AP GEOTECHNICS
a ground investigation and consultancy service

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17 GLENLOCH ROAD, BELSIZE PARK, LONDON NW3 4DJ

Geotechnical Report

Client
Ms Maria Stamoulis

Agent
THe Consultants

Report No. 3725

21 March 2012

CONTENTS

17 GLENLOCH ROAD
BELSIZE PARK
LONDON
NW3 4DJ

Geotechnical investigation

Synopsis

An investigation has been carried out at 17 Glenloch Road on the instructions of Ms Maria Stamoulis and under the technical direction of THe Consultants, Consulting Engineers to the client.

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 basement.

A single windowless sampler bore in addition to two trial pits were carried out, supported by a programme of in - situ and laboratory testing.

The results indicate that spread foundations will be acceptable for the new basement and appropriate design data is provided. Groundwater levels are such that the basement should be fully water proofed.

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1
Site description

The property lies on the south eastern side of Glenloch Road as shown at Figure 1 of Appendix A, at the National Grid reference $^{5}271\ ^{1}849$.

Glenloch Road is situated on undulating land to the north of the River Thames. The site itself falls at a very shallow gradient to the south west.

The general arrangement of the site is shown on Figure 2. Overall plan dimensions of the plot are about 6 m wide by 22 m deep, the majority of which is occupied by the building with a small paved area at the front and at the rear.

The current building is a Victorian mid - terraced house and is of three storeys above a basement approximately 1.8 m deep. The footprint of the ground floor is about 6 x 15 m with a small shower room extending to the rear as shown at Figure 2.

Nearby properties on Glenloch Road are entirely residential.

2
Development proposals

It is intended to extend the existing basement in depth, approximately down to 3.5 m, and in lateral extent to provide additional living space. The proposed basement plan and section are shown at Figures 3 & 4 of Appendix A respectively.

3
Geology

Published records of the British Geological Survey indicate the site to lie on London Clay.

4
Field work

The extent of the field work was agreed with the Client and comprised one windowless sampler bore to 10 m depth with an in - situ dynamic probe test immediately adjacent to 11.6 m. In addition, two hand excavated trial pits were carried out to expose the existing footings. Locations of the fieldwork are shown at Figure 2 of Appendix A.

Continuous samples were recovered from the windowless sampler for subsequent laboratory examination and testing. Details of the strata encountered are provided on the Borehole and Trial Pit Records at Appendix B; together with particulars of the samples recovered, groundwater observations and sections showing the existing footings.

A standpipe was installed to monitor groundwater conditions beneath the site on the 6th February 2012, the pipe was then monitored on 28th February 2012 and finally on the 16th March 2012, details are provided on the Standpipe Record at Appendix C.

An in - situ permeability test was carried out within the standpipe on the 28th February 2012 which proved that after the surroundings of the installation were filled, only a small loss of 20 mm head occurred after two and a half hours.

Results of the dynamic probe test are presented 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 and thus to assess its load bearing capacity.
- Soluble sulphate concentration and pH value: for the specification of buried concrete.

Results of these tests are presented at Appendix E.

6
Ground conditions

6.1
Stratigraphy

The stratigraphy of the site as revealed by the investigation is given in detail at Appendix B and described in general terms hereafter.

6.1.1
Made Ground

Made Ground was proved to 2.10 m depth and comprised brown and brown grey clay with brick fragments.

6.1.2
London Clay

This formation was encountered directly beneath the Made Ground and comprised orange brown clay, typical of weathered London Clay. Selenite crystals were noted from about 4 m depth.

A subordinate silt fraction was common whilst thin claystones were encountered at 7.60 m depth.

Laboratory tests confirmed the very high plasticity expected of London Clay with Plasticity Indices of 47 - 49 %. The shear strength gradually increased with depth, being classified as firm increasing to stiff.

6.2
Groundwater

The borehole encountered a local seepage at 8.2 m depth.

London Clay has a very low permeability and it is likely that the speed of drilling will have precluded true groundwater conditions being established. A simple standpipe was therefore installed at the site on the 6th February 2012, it was then monitored on the 28 February 2012 and found water at 1.35 m. This increased to 0.96 m depth when monitored for the final time on the 16th March 2012. Water levels are shown on the Standpipe Record at Appendix C.

7
Discussion

7.1
General

Some Made Ground has been encountered during the investigation and it is therefore probable that other pockets of Made Ground or disturbed ground will be present; perhaps deeper, of different character or associated with underground construction. These materials are not expected to be suitable for engineering use and should be neglected for load bearing purposes.

All remnants of underground construction should be removed to permit construction to proceed without hindrance and to perform satisfactorily.

7.2
Foundations

The proposed basement excavation implies a minimum formation depth for spread footings approximately 4.00 m below current ground level. Weathered London Clay was present at this depth which generally offers an acceptable bearing stratum for moderate loads.

A net allowable bearing capacity of 120 kPa is available for strip foundations up to 1.2m width. The total settlement of foundations acting at the allowable bearing capacity and of the maximum size is not expected to exceed 25 mm. Approximately 25% will occur immediately load is applied, with the remainder at a gradually decreasing rate over the ensuing years. Differential settlement between adjacent footings of similar loading and geometry is not expected to exceed approximately half the total.

It may theoretically be possible to use narrow strip footings to carry light structural loads. However, we recommend that a minimum width of 0.45m be employed for strip foundations.

The formation will deteriorate rapidly on exposure especially in the presence of water. Foundations should therefore be cast immediately the excavation is complete unless protected by a layer of blinding concrete.

7.3
Excavations

7.3.1
Stability

Made Ground is inherently variable in both composition and compaction. It should be regarded as unstable and fully supported at all times. Any apparent stability that may be present immediately on excavation must not be relied upon.

London Clay is generally able to support vertical excavated faces of moderate depth in the short term. However, the basement excavation needs to be fully supported at all times to take pressures exerted from the existing and neighbouring buildings.

It should be ensured that there is no loss of support to both the subject property and its neighbours. Both temporary and permanent works should therefore resist lateral earth pressures arising from superimposed loads in addition to those generated by the soil and water without significant deformation.

Lateral earth pressures acting on the basement walls should be assessed from the effective stress parameters given in Table 1.

