GROUND INVESTIGATION REPORT

for the site at

15 ROSSLYN HILL, HAMPSTEAD, LONDON NW3 5UJ

on behalf of

GEOFFREY HO C/O CROFT STRUCTURAL ENGINEERS

Report Reference: GWPR2346/GIR/January 2018		Status: FINAL
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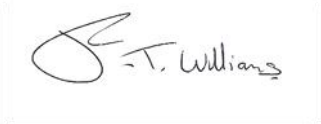
V1.01 January 2018		
	Robin Gledhill MSci (Hons) Graduate Geotechnical & Geo-Environmental Engineer	Francis Williams M.Geol. (Hons) FGS CGeol CEnv AGS Director
File Reference: Ground and Water/Project Files/ GWPR2346 15 Rosslyn Hill, Hampstead		

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1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Geoffrey Ho and Croft Structural Engineers on the 6th November 2017 to conduct a Ground Investigation and Basement Impact Assessment on a site at 15 Rosslyn Hill, Hampstead, London NW3 5UJ. The scope of the investigation was detailed within the Ground and Water Limited quotation ref. GWQ3543 dated 2nd November 2017.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

A Desk Study and full-scale contamination assessment were not part of the remit of this report.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions and development proposals on-site, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

2.0 SITE SETTING

2.1 Site Location

The site comprised a 340m^2 rectangular shaped plot of land, orientated in a north-east to south-west direction, located on the south-west side of Rosslyn Hill, with Lyndhurst Road to the south-west. The site was located in the Hampstead area of north-west London, within the London Borough of Camden.

The national grid reference for the centre of the site was approximately TQ 26972 85417. A site location plan is given within Figure 1. A plan showing the site development area is given within Figure 2.

2.2 Site Description

The site comprised a semi-detached four storey residential building with lower ground floor. A paved front garden was accessed via a thin gate (assumed ~0.80 – 0.90m wide) with adjacent paved parking area with open access onto Rosslyn Hill. A thin side access, down the south-east side of the property, led to the private rear garden. The rear garden was also accessible via a thin rear gate off Lyndhurst Road.

Site topography was derived using an online Elevation Finder tool and by reviewing the section drawings for the site. A variation in ground level of between 79.70m – 80.70m AOD was noted across the property. The paved off-street parking area at the front is approximately ~1.00m higher than the rear garden level of the property. An aerial view of the site can be seen within Figure 3. The existing development plan and section can be seen in Figures 4 and 5 respectively.

The site environs were noted to be sloping gently to moderately in an easterly direction.

2.3 Proposed Development

At the time of reporting, January 2018, it was understood that the proposed development will comprise a two storey extension to the rear of the existing property, including an extension of the existing basement/lower ground floor. The existing basement was understood to be constructed at depths of ~2.68m below the current front ground level (bfgl), ~1.68m below the rear garden level (brgl). The proposed basement extension, into the rear garden, will maintain these levels. A lowered garden terrace will be excavated 0.80m lower than the existing garden level, just beyond the basement extension. The extreme south-west of the garden will keep its existing levels, with steps down to basement/lower ground floor. Proposed Development plans and sections can be seen in Figures 6 and 7 respectively.

2.4 Geology

The geology map of the British Geological Survey of the Hampstead area (Sheet No. 256: North London) revealed the site to be situated on the boundary between the Claygate Member of the London Clay Formation and underlying London Clay Formation. No superficial deposits were present.

Claygate Member of the London Clay Formation

The Claygate Member of the London Clay Formation comprises alternating layers of clayey sand and sandy clays. The sands usually overlie the clays. The clays are typically brown to mauve mottled and are overconsolidated. The bed is transitional and overlays the undivided London Clay Formation. It has been used extensively for brick making.

London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface.

Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay Formation, and precautions against sulphate attack to concrete are sometimes required.

The lowest part of the formation is a sandy bed with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

Examination of the online BGS borehole records revealed a borehole located ~40m north-west of the site. The borehole encountered a thin capping of tarmac of 0.30m underlain by clay to a depth of ~15.84m bgl.

2.5 Hydrogeology and Hydrology

A study of the aquifer maps on the Environment Agency website revealed the site to be located on the boundary between **Unproductive Strata** relating to the bedrock of the London Clay Formation and a **Secondary (A) Aquifer** comprising of the Claygate Member of the London Clay Formation. No designation was given for any superficial deposits due to their absence.

Superficial (Drift) deposits are permeable unconsolidated (loose) deposits, for example, sands and gravels. The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Unproductive strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

Secondary Aquifers include a wide range of drift deposits with an equally wide range of water permeability and storage capacities. Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Examination of the Environment Agency records showed that the site **did not** fall within a Groundwater Source Protection Zone as classified in the Policy and Practice for the Protection of Groundwater.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at deep depth (>6m) below existing ground level (bgl). It was considered that the groundwater was flowing in a south-easterly direction in alignment with local topography.

Examination of the Environment Agency records showed that the site was situated within a **Flood Zone 1**, i.e. an area with low probability of flooding.

2.6 Radon

BRE 211 (2015) Map 5 of London, Sussex and West Kent revealed the site **was not** located within an area where mandatory protection measures against the ingress of Radon were required. The site **was not** located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Site works were undertaken on the 7th and 8th November 2017 and comprised the drilling of 1No. Premier Windowless Sampler Borehole (at the front of the property) and 1No. Hand Held Window Sampler Borehole (at the rear of the property), referenced BH1 and WS2 respectively, to depths of 8.45m bfgl (below front ground level) and 5.60m brgl (below rear ground level) respectively. Standard Penetration Tests (SPTs) were carried out within BH1 at 1.00m intervals.

Site works also comprised the excavation of 3No. Foundation Exposures (TP/FE1 – TP/FE3) to depths of 0.25m below basement level (bbl) – 0.80m brgl, the section for which can be seen in Figures 9 – 11.

A combined bio-gas and ground water monitoring well was installed in BH1 to 5.00m bfgl.

Combined Ground-gas and Groundwater Monitoring Well Construction				
Trial Hole	**Depth of Installation (m bfgl)**	**Thickness of slotted piping with gravel filter pack (m)**	**Depth of plain piping with bentonite seal (m bfgl)**	**Piping external diameter (mm)**
BH1	5.00	4.00	1.00	50

The approximate locations of the trial holes can be seen within Figure 8.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, exploratory positions were relocated away from these areas.

Upon completion of the site works, the trial holes were backfilled and made good/reinstated in relation to the surrounding area.

3.2 Sampling Procedures

Small disturbed samples were recovered from the trial holes at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.50m intervals during broad homogenous soil horizons.

A selection of samples were despatched for geotechnical testing purposes.

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 Soil Conditions

The boreholes were logged by Robin Gledhill of Ground and Water Limited generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the trial holes drilled on the site generally conformed to that anticipated from examination of the geology map. A capping of Made Ground was noted to overlie the soils of the Claygate Member of the London Clay Formation.

The ground conditions encountered during the investigation are described in this section. For more complete information about the Made Ground and the Claygate Member of the London Clay Formation at particular points, reference must be made to the individual trial hole logs within Appendix B.

The trial hole location plan can be viewed in Figure 8.

