Appendix 5 Site Investigations

Standpipe Readings

	18.12.13		23.01.14	
Location	Depth BGL	OD	Depth BGL	OD
WS1 [West]	2.8m	+88.0m	1.5m	+89.3m
WS2 [East]	2.0m	+88.9m	0.8m	+90.1m
Difference across site		0.9m		0.8m

Road level at WS2 = +92.8m OD with road gradient at 1 in 10.

WS1 and WS2 spaced 18m apart so water table difference of 0.9m gives gradient of 1 in 20.

Extrapolating gradients:

- with water table in WS2 as +90.1m, water table at surface 55m to the west.
- with water table in WS2 as +88.9m, water table at surface 80m to the west.

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40 FROGNAL LANE
CAMDEN
LONDON NW3 6PP

Geotechnical Investigation

Client
Mr A Matuzny

Consulting Engineer
Train and Kemp
Architect
TGN Architects

Report No. 3611-2

30 September 2011

CONTENTS

40 FROGNAL LANE
CAMDEN
LONDON NW3 6PP

Geotechnical investigation

Synopsis

An investigation has been carried out at 40 Frognal Lane in Camden on the instructions of TGN Architects, professional advisors to client Mr. A Matuzny. Technical direction to the investigation has been provide by the client's Consulting Engineers, Messrs. Train and Kemp.

The purpose of the investigation was to determine the ground conditions and to provide recommendations in respect of foundation design and other geotechnical matters for the proposed underground swimming pool. An Hydrological Assessment[1] been conducted which should be read in conjunction with the discussion and recommendations herein.

This report describes the work carried out in the field and the laboratory, presents the test results and discusses their implications for the proposals.

Data is provided in respect of lateral earth pressures and vertical load capacity for the perimeter pile wall, soil swelling at the base of the excavation and associated aspects of the proposed construction.

[1] *Report No. 3611: Hydrological Assessment, 40 Frognal Lane, Camden; AP Geotechnics Ltd., 21 September 2011*

1

Site description

The property lies on the south side of Frognal Lane at the National Grid reference $^{5}260$ $^{1}855$ with a general layout as illustrated at Figure 1 of Appendix A.

Frognal Lane is relatively flat in the vicinity of the existing property and to the east but falls at increasing gradient west of the property, reaching a slope of approximately 7° (1:8) at the western boundary.

The property is situated on the undulating land to the north of the River Thames. A tributary of the Westbourne rises about 200 m south south west of the site according to Barton[2]. This location is some 15 m lower than the site, the stream now being entirely culverted.

The general arrangement of the site is shown at Figure 2. The house is an established large detached residence on two storeys above a lower ground floor. Overall plan dimensions are about 20m by 10m. It is aligned on approximately level ground north north west to south south east and surrounded by similar residential property. Access is provided via a drive from Frognal Lane which leads to a detached garage on the Frognal Lane frontage and thence to the north end of the house. A patio and landscaped garden adjoin the west side of the house. The garden is laid to lawn with ornamental planting, a pergola and fountain; and is about half a storey height below the ground floor level. The western edge of the site is a little lower than the garden level and was somewhat overgrown at the time of inspection.

---

[2] *Lost Rivers of London, Nicholas Barton, Historical Publications Ltd., 1992*

2

Development proposals

It is intended to construct an underground swimming pool beneath the garden as shown at Figures 3 & 4. Bored piles will be installed around the perimeter of the excavation to provide lateral support by means of a cantilever wall and they will also carry the imposed vertical loads, whether compression or tension.

3

Geology

The British Geological Survey indicate the property is underlain by the Claygate Member, the upper part of the London Clay Formation, with the younger Bagshot Formation being present on the higher ground to the north and north east, and the London Clay itself at outcrop to the south east as shown at Figure 5.

4

Field work

The field work comprised two boreholes drilled by light percussive techniques to 18 m depth at the approximate locations shown on Figure 2 of Appendix A.

Representative samples were recovered from the boreholes for subsequent laboratory examination and testing; whilst Standard Penetration Tests (SPT) were carried out as

appropriate. Details of the strata encountered are provided on the Borehole Records at Appendix B; together with particulars of the samples recovered, groundwater observations and SPT results. The profile of SPT with depth is also presented at Figure 6 of Appendix A.

A standpipe was installed in BH 1 to monitor groundwater levels. Readings are provided at Appendix C. A falling head was undertaken to establish the mass permeability of the soil as part of the Hydrological Assessment and the results included at Appendix D.

5
Laboratory testing

The following laboratory tests were conducted on samples recovered during the field work:-

- Natural moisture content: to assess the in situ condition of the soil.
- Liquid and Plastic Limits: to classify cohesive soil into behavioural groups.
- Unconsolidated undrained triaxial compression: to determine the shear strength of cohesive material under immediate loading and thus to assess its load bearing capacity.
- Consolidated undrained triaxial compression with pore pressure measurement: to assess the long term shear strength characteristics of cohesive soil.
- One - dimensional consolidation: to determine the deformation characteristics of clay under applied loading and unloading.
- Sulphate concentration and pH value: for the specification of buried concrete.

- Waste Acceptance Criteria: for disposal of construction spoil:-

Metals and semi - metals:	Arsenic, cadmium, chromium, lead, mercury, selenium, copper, nickel, zinc and boron.
Waste Acceptance Criteria:	Full solid waste suite Compliance leachate test at 10:1 dilution

Results of these tests are presented at Appendix E. The variation of shear strength with depth is also shown at Figure 7 of Appendix A.

6
Ground conditions

6.1
Stratigraphy

The general stratigraphy of the site as revealed by the boreholes is given in detail at Appendix B. It is illustrated in the section at right and described in general terms hereafter.

6.1.1
Made Ground

Both boreholes encountered Made Ground beneath the lawn, consisting of brick rubble within various parent clays. These layers extended to 1.3 m depth in BH 1 and 0.9 m in BH 2.

6.1.2
Claygate Member

Soil typical of the Claygate Member was found to between 5.1 & 5.6 m depth, generally comprising firm mottled brown and grey silty clay. Root penetration was observed in BH 2 to about 2.5 m depth and some fissures were evident below 4.5 m.

6.1.3
London Clay

The weathered part of this stratum was represented by a brown clay with occasional pockets of fine sand. At 7.8 - 8.6 m depth it was superceded by the grey clay which is typical of the fresh material. Fissures were noted throughout this formation and it was adjudged to be in a generally stiff condition, becoming very stiff at depth in BH 1.

6.2
Groundwater

During drilling, groundwater was encountered within the Made Ground of BH 1 at 1.6 m depth and at the base of the Claygate Member in both bores, at 5.0 - 5.3 m depth. Water levels rose only slightly during the subsequent observational pause in drilling. Full details of these strikes are provided on the appropriate Borehole Record.

The standpipe installed into BH 1 has been monitored on 5 August and 20 September 2011 and recorded water levels of 3.87 and 2.86 m below ground respectively.

7

Discussion

7.1

General

Some Made Ground has been found during the investigation and it is evident that the site has already carried development. It is therefore possible that other pockets of Made Ground may be present; perhaps of different character, deeper or associated with underground construction. Any remnants of underground construction should be removed to permit the proposals to be constructed without hindrance and to perform satisfactorily.

7.2

Pile design

The perimeter pile wall will be required to act as a retaining structure to resist the lateral earth pressures generated by the excavation for the pool without significant deformation. These may be assessed from the parameters of Table 1.

Table 1: Design parameters for lateral earth pressure assessment

Stratum	Approximate depth m	Bulk density Mg/m^3	Effective cohesion kPa	Effective angle of internal shearing resistance degrees
Made Ground	GL - 1.3	1.8	0	20
Claygate Member	1.3 - 5.6	1.8	0	25
London Clay	5.6 - 18.0	2.1	0	22

The piles should be installed with minimal vibration to reduce the risk of damage to the house and any other nearby structures. Cfa piles are therefore preferred. The pile wall should be sufficiently rigid to ensure there is no loss of support to the house and should be able to withstand any superimposed loading in addition to those generated by the ground conditions.

It is assumed the pile wall and swimming pool will form a single structural unit and tensile or compressive vertical load carried by the piles may be assessed from Tables 2 & 3.

Table 1: Preliminary design parameters for bored piles - Shaft friction

Stratum	Depth, m	Ultimate unit shaft friction
All material	0.0 - 7.0	Ignore
London Clay	7.0 - 18.0	Increases linearly from 70 to 90

Table 3: Preliminary design parameters for bored piles - End bearing capacity

Stratum	Depth, m	Ultimate unit end bearing capacity
London Clay	7.0 - 18.0	Increases linearly from 1050 to 1350 kPa

The parameters of Table 2 are derived in conjunction with an adhesion factor of 0.6. No shaft friction should be adopted within the depth of construction, assumed to 7 m below ground, in view of the relaxation from lateral earth pressures on the active side of the perimeter piles and due to construction disturbance. Piles are to be installed at close centres and thus shaft friction will not be generated over their full cross section.

Factors of safety must be applied to the ultimate loads calculated from the Tables 2 & 3. A value of 3 is recommended on both shaft friction and end bearing.

The actual load capacity achieved in practice depends upon the precise installation procedures. Advice should therefore be sought from specialist contractors to verify the load capacity and settlement characteristics of their particular piles in the ground conditions revealed by this investigation.

7.3
Excavations

7.3.1
Stability

The main excavation will be supported by the perimeter pile wall.

Should the proposals required local excavation for subsidiary construction, the Made Ground should be regarded as unstable. Although the silty clays of the Claygate Member are generally able to support vertical excavated faces of moderate depth in the short term, the softer material at the contact with the Made Ground in BH 1 should also be regarded as unstable.

It is unlikely that sufficient space will be available to batter potentially unstable material to a safe angle of repose and excavations in these materials should therefore be supported at all times, as should all excavations greater than 1.2 m depth and those that are required to remain open for some time.

7.3.2
Groundwater

Groundwater observations during the investigation indicate a standing water level of about 2.8 m depth although this may rise as a result of heavy rainfall. Water was also found below the Made Ground at just over 1 m depth during drilling, indicating the potential for a perched water table.

Except for perhaps any perched water at high level or in the Made Ground, the Claygate Member has a fairly low permeability and the rate of inflow is expected to be limited. Nevertheless, water ingress should be expected during pile construction and through the completed pile wall.

Hydrostatic uplift will therefore act upon the development proposals and the underground construction should be designed to withstand the resulting forces.

7.3.3
Soil swelling

The underlying London Clay will swell as the vertical effective stress is reduced by the excavation. Movement will consist of two components; immediate elastic relaxation followed by long term swelling at gradually decreasing rate. The former, elastic, component will be unnoticed as it will be removed during final trimming of the excavation.

