HERTS & ESSEX SITE INVESTIGATIONS

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GEOTECHNICAL ASSESSMENTS – ENVIRONMENTAL ASSESSMENT - DESKTOP STUDY – CONTAMINATED LAND

25th February 2022 Our ref : CSG/17185

London Building Company
26 / 28 Lytton Road
New Barnet
London
EN5 5BY

For the attention of K. Screeney Esq.,

Dear Sir,

Re: Bird in the Hand, West End Lane, London NW6 4NX: Site Investigation

SECTION 1 INTRODUCTION

1.01 In accordance with your instructions, we visited the above site during February 2022.

1.02 The purpose of our visit was to carry out an investigation into the subsoil conditions in order to assess the suitability of the site for the development of a new residential structure with associated landscaping.

1.03 The comments and opinions expressed are based purely on the conditions encountered and the subsequent laboratory testing. The locations of the excavations have been assessed on site.

1.04 Some special condition may be present on site that, to date, has not been encountered within the scope of the site investigation works and therefore will not have been taken into account within this report.

1.05 All ground water recordings or their absence relate to short term observations and do not allow for fluctuations due to seasonal or other effects.

SECTION 2 DESCRIPTION OF SITE

2.01 The site is formed by an existing commercial public house which includes a car park running across the rear of the site. The site is laid to hard landscaping in full.

2.02 The site is surrounded by residential land with a block of private garages to the south of the site area.

SECTION 3 FIELDWORK

3.01 In order to assess the site, the proposals have been made to assess both the shallow and deeper soils profiles in order to enable the design of potentially traditional foundations or piled foundations should this option become unviable. In order to complete these works, the following site investigation works were implemented.

- 2No Shell & Auger borehole sunk immediately outside the footprint of the proposed structure in order to assess soils, complete insitu testing, recover samples and record the soil profile. The depth of these boreholes were identified as 1.20 metres and 25.00 metres deep. The date of these works was recorded as 8th to 9th February 2022.
- 2No Dynamic Competitor Rig Boreholes sunk to a depth of between 1.56 metres and 10.00 metres – Date Of Works – 9th February 2022.
- Installation of a standpipe in BH2 to a depth of 5.00 metres
- Laboratory Testing – February 2022.

3.02 The location of these works is indicated on the site plan-forming appendix one.

3.03 The various strata encountered were noted and are recorded on the borehole logs forming appendix two.

3.04 Full ranges of samples were recovered as noted and retained for subsequent laboratory testing.

SECTION 4 LABORATORY TESTING

4.01 All samples were tested in accordance with BS:1377:1990, methods for test for civil engineering purposes.

4.02 Selected samples were recovered to determine their Atterberg Limits, Hand Penetrometer testing, Triaxial Testing, Soluble Sulphate value and pH.

4.03 The results of this laboratory testing are enclosed and form appendix three

SECTION 5 SITE INFORMATION

5.01 The site has been reviewed and we can confirm that the geology within the site is as follows :-

Table 3 Geological Profile

Stratum	***Description***	***Depth, Range***	***Thickness, Range***
Made Ground	Loose to compact clay FILL with flint gravel and brick fragments	1.20-1.56m	1.20-1.56m
	Crushed tarmac (0.10m) over brown clayey sandy brick FILL	0.80m	0.80m
LONDON CLAY	Firm to stiff brown mottled grey slightly silty CLAY	25m+	8.80m+ to 24.20m+
Ground Water : No groundwater has been identified based on the short term observations to date.			

SECTION 6 RESULTS

6.01 By inspection of the borehole logs and from a visual assessment of the samples recovered, a scheme of laboratory testing has been undertaken. The results are enclosed within appendix three and prove the following:

6.02 Laboratory testing has been undertaken in accordance with BS 1377:1990, (Methods for Tests for Soils for Civil Engineering Purposes), the results of which are enclosed.

6.03 Included within the laboratory testing was sulphate analysis, which can determine the use of sulphate resisting cement within the foundation design for the development. The results are enclosed and prove the classification in accordance with ACEC to be DS-1/AC-1S.

6.04 Hand Penetrometer tests have been undertaken disturbed samples recovered from the site works. From the information gathered, it is recorded that cohesion values of between 48-150+kN/m² were achieved.