For the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as follows:

Concrete Slab
Made Ground
Claygate Member of the London Clay Formation

Surface Cover (At ground level or at basement level)
The following were encountered at surface within the trial holes:

Surface Cover (At ground level or at basement level)	Thickness (m)
Paving Slab (BH1, TP/FE1 & TP/FE3)	0.05 – 0.05

Made Ground
Made Ground was recorded to proved depths of between 0.90m brgl – 2.50m bfgl in BH1 – WS2 and to the base of the foundation exposures at depths of between 0.30m bbl – 0.80m brgl. The Made Ground comprised a dark brown to brown clayey silty gravelly sand to gravelly silty clay. The sand was fine to coarse grained. The gravel was rare to abundant, fine to coarse, sub-angular to sub-rounded flint, concrete and brick. Rare carbonaceous material was noted in WS2.

Claygate Member of the London Clay Formation
Soils described as representative of the Claygate Member of the London Clay Formation were noted to underlie the Made Ground, for the remaining depth of the boreholes, at depths of between 5.60m brgl – 8.45m bfgl, and comprised a grey brown sandy silty clay. The sand was fine to medium grained. Occasional pockets of orange sandy silt were noted. Fine selenite crystals were noted, becoming fine to medium grained from 3.50m brgl in WS2.

4.2 Foundation Exposures

A description of the foundation layout and ground conditions encountered within the hand dug trial pit/foundation exposures are given within this section of the report. The Foundation Exposures plan can be seen in Figures 9 - 11.

TP/FE1

Trial pit foundation exposure TP/FE1 was hand excavated on the south-western wall of the current property, at basement level. The exact location of the trial hole can be seen in Figure 8 with a section drawing of the foundation encountered in Figure 9.

A rendered brick was noted to basement floor level. From basement level to a depth of 0.08m bbl a brick wall was noted. The brick wall was noted to rest on two brick steps, which stepped out by 0.04m and where a total of 0.16m in thickness. The brick steps was noted to rest upon Made Ground described as a dark brown gravelly sandy silty clay at 0.24m bbl. The sand was fine to coarse grained. The gravel was rare, fine to coarse, sub-angular to sub-rounded, flint and brick.

The ground conditions encountered directly surrounding the foundation are shown in Figure 9.

- No roots were noted to within TP/FE1.
- No groundwater was noted during excavation of the foundation exposure.

TP/FE2

Trial pit foundation exposure TP/FE2 was hand excavated on the south-eastern boundary wall of the private garden area, at ground level. The exact location of the trial hole can be seen in Figure 8 with a section drawing of the foundation encountered in Figure 10.

A brick was noted to ground level. From ground level to a depth of 0.63m brgl a brick wall was noted. The brick wall was resting on two brick steps, which stepped out by 0.05 – 0.06m and were 0.05 – 0.08m in thickness. The brick steps were noted to rest upon soils of the Made Ground, which were described as a dark brown gravelly sandy silty clay. The sand was fine to coarse grained. The gravel was rare, fine to coarse, sub-angular to sub-rounded, flint and brick.

The ground conditions encountered directly surrounding the foundation are shown in Figure 10.

- Roots were noted to the base of TP/FE2 at 0.80m brgl.
- No groundwater was noted during excavation of the foundation exposure.

TP/FE3

Trial pit foundation exposure TP/FE3 was hand excavated on the north-western boundary wall of the private garden area, at ground level. The exact location of the trial hole can be seen in Figure 8 with a section drawing of the foundation encountered in Figure 11.

A rendered brick wall was noted to ground level. From ground level to a depth of 0.40m brgl a rendered wall was noted. The rendered wall was resting on two brick steps, the first of which stepped out by 0.20m, with the second by 0.07m. The steps were each 0.06m in thickness. The brick steps were noted to rest upon Made Ground comprising a dark brown gravelly silty clayey sand. The sand was fine to coarse grained. The gravel was occasional, fine to coarse, sub-angular to sub-rounded, flint, chalk and brick.

The ground conditions encountered directly surrounding the foundation are shown in Figure 11.

- Roots were noted to the base of TP/FE2 at 0.75m brgl.

- No groundwater was noted during excavation of the foundation exposure.

4.3 Roots Encountered

Fresh roots were recorded to a depth of 0.30m bfgl within BH1 with decaying roots recorded to 2.00m bfgl. Fresh roots were recorded to 1.00m brgl in WS2 with fine decaying roots recorded to 3.20m brgl. Roots were noted to the base of the foundation exposures TP/FE2 – TP/FE3, depths of between 0.75m – 0.80m brgl. No roots were encountered within the foundation exposure at basement level TP/FE1.

Trial Hole	Fresh Root Depth (m)	Decaying Root Depth (m)
BH1	0.30 (bfgl)	2.00 (bfgl)
WS2	1.00 (brgl)	3.20 (brgl)
TP/FE1	None Noted	None Noted
TP/FE2	0.80 (brgl)	None Noted
TP/FE3	0.75(brgl)	None Noted

It must be noted that the chance of determining actual depth of root penetration through a single narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.4 Groundwater Conditions

A groundwater strike was encountered at 6.20m bfgl BH1. Groundwater seepage was noted within WS2 at 0.50m brgl.

A return visit to monitor the combined bio-gas and groundwater well installed in BH1 was undertaken by a Ground and Water Limited Engineer on the 20th December 2017. Groundwater was noted to be resting at 4.07m bfgl, in the 5.00m deep well installed.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site. The investigation was undertaken in December 2017 when groundwater levels are likely to be rising from their annual minimum (lowest elevation) and approaching their annual maximum (highest elevation).

Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site.

4.5 Obstructions

No artificial or natural sub-surface obstructions were noted during drilling of the boreholes.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

Standard Penetration Tests (SPT's) were undertaken within BH1 at 1.00m intervals to the base of the boreholes. The results of the SPT's have not been amended to take into account hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7. The test results are presented on the borehole logs within Appendix B.

Windowless Sampler Boreholes provide samples of the ground for assessment but they do not give any engineering data. The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50 mm and an inside diameter of 35 mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5 kg falling through a distance of 760 mm. The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 75 mm up to a depth of 450 mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

The test results are presented on the trial hole logs within Appendix B.

5.2 Laboratory Geotechnical Testing

A programme of geotechnical laboratory testing, scheduled by Ground and Water Limited and carried out by K4 Soils Laboratory and QTS Environmental Limited, was undertaken on samples recovered from the natural ground. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:2016. Details of the specific tests used in each case are given below:

Standard Methodology for Laboratory Geotechnical Testing		
Test	**Standard**	**Number of Tests**
Atterberg Limit Tests	BS1377:2016:Part 2:Clauses 3.2, 4.3 & 5	5
Moisture Content Determinations	BS1377:1990:Part 2:Clause 3.2	4
Water Soluble Sulphate & pH	BS1377:2016:Part 3:Clause 5	1
BRE Special Digest 1 (incl. Ph, Electrical Conductivity, Total Sulphate, W/S Sulphate, Total Chlorine, W/S Chlorine, Total Sulphur, Ammonium as NH4, W/S Nitrate, W/S Magnesium)	BRE Special Digest 1 "Concrete in Aggressive Ground (BRE, 2005).	2

5.2.1 Atterberg Limit Tests

A précis of the results of Atterberg Limit Testing undertaken on one sample of the Made Ground and four samples of the underlying cohesive Claygate Member of the London Clay Formation encountered can be seen tabulated overleaf.