Table 1: Design parameters for earth pressure assessment

Stratum	Bulk density, Mg/m^3	Effective Cohesion, kPa	Effective angle of internal shearing resistance, degrees
Made Ground	1.80	0	25
London Clay	1.90	0	20

7.3.2
Groundwater

The very low permeability of London Clay precludes true groundwater levels being established during drilling.

It is unlikely that the water levels recorded represent the true water table within the London Clay. However it is probable that these levels are a result of a perched water table within the Made Ground.

The rate of inflow into excavations may well be limited and could be controlled by conventional pumping from shallow sumps. In light of the high water levels observed, full water proofing of the basement is recommended.

7.3.3
Soil swelling

Excavation for that part of the basement under the rear garden will reduce the vertical stress by about 60 kPa over an approximately rectangular area 5 m long and 6 m wide. This will induce swelling of the clay and consequential heave at basement level.

Heave will occur in two phases; firstly as elastic recovery immediately the excavation is complete and, secondly, as long term swelling of the clay. The elastic movement will be unnoticed as it is automatically removed during final trimming of the excavation. Long term swelling is the reverse of consolidation and, similarly, occurs at gradually decreasing rate in the years following excavation.

The area of loading within the part of the basement away from the existing footprint will be considerably lighter than that of the rest of the basement. Due to this, differential movement will occur between the two areas which could in turn cause damage at the junction between the two sections.

It is recommended that suspended basement floor is constructed with a void beneath to accommodate potential heave. Alternativley a robust construction method should be used to resist swelling forces.

7.4
Buried concrete

Laboratory tests yielded a maximum soluble sulphate concentration of 1.65 g/l which results in a Design Sulphate Class[1] of DS-3 for the site.

Although the London Clay has a very low permeability, groundwater conditions must be considered mobile in view of the observed seepage. All pH determinations exceed 6.5 and the aggressive chemical environment for concrete, ACEC, is therefore class as AC-3.

M A McCann
AP GEOTECHNICS LTD.
21 March 2012

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

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.

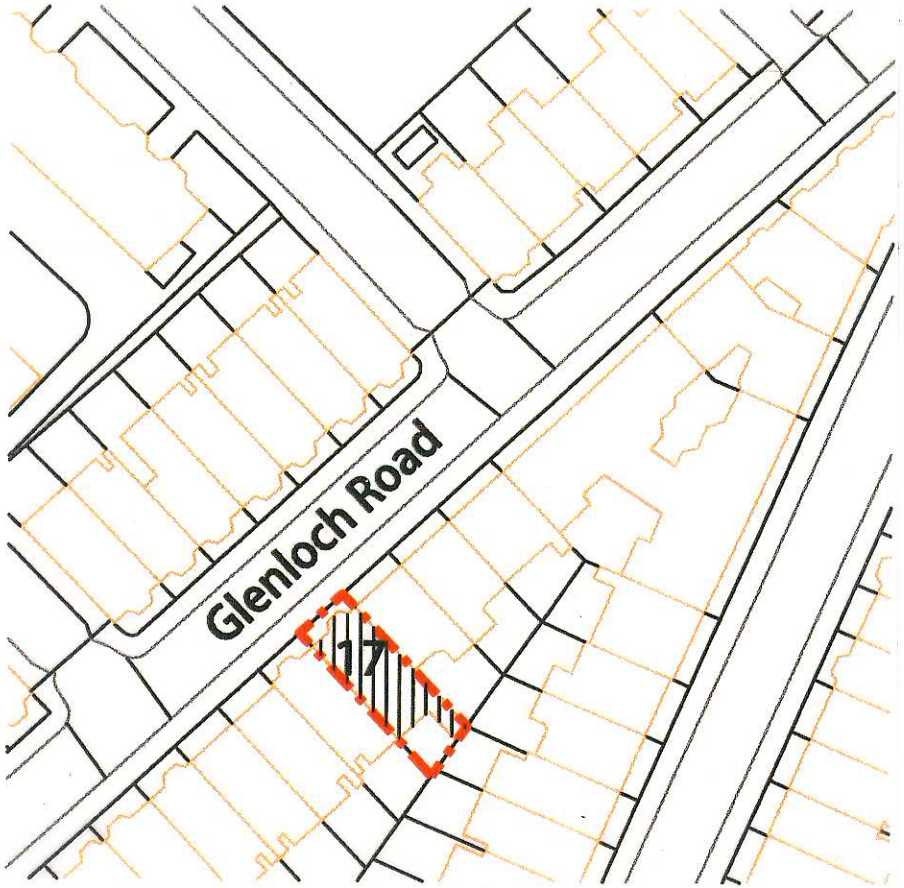
Groundwater levels are subject to variations caused by changes in drainage conditions and seasonal climatic changes.