6.05 Undrained triaxial testing was also completed on undisturbed samples recovered from the site works, (two samples), which confirmed that the undrained shear strength of the subsoil is measured as 36-177kN/m².

6.06 The calculation of these values presented in Appendix Three, Sheet One can be converted into an allowable bearing capacity using the apparent cohesion values and multiplying them by factors to produce the allowable bearing capacity. The calculation can be completed using factors based on the relationship between the depth of the proposed foundation and the width of the foundation based on work by Skempton. As a rule of thumb, the apparent cohesion can be multiplied by 6 and divided by a factor of safety of 3 to achieve the allowable bearing capacity.

6.07 Atterberg Limits tests proved the clay soils to be of very high plasticity, (PI=46-56%), which indicates a high susceptibility to movement associated with moisture content change.

6.08 A measurement of the potential desiccation has been completed using Driscoll's Method of Desiccation Analysis which uses a comparison of moisture content profiles measures against the liquid limit measured in the Atterberg test. This makes an assumption of the state of the soil moisture content against the state of the soil in its liquid state to assess desiccation. Driscoll make a comparison that the soils would likely be in a state of slight desiccation if the moisture content of the soil was less than 0.5 multiplied by the liquid limit state of the soil, (slight desiccation being a level of desiccation at which overburden pressure may influence), and significant desiccation if the moisture content of the soil was less than 0.4 multiplied by the liquid limit, (significant desiccation being a level which would be un-natural to reduce to and therefore influenced by surrounding trees or vegetation).

6.09 Utilizing this method of assessment, it can be seen that no obvious desiccation is recorded in place.

SECTION 7 CONCLUSIONS

7.01 Any new foundations should be seated at a depth of as a minimum, 0.90 meters below the site level to overcome the impact of weathering. In order for foundations to be seated in materials suitable for the proposed foundations, factors will influence the design which are as follows, (although, this list in not exhaustive) :-

- Any new foundations should be seated in a uniform geotechnical material with regards possible volume change, future movements and differential settlements based on variable soils.
- Allowable bearing capacity.
- The proposed development.
- Groundwater.
- Trees.
- Topography, and
- Solution Features.

7.02 Any new foundations should be taken to depths in excess of the influence of any surrounding trees or vegetation, (recently removed, existing or proposed). An assessment has been recorded as to the depth of the existing root system within the site. This cannot be utilized across the site due to limited observations and as such, a guideline should be used to determine the depth of foundations required in order to overcome the influence of any surrounding vegetation.

7.03 As a result, we would suggest that any new foundations should be taken to a minimum depth of 1.00m. The use of NHBC Chapter 4.2, (Building Near Trees), should be incorporated in the design of any foundations, which dictates species, clay type and, ultimately, foundation depth. This is only a guideline that should be implemented as a method of costing the substructure within the development. The depth of any root systems within the subsoil will dictate the actual in-situ depth of any foundations across the site. It is envisaged that NHBC Chapter 4.2 will provide a reasonable assessment of actual foundation depths.

7.04 Where trees are to be removed or have recently been removed from the site in order to provide new landscaping or to enable the development to take place, the existing height of the trees and vegetation to be/or that has been removed should be used in assessing the proposed foundation depths local to those specific trees.

7.05 Where trees are to remain and will undergo some degree of growth to reach maturity, the mature height of the tree should be used within NHBC Chapter 4.20m.

7.06 Based on the geology identified at the site, it is recorded that the upper soils are recorded as relatively soft exhibiting undrained shear strengths of between 36-84kN/m² which would suggest that the upper soils are unlikely to be suitable for use as a founding material. Additionally, the basement construction across the site will likely remove the potential for shallow foundations to be used.

7.07 The depth of piles can be calculated using the parameters defined within this report, (to include the undrained shear strength parameters recorded in appendix three of this report) and a structural engineers calculations in respect to loading of the proposed structure. The information within this report could be sent to a piling contractor who would be able to provide bespoke design parameters based on the information provided and costs of associated works to develop those piles.

7.08 Given the close proximity of surrounding structures, we would suggest that a system of Continuous flight augered piles would form the optimum foundation solution which would include bottom fed concrete infill.