Atterberg Limit Tests Results Summary							
Stratum	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class Range	Consistency Index (Ic)	Volume Change Potential Range	
						NHBC	BRE
Made Ground	18	80	20	CI	1.25 (Very Stiff)	Medium	Medium
Claygate Member of the London Clay Formation	31 – 34	100	44 – 50	CV	0.90 – 0.98 (Stiff)	High	High

NB: NP – Non-plastic

BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)

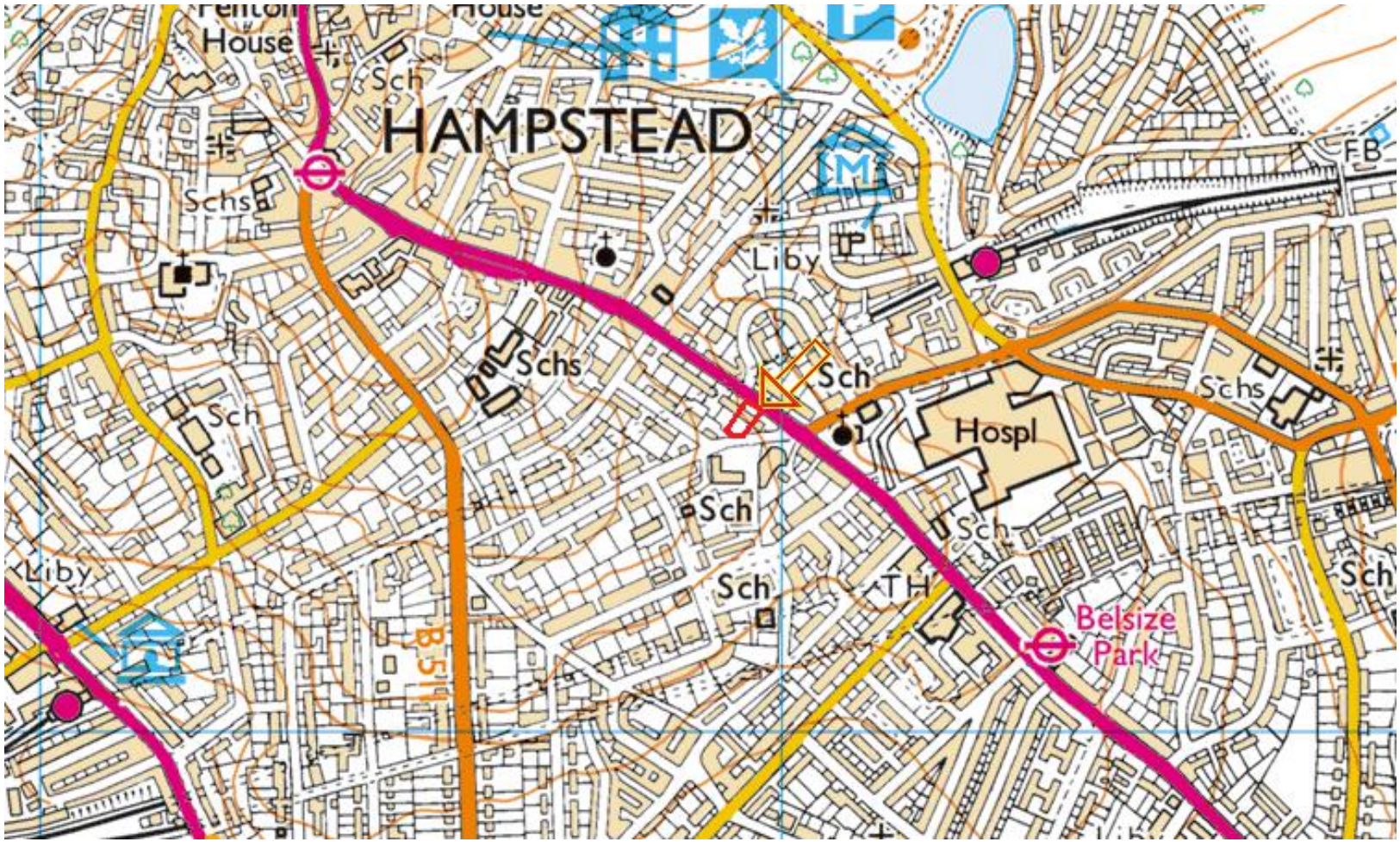
Soil Classification based on British Soil Classification System.

Consistency Index (Ic) based on BS EN IS0 14688-2:2004.

5.2.2 Sulphate and pH Tests

A water soluble sulphate and pH test was undertaken on one sample from the Made Ground (BH1/1.50m bfgl). The results are presented below.

Determinand	Unit	Value
pH	-	7.50
Sulphate (water soluble)	mg/l	160



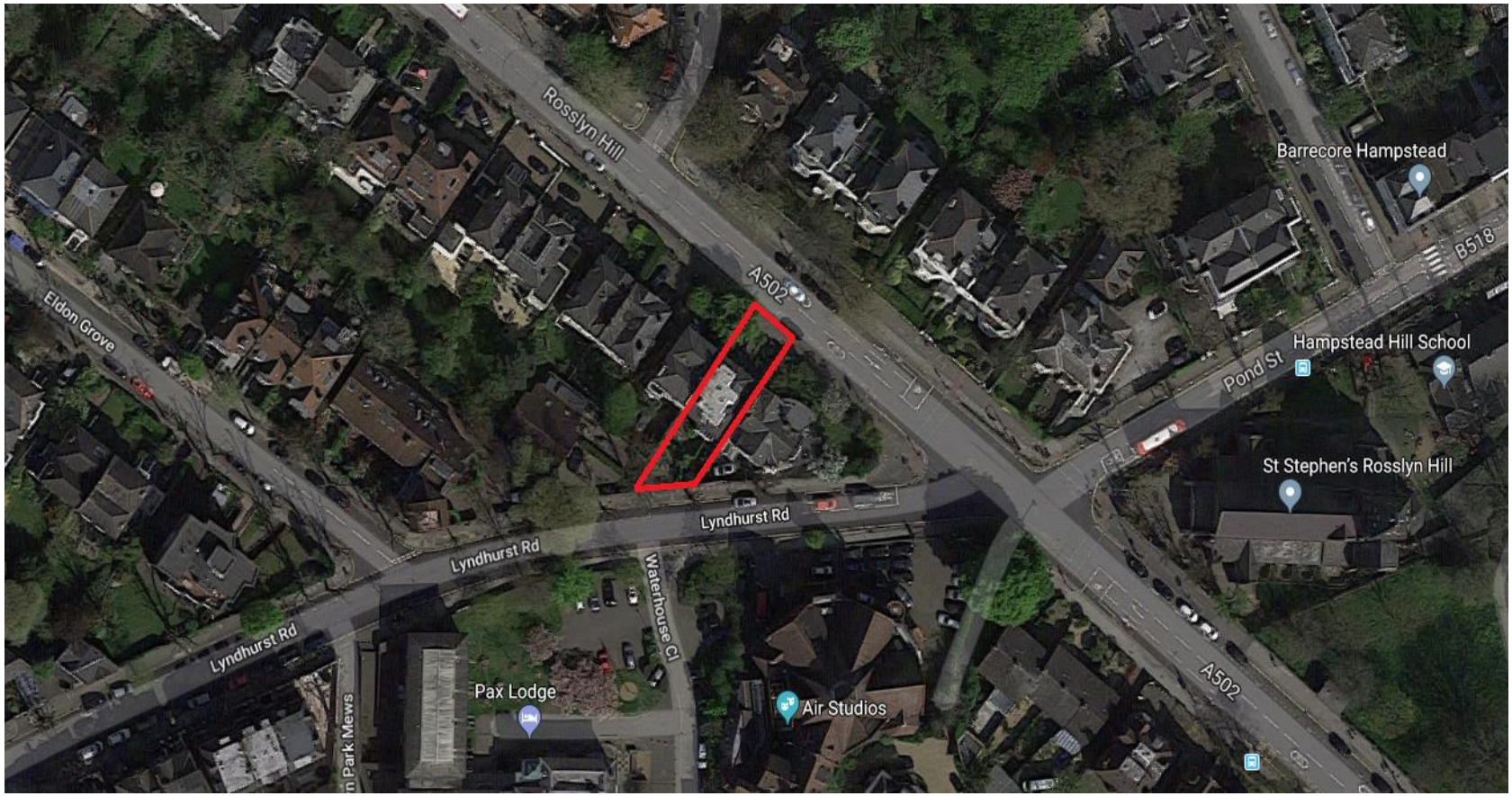
Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ		**Figure 1**
Client: Geoffrey Ho	**Date:** January 2018	ground&water
Site Location Plan	**Ref:** GWPR2346	

APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ		**Figure 2**
Client: Geoffrey Ho	**Date:** January 2018	ground&water
Site Development Area	**Ref:** GWPR2346	

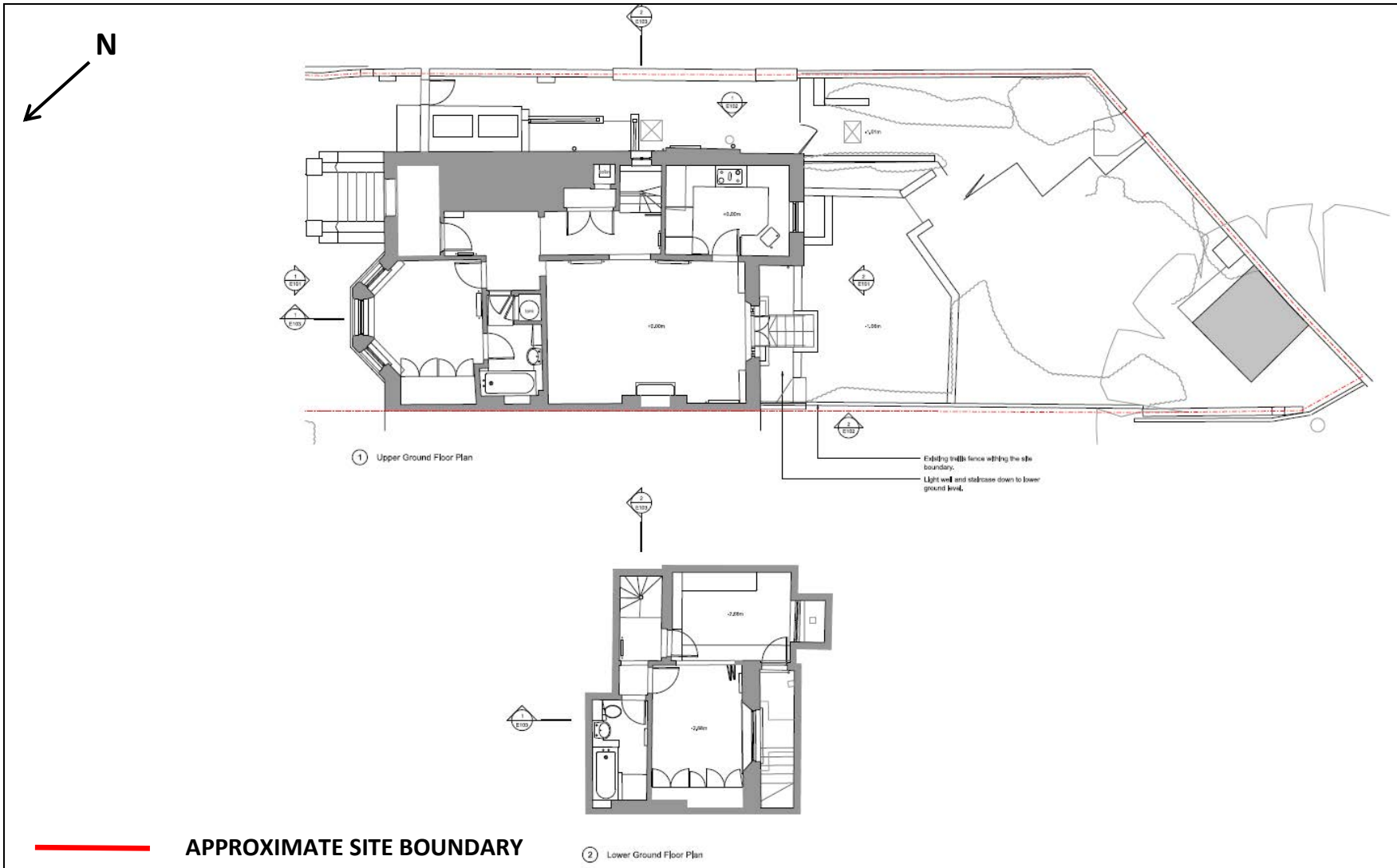
N



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ		**Figure 3**
Client: Geoffrey Ho	**Date:** January 2018	ground&water
Aerial View of Site	**Ref:** GWPR2346	

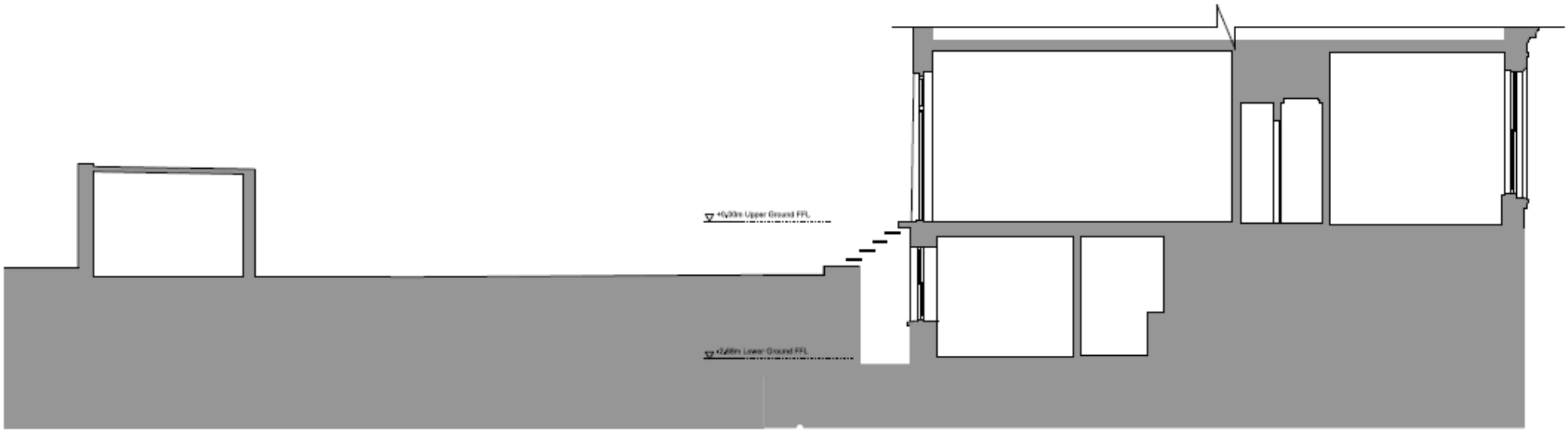


APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ		**Figure 4**
Client: Geoffrey Ho	**Date:** January 2018	ground&water
Existing Development Plan	**Ref:** GWPR2346	