The magnitude of long term swelling in the centre of the pool is calculated at about 45 mm. A void should therefore be formed beneath the base slabs of the pool and of the upper level construction to accommodate the soil swelling. Alternatively, the base slabs and piles should be designed to resist the resulting upward forces

7.4

Disposal of construction spoil

The Waste Acceptance Criteria for disposal of construction spoil were ascertained on an aggregated sample by the full solid waste suite and then by the compliance leaching test. The data sheets are presented at Appendix E and show that all results fall within the Inert Waste Landfill classification.

All material that is removed from site should be transported to a suitable receiving facility. The results of the Waste Acceptance Criteria testing should be forwarded to the facility to ensure that it is acceptable and copies of all Transfer Notices retained to comply with the legislation.

In addition, analysis was conducted for a suite of heavy metals and semi - metals as listed at Section 5 to assist the receiving facility. The results have been compared with CLEA Soil Guideline Values (SGVs)[3] and LQM/CIEH Generic Assessment Criteria (GAC)[4] and the relevant thresholds are included on the data sheets. All those for which an SGV or GAC has been published lie below the residential threshold. For contaminants where no published

[3] *The Contaminated Land Exposure Assessment Model., R & D Publications SGV 1 et al, Department for Environment, Food and Rural Affairs & The Environment Agency, March 2002*

[4] *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition); Nathanail, C.P., McCaffrey, C. et al; Land Quality Management Ltd., 2009*

guidance is available, the results were either below the limit of detection for the tests or are not considered significant based upon our experience and current industry practice.

Appropriate health and safety precautions, such as detailed in HS(G)66[5] and elsewhere, must be followed by the construction workforce and others who may come into contact with contaminated soil. These should be agreed with the Health and Safety Executive and are likely to include, but not be restricted to, the following:-

- maintain good standards of personal hygiene.
- wear personal protective clothing that is changed and cleaned frequently to eliminate skin contact.
- prevent ingestion by using washing and changing facilities at all break times.
- not eating, drinking or smoking between break times.
- control the spread of dust and airborne mists to prevent inhalation.

7.5
Buried concrete

Laboratory tests yielded a maximum soluble sulphate concentration of 2.03 g/l which results in a Design Sulphate Class[6] of DS-3 for the site. The comparable test on groundwater found a maximum sulphate concentration of 0.24 g/l which is less onerous.

---

[5] *Protection of workers and the general public during the development of contaminated land, HS(G)66, Health and Safety Executive, 1991*

[6] *Concrete in aggressive ground, BRE Special Digest 1, Building Research Establishment, 2005*

Groundwater conditions must be considered mobile and both soil and groundwater were close to neutral. The aggressive chemical environment for concrete, ACEC, is therefore class AC-3.

A W Parr
AP GEOTECHNICS LTD.
30 September 2011

PROCEDURAL NOTES for GROUND INVESTIGATIONS

General

This report is based upon data obtained from field descriptions of the strata and examination of the samples by an engineer, together with the results of in situ and laboratory tests as appropriate. Responsibility cannot be accepted for variations in ground conditions between and around any of the exploratory points that is not revealed by the data. Whilst the report may offer an opinion on the ground conditions between exploratory points and below the depth of investigation, this is for guidance only and no liability is accepted for its accuracy. Unless specifically included in the report, it should be assumed that no testing has been carried out in respect of asbestos or Japanese Knotweed and no liability is inferred or will be accepted.

Drilling procedure

Boring by light cable percussion drilling allows the ground conditions to be reasonably well established. However, a certain amount of disturbance is inevitable and some mixing of soils can occur.

Sampling procedure

"Undisturbed" samples of predominantly cohesive soils are taken with a 100mm diameter open tube sampler, generally in accordance with BS 5930: 1999.

Where appropriate, or where an undisturbed sample is unsuccessful, disturbed samples are recovered and sealed into polythene bags.

Groundwater samples are taken when water is encountered in sufficient quantity.

Standard penetration tests

The test is conducted generally in accordance with BS 1377: Part 9: 1990. The sampler tube is subject to a seating drive of 150mm into the soil at the base of the borehole. Results are given on the Borehole Records as the number of blows required to drive the sampler tube a further 300mm and this is known as the "N" value. Where the driving resistance is such that full penetration is not achieved, the test is generally terminated after 50 blows and the actual distance penetrated is recorded.

Groundwater

Groundwater observations necessarily reflect the conditions encountered at the time of the exploratory work. Long term monitoring of standpipes is usually required to establish an equilibrium water level since the normal rate of boring is too fast to permit steady state conditions to be achieved.

Groundwater levels are subject to variations caused by changes in drainage conditions and seasonal climatic changes.

Water may necessarily be added to advance the bore whilst casing may be required to maintain an open hole. These can both mask subsequent groundwater observations and are therefore noted on the individual Borehole Record.

APPENDICES

A Figures

B Borehole Records

C Standpipe Records

D In Situ Permeability Test

E Laboratory Test Results

APPENDIX A

FIGURES

40 Frognal Lane, Camden

Site location

Scale unknown

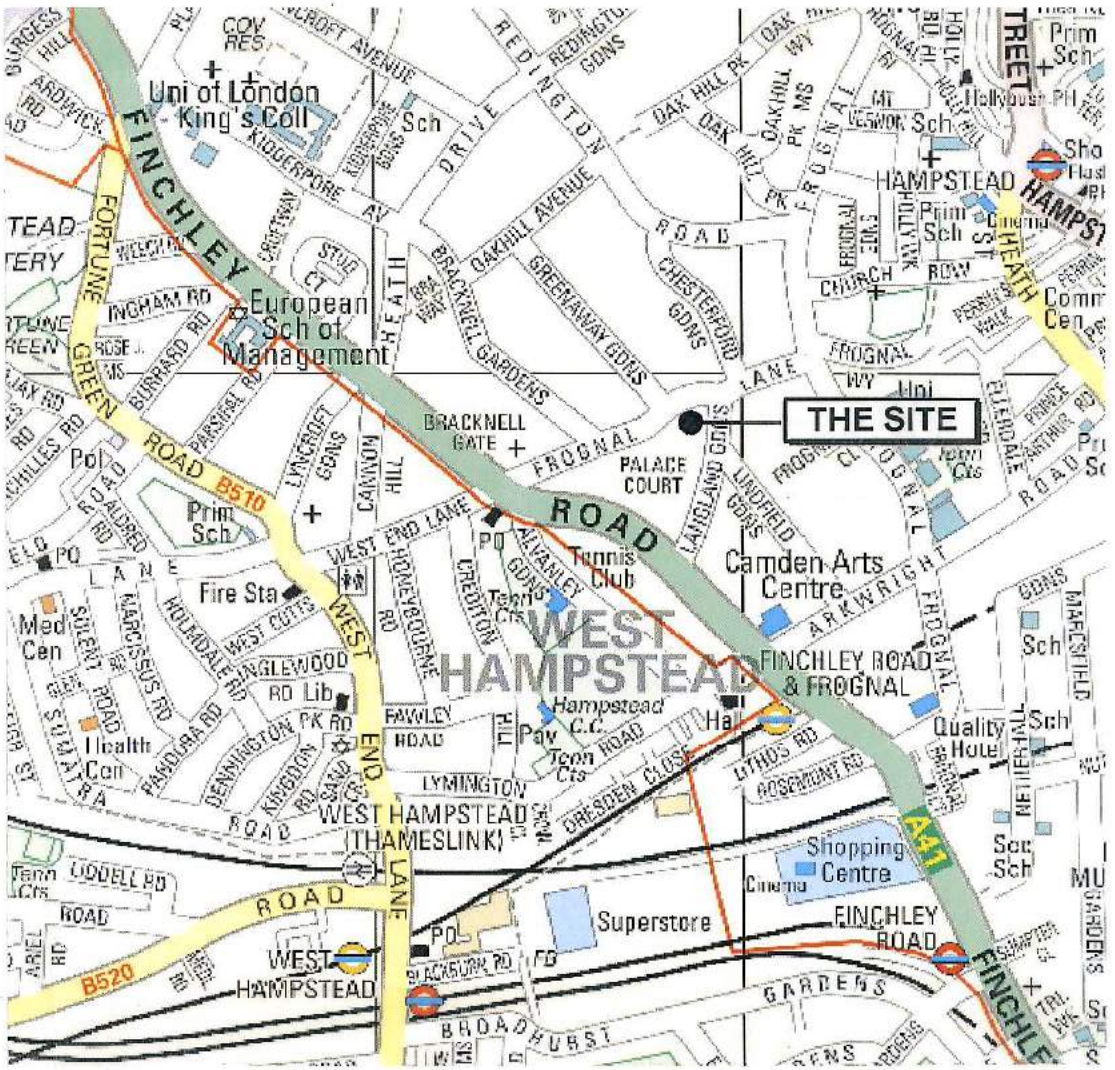
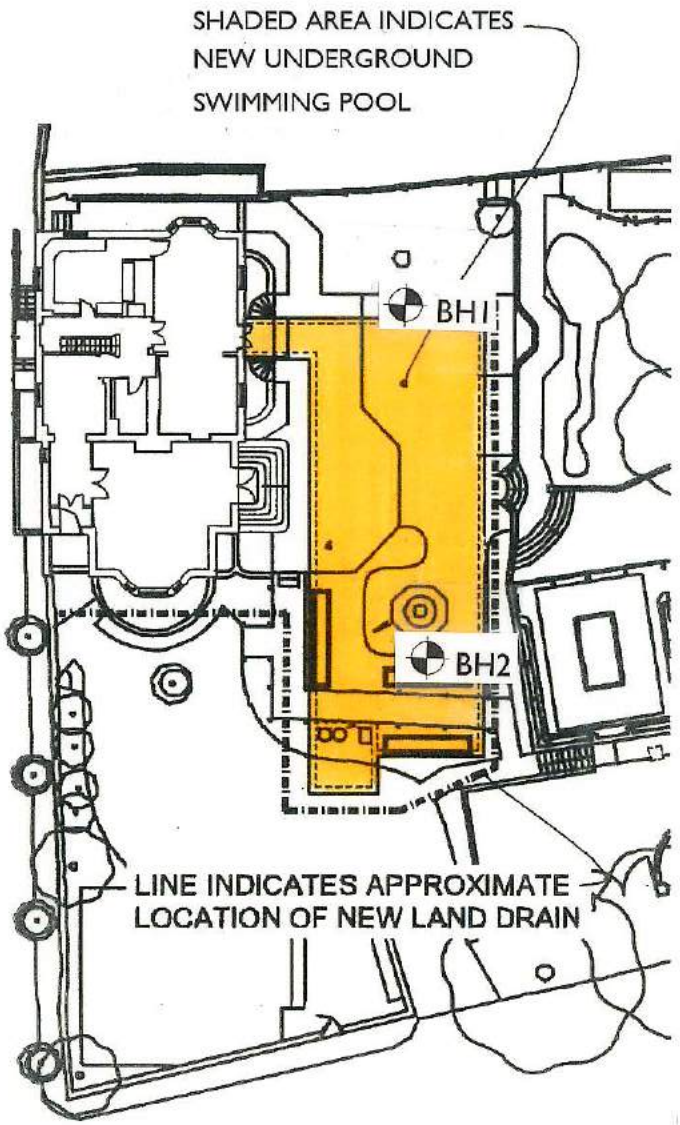


