



# Ground Investigation

**soils**  
L I M I T E D

**Geotechnical & Environmental Consultants**

**Phase II Ground Investigation Report**

**At**

**77-79 Charlotte Street, London W1T 4PW**

**for**

**Charlotte Street Property Ltd**

**Soils Limited  
Newton House  
Cross Road  
Tadworth  
Surrey KT20 5SR  
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**REPORT 14653/GIR**

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# Ground Investigation Report

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**Job Title: 77-79 Charlotte Street, London W1T 4PW**

**Client: Charlotte Street Property Ltd**

## CONTROL DOCUMENT



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Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person 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.



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**Ground Investigation Report**

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**77-79 Charlotte Street, London W1T 4PW**

**For**

**Charlotte Street Property Ltd c/o MLM Consulting Engineers**

**Commission**

Soils Limited were commissioned by MLM Consulting Engineers acting on behalf of Charlotte Street Property Ltd to undertake a Phase II Ground Investigation on land at 77-79 Charlotte Street, London W1T 4PW and the scope of the investigation was outlined in Soils Limited subsequent quotation reference Q15880 dated 4<sup>th</sup> November 2014. The specification for the investigation (Ref: ARP/665721/DS, dated 23<sup>rd</sup> October 2014) was given by MLM.

This document comprises the Phase II Intrusive Report and incorporates the results, discussion and conclusions to the Intrusive Investigation.

This Phase II GIR must be read in conjunction with the Phase I Desk Study, produced by Soils Limited ref: 14653/DS dated January 2015.

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### **Section 1    General**

The site works were performed in accordance with the methods given in BS 5930+A2:2010 and BS EN ISO 22476-2&3:2005.

The geotechnical laboratory testing was performed by K4 Soils Laboratories in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice was adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by QTS Environmental Limited in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures.

This investigation did not comprise an environmental audit of the site or its environs.

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



## Section 2 Introduction

### 2.1 Objective of Investigation

The overall objective was understood to be to supply the client and their designers with information regarding ground conditions, to assist them in preparing a foundation scheme for redevelopment that was appropriate to the conditions present on the site.

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

Soil and groundwater samples were to be taken and tested for a range of potential contaminants based on the Conceptual Site Model (CSM) in the Phase I Desk Study prepared by Soils Limited and/or the revised Conceptual Site Model found in this report.

### 2.2 Location

The site area is 0.03ha. It is situated at 77-79 Charlotte Street, London W1T 4PW, at O.S. National Grid Reference of TQ 29354 81787. The site location map and plan are presented in Figures 2.1 and 2.2, the details of the conditions of site can be obtained from the Site Walkover within the 14653/DS section 3.1.

The site is occupied by an existing "L" shaped building; approximately 25m long x 12m wide – to the front entrance (east) and x 6m wide to the rear entrance (west). It was a five storey building with a lower ground level (basement). It was bounded by similar sized building to the north and south. The southern building was under development at the time of the preparation of this report.



Figure 2.1 Site Location Map





**Figure 2.2 Site Location Plan**

### 2.3 Proposed Redevelopment

The proposed development comprises the demolition of the existing building and construction of a new six storey building with a two level basement. The basement level is to be approximately 8m below existing ground (street) level. The current proposal for the new building is to construct a concrete frame from the first floor slab down to the basement and a lightweight steel framed structure from first to roof level. It was intended to be of mix usage; with upper floors from roof to second for residential and first floor to basement for commercial/office usage, with no areas of soft landscaping.

The proposed building was to be supported by load bearing columns or walls within external walls. The axial load from these columns and walls at foundation level would be of order 1500kN and 120kN/m (gross) respectively.

The RC basement slab would be 25m long and 12m wide (front entrance) and 6m wide (rear entrance), and 0.30m thick and was to be ground bearing slab with a uniformly distributed load of order 15kN/m<sup>2</sup> (gross).

In compiling this report reliance was placed on drawing number 2128/L306 dated 9/12/14 prepared by Cove Burgess Architects LLP which was supplied by MLM, and other drawings

by MLM without numbers and dates. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes. The proposed layout and the sections are given on Figures 2.3-2.6.