SW NE

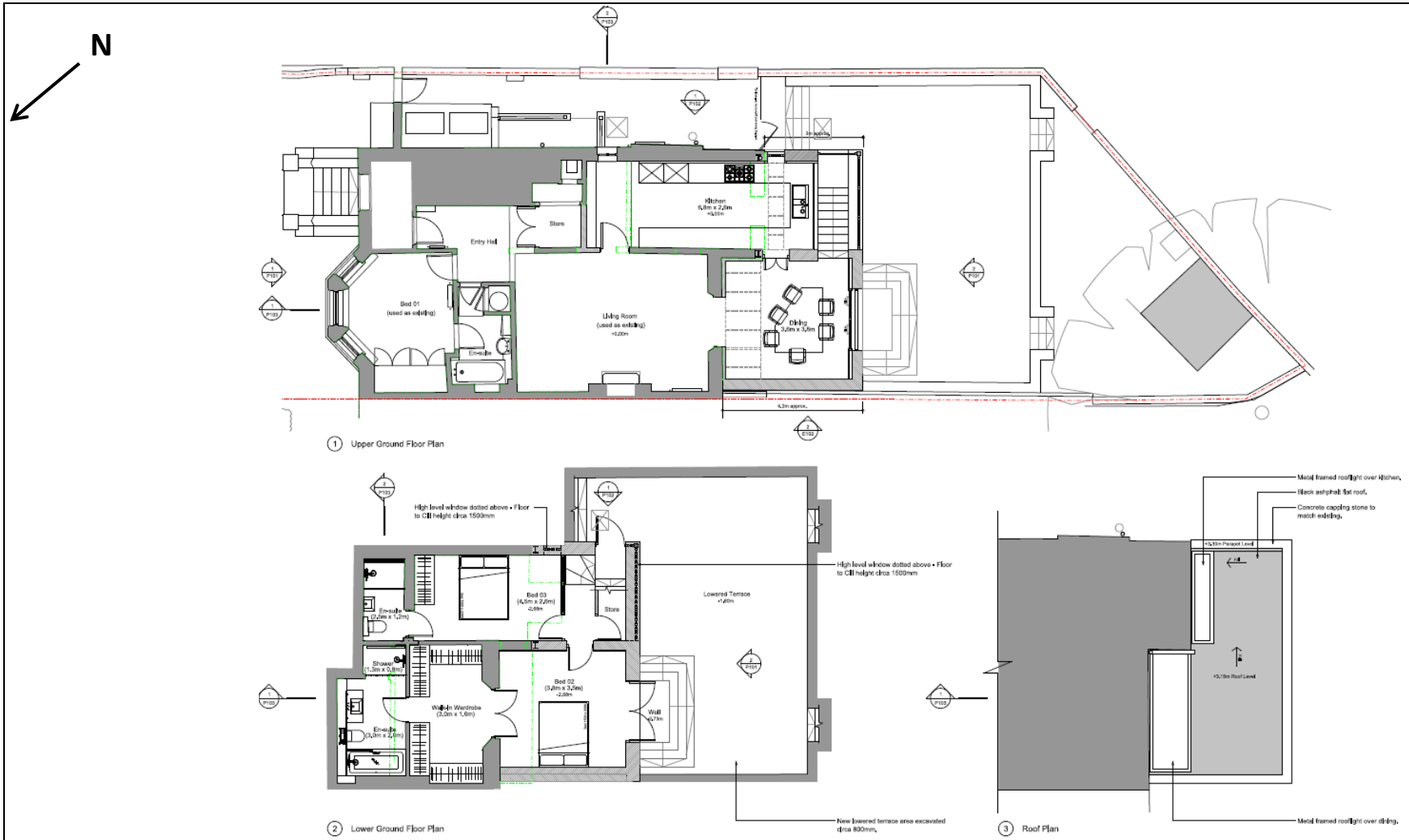


1 Long Section

APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ		Figure 5
Client: Geoffrey Ho	Date: January 2018	ground&water
Existing Development (Section View)	Ref: GWPR2346	



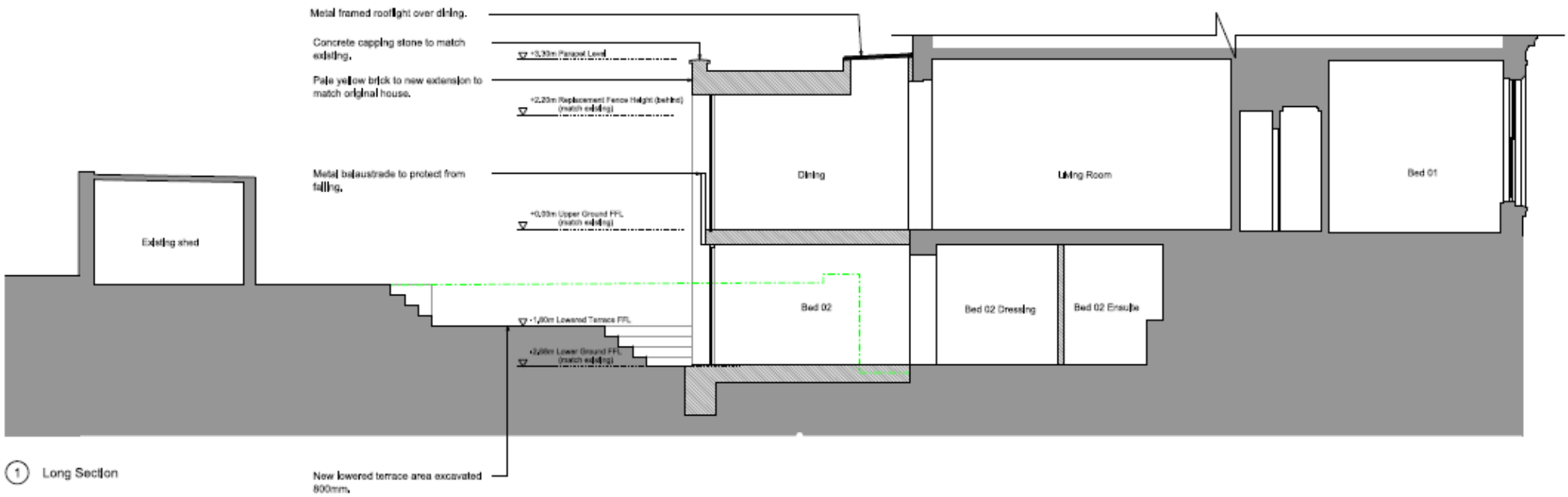
APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ	**Figure 4**
Client: Geoffrey Ho	**Date:** January 2018
Proposed Development Plan	**Ref:** GWPR2346