Figure 1



40 Frognal Lane, Camden

Plan showing general arrangement of the site

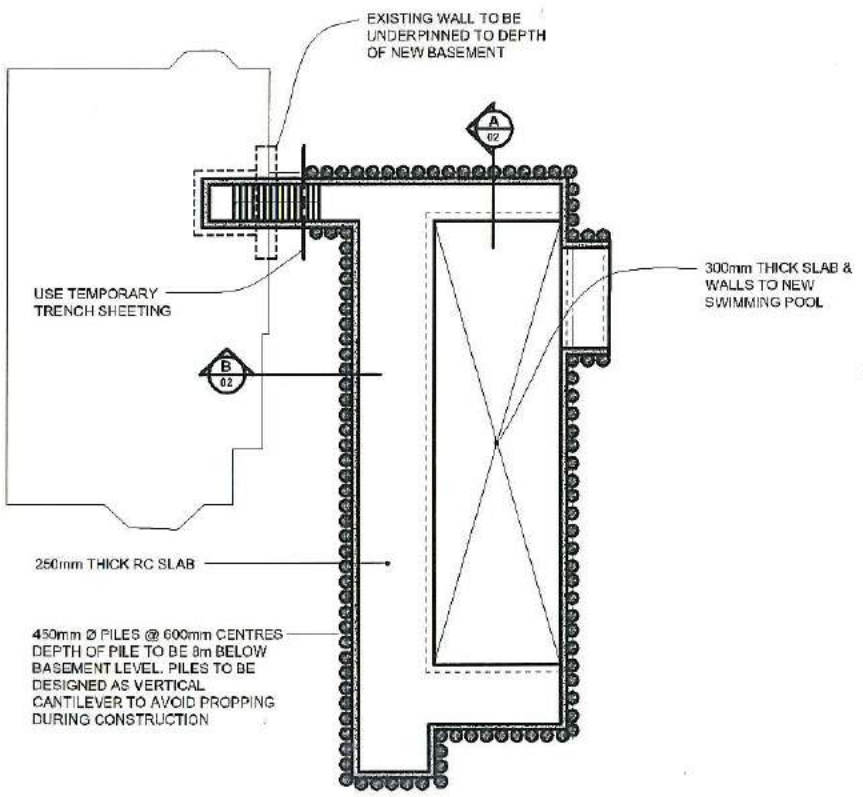
Scale unknown

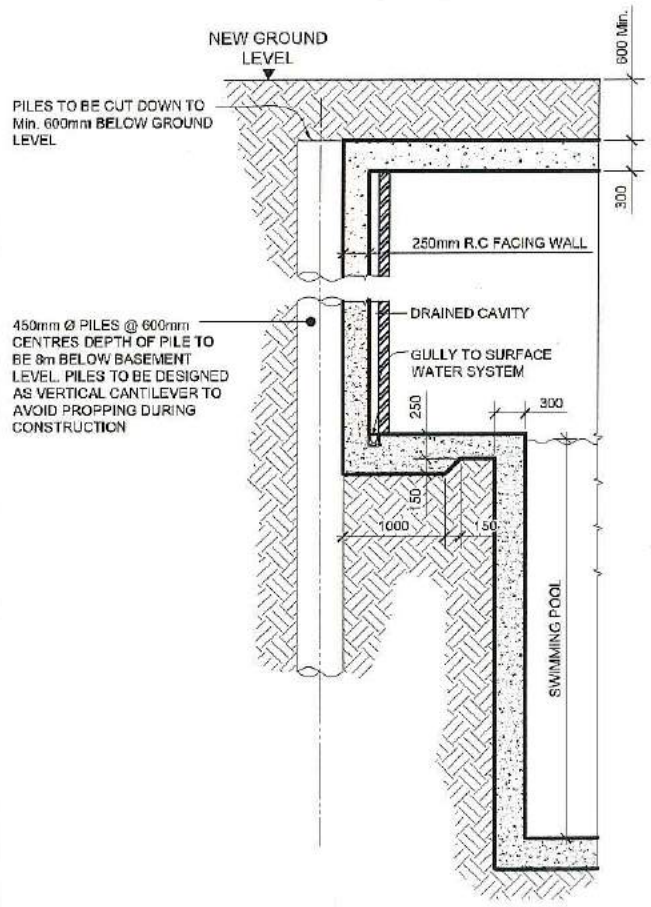
Figure 2

40 Frognal Lane, Camden

Development proposals
Plan and Section AA

Scale unknown





SECTION A-A

Figure 3

40 Frognal Lane, Camden

Development proposals
Section BB

Scale unknown

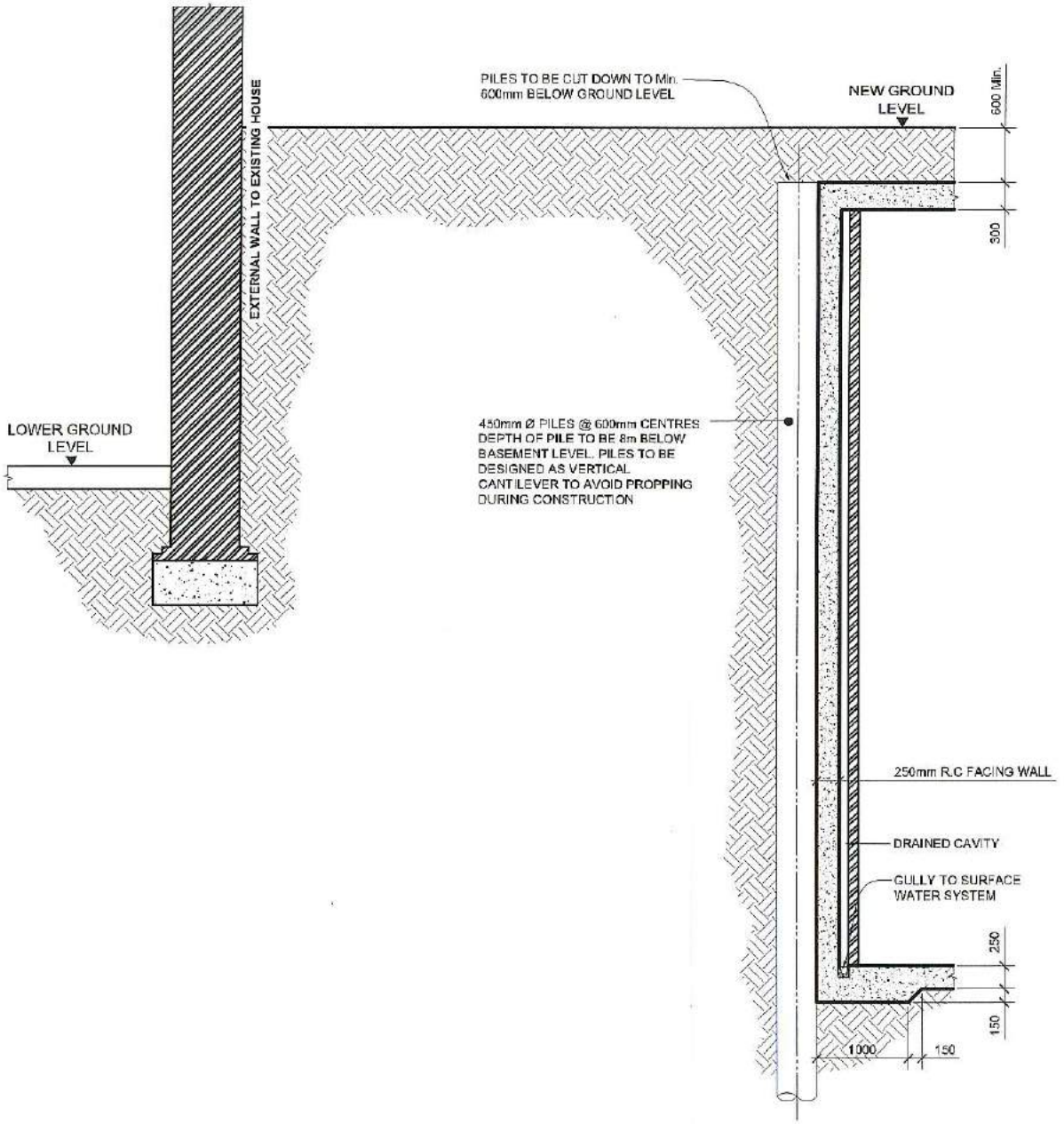
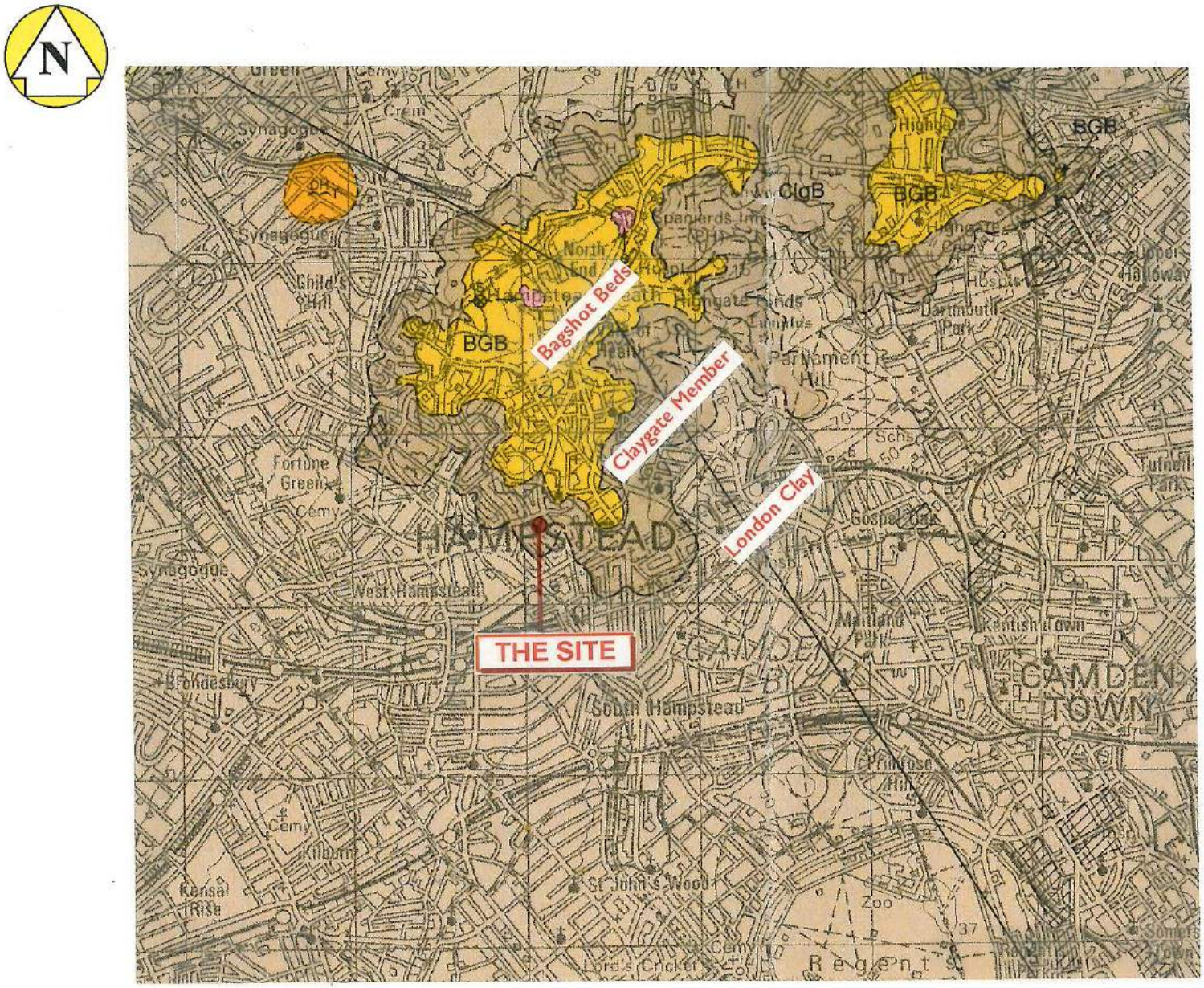