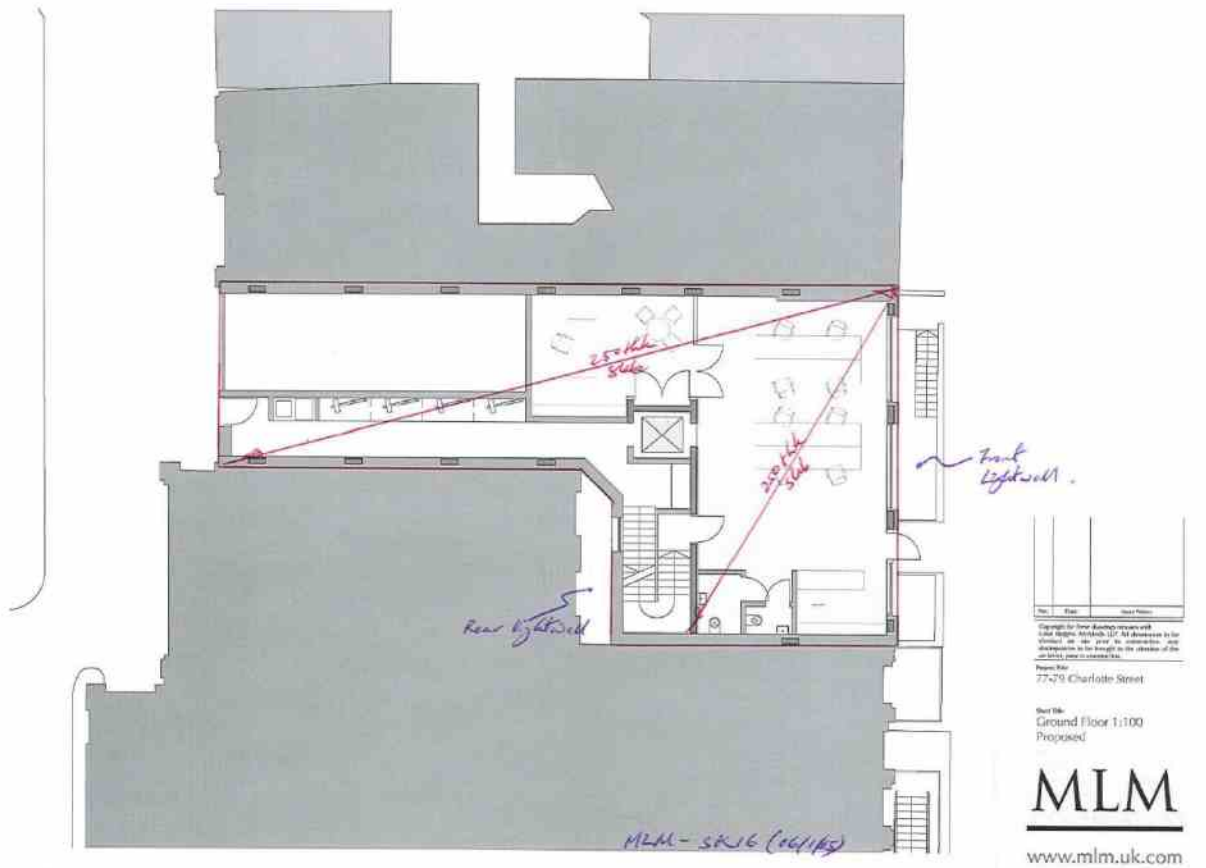


Figure 2.3 Proposed Ground Floor Plan

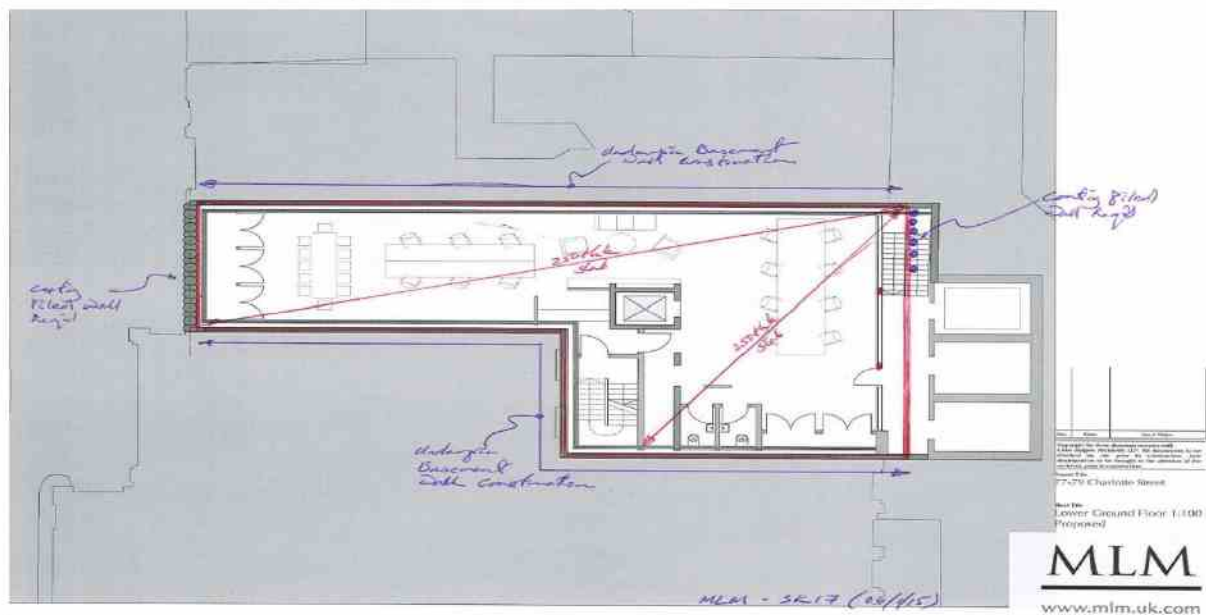


Figure 2.4 Proposed Lower Ground Floor Plan



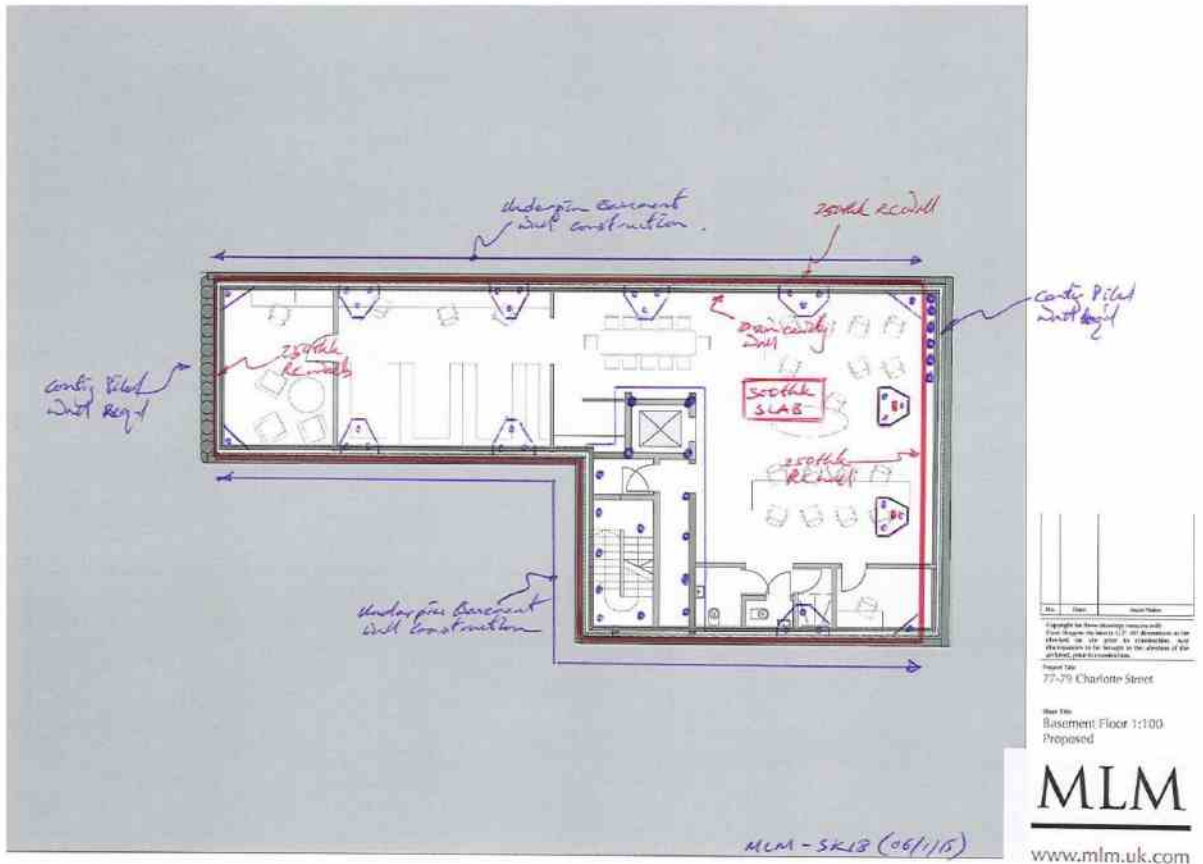


Figure 2.5 Proposed Basement Floor Plan