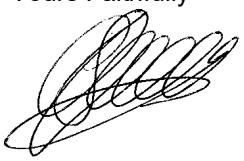
7.09 Protection against heave and shrinkage should be included in any design in accordance with NHBC Chapter 4.2, (Building Near Trees) and include in any pile and also ground beam design.

7.10 A suspended floor should be included in any design guide where foundation depths exceed 1.50 metres due to the influence of trees or where made ground or compressible soil is in place to depths in excess of 0.60 metres unless it can be proven that these made ground is of a uniform density and consistency across the build.

7.11 All foundations should be designed by a suitably qualified engineer with regard loading for the proposed structure.

I hope the foregoing is sufficient for your requirements, although please do not hesitate to contact us should require any further information regarding the above.

Yours Faithfully



C.S.Gray M.Sc
Contract Engineer

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Appendix No	1
Sheet No	1
Job No	17185
Date	Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Location Plan

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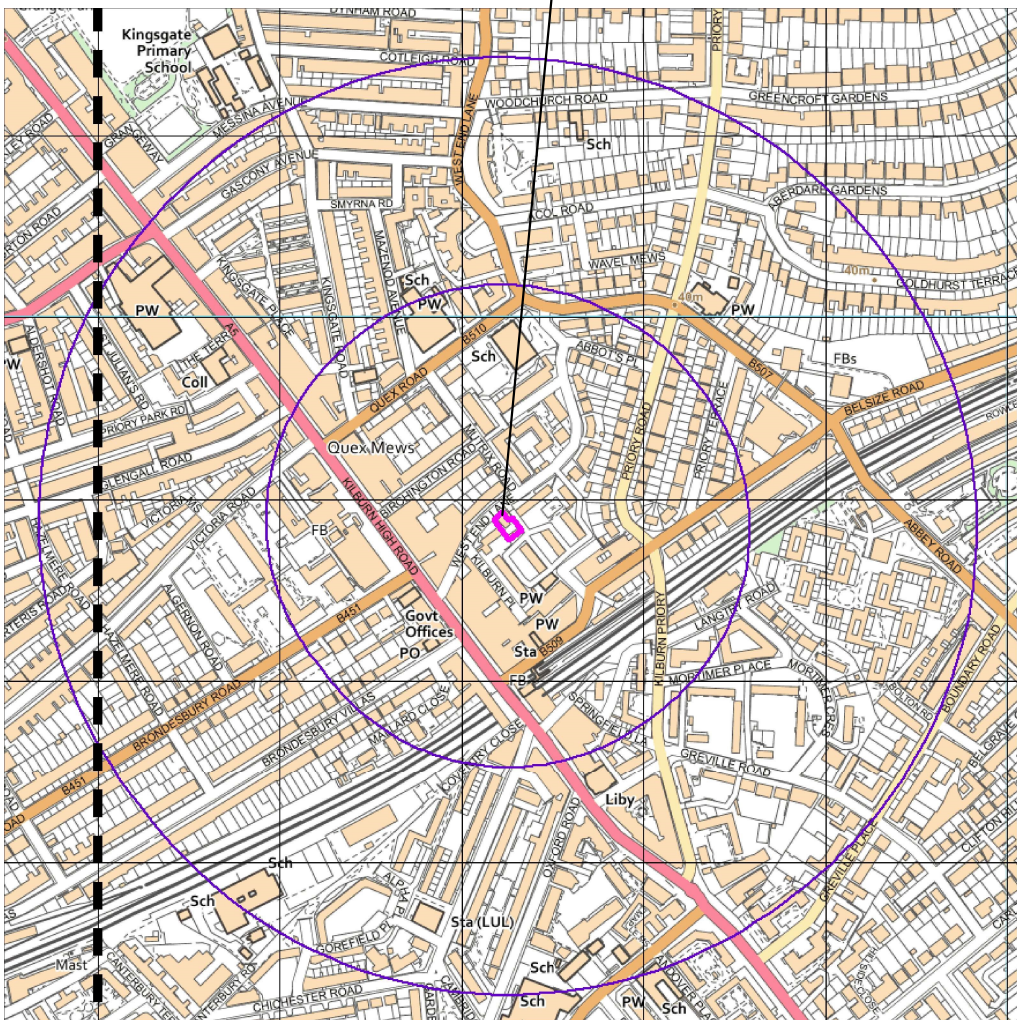
The Site