Figure 4



40 Frognal Lane, Camden

Geology

Scale unknown

Figure 5

SPT PROFILE
40 Frognal Lane, Camden

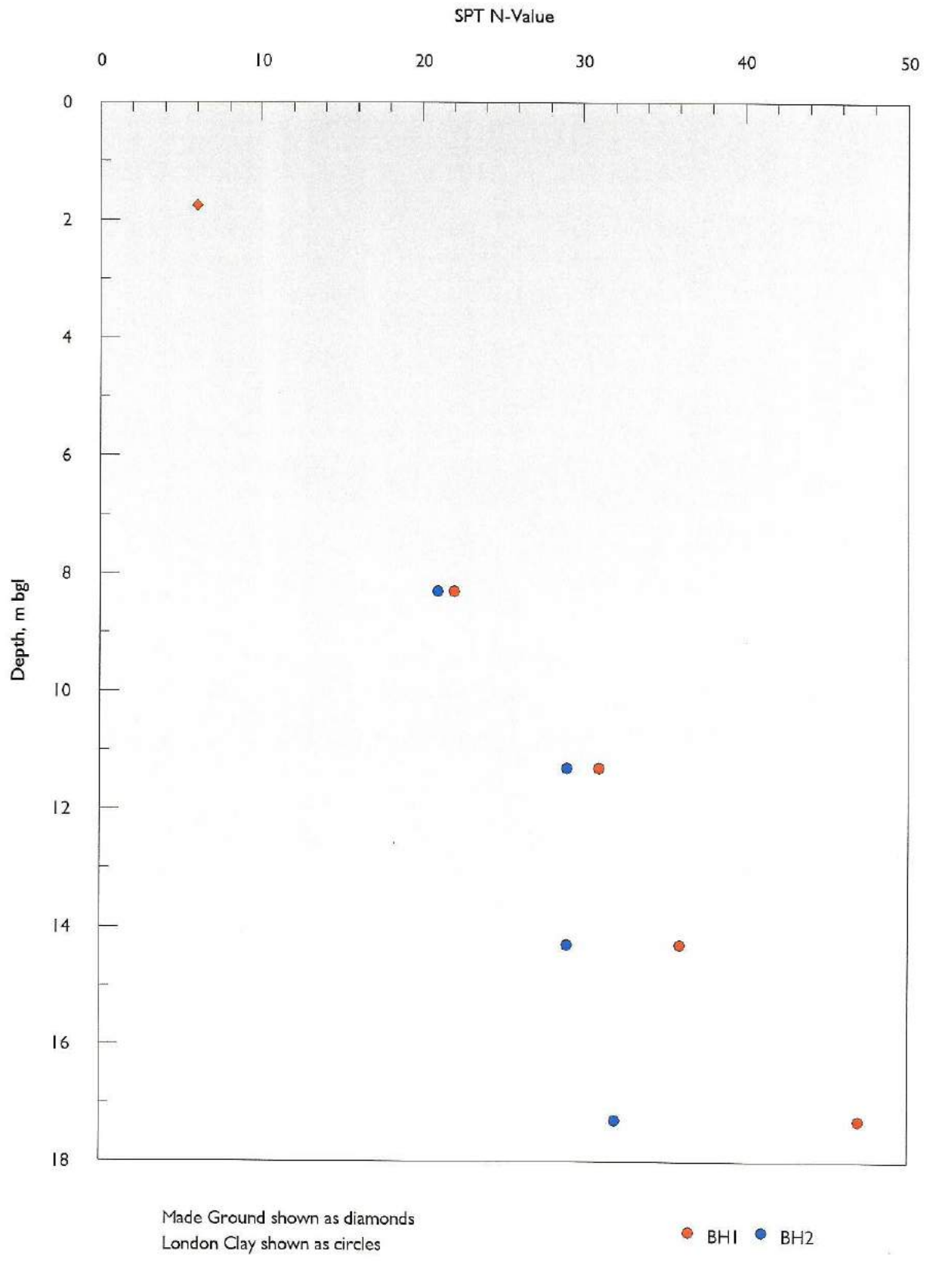


Figure 6

SHEAR STRENGTH PROFILE
40 Frognal Lane, Camden

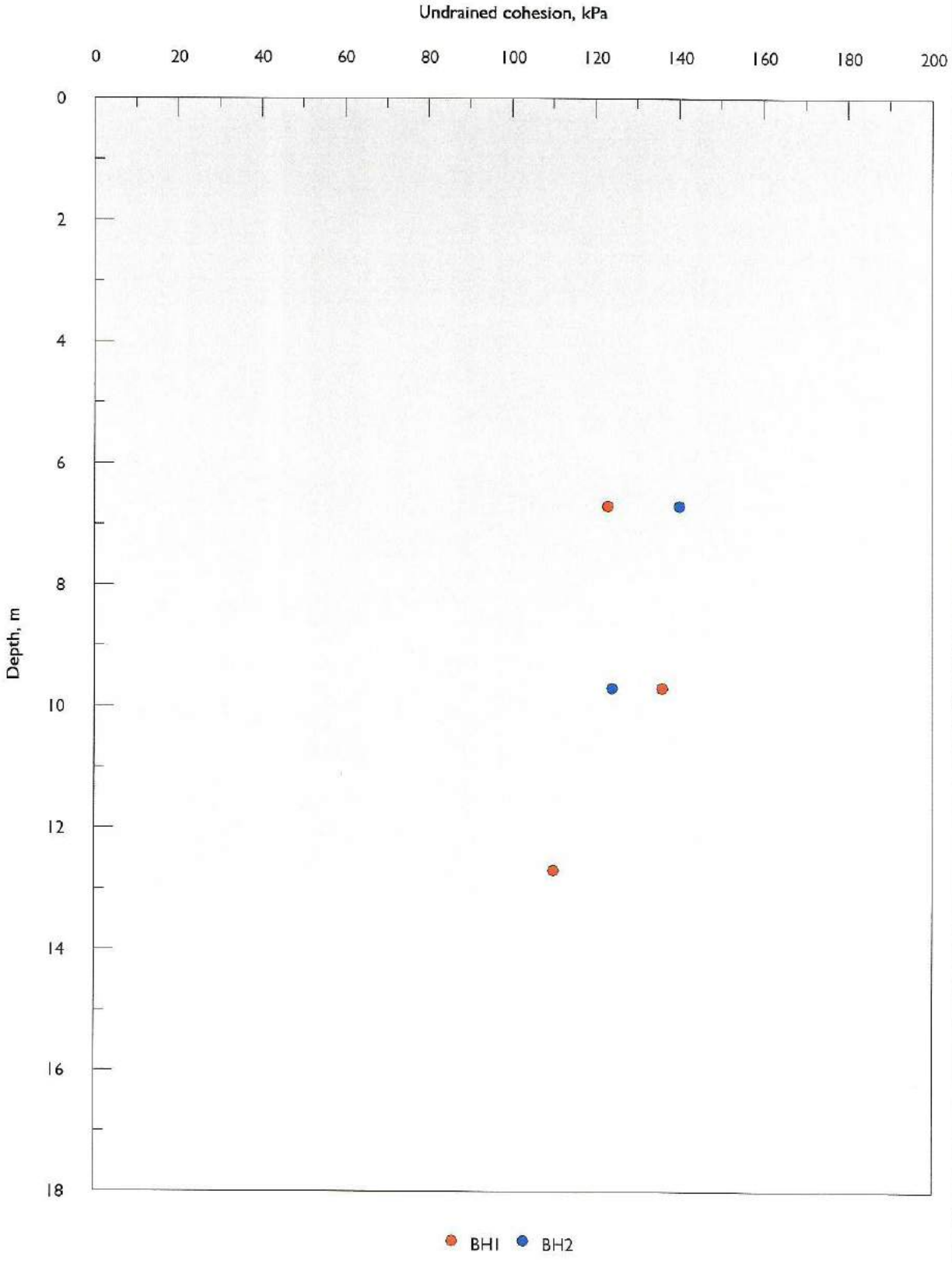


Figure 7

APPENDIX B

BOREHOLE RECORDS

SYMBOLS and ABBREVIATIONS

Samples

Undisturbed

U	Standard open drive "undisturbed" 102mm dia. in boreholes 38mm dia. in trial pits, window sampler and hand auger
T	Thin wall open drive
P	Piston
C	CBR mould

Disturbed

D	Small
B	Bulk
C	Contaminants: plastic tub
J	brown glass jar
W	Water

In situ tests

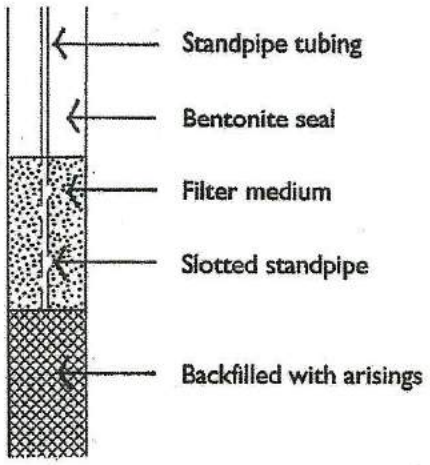
SPT	Standard Penetration Test, open shoe
CPT	solid cone
	N value is number of blows for 300mm penetration. Blow count also given as seating drive followed by four increments of 75mm.
V ( )	Vane test (c_u kPa)
P ( )	Hand penetrometer (c_u kg/cm^2)
M ( )	Mexe probe (CBR %)