ground&water

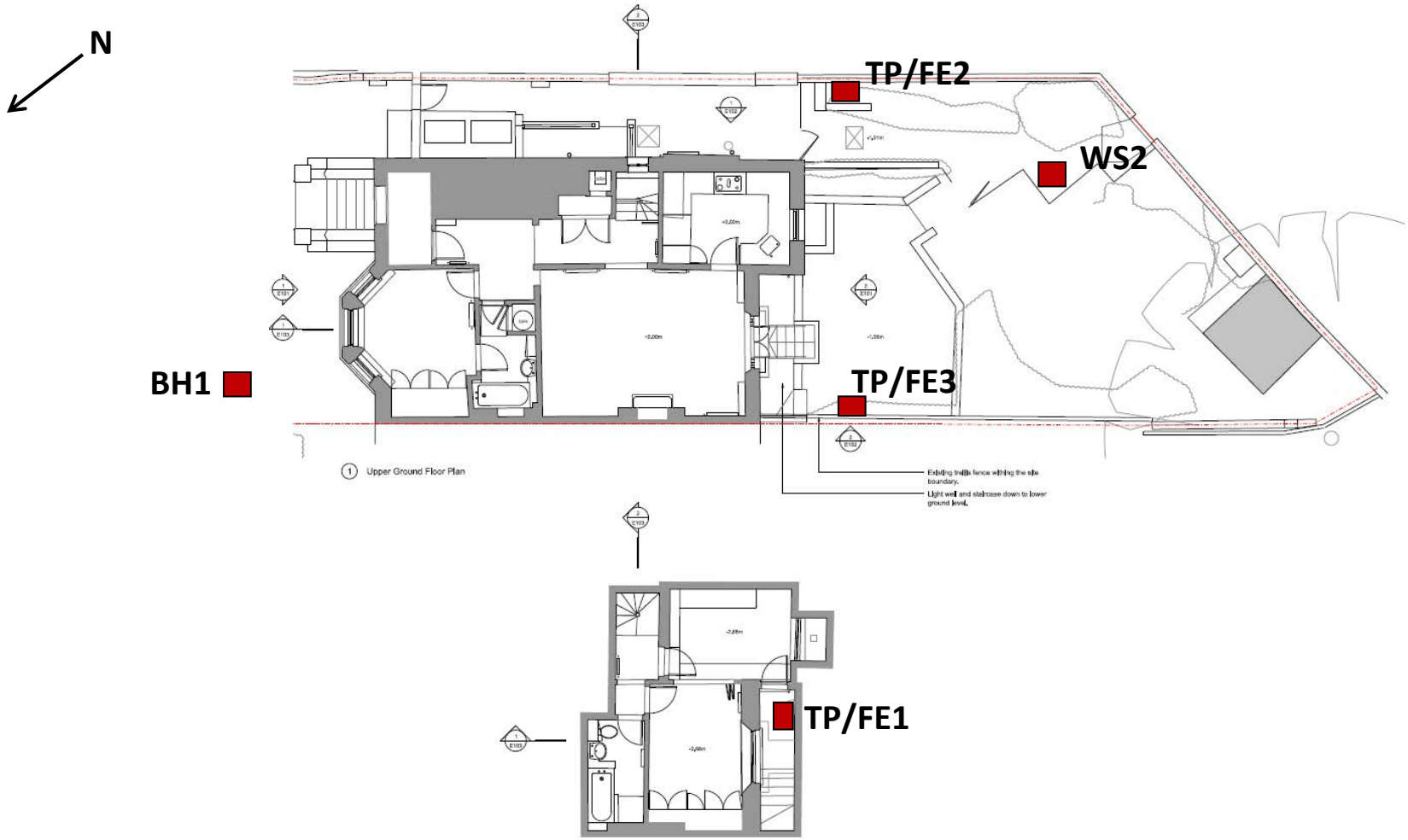
SW **NE**



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ		**Figure 5**
Client: Geoffrey Ho	**Date:** January 2018	ground&water
Proposed Development (Section View)	**Ref:** GWPR2346	

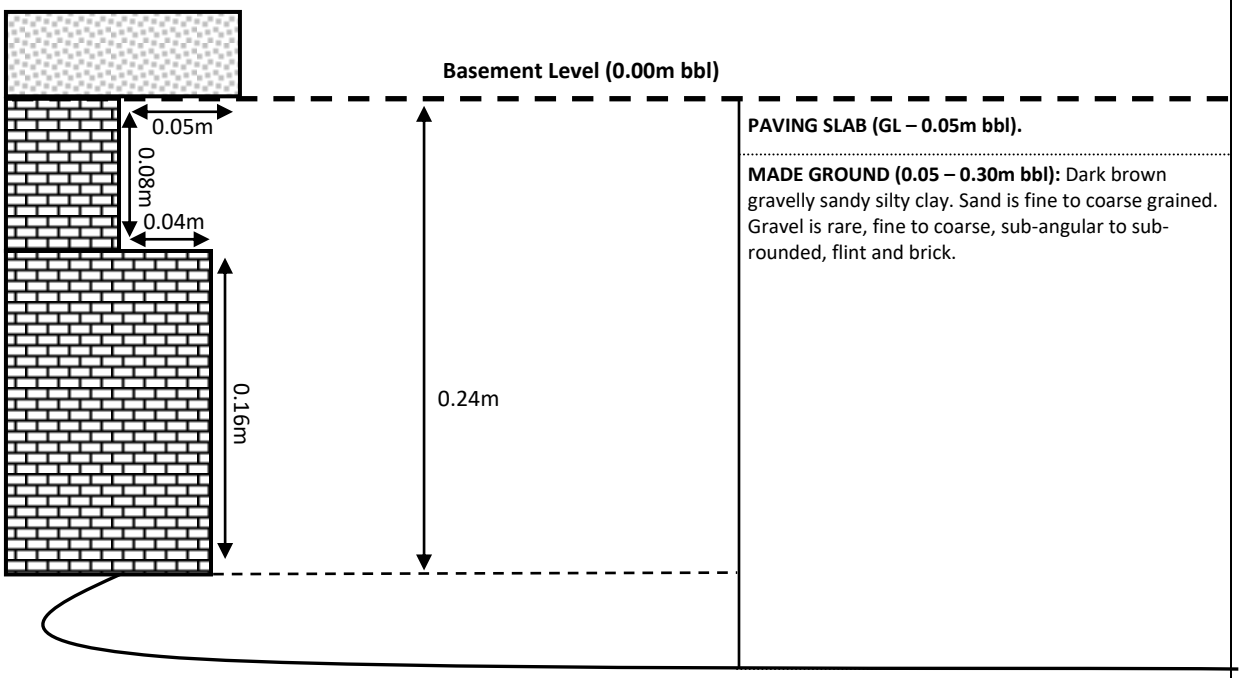


APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 15 Rosslyn Hill, Hampstead, London NW3 5UJ	**Figure 8**
Client: Geoffrey Ho	**Date:** January 2018
Trial Hole Location Plan	**Ref:** GWPR2346