Not to Scale
Sketch No. : GEO / 17185 / 01 / 01

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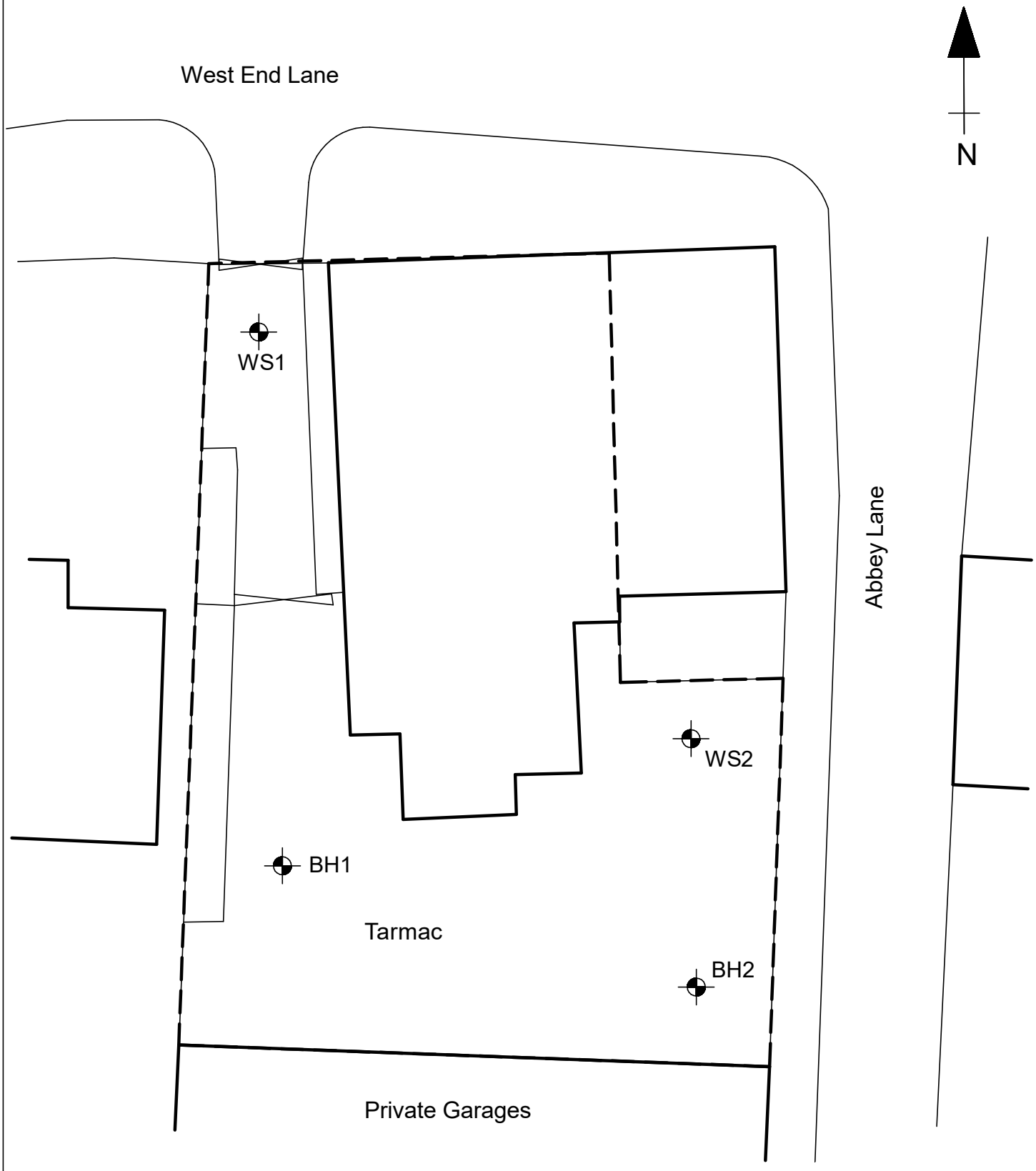
Appendix No	1
Sheet No	2
Job No	17185
Date	Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Existing Site Plan



Not to Scale

Sketch No. : GEO / 17185 / 01 / 02

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Appendix No 2
Sheet No 1
Job No 17185
Date Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Borehole One