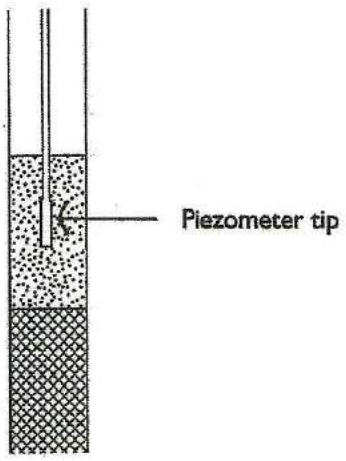
Water records

Σ_1	Standing level
∇_1	Depth encountered

suffix identifies separate strikes

Standpipes





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Site	Borehole Number
40 FROGNAL LANE, CAMDEN	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 6.00m		Mr A Matuzny	3611

Location	Dates	Engineer	Sheet
See Site Plan	22/07/2011-25/07/2011	Train and Kemp / TGN Architects	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.35)	MADE GROUND: Grass and topsoil over brick fragments			
0.20	J1					0.35				
0.35	J2					(0.25)	MADE GROUND: Compact brick rubble			
0.50	J3					0.60				
0.75	J4					(0.15)	MADE GROUND: Soft dark brown silty clay and brick fragments			
0.90	J5					0.75				
						(0.15)	MADE GROUND: Soft grey clay and brick fragments			
1.30	J7					0.90				
1.40	W6					(0.40)	MADE GROUND: Soft brown and grey clay with brick fragments			
1.45-1.90	SPT N=6	1.00	DRY	1,1/1,1,2,2 medium(1) at 1.60m, rose to 1.40m in 20 mins, sealed at 2.00m.		1.30				
1.50-1.70	B8					(0.20)	Soft brown grey CLAY with silt veins			
1.75	J9					1.50				
						(0.20)	Firm brown gravelly silty CLAY			
2.00-2.45	U10	2.00	DRY	20 blows		1.70				
2.45	C11						Firm brown mottled orange brown and grey silty CLAY			
3.00-3.45	U12	3.00	DRY	23 blows						
3.45	C13					(3.90)				
4.00-4.45	U14	3.00	DRY	21 blows						
4.45	C15									
5.00	W24			slow(2) at 5.00m, rose to 4.95m in 20 mins, sealed at 6.00m.						
5.00-5.45	U16	3.00	DAMP	30 blows						
5.45	C17					5.60	Stiff fissured brown CLAY with occasional pockets of fine orange brown sand			
5.60	J18									
6.50-6.95	U19	6.00	DRY	35 blows						
6.95	C20					(3.00)				
8.00-8.75	SPT N=22	6.00	DRY	2,6/4,5,6,7						
8.60	J21					8.60	Stiff fissured grey CLAY			
9.50-9.95	U22	6.00	DRY	40 blows						

Remarks
Electric cable warning tape in services pit at 0.4m. Pit extended to one side.
Excavating from 0.00m to 1.00m for 2 hours.

Scale (approx)	Logged By
1:50	ljs

Figure No. 3611.BH1

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Site: 40 FROGNAL LANE, CAMDEN			Borehole Number: BH1
Boring Method: Cable Percussion	Casing Diameter: 150mm cased to 6.00m	Ground Level (mOD):	Client: Mr A Matuzny
	Location: See Site Plan	Dates: 22/07/2011-25/07/2011	Engineer: Train and Kemp / TGN Architects
Job Number: 3611			Sheet: 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
9.95	C23						Stiff fissured grey CLAY			
				22/07/2011:DRY		(3.70)				
11.00-11.75	SPT N=31	6.00	DRY	25/07/2011:DRY 3,6/7,7,8,9						
						12.30				
12.50-12.95	U25	6.00	DRY	40 blows			Very stiff fissured dark grey CLAY			
12.95	C26									
14.00-14.75	SPT N=36	6.00	DRY	3,5/7,8,9,12						
						(5.70)				
15.50-15.95	U27	6.00	DRY	45 blows						
15.95	C28						becoming silty			
17.00-17.75	SPT N=47	6.00	DRY	5,7/8,10,15,14						
18.00	J29			25/07/2011:DRY		18.00				
							Complete at 18.00m			

Remarks

Scale (approx)	Logged By
1:50	ljs

Figure No. 3611.BH1

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Site	Borehole Number
40 FROGNAL LANE, CAMDEN	BH2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 6.00m		Mr A Matuzny	3611

Location	Dates	Engineer	Sheet
See Site Plan	20/07/2011-21/07/2011	Train and Kemp / TGN Architects	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	J1					(0.15)	MADE GROUND: Grassed topsoil with brick and gravel fragments		
0.15	J2					0.15			
0.50	J3					(0.75)	MADE GROUND: Friable brown clay with builder's rubble		
0.90	J4					0.90			
1.00-1.45	U5	1.00	DRY	16 blows			Firm brown mottled light brown silty CLAY		
1.45	C6								
2.00-2.45	U7	1.20	DRY	20 blows					
2.45	C8						...tree roots visible to 2.5m		
3.00-3.45	U9	1.20	DRY	20 blows		(4.20)			
3.45	C10								
4.00-4.45	U11	1.20	DRY	25 blows					
4.45	C12						...becoming fissured		
5.00-5.45	U13	1.20	DRY	25 blows		5.10			▼1
5.45	C14			medium(1) at 5.30m, rose to 5.10m in 20 mins, sealed at 5.50m.			Stiff fissured brown CLAY with occasional pockets of fine sand		▽1
6.50-6.95	U15	6.00	DRY	35 blows		(2.70)			
6.95	C16								
7.80	J16A					7.80			
8.00-8.75	SPT N=21	6.00	DRY	2,3/4,4,6,7			Stiff fissured dark grey CLAY		
9.50-9.95	U17	6.00	DRY	45 blows 20/07/2011:DRY					
				21/07/2011:DRY					

Remarks
Backfilled with arisings
Excavating from 0.00m to 1.00m for 1.50 hours.

Scale (approx)	Logged By
1:50	ljs

Figure No. 3611.BH2

AP GEOTECHNICS
T 01932 848460
F 01932 851255
E mail@apgeotechnics.co.uk

Site	Borehole Number
40 FROGNAL LANE, CAMDEN	BH2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion	150mm cased to 6.00m		Mr A Matuzny	3611
	Location	**Dates**	**Engineer**	**Sheet**
	See Site Plan	20/07/2011-21/07/2011	Train and Kemp / TGN Architects	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
9.95	C18						Stiff fissured dark grey CLAY		
11.00-11.75	SPT N=29	6.00	DRY	3,5/6,7,7,9					
12.50-12.95	U19	6.00	DRY	45 blows		(7.20)			
12.95	C20								
14.00-14.75	SPT N=29	6.00	DRY	3,4/5,7,8,9					
						15.00			
							Stiff fissured grey CLAY with pockets of silt		
15.50-15.95	U21								
15.95	C22								
						(3.00)			
17.00-17.45	SPT N=32			3,4/6,8,9,9					
18.00	J23			21/07/2011:DRY		18.00			
							Complete at 18.00m		

Remarks

Scale (approx)	Logged By
1:50	ljs

Figure No. 3611.BH2

APPENDIX C

STANDPIPE RECORDS

STANDPIPE RECORDS

WATER LEVELS

Project: 40 FROGNAL LANE, CAMDEN
Client: Mr A Matuzny
Agent: Train and Kemp / TGN Architects

Project No. 3611
Sheet No. 1/1

Location	BH1															
Red. level																
	Water level															
Date	m bgl	m OD	m bgl	m OD												
05/08/2011	3.87															
20/09/2011	2.86															

Remarks

APPENDIX D

IN SITU PERMEABILITY TEST

IN SITU PERMEABILITY TEST

HVORSLEV'S TIME LAG

Project: 40 FROGNAL LANE, CAMDEN
Client: Arlington Management Services Limited

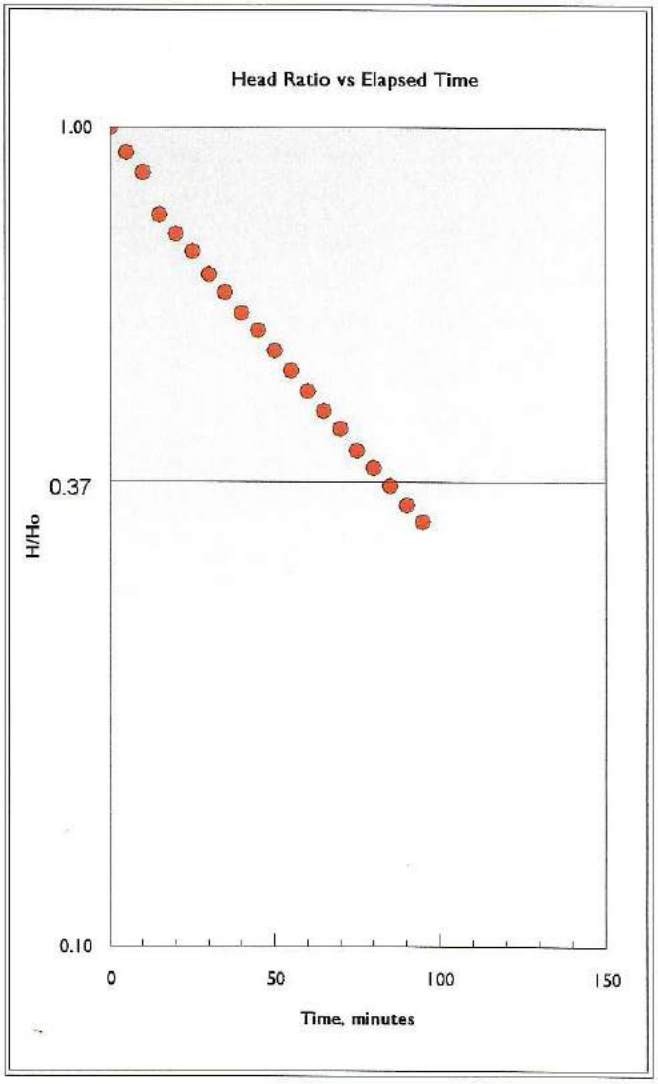
Project No: 3611
Sheet No: 1/1

Location: BH 1
Test depth from 7.00 m
to 1.00 m

Height of casing above g.l., m	0.00
Depth of casing below g.l., m	1.00
Diameter of casing, m	0.15
Depth to water at start of test, m b g.l.	2.86

Description of stratum under test
Claygate Member to 5.6m then London Clay

Elapsed Time min	Depth to Water, m from Casing	Depth to Water, m from GL	H	H/Ho
0	6.00	6.00	-3.14	1.000
5	5.79	5.79	-2.93	0.933
10	5.63	5.63	-2.77	0.882
15	5.32	5.32	-2.46	0.783
20	5.19	5.19	-2.33	0.742
25	5.08	5.08	-2.22	0.707
30	4.94	4.94	-2.08	0.662
35	4.84	4.84	-1.98	0.631
40	4.73	4.73	-1.87	0.596
45	4.64	4.64	-1.78	0.567
50	4.54	4.54	-1.68	0.535
55	4.45	4.45	-1.59	0.506
60	4.36	4.36	-1.50	0.478
65	4.28	4.28	-1.42	0.452
70	4.21	4.21	-1.35	0.430
75	4.13	4.13	-1.27	0.404
80	4.07	4.07	-1.21	0.385
85	4.01	4.01	-1.15	0.366
90	3.95	3.95	-1.09	0.347
95	3.90	3.90	-1.04	0.331



k = A/FT

A = 0.018 m²
F = 8.603 m
T = 82 min
k = 4.18E-007 m/s

APPENDIX E

LABORATORY TEST RESULTS

SUMMARY OF GEOTECHNICAL TESTS

Project: 40 FROGNAL LANE, CAMDEN
Client: Mr A Matuzny
Agent: Train and Kemp/TGN Architects

Project No: 3611
Sheet No: 1/2

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
BH1	J2-J7	0.35-1.35-	Made Ground: clay and brick																<0.01	7.9
	W6	1.40	Groundwater															0.18		6.79
	U10	2.00	Firm mottled brown, orange brown and grey silty CLAY																0.11	7.31
	U16	5.00	Firm mottled brown, orange brown and grey silty CLAY																0.49	6.47
	W24	5.00	Groundwater															0.24		7.48
	U19	6.50	Stiff fissured brown CLAY with occasional pockets of fine sand	28	66	20	46	100	46	CH	UU 102	28	2.07	130	247	123			2.03	6.82
	U22	9.50	Stiff fissured grey CLAY	28	73	22	51	100	51	CV	UU 102	28	2.1	190	273	136				
	U25	12.50	Very stiff fissured dark grey CLAY								UU 102	29	2.01	250 (premature failure)	220	110				

Note: Soil Classification based upon unmodified Plasticity Index

SUMMARY OF GEOTECHNICAL TESTS

Project: 40 FROGNAL LANE, CAMDEN
Client: Mr A Matuzny
Agent: Train and Kemp/TGN Architects

Project No: 3611
Sheet No: 2/2

Location	Sample No	Depth m	Description	CLASSIFICATION							TRIAXIAL COMPRESSION - TOTAL STRESS							CHEMICAL		
				Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
BH2	J3	0.50	Made Ground: Friable clay with builder's rubble																0.15	7.46
	U15	6.50	Stiff fissured brown CLAY with occasional pockets of fine sand								UU 102	28	2.1	130	280	140				
	U17	9.50	Stiff fissured dark grey CLAY								UU 102	27	2.11	190	248	124				

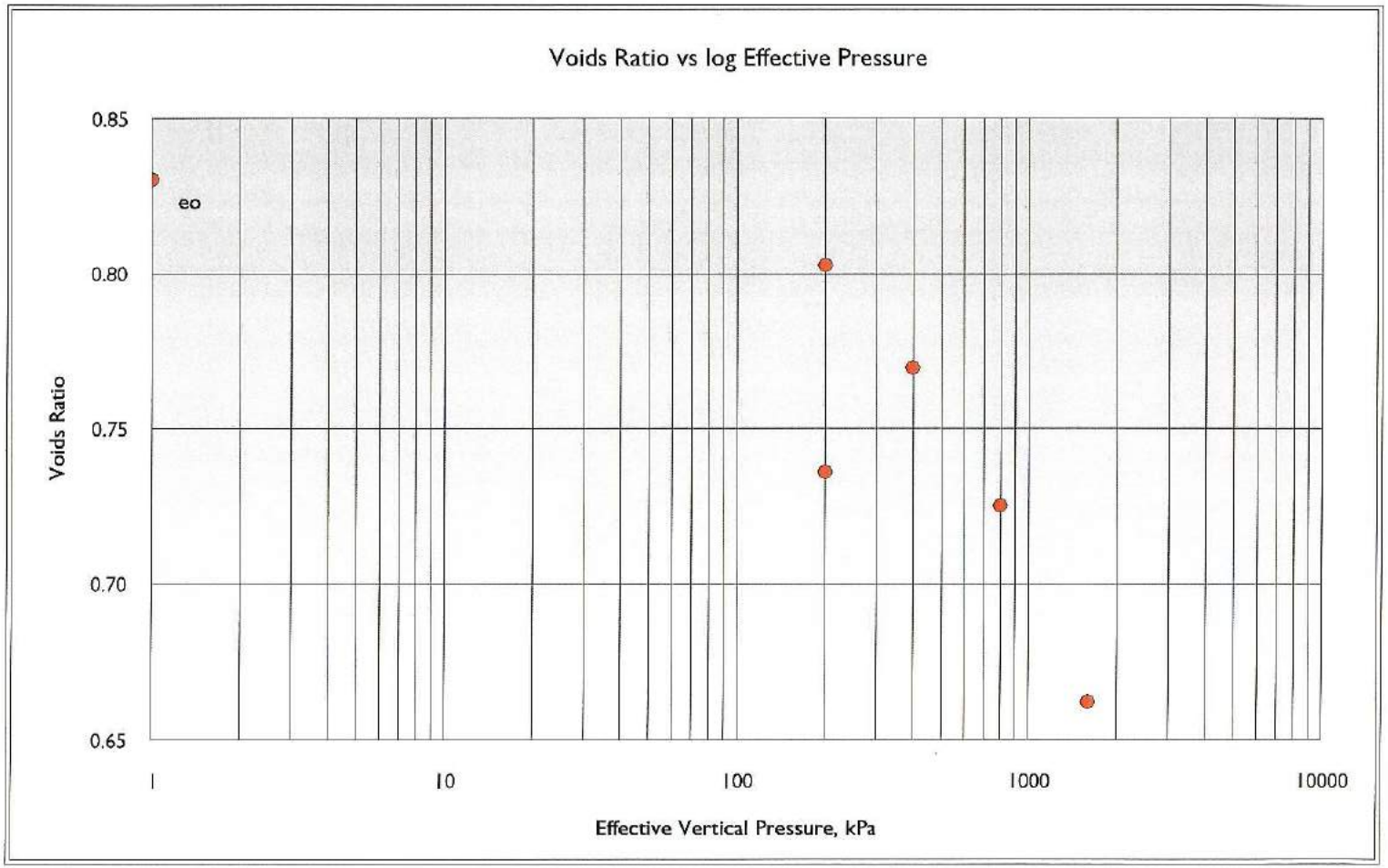
Note: Soil Classification based upon unmodified Plasticity Index

ONE - DIMENSIONAL CONSOLIDATION TEST

Project: 40 FROGNAL LANE
Client: Mr A Matuzny
Agent: Train and Kemp / TGN Architects

Project No: 3611
Sheet No. 1/2

Borehole	Sample	Depth, m
1	U19	6.50
Description		
Stiff fissured brown CLAY with occasional pockets of fine sand		
Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.750 measured	start 25 finish 24	1.502
Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.649	0.076
200		
	0.554	0.092
400		
	0.600	0.063
800		
	0.523	0.046
1600		
	0.456	0.032
200		



ONE - DIMENSIONAL CONSOLIDATION TEST

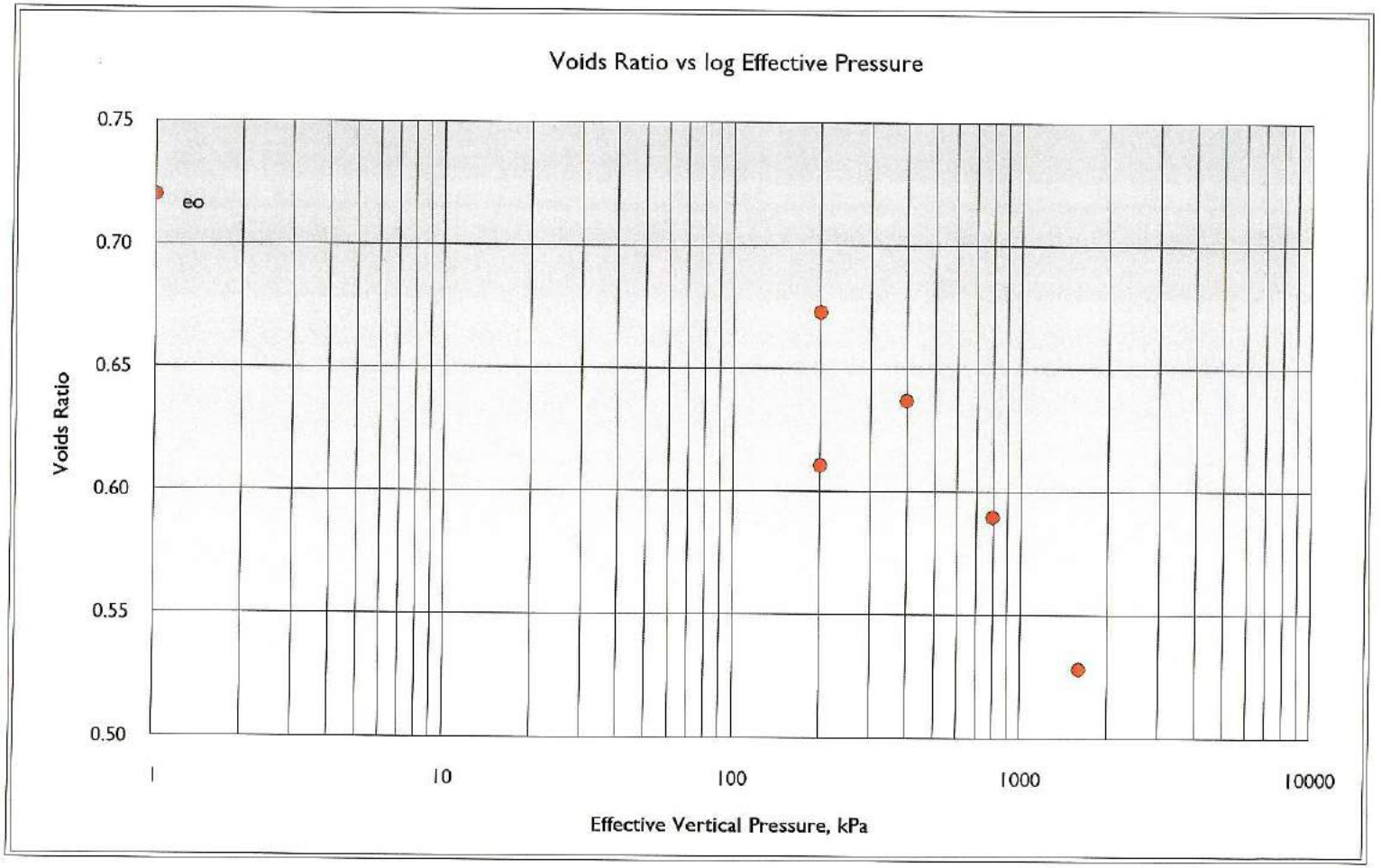
Project: 40 FROGNAL LANE
Client: Mr A Matuzny
Agent: Train and Kemp / TGN Architects