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

APPENDIX A

FIGURES



17 Glenloch Road, Belsize Park, London NW3 4DJ

Site location

Scale unknown

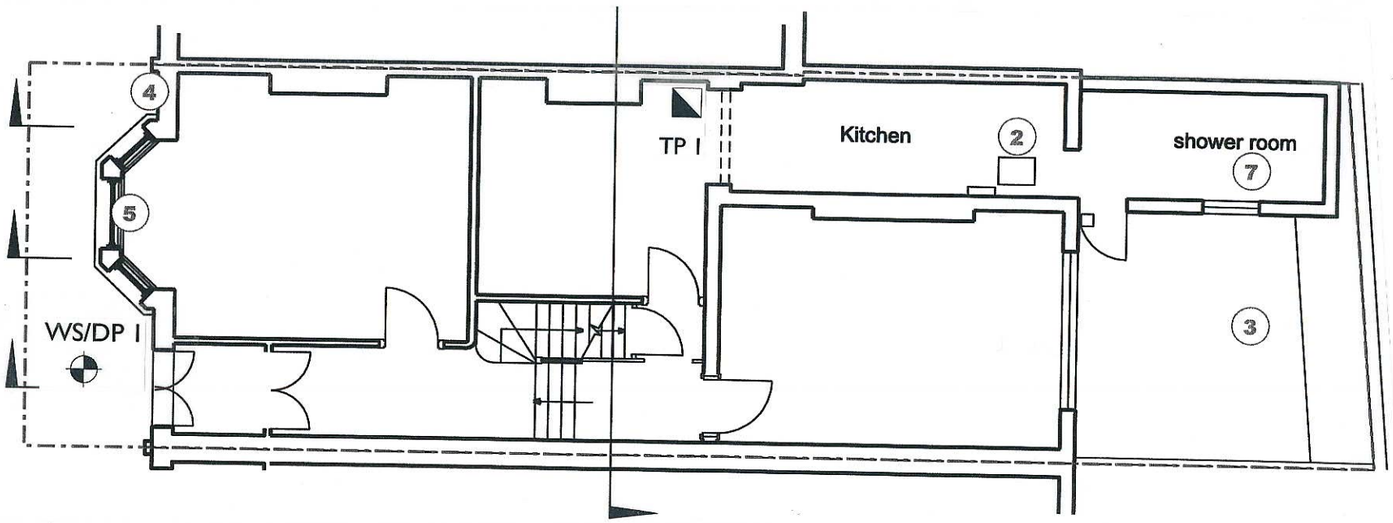
Figure 1

17 Glenloch Road, Belsize Park,
London NW3 4DJ

Site plan including basement

Scale: 1/100

Ground Floor



Basement

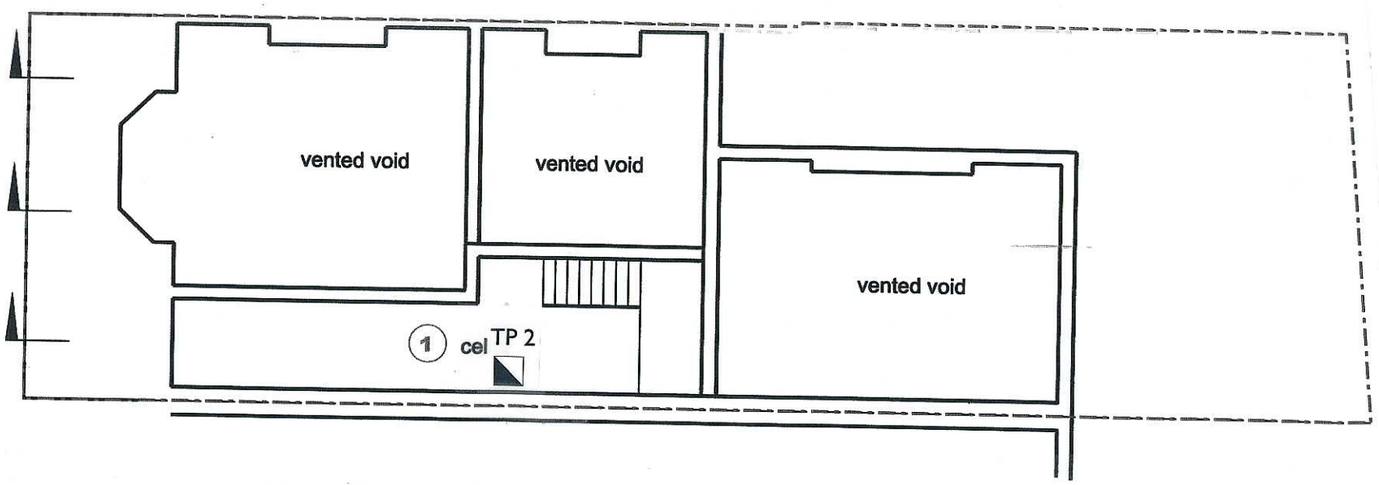


Figure 2

17 Glenloch Road, Belsize Park, London NW3 4DJ

Proposed basement plan

Scale 1/100

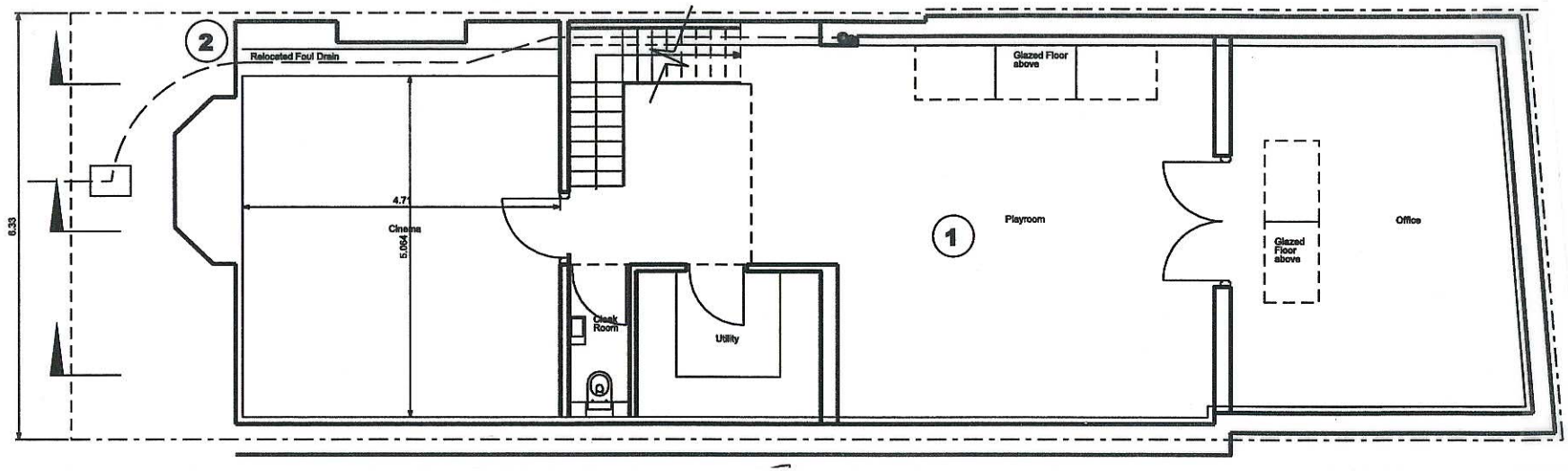


Figure 3

17 Glenloch Road, Belsize Park,
London NW3 4DJ

Proposed basement section

Scale: 1/100

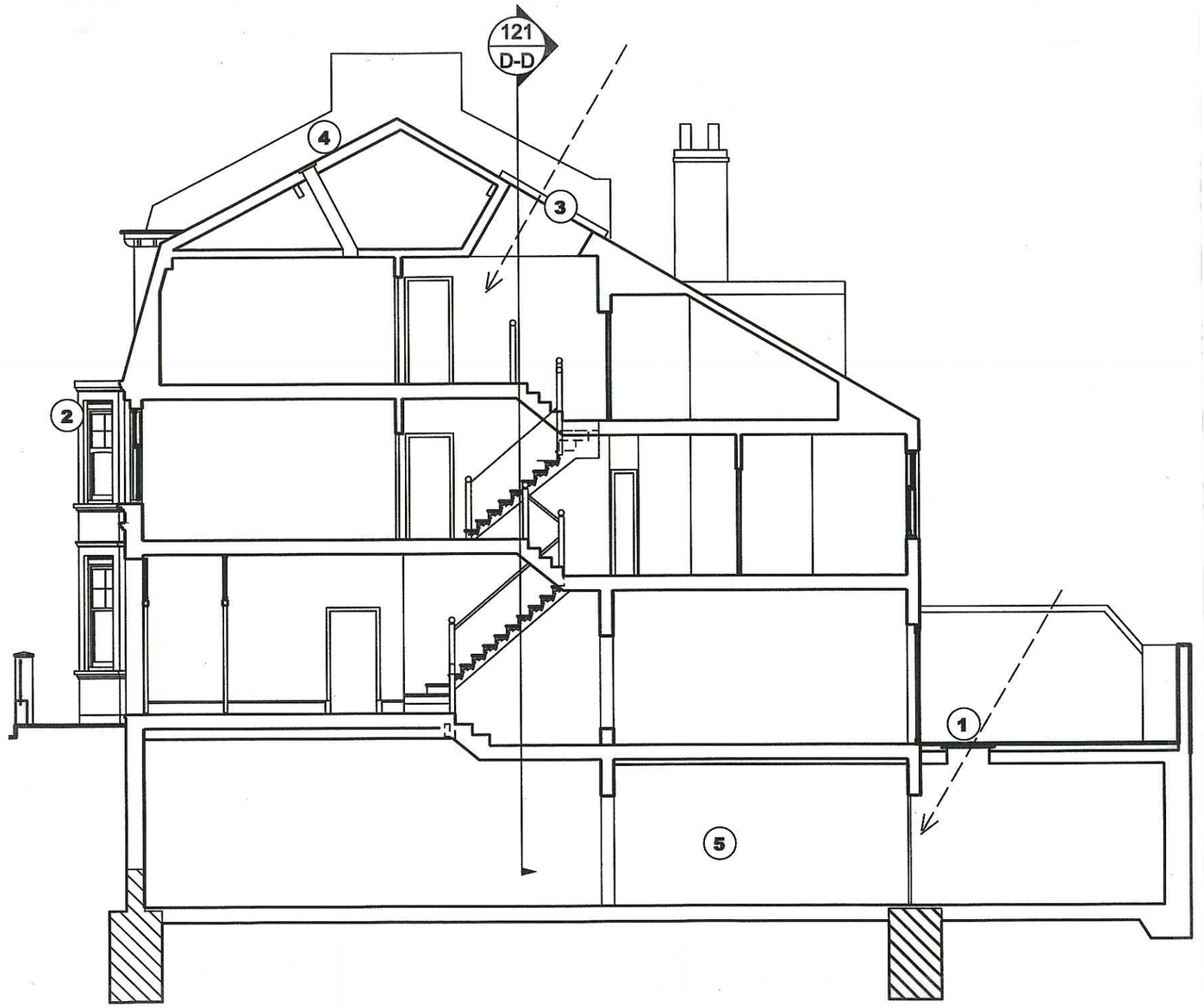


Figure 4

APPENDIX B

BOREHOLE AND TRIAL PIT 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

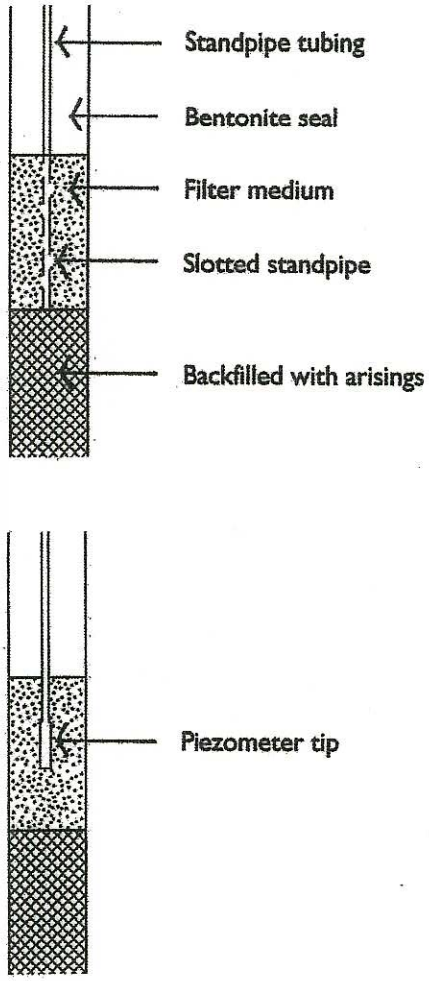
SPT	Standard Penetration Test, open shoe
CPT	solid cone
	N value is number of blows for 300mm penetration. Blow count also given as seating drive followed by four increments of 75mm.
V ( )	Vane test (c_u kPa)
P ( )	Hand penetrometer (c_u kg/cm^2)
M ( )	Mexe probe (CBR %)

Water records

Σ_1	Standing level
∇_1	Depth encountered

suffix identifies separate strikes

Standpipes



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Site	Number
17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ	WS1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Ms Maria Stamoulis	3725
	Location See Site Plan	**Dates** 06/02/2012	**Engineer** THe Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.10) 0.10	Paving slab over sand			
						MADE GROUND: Soft brown slightly sandy gravelly clay with brick fragments. Gravel of flint			
					(1.10) 1.20				
1.00-2.00	L1		100% recovery			MADE GROUND: Soft brown grey mottled black CLAY with brick fragments			
					(0.90) 2.10				
2.00-3.00	L2		80% recovery			Firm brown mottled grey CLAY with occasional small pockets of silt			
					(0.40) 2.50				
						Firm to stiff brown and grey brown CLAY			
3.00-4.00	L3		100% recovery						
4.00-5.00	L4		80% recovery			...selenite crystals 4.40 m to base			
5.00-6.00	L5		100% recovery						
					(6.80)				
6.00-7.00	L6		100% recovery						
7.00-8.00	L7		100% recovery			...claystone at 7.60 m			
8.00-9.00	L8		100% recovery						
9.00-10.00	L9		100% recovery						
					9.30	Stiff dark brown CLAY			
					(0.70) 10.00				