ground&water

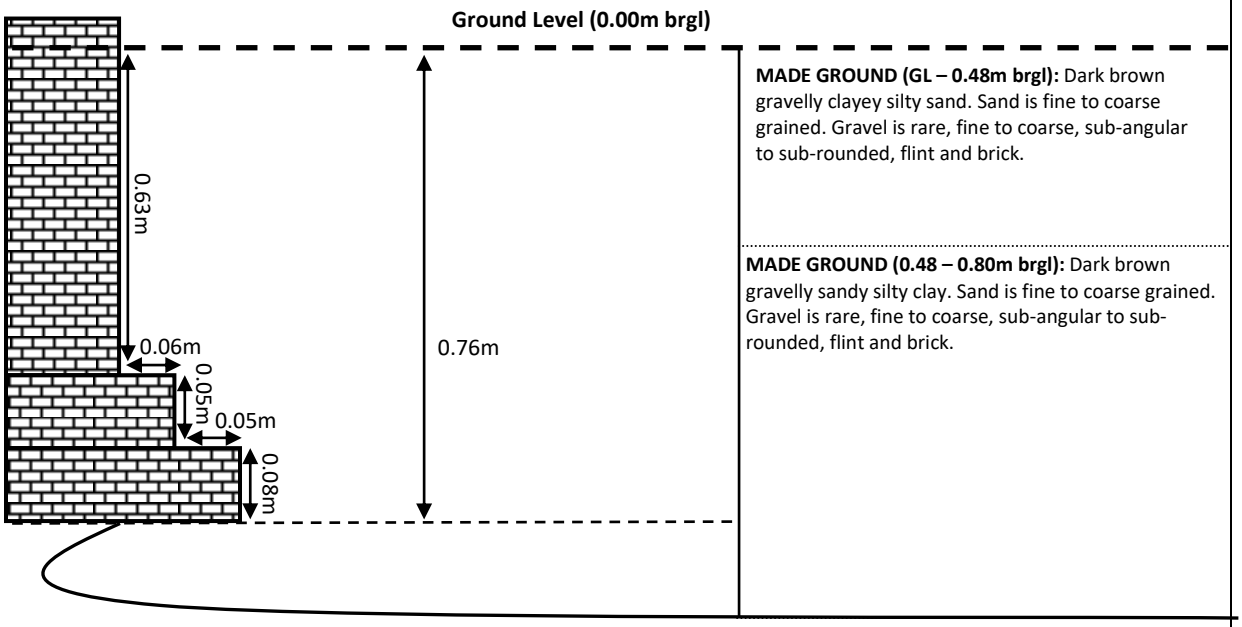


Render

Brick

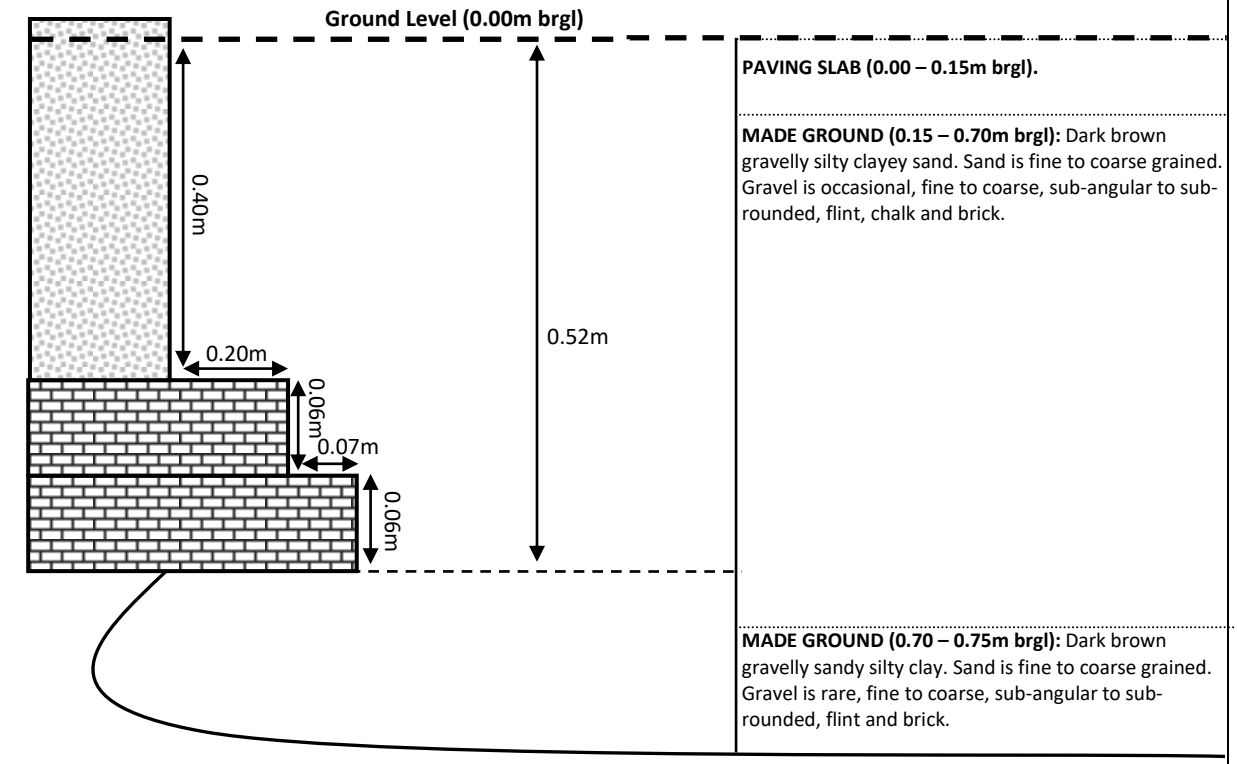
NOTE: NOT TO SCALE

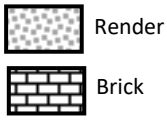
Project: **15 Rosslyn Hill, Hampstead, London NW3 5UJ**		**Figure 9**
Client: **Geoffrey Ho**	**Date:** **January 2018**	ground&water
Section Drawing: Foundation Exposure TP/FE1	**Ref:** **GWPR2346**	



NOTE: NOT TO SCALE

Project: **15 Rosslyn Hill, Hampstead, London NW3 5UJ**		**Figure 10**
Client: **Geoffrey Ho**	**Date:** **January 2018**	ground&water
Section Drawing: Foundation Exposure TP/FE2	**Ref:** **GWPR2346**	





NOTE: NOT TO SCALE

Project: **15 Rosslyn Hill, Hampstead, London NW3 5UJ**		**Figure 11**
Client: **Geoffrey Ho**	**Date:** **January 2018**	ground&water
Section Drawing: Foundation Exposure TP/FE3	**Ref:** **GWPR2346**	

APPENDIX A
Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly, any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to 15 Rosslyn Hill, Hampstead, London NW3 5UJ.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

APPENDIX B
Fieldwork Logs

Ground and Water Ltd

Borehole No
BH1
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
15 Rosslyn Hill	GWPR2346		WLS
Location: Hampstead, London NW3 5UJ		Level: -	Scale 1:50
Client: Geoffrey Ho		Dates: 08/11/2017	Logged By RG