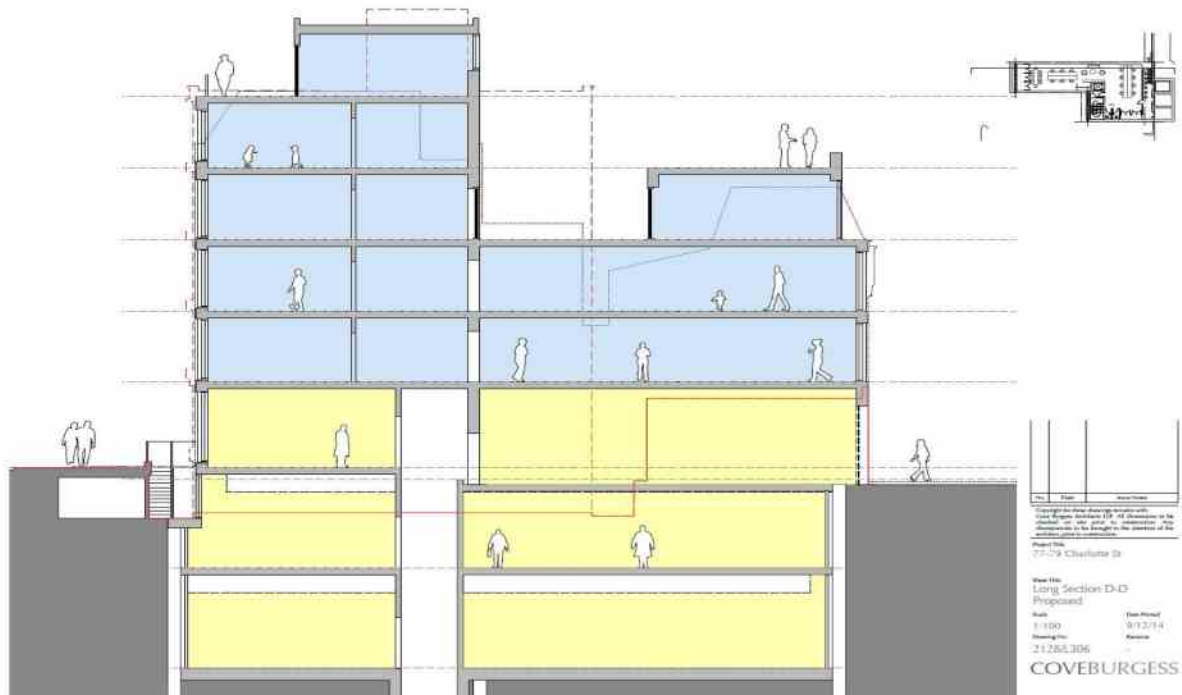


Figure 2.6 Proposed Section



## 2.4 Limitations and Disclaimers

This Phase II Ground Investigation Report relates to the site located on land at 77-79 Charlotte Street, London W1T 4PW and was prepared for the sole benefit of Charlotte Street Property Ltd (The "Client") and was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contact of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

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 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.