Remarks
Hand excavated service pit to 1.00 m
Slight water seepage at 8.2m
Strata depths approximate where recovery <100%

Scale (approx)	Logged By
1:50	MM

Figure No. 3725.WS1

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Site	Trial Pit Number
17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ	TP1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Ms Maria Stamoulis	3725
	Location	**Dates**	**Engineer**	**Sheet**
	See site plan	28/02/2012	THe Consultants	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.02) 0.02	Floor Boards		
						VOID		
					(0.60)			
0.57	D1				0.62			
					(0.06)	CONCRETE		
					0.68	Firm brown and orange brown CLAY		
					(0.57)			
1.00	D2							
1.25	V1 81.33kPa		80, 80, 84/Av. 81.33		1.25	Complete at 1.25m		

Plan

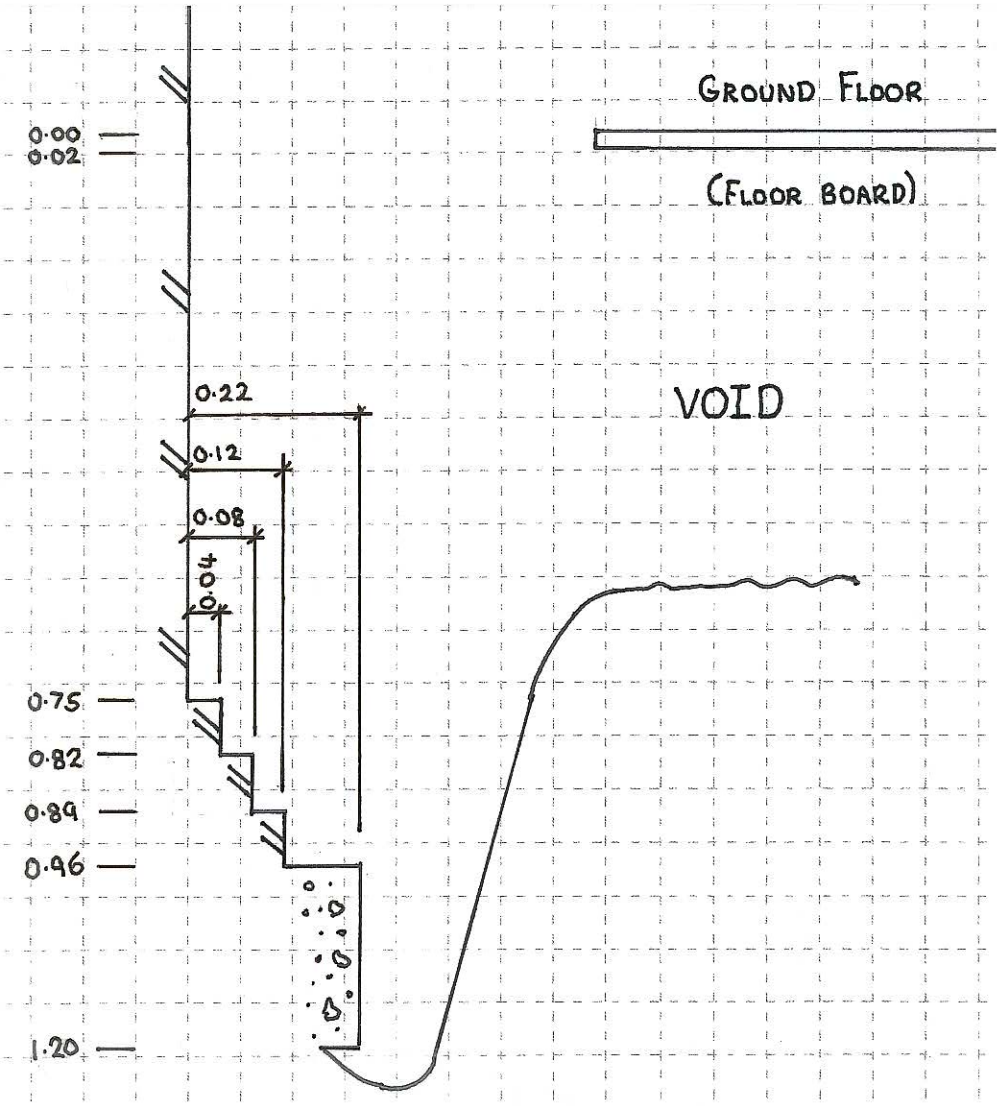
Remarks

Pit stable and dry
Backfilled with arisings

Scale (approx)	Logged By	Figure No.
1:10	MM	3725.TP1

AP GEOTECHNICS	T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk	Site 17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ	Trial Pit Number TP1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Ms Maria Stamoulis	3725
	Location See site plan	**Dates** 28/02/2012	**Engineer** THe Consultants	**Sheet** 2/2



	Scale (approx)	Logged By	Figure No.
	1:10	MM	3725.TP1

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Site	Trial Pit Number
17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ	TP2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Ms Maria Stamoulis	3725
	Location	**Dates** 28/02/2012	**Engineer** THe Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.02) 0.02	CONCRETE		
						MADE GROUND: Brown sandy clay with brick fragments		
0.15	D1				(0.25)			
					0.27			
						Soft to firm brown and orange brown CLAY		
					(0.23)			
0.50	V1 66.67kPa		72, 62, 66/Av. 66.67		0.50			
0.50	D2					Complete at 0.50m		