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.05			PAVING SLAB
		0.30	D					MADE GROUND: Dark brown clayey silty gravelly sand. Sand is fine to coarse grained. Gravel is abundant, fine to coarse, sub-angular to sub-rounded, flint, concrete and brick.
		0.50	D					
		0.80	D					
		1.00	SPT	N=12	1.00			
		1.00	D	(1,2/ 3,3,3,3)				MADE GROUND: Brown sandy gravelly silty clay. Sand is fine to medium grained. Gravel is rare to occasional, fine to coarse, sub-angular to sub-rounded, flint and brick.
		1.50	D					
		2.00	SPT	N=12				
		2.00	D	(2,2/ 2,3,3,4)				
		2.50	D		2.50			CLAYGATE MEMBER OF THE LONDON CLAY FORMATION: Grey brown sandy silty CLAY. Sand is fine to medium grained. Occasional small pockets of orange sandy silt. Fine selenite crystals throughout.
		3.00	SPT	N=17				
		3.00	D	(2,2/ 3,4,5,5)				
		3.50	D					
		4.00	SPT	N=13				
		4.00	D	(2,2/ 3,3,3,4)				
		4.50	D					
		5.00	SPT	N=12				
		5.00	D	(3,3/ 3,3,3,3)				
		5.50	D					
	▽	6.00	SPT	N=14				
	▽	6.00	D	(3,3/ 3,3,4,4)				
		6.50	D					
		7.00	SPT	N=21				
		7.00	D	(4,4/ 4,6,5,6)				
		7.50	D					
		8.00	SPT	N=22				
		8.00	D	(4,4/ 5,5,6,6)				
					8.45			End of Borehole at 8.45 m
			Type	Results				

Remarks: Groundwater strike at 6.20m bgl.
Roots noted to 0.30m bgl. Decaying roots to 2.00m bgl.

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Ground and Water Ltd

Borehole No
WS2
Sheet 1 of 1

Project Name 15 Rosslyn Hill	Project No. GWPR2346	Co-ords: -	Hole Type WS
Location: Hampstead, London NW3 5UJ		Level: -	Scale 1:50
Client: Geoffrey Ho		Dates: 06/11/2017	Logged By RG

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	▽	0.30	D					MADE GROUND: Dark brown gravelly silty clay. Gravel is rare, fine to coarse, sub-angular to sub-rounded, flint and brick. Rare carbonaceous material.
		0.50	D					
		0.80	D		0.90			
		1.00	D					CLAYGATE MEMBER OF THE LONDON CLAY FORMATION: Grey brown sandy silty CLAY. Sand is fine to medium grained. Occasional small pockets of orange sandy silt. Fine selenite crystals, becoming fine to medium from 3.50m bgl.
		1.50	D					
		2.00	D					
		2.50	D					
		3.00	D					
		3.50	D					
		4.00	D					
		4.50	D					
		5.00	D					
		5.50	D		5.60			End of Borehole at 5.60 m
			Type	Results				

Remarks: Groundwater seepage at 0.50m bgl.
Roots noted to 1.00m bgl. Fine decaying roots to 3.20m bgl.

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APPENDIX C
Geotechnical Laboratory Test Results

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
23688	15 Rosslyn Hill, Hampstead	Samples received	17/11/2017
		Schedule received	16/11/2017
Project No.	Client	Project started	17/11/2017
GWPR2346	Ground & Water Ltd	Testing Started	27/11/2017

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top m	Base m	Type		%	%	%	%	%	
BH1	-	1.50	-	D	Brown, grey and orangish brown slightly gravelly silty CLAY with occasional brick fragments (gravel is fmc and sub-angular to sub-rounded)	18	80	43	18	25	
BH1	-	2.50	-	D	Brown silty CLAY	29					
BH1	-	3.50	-	D	Brown silty CLAY	31	100	80	30	50	
BH1	-	4.50	-	D	Brown silty CLAY with bluish grey veins, orangish brown sandy patches and scattered selenite crystals	30					
BH1	-	5.50	-	D	Brown silty CLAY with scattered selenite crystals	30					
BH1	-	6.50	-	D	Brown silty CLAY	31	100	74	30	44	
BH1	-	7.50	-	D	Brown silty CLAY with scattered selenite crystals	32					
WS2	-	1.50	-	D	Brown silty CLAY	34	100	79	29	50	
WS2	-	3.00	-	D	Brown silty CLAY	32	100	76	31	45	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials **J.P**

Date: 28/11/2017

Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
23688	15 Rosslyn Hill, Hampstead	Samples received	17/11/2017
		Schedule received	16/11/2017
Project No.	Client	Project started	17/11/2017
GWPR2346	Ground & Water Ltd	Testing Started	23/11/2017

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top m	Base m	Type		%	g/l	g/l		
BH1	-	1.50	-	D	Brown, grey and orangish brown slightly gravelly silty CLAY with occasional brick fragments (gravel is fmc and sub-angular to sub-rounded)	84	0.13	0.16	7.50	

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials J.P

Date: 28/11/2017

Alice Tettmar
Ground & Water Ltd
2 The Long Barn
Norton Farm
Selborne Road
Alton
Hampshire
GU34 3NB

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 17-67217

Site Reference:	15 Rosslyn Hill, Hampstead
Project / Job Ref:	GWPR2346
Order No:	None Supplied
Sample Receipt Date:	17/11/2017
Sample Scheduled Date:	17/11/2017
Report Issue Number:	1
Reporting Date:	23/11/2017

Authorised by:

Kevin Old
Associate Director of Laboratory

Authorised by:

Russell Jarvis
Associate Director of Client Services

QTSE is the trading name of DETS Ltd, company registration number 03705645

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
QTS Environmental Report No: 17-67217	**Date Sampled**	08/11/17	06/11/17			
Ground & Water Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: 15 Rosslyn Hill, Hampstead	**TP / BH No**	BH1	WS2			
Project / Job Ref: GWPR2346	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	5.00	2.00			
Reporting Date: 23/11/2017	**QTSE Sample No**	302327	302328			

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.5	8.0			
Total Sulphate as SO_4	mg/kg	< 200	NONE	1748	300			
Total Sulphate as SO_4	%	< 0.02	NONE	0.17	0.03			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	1170	192			
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	1.17	0.19			
Total Sulphur	%	< 0.02	NONE	0.08	< 0.02			
Ammonium as NH_4	mg/kg	< 0.5	NONE	< 0.5	3.1			
Ammonium as NH_4	mg/l	< 0.05	NONE	< 0.05	0.31			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	238	60			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	119	29.8			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	< 3	< 3			
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	< 1.5	< 1.5			
W/S Magnesium	mg/l	< 0.1	NONE	64	11			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C
Subcontracted analysis (S)

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 17-67217	
Ground & Water Ltd	
Site Reference: 15 Rosslyn Hill, Hampstead	
Project / Job Ref: GWPR2346	
Order No: None Supplied	
Reporting Date: 23/11/2017	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
302327	BH1	None Supplied	5.00	19.7	Brown clay
$ 302328	WS2	None Supplied	2.00	21.4	Brown clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

$ samples exceeded recommended holding times

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 17-67217
Ground & Water Ltd
Site Reference: 15 Rosslyn Hill, Hampstead
Project / Job Ref: GWPR2346
Order No: None Supplied
Reporting Date: 23/11/2017

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received