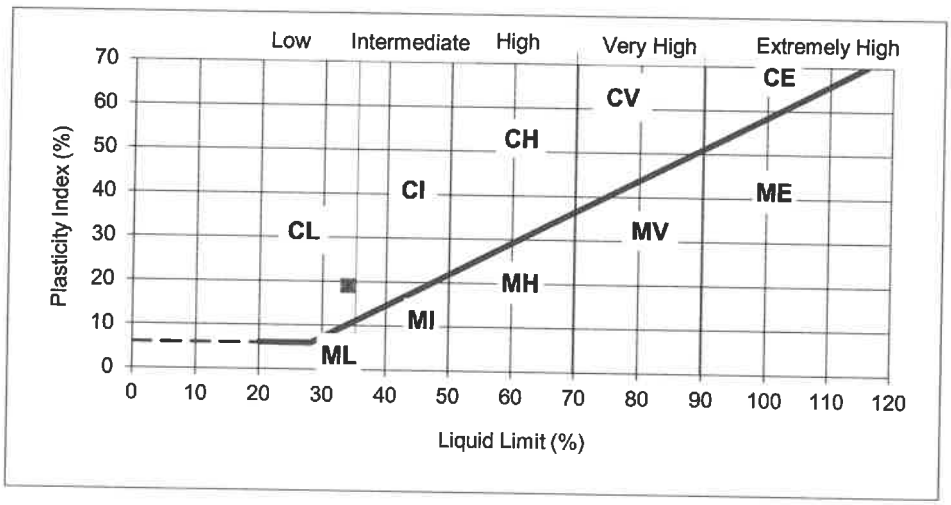
LIQUID AND PLASTIC LIMIT
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Robert E Fry & Associates Ltd (REFA)
SITE	19192 - Garstang Road, Barton
JOB NUMBER	MRN 3541/35

SAMPLE LABEL	WS01 - 1.0m	DATE SAMPLED	Not advised
SAMPLE No.	87087	DATE RECEIVED	26-Nov-19
DATE TESTED	27-Nov-19	SAMPLED BY	Client

MATERIAL	Firm to stiff red brown sitly sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
21	34	15	19	96



REMARKS
Sample tested in natural condition

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 04-Dec-19

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

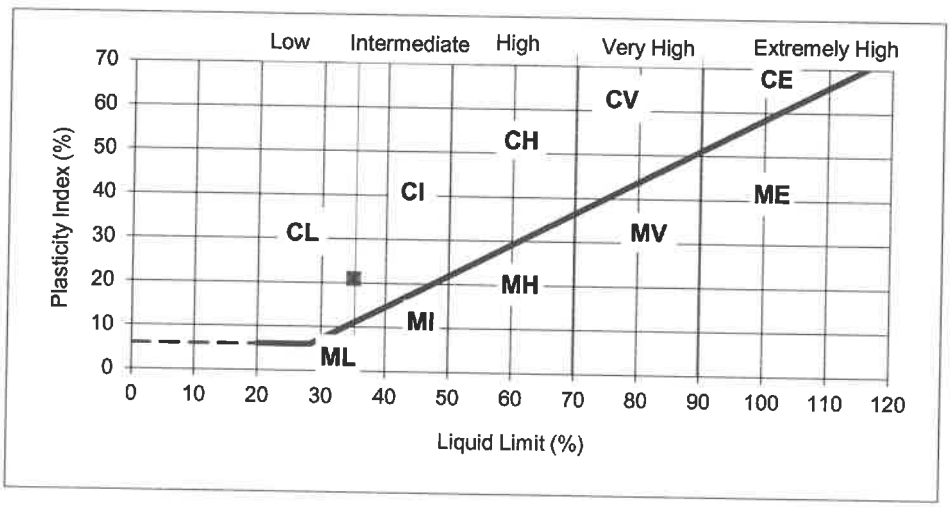
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Robert E Fry & Associates Ltd (REFA)
SITE	19192 - Garstang Road, Barton
JOB NUMBER	MRN 3541/35

SAMPLE LABEL	WS01 - 2.0m	DATE SAMPLED	Not advised
SAMPLE No.	87088	DATE RECEIVED	26-Nov-19
DATE TESTED	27-Nov-19	SAMPLED BY	Client

MATERIAL	Stiff red brown sitly sandy CLAY
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
14	35	14	21	98



REMARKS
Sample tested in natural condition

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 04-Dec-19

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
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UKAS TESTING 1580

TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

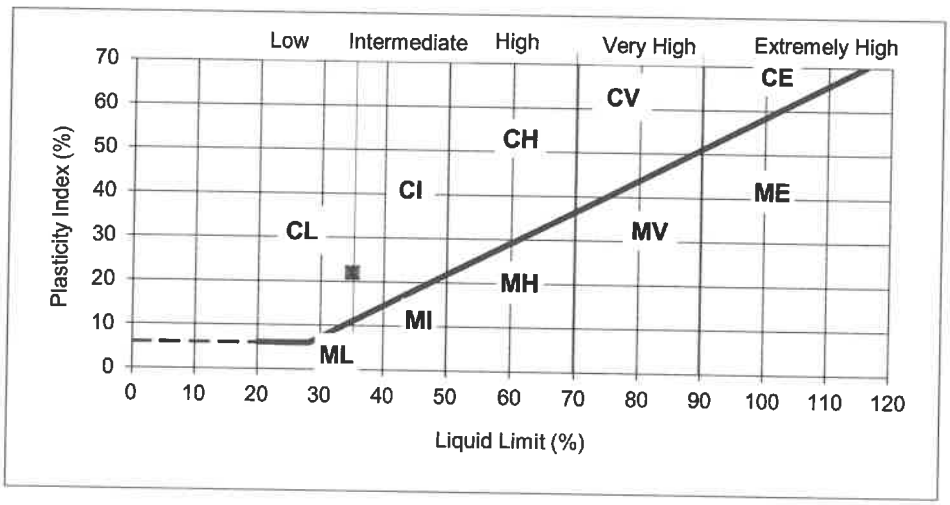
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Robert E Fry & Associates Ltd (REFA)
SITE	19192 - Garstang Road, Barton
JOB NUMBER	MRN 3541/35

SAMPLE LABEL	WS02 1.5m	DATE SAMPLED	Not advised
SAMPLE No.	87089	DATE RECEIVED	26-Nov-19
DATE TESTED	27-Nov-19	SAMPLED BY	Client

MATERIAL	Stiff red brown sitly sandy CLAY
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
14	35	13	22	94



REMARKS
Sample tested in natural condition

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 04-Dec-19

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
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TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

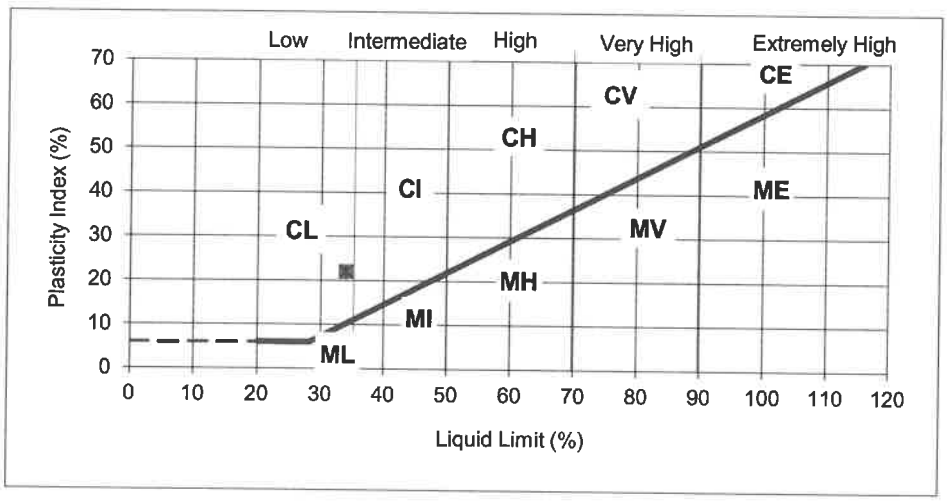
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Robert E Fry & Associates Ltd (REFA)
SITE	19192 - Garstang Road, Barton
JOB NUMBER	MRN 3541/35

SAMPLE LABEL	WS02 - 2.0m	DATE SAMPLED	Not advised
SAMPLE No.	87090	DATE RECEIVED	26-Nov-19
DATE TESTED	27-Nov-19	SAMPLED BY	Client

MATERIAL	Stiff red brown sitly sandy CLAY
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
14	34	12	22	95



REMARKS
Sample tested in natural condition

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 04-Dec-19

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
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UKAS TESTING 1580

TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

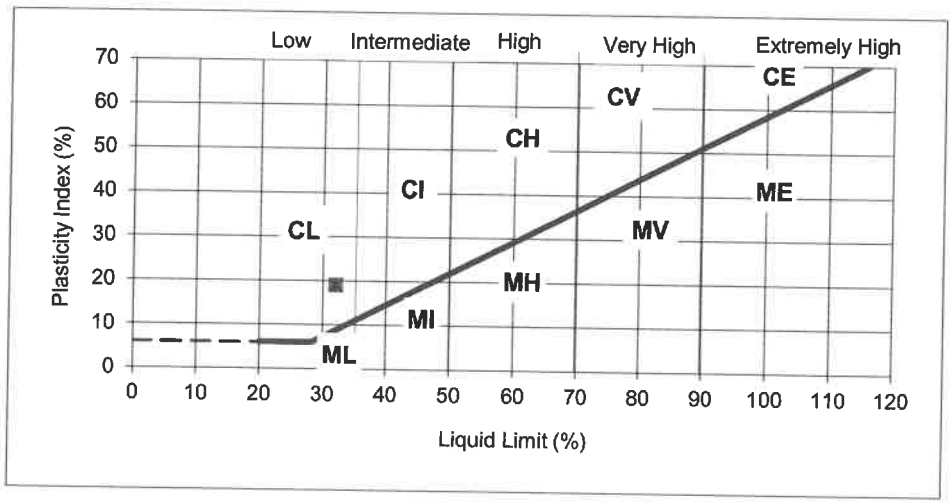
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Robert E Fry & Associates Ltd (REFA)
SITE	19192 - Garstang Road, Barton
JOB NUMBER	MRN 3541/35

SAMPLE LABEL	WS03 1.4m	DATE SAMPLED	Not advised
SAMPLE No.	87092	DATE RECEIVED	26-Nov-19
DATE TESTED	27-Nov-19	SAMPLED BY	Client

MATERIAL	Firm to stiff red brown sitly sandy CLAY
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
21	32	13	19	97



REMARKS
Sample tested in natural condition

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 04-Dec-19

MURRAY RIX

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UKAS TESTING
1580

TEST CERTIFICATE

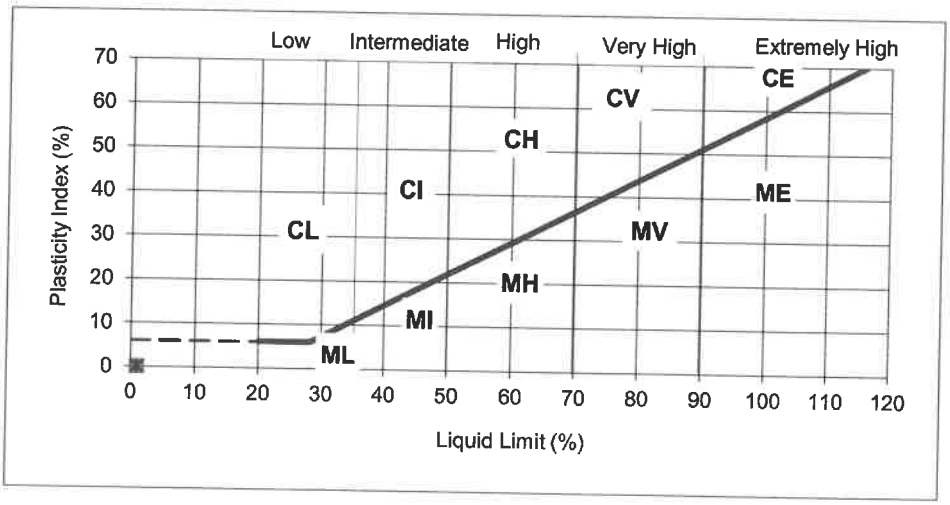
LIQUID AND PLASTIC LIMIT
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Robert E Fry & Associates Ltd (REFA)
SITE	19192 - Garstang Road, Barton
JOB NUMBER	MRN 3541/35

SAMPLE LABEL	WS04 1.0m	DATE SAMPLED	Not advised
SAMPLE No.	87093	DATE RECEIVED	26-Nov-19
DATE TESTED	27-Nov-19	SAMPLED BY	Client

MATERIAL	Red brown silty fine SAND
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
14	N/A	Non Plastic	N/A	81



REMARKS
Sample tested after wet sieving

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 04-Dec-19