Plan

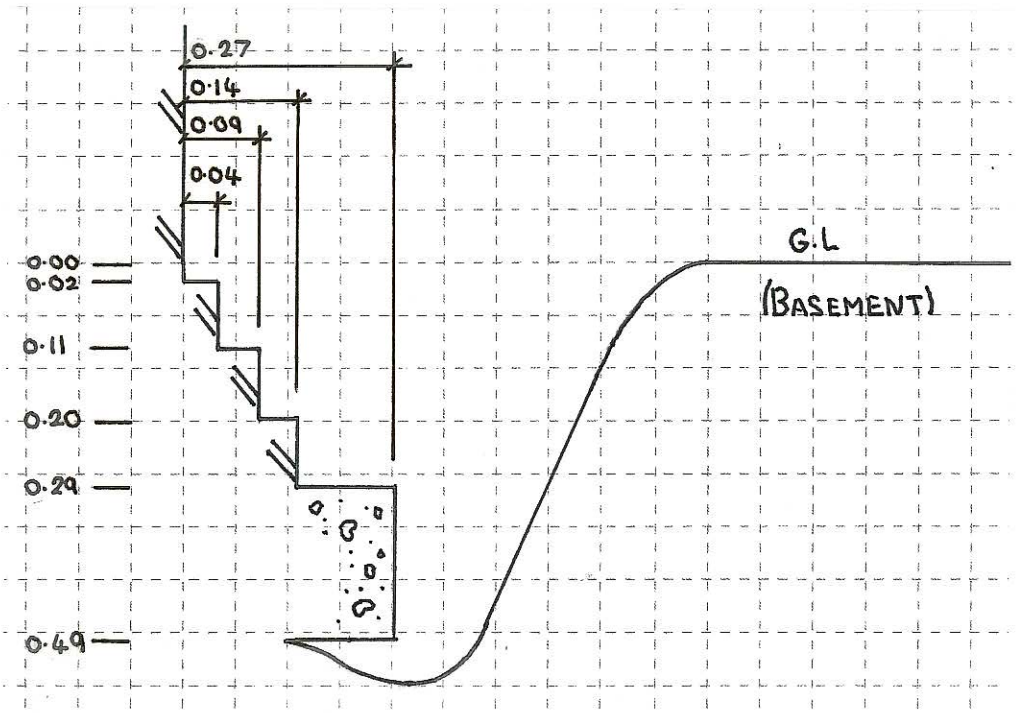
Remarks

Excavated within the cellar at basement level
Pit stable
Water seepage at base
Backfilled with arisings

Scale (approx)	Logged By	Figure No.
1:10	MM	3725.TP2

AP GEOTECHNICS	T 01932 848460 F 01932 851255 E mail@apgeotechnics.co.uk	Site 17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ	Trial Pit Number TP2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Ms Maria Stamoulis	3725
	Location	**Dates** 28/02/2012	**Engineer** THe Consultants	**Sheet** 2/2



	Scale (approx)	Logged By	Figure No.
	1:10	MM	3725.TP2

APPENDIX C

STANDPIPE RECORDS

STANDPIPE RECORDS

WATER LEVELS

Project: 17 GLENLOCH ROAD, BELSIZE PARK, LONDON
Client: Ms Maria Stamoulis
Agent: THe Consultants

Project No. 3725
Sheet No. 1/1

Location	WS1
Red. level	
Date	Water level
	m bgl
28/02/2012	1.35
16/03/2012	0.96

Remarks

APPENDIX D

IN SITU TEST RESULTS

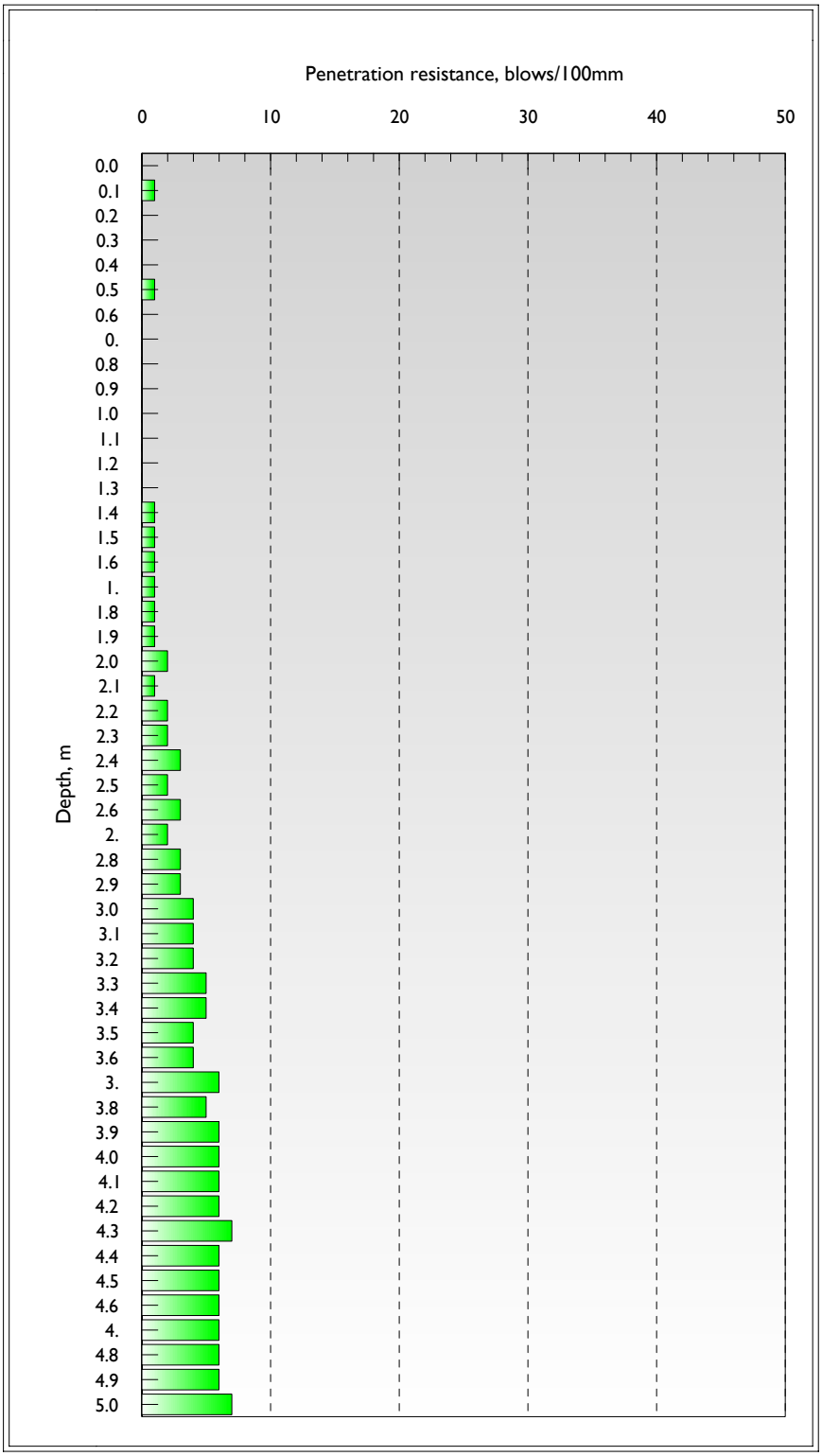
DYNAMIC PROBE RECORD

Project: 17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ
Client: Ms Maria Stamoulis
Agent: THe Consultants