Project No: 3611
Sheet No. 2/2

Borehole	Sample	Depth, m
1	U22	9.50
Description		
Stiff fissured grey CLAY		

Specific Gravity	Moisture Cont. %	Dry Density Mg/m³
2.750 measured	start 25 finish 23	1.599

Pressure kPa	Coefficient of Consolidation m²/year	Coefficient of Compressibility m²/MN
0		
	0.344	0.137
200		
	0.379	0.108
400		
	0.375	0.072
800		
	0.489	0.048
1600		
	0.441	0.039
200		



CONTAMINANTS IN SOIL

Project: 40 FROGNAL LANE, CAMDEN
Client: Mr A Matuzny
Agent: Train and Kemp/TGN Architects

Project No: 3611
Sheet No: 1/1

Location	Sample	Depth	Arsenic	Cadmium	Chromium	Lead	Mercury	Nickel	Copper	Zinc	Selenium	Boron	PAH	Phenols	Hexavalent	TPH by GCMS							pH
		m					inorganic					water sol.	screen	tot. monohydric	Chromium	C8 - C10	C10 - C12	C12 - C16	C16 - C21	C21 - C35	Total C8 - C35		value
BH1		1.30	18.1	<0.5	49	291	0.6	23	50	113	0.8	1.2			<2								
GAC[1]	residential			3	627				2330	3750		291		210									
	commercial			348	8840				71700	665000		192000		1100000									
CLEA[2]	residential		32				170	130			350												
	commercial		640				3600	1800			13000												

Notes

1. LQM/CIEH GAC given at 1% soil organic matter
2. CLEA SGVs given at 6% soil organic matter

All units are mg/kg dry weight of soil unless otherwise stated, except for pH which is dimensionless

Exceptions denoted thus: Residential XX
Commercial XX

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone (01424) 718618
Facsimile (01424) 729911

2683 2683

THE ENVIRONMENTAL LABORATORY LTD

Waste Acceptance Criteria ANALYTICAL RESULTS

Report No:	ANALYTICAL REPORT No. AR34276A					Page 3 of 6	
					CLIENT:	AP Geotechnics Limited	
Project Name:	Frognall Lane						
Lab Reference	10351				Landfill Waste Acceptance Criteria Limits		
Sampling Date	–				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH1						
Depth	0.35 - 1.30						
Solid Waste Analysis							
TOC (%)	1.6				3%	5%	6%
Loss on Ignition (%)**	4.0				–	–	10%
BTEX (mg/kg)**	1.97				6	–	–
Sum of PCBs (mg/kg)**	0.03				1	–	–
Mineral Oil (mg/kg)**	<5				500	–	–
Total PAH (mg/kg)**	3.7				100	–	–
pH (Units)**	7.9				–	–	–
Acid Neutralisation Capacity (mol/kg)	<0.1				–	To be evaluated	To be evaluated
Eluate Analysis	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l	mg/l		mg/kg			
Arsenic*	<0.005	<0.005		<0.1	0.5	2	25
Barium*	0.040	0.011		<0.1	20	100	300
Cadmium*	<0.001	<0.001		<0.01	0.04	1	5
Chromium*	<0.005	<0.005		<0.1	0.5	10	70
Copper*	0.008	<0.005		<0.1	2	50	100
Mercury*	<0.0001	<0.0001		<0.001	0.01	0.2	2
Molybdenum*	0.010	0.006		<0.1	0.5	10	30
Nickel*	<0.005	<0.005		<0.1	0.4	10	40
Lead*	<0.005	<0.005		<0.1	0.5	10	50
Antimony	<0.005	<0.005		<0.01	0.06	0.7	5
Selenium	<0.005	<0.005		<0.01	0.1	0.5	7
Zinc*	0.013	<0.005		<0.1	4	50	200
Chloride*	48	22		131	800	15000	25000
Fluoride*	1	1		5	10	150	500
Sulphate*	110	24		193	1000	20000	50000
TDS	76	18		139	4000	60000	100000
Phenol Index	<0.5	<0.5		<0.5	1	-	-
DOC	<50	<50		<1	500	800	1000
Leach Test Information							
pH *	8.1	8.1					
EC*	592	247					
Sample Mass (kg)	0.208						
Dry Matter (%)	84						
Moisture (%)	20						
Stage 1							
Volume Eluate L2 (litres)	0.316						
Filtered Eluate VE1 (litres)	0.146						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation

* = UKAS accredited

** - MCERTS accredited test

soils LIMITED

Geotechnical &
Environmental Consultants

Newton House
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Tadworth
Surrey
KT20 5SR

T: 44(0)1737 814221

www.soilslimited.co.uk

Fitzpatrick Construction Ltd

Via Email Only: shelly@fitzp.com

FAO: Brian Fitzpatrick

10 January 2014

Our ref: 14005/FDL/RG

Dear Sir

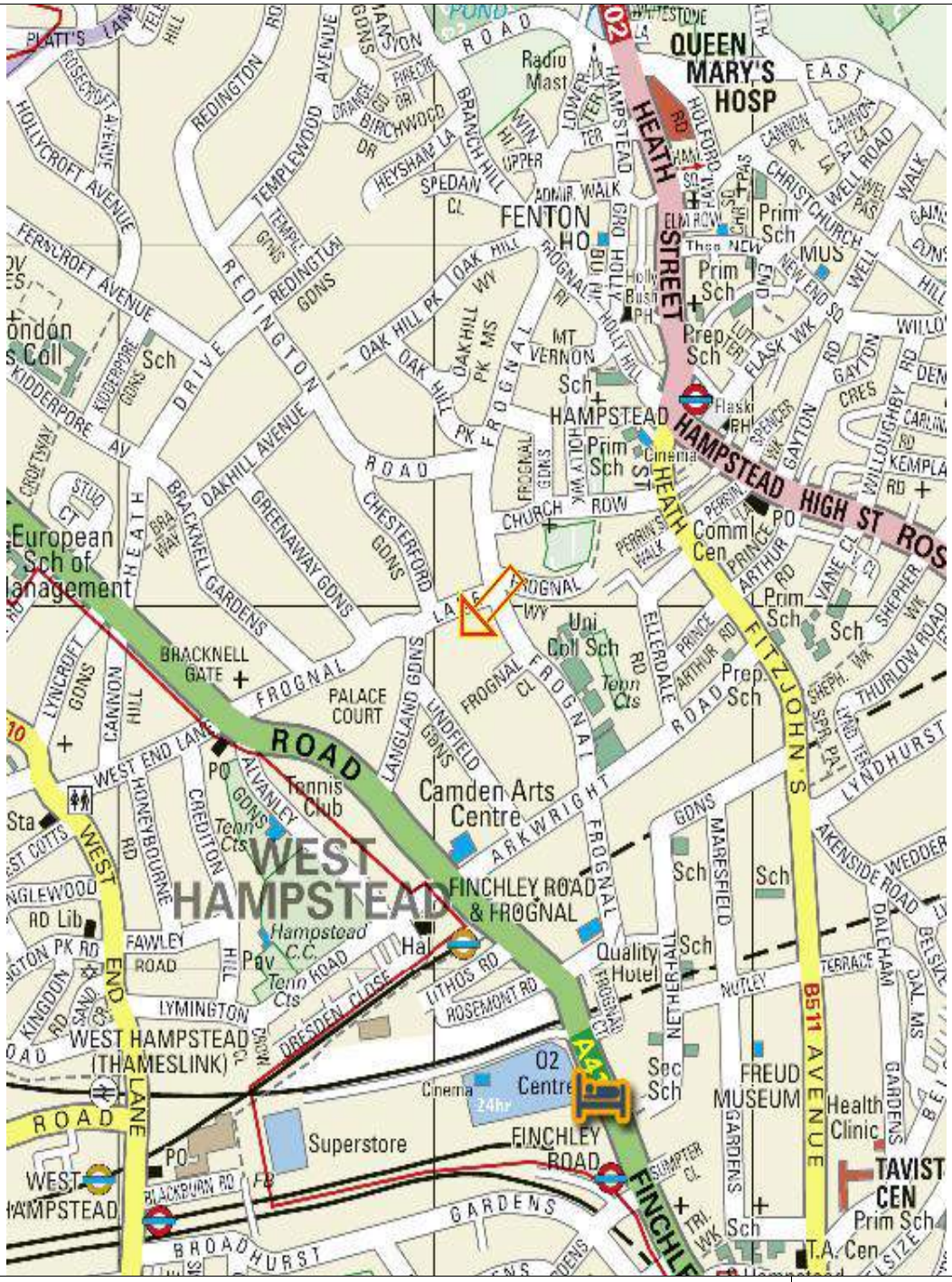
Re: 38 Frognal Lane, Hampstead, London, NW3 6PP

Please find enclosed the field data on the Ground Investigation undertaken on the aforementioned site.

We trust this is the requested data, though should you have any queries please do not hesitate to contact us.

Yours sincerely

Roland Galinski
rg@soilslimited.co.uk
for and on behalf of Soils Limited
enc



Project: **38 Frognal Lane, Hampstead, London, NW3 6PP**	**Fig No. 1**
Client **Fitzpatrick Construction Ltd**	Date: **January 2014**
Site Location Map	Ref: **14005**

soils LIMITED

Geotechnical & Environmental Consultants

Project: **38 Frognal Lane, Hampstead, London, NW3 6PP**	**Fig No. 2**
Client **Fitzpatrick Construction Ltd**	Date: **January 2014**
Site Location Plan	Ref: **14005**

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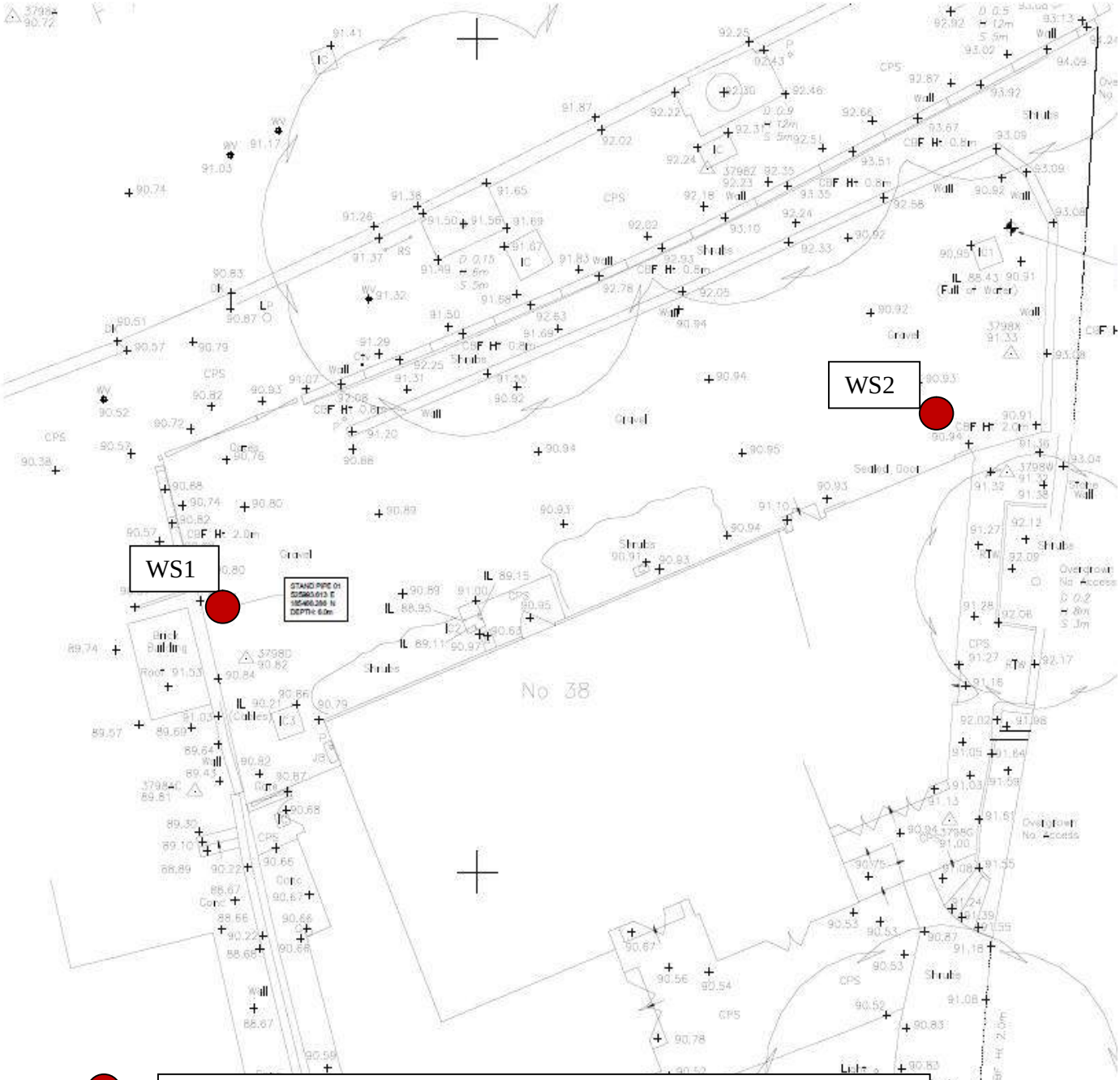

Windowless sampler borehole with groundwater monitoring well

WS2 location was moved due to a car parked over proposed location

Project: **38 Frognal Lane, Hampstead, London, NW3 6PP**		**Fig No. 3**
Client **Fitzpatrick Construction Ltd**	Date: **January 2014**	soils LIMITED
Trial Hole Location Plan	Ref: **14005**	**Geotechnical & Environmental Consultants**

Soils Limited
Newton House
Cross Road
Tadworth
Surrey KT20 5SR
Tel: 01737 814221
Fax: 01737 812557

Record of Borehole WS 1

Start Date:	18/12/2014	**Ground Level:**	-
End Date:	18/12/2014	**Easting:**	-
Logged By:	GB	**Northing:**	-

Site: 38 Frognal Lane, Hampstead, London, NW3 6PP
Client: Fitzpatrick Construction Ltd
Project No: 14005

Boring Method: WS
Weather:
Driller: SN

Samples, In-situ Tests & Installations | Strata

Depth	Type	Result	S/Pipe	Elev	Legend	Depth/(Thk)	Description
0.40	D & J					0.13 (0.13)	10mm shingle over block paving, reinforcement grid. MADE GROUND
0.60	D & J					0.35 (0.22)	Pink crushed limestone. MADE GROUND
0.80	D & J					0.55 (0.20)	Soft to firm dark orangish red sandy CLAY with brick and ash fragments and occasional rootlets. MADE GROUND
1.00	D					0.90 (0.35)	Soft to very soft light orangish brown becoming dark greyish mottled brown CLAY at 2.80m with occasional rootlets. CLAYGATE MEMBER
1.50	D						
2.00	D						
2.50	D					3.10 (2.20)	
3.00	D						
3.50	D						
4.00	D					4.00 (0.90)	Soft to firm brown closely fissured CLAY. CLAYGATE MEMBER
4.50	D						
5.00	D					2.00 (2.00)	
5.50	D						
6.00	D					6.00	End of Borehole at 6.00 m

Daily Progress

Date	Time	Hole	Depth	Water Depth

Water Strikes

Strike Depth	Casing Depth	Date	Time	Post Depth	Elapsed Minutes	Depth Sealed
2.80	-	18/12/2014	0000	5.25	10	-

Chiselling

Start Depth	End Depth	Hours

Hole Diameter

Depth	Diam. (mm)

Casing Diameter

Depth	Diam. (mm)

General Remarks:
Roots observed to 2.80m bgl

Soils Limited
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Cross Road
Tadworth
Surrey KT20 5SR
Tel: 01737 814221
Fax: 01737 812557

Record of Borehole WS 2

Start Date:	18/12/2014	**Ground Level:**	-
End Date:	18/12/2014	**Easting:**	-
Logged By:	GB	**Northing:**	-

Site: 38 Frognal Lane, Hampstead, London, NW3 6PP
Client: Fitzpatrick Construction Ltd
Project No: 14005

Boring Method: WS
Weather:
Driller: SN

Samples, In-situ Tests & Installations | Strata

Depth	Type	Result	S/Pipe	Elev	Legend	Depth/(Thk)	Description
						0.13 (0.13)	10mm shingle black plastic reinforcement grid. MADE GROUND
						0.35 (0.22)	White crushed limestone. MADE GROUND
0.45	D & J						Soft becoming firm light orangish brown slightly silty CLAY with occasional rootlets and occasional sandy partings. Claystone band at 2.30m bgl. CLAYGATE MEMBER
0.60	D & J						
0.80	D & J						
1.00	D						
1.50	D						
2.00	D						
2.50	D						
3.00	D						
						5.65	
3.50	D						
4.00	D						
4.50	D						
5.00	D						
5.50	D						
6.00	D					6.00	End of Borehole at 6.00 m

Daily Progress

Date	Time	Hole	Depth	Water Depth

Water Strikes

Strike Depth	Casing Depth	Date	Time	Post Depth	Elapsed Minutes	Depth Sealed
2.00	-	18/12/2014	0000	1.56	15	-

Chiselling

Start Depth	End Depth	Hours

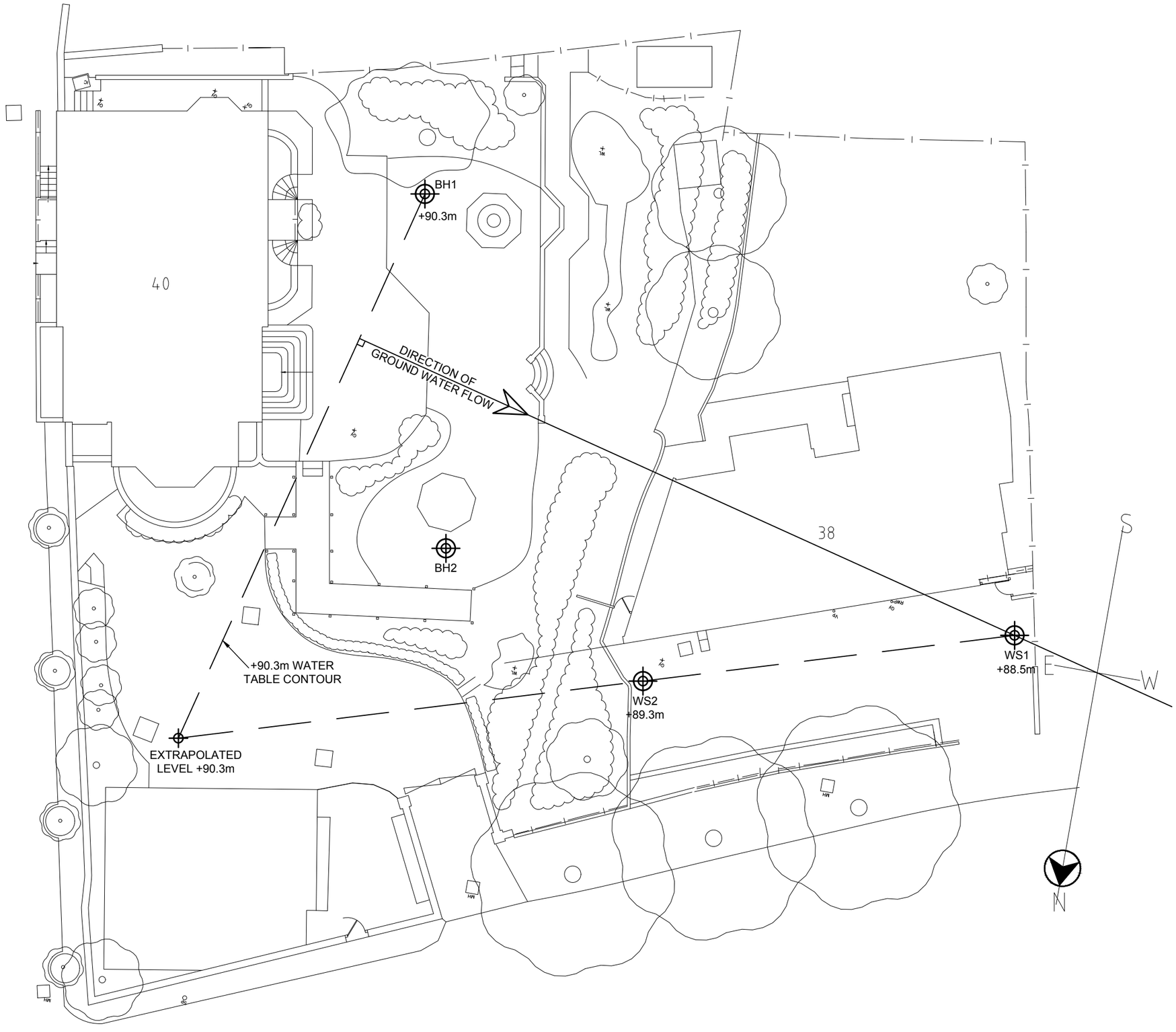
Hole Diameter

Depth	Diam. (mm)

Casing Diameter

Depth	Diam. (mm)

General Remarks:
Roots observed to 2.00m bgl



GENERAL NOTES:

WATER LEVELS TAKEN FROM SITE INVESTIGATION.

Rev.	Description	By	Chkd.	Date
P1	PRELIMINARY ISSUE FOR COMMENT & INFORMATION	AL	NCT	20.08

TRAIN AND KEMP
ENGINEERING BUSINESS SOLUTIONS

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mail@trainandkemp.co.uk www.trainandkemp.co.uk

Client:

Project: 40 FROGNAL LANE

Title: BOREHOLE LOCATIONS & WATER TABLE TRIANGULATION

Drawing Status: PRELIMINARY ISSUE

Date: AUG 2015	Drawing No.	Rev.
Scale: 1:200 @A3	10998/SI/01	P1
Drawn: AL		
Chkd: NCT		