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Crushed tarmac		0.40	0.40								
Loose to compact clay FILL with flint gravel and brick fragments		1.20	0.80								
Closed at 1.20m Obstruction - No progress											

1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10

Remarks

Scale 1 : 50

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample ▼ - Water Struck D - Disturbed Sample ▽ - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

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Appendix No 2
Sheet No 2
Job No 17185
Date Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Borehole Two

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Crushed tarmac (0.10m) over brown clayey sandy brick FILL		0.80	0.80		1	B	0.50	N=12		Bentonite Seal	
Firm grey brown moderately silty CLAY with flint gravel		1.20	0.40								
Soft to firm brown mottled grey CLAY with flint gravel		1.70	0.50							Solid Pipework	1.40
Soft to firm brown mottled grey CLAY		2.25	0.55		1	U	1.80				
Firm grey slightly silty CLAY		2.50	0.25								
Firm to stiff brown mottled grey slightly silty CLAY Weak claystone from 3.15 to 3.20m			8.10		2	U	2.70			50 mmø Slotted Pipework	
					3	U	4.00				
					4	U	5.00			Pea Shingle	
					5	U	6.50				
					6	U	8.00				
					7	U	9.50				

Remarks

Scale 1 : 50

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

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Appendix No 2
Sheet No 3
Job No 17185
Date Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Borehole Two .... continued

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
As above		1.20	8.10								
Stiff grey slightly silty CLAY					8	U	11.00				
					9	U	12.50				
					10	U	14.50				
			14.40								
					11	U	15.50				
					12	U	17.00				
					13	U	18.50				

Remarks

Scale 1 : 50

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

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Appendix No 2
Sheet No 4
Job No 17185
Date Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Borehole Two ....continued

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
As above			14.40		14	U	20.00				
					15	U	21.50				
					16	U	23.00				
					17	U	24.50				
		25.00									
Borehole closed at 25.00 m											

Remarks

Scale 1 : 50

Key : U - Undisturbed Sample (100mm **diameter)** B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

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Appendix No 2
Sheet No 5
Job No 17185
Date Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Window Sampler One

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Crushed tarmac		0.40	0.40								
Loose to compact silty clay FILL with flint gravel and brick fragments		1.56	1.16								
Closed at 1.56m Obstruction - No progress											

1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10

Remarks

Scale 1 : 50

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample ▼ - Water Struck D - Disturbed Sample ▽ - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

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Appendix No 2
Sheet No 6
Job No 17185
Date Feb 2022

Bird in the Hand, West End Lane, London NW6 4NX

Window Sampler Two

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Crushed tarmac		0.60	0.60		1	U	GL - 1.00				
Loose to compact clayey FILL with flint gravel and much brick butts and fragments		1.20	0.60		2	U	1.00-2.00				1.00
Firm to stiff brown mottled grey slightly silty CLAY			8.80		3	U	2.00-3.00				
					4	U	3.00-4.00				
					5	U	4.00-5.00				
					6	U	5.00-6.00				
					7	U	6.00-7.00				
					8	U	7.00-8.00				
					9	U	8.00-9.00				
					10	U	9.00-10.00				
Closed at 10.00m		10.00									

Remarks

Scale 1 : 50

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

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APPENDIX 3
SHEET 1
JOB NUMBER 17185
DATE Feb-22

LOCATION Bird in Hand, West End Lane, London NW6 4NX

HAND PENETROMETER STRENGTH TEST RESULTS

Excavation Location Number	*Depth (m)*	*Sample*	*Natural Moisture Content (%)*	*Bulk Density (Mg/m³)*	*Lateral Pressure (kN/m²)*	*Hand Penotrometer (Undrained)*	*Angle of Shearing resistance (degrees)*	*Estimated Allowable Bearing Capacity (kN/m²)*
WS2	2.00	U	38			24		48
WS2	3.00	U	34			42		84
WS2	4.00	U	34			78		150+
WS2	5.00	U	31			84		150+
WS2	6.00	U	33			102		150+
WS2	7.00	U	32			105		150+
WS2	8.00	U	31			102		150+
WS2	9.00	U	31			150+		150+
WS2	10.00	U	32			102		150+

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APPENDIX 3
SHEET 2
JOB NUMBER 17185
DATE Feb-22

LOCATION Bird in Hand, West End Lane, London NW6 4NX

TRIAXIAL TEST RESULTS

Excavation Location Number	*Depth*	*Sample*	*Natural Moisture Content*	*Bulk Density*	*Lateral Pressure*	*Deviator Stress*	*Apparent Cohesion*	*Angle of Shearing resistance*	*Remarks*
	m		*(%)*	*(Mg/m³)*	*(kN/m²)*	*(kN/m²)*	*(kN/m²)*	*(degrees)*	
BH2	1.80	U1	43	1.89	36	72	36	-	
BH2	2.70	U2	33	1.90	54	96	48	-	
BH2	4.00	U3	33	2.00	80	150	75	-	
BH2	5.00	U4	32	2.01	100	258	129	-	
BH2	6.50	U5	31	1.99	130	270	135	-	
BH2	8.00	U6	30	1.97	160	264	132	-	
BH2	9.50	U7	31	2.00	190	288	144	-	
BH2	11.00	U8	27	2.02	220	300	150	-	
BH2	12.50	U9	27	1.97	250	327	163	-	
BH2	14.00	U10	27	2.00	280	330	165	-	
BH2	15.50	U11	26	2.02	310	324	162	-	
BH2	17.00	U12	27	2.03	340	265	132	-	
BH2	18.50	U13	28	2.01	370	324	162	-	
BH2	20.00	U14	27	2.04	400	354	177	-	
BH2	21.50	U15	25	2.01	430	288	144	-	
BH2	23.00	U16	27	2.00	460	317	158	-	
BH2	24.50	U17	27	2.01	490	300	150	-	

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APPENDIX 3
SHEET 3
JOB NUMBER 17185
DATE Feb-22

LOCATION Bird in Hand, West End Lane, London NW6 4NX

ATTERBERG LIMITS TEST DATA

Excavation Location Number	*Depth (m)*	*Sample*	*Natural Moisture Content (%)*	*Liquid Limit (%)*	*Plastic Index (%)*	*Plasticity Index (%)*	*Group Symbol*	*Ammended Plasticity Index (%)*	*Desiccation Profile*	*Percentage Retained on 425 Micron Sieve (%)*
BH2	1.80	U1	43	87	31	56	CV	56		0
BH2	2.70	U2	33	78	30	48	CV	48		0
BH2	4.00	U3	33	78	29	49	CV	49		0
BH2	5.00	U4	32							
BH2	6.50	U5	31							
BH2	8.00	U6	30	84	30	54	CV	54		0
BH2	9.50	U7	31							
BH2	11.00	U8	27							
BH2	12.50	U9	27							
BH2	14.00	U10	27	74	28	46	CV	46		0
BH2	15.50	U11	26							
BH2	17.00	U12	27							
BH2	18.50	U13	28	77	29	48	CV	48		0
BH2	20.00	U14	27							
BH2	21.50	U15	25	78	30	48	CV	48		0
BH2	23.00	U16	27							
BH2	24.50	U17	27	78	29	49	CV	49		0
WS2	2.00	U	38							
WS2	3.00	U	34	78	29	49	CV	49		0
WS2	4.00	U	34							
WS2	5.00	U	31							
WS2	6.00	U	33	78	30	48	CV	48		0
WS2	7.00	U	32							
WS2	8.00	U	31							
WS2	9.00	U	31							
WS2	10.00	U	32	87	31	56	CV	56		0

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APPENDIX 3
SHEET 4
JOB NUMBER 17185
DATE Feb-22

LOCATION Bird in Hand, West End Lane, London NW6 4NX

SULPHATE ANALYSIS

Excavation Location Number	*Depth (m)*	*Sample*	*Concentrations of Soluble Sulphate*			*Classification*	*pH*
			Soil		*Groundwater*		
			Total SO4 (%)	*SO4 in 2:1 Water:soil (g/l)*			
BH2	4.00	U3		0.34		DS-1 / AC-1s	7.98
BH2	14.00	U10		0.25		DS-1 / AC-1s	7.68
BH2	21.50	U15		0.19		DS-1 / AC-1s	7.51
WS2	6.00	U		0.27		DS-1 / AC-1s	7.96