Project No: 3725
Sheet No: 1/3

Probe No.	DP1

Depth m	Blows/ 100mm	Torque Nm
0.0		
0.1	1	
0.2	0	
0.3	0	
0.4	0	
0.5	1	
0.6	0	
0.7	0	
0.8	0	
0.9	0	
1.0	0	
1.1	0	
1.2	0	
1.3	0	
1.4	1	
1.5	1	
1.6	1	
1.7	1	
1.8	1	
1.9	1	
2.0	2	
2.1	1	
2.2	2	
2.3	2	
2.4	3	
2.5	2	
2.6	3	
2.7	2	
2.8	3	
2.9	3	
3.0	4	
3.1	4	
3.2	4	
3.3	5	
3.4	5	
3.5	4	
3.6	4	
3.7	6	
3.8	5	
3.9	6	
4.0	6	
4.1	6	
4.2	6	
4.3	7	
4.4	6	
4.5	6	
4.6	6	
4.7	6	
4.8	6	
4.9	6	
5.0	7	



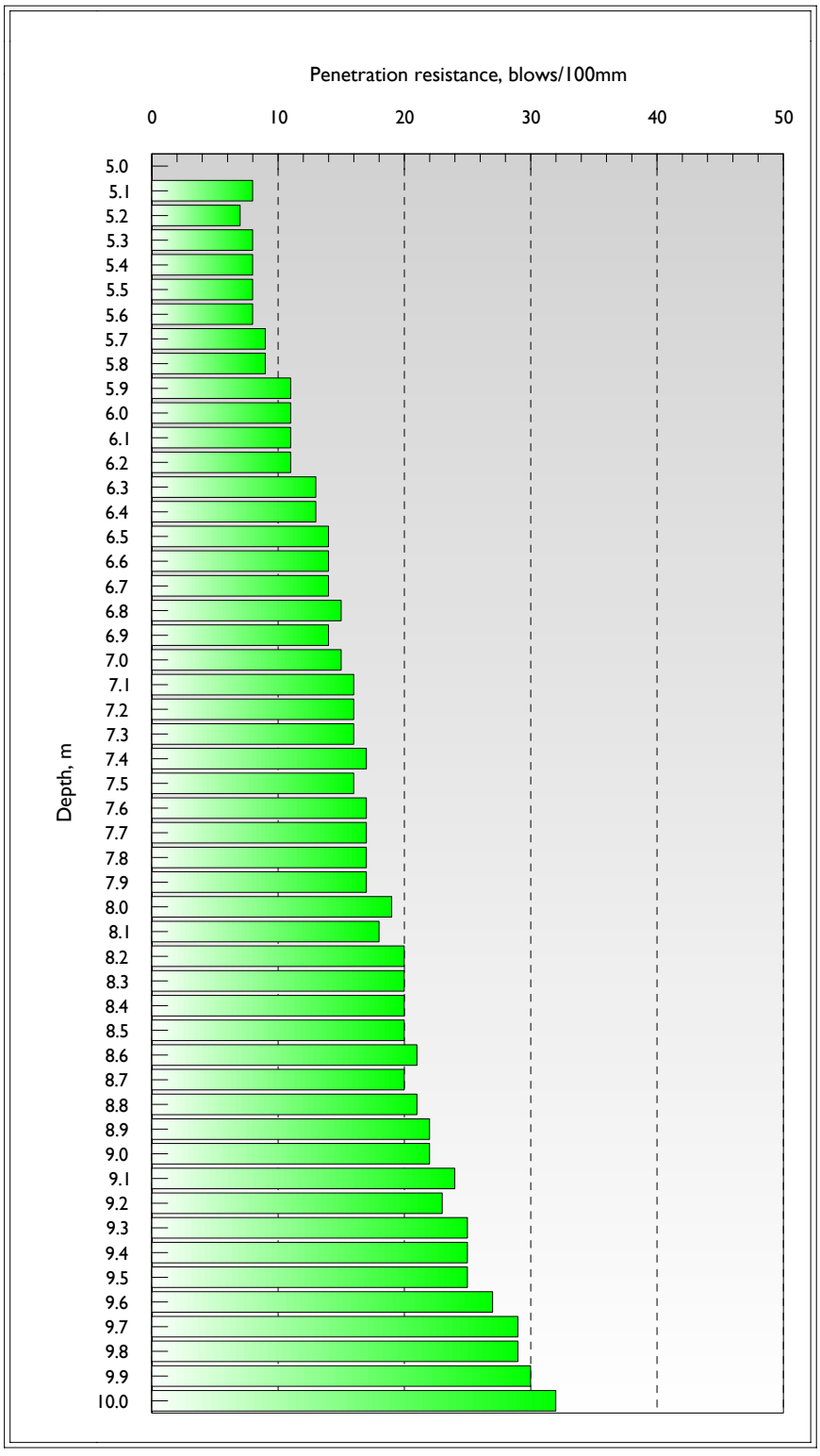
DYNAMIC PROBE RECORD

Project: 17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ
Client: Ms Maria Stamoulis
Agent: THe Consultants

Project No: 3725
Sheet No: 2/3

Probe No.	DP1

Depth m	Blows/ 100mm	Torque Nm
5.0		
5.1	8	
5.2	7	
5.3	8	
5.4	8	
5.5	8	
5.6	8	
5.7	9	
5.8	9	
5.9	11	
6.0	11	
6.1	11	
6.2	11	
6.3	13	
6.4	13	
6.5	14	
6.6	14	
6.7	14	
6.8	15	
6.9	14	
7.0	15	
7.1	16	
7.2	16	
7.3	16	
7.4	17	
7.5	16	
7.6	17	
7.7	17	
7.8	17	
7.9	17	
8.0	19	
8.1	18	
8.2	20	
8.3	20	
8.4	20	
8.5	20	
8.6	21	
8.7	20	
8.8	21	
8.9	22	
9.0	22	
9.1	24	
9.2	23	
9.3	25	
9.4	25	
9.5	25	
9.6	27	
9.7	29	
9.8	29	
9.9	30	
10.0	32	



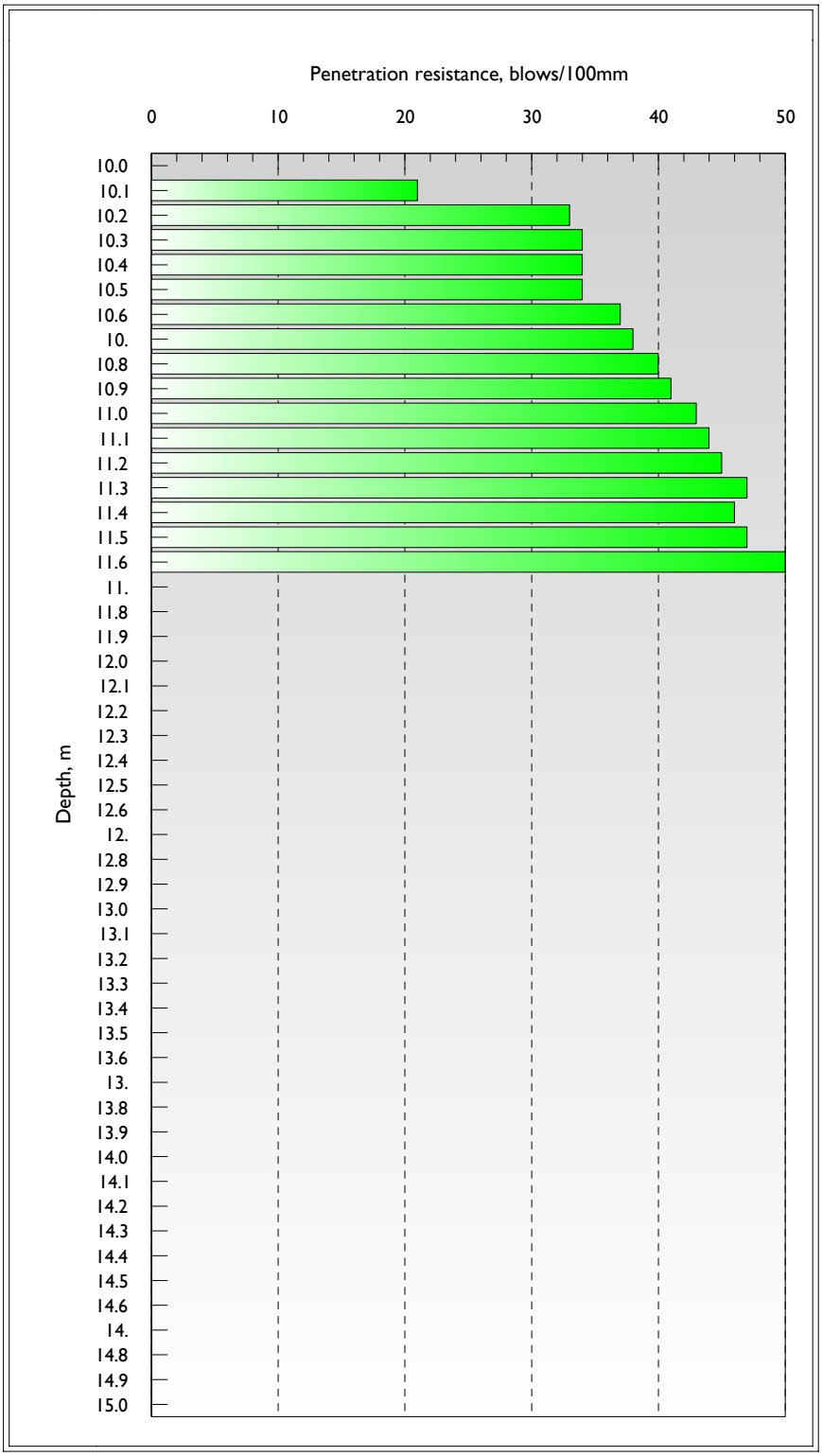
DYNAMIC PROBE RECORD

Project: 17 GLENLOCH ROAD, BELSIZE PARK, NW3 4DJ
Client: Ms Maria Stamoulis
Agent: THe Consultants

Project No: 3725
Sheet No: 3/3

Probe No.	DP1

Depth m	Blows/ 100mm	Torque Nm
10.0		
10.1	21	
10.2	33	
10.3	34	
10.4	34	
10.5	34	
10.6	37	
10.7	38	
10.8	40	
10.9	41	
11.0	43	
11.1	44	
11.2	45	
11.3	47	
11.4	46	
11.5	47	
11.6	50	
11.7		
11.8		
11.9		
12.0		
12.1		
12.2		
12.3		
12.4		
12.5		
12.6		
12.7		
12.8		
12.9		
13.0		
13.1		
13.2		
13.3		
13.4		
13.5		
13.6		
13.7		
13.8		
13.9		
14.0		
14.1		
14.2		
14.3		
14.4		
14.5		
14.6		
14.7		
14.8		
14.9		
15.0		



APPENDIX E

LABORATORY TEST RESULTS

SUMMARY OF GEOTECHNICAL TESTS

Project: 17 GLENLOCH ROAD, BELSIZE PARK, LONDON
Client: Ms Maria Stamoulis
Agent: THe Consultants

Project No: 3725
Sheet No: 1/1

Location	Sample No	Depth m	Description	CLASSIFICATION Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index %	Passing 425µm %	Mod. Plast. Index %	Class	TRIAXIAL COMPRESSION - TOTAL STRESS Type	Moisture Content %	Bulk Density Mg/m³	Radial Stress kPa	Deviator Stress kPa	Cohesion cu, kPa assuming Øu = 0	Cohesion cu, kPa Øu, deg	CHEMICAL Sulphate (SO4) Water g/l	Sulphate (SO4) Soil (Sol) g/l	pH
WS1		2.50	Firm brown and grey brown CLAY	33	74	25	49	100	49	CV									0.34	8.30
		3.40	Firm brown and grey brown CLAY																0.27	8.08
		3.50	Firm brown and grey brown CLAY								U38	34	1.90	70	127	63	20			
		4.00	Stiff brown and grey brown CLAY	30	74	27	47	100	47	CV									1.65	8.15
		4.90	Stiff brown and grey brown CLAY																1.60	7.94
		5.00	Stiff brown and grey brown CLAY								U38	31	1.96	100	277	138	20			
		8.00	Soft brown and grey brown CLAY								U38	36	1.82	160	70	35*	20			

*Premature failure

Note: Soil Classification based upon unmodified Plasticity Index