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.

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. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as *"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused"*.

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets remains with Soils Limited. License is for the sole use of the client and may not be assigned, transferred or given to a third party.

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## Section 3 Site Works

### 3.1 Proposed Works

The proposed site works to be undertaken comprised the following items:

- The attendance of service tracing engineer to clear the trial holes of services;
- The attendance of UXO specialist to clear the trial hole of any UXO;
- The drilling of 1No. 25m (BH1) deep borehole using a demountable cable percussion drilling rig at a location given by MLM;
- The drilling of 2No. window sampler boreholes (WS1 and WS2) at locations given by MLM;
- The driving of 2No. dynamic probes (DP1 and DP2) tests at locations adjacent and prior to the proposed window sampler boreholes;
- The hand excavation of two trial pits (TP1 and TP2) to reveal the foundations of the building onsite, at locations given by MLM;
- The installation of a groundwater monitoring well within borehole BH1 to a depth of 5m bgl, as instructed by MLM;
- Logging, sampling and in-situ testing as appropriate to the ground conditions encountered in the boreholes;

#### 3.1.1 Works Undertaken

The works undertaken comprised the following items:

- Service clearance engineer attended site and clear the trial holes to avoid any services on site;
- UXO specialist attended site and clear the trial holes to avoid any potential UXO;
- The drilling of 1No. borehole (BH1) to a depth of 25.00m bgl (metres below existing lower ground level) using a demountable cable percussion drilling rig, at a location given by MLM and where access was gained and clear of services;
- The drilling of 2No. window sampler boreholes (WS1 and WS2) to depths of 6.50m and 6.00m bgl respectively, at locations given by MLM Consulting and where access was gained and cleared of services;
- The driving of 2No. dynamic probes (DP1 and DP2) using a Dynamic Probe "Heavy" (DPH) to depths of 8.00m and 10.00m bgl respectively, locations adjacent to the proposed windowless sampler boreholes;
- The hand excavation of 2No. trial pits (TP1 and TP2) to depths of 0.50m and 0.90m bgl respectively, at locations given MLM Consulting and where access was gained and clear of services. A third trial pit (TP3) was undertaken to a of 1.30m bgl as instructed by MLM. The trial pits were to reveal the foundations of the building on site;
- The installation of a groundwater monitoring well within BH1 to a depth of 7.00m bgl, to allow the long term soils gas and groundwater monitoring to be undertaken by Soils Limited. Additionally, a second well was installed in WS2 to a depth of 3.60m bgl;



- Logging, sampling and in-situ testing as appropriate to the ground conditions encountered in the trial holes.

The approximate trial hole locations as undertaken on site are given on Figure 3.1.

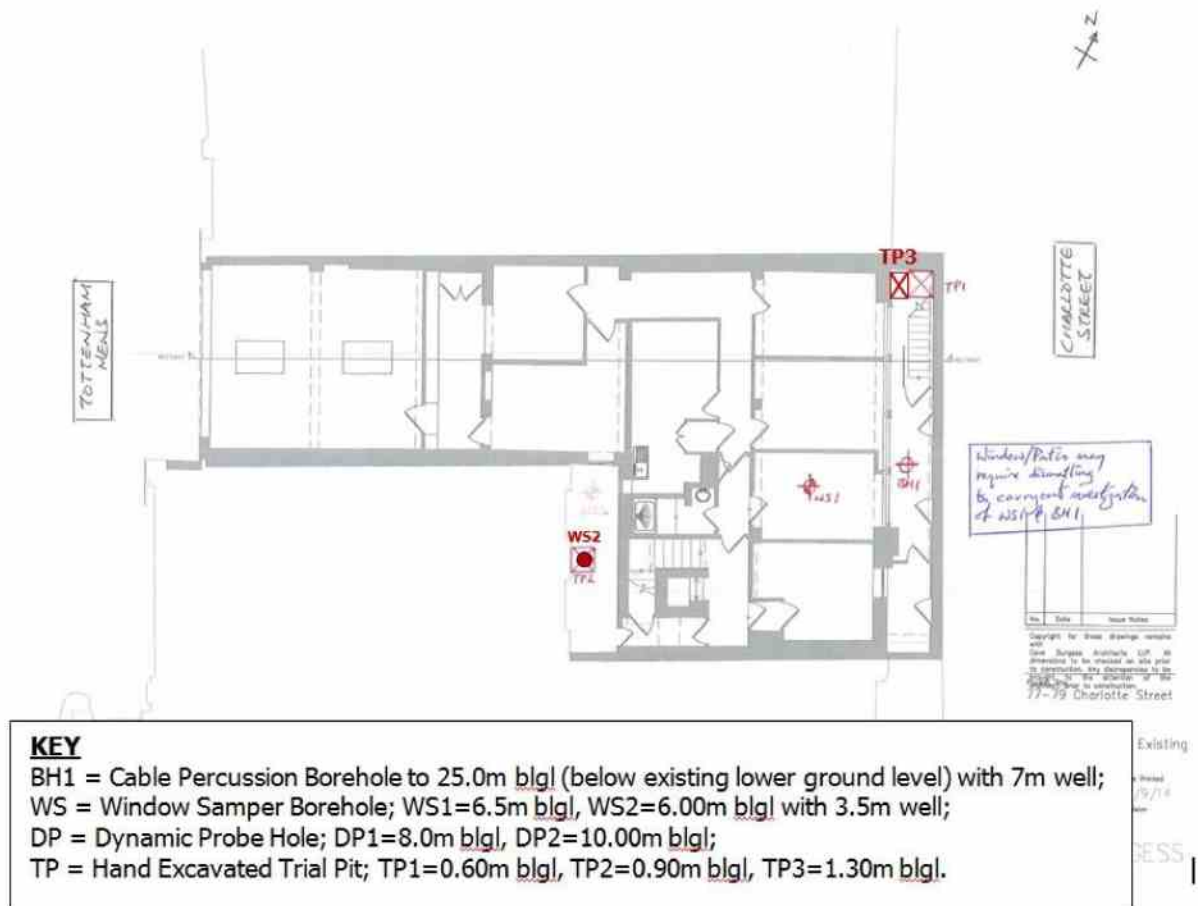


Figure 3.1 – Trial Hole Location Plan

### 3.2 Anticipated Geology

The 1:50 000 BGS map showed the site to be located on the Lynch Hill Gravel Member overlying the soils of the London Clay Formation. It is likely that a significant thickness of Made Ground may be encountered on this site given the historical activities around it.

#### 3.2.1 Lynch Hill Gravel Member

The rivers of the south-east of England, including the River Thames and its tributaries, have been subject to at least three changes of level since Pleistocene times. One result has been the formation of a complex series of River Terrace Gravels. These terraces represent ancient floodplain deposits that became isolated as the river cut downwards to lower levels. The Lynch Hill Gravel Member is found at an elevation that approximates to the present floodplain gravel.

The composition of the River Terrace Gravels varies greatly, depending on the source material available in the river’s catchment. Deposits generally consist of sands and

gravels of roughly bedded flint or chert gravels commonly in a matrix of silts and clays.

### 3.2.2 London Clay Formation

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 beds with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

In the north London area the upper part of the London Clay Formation has been disturbed by glacial action and may contain pockets of sand and gravel.

### 3.3 Ground Conditions

Between the 24<sup>th</sup> and 26<sup>th</sup> November 2014, 2No. window sampler boreholes (WS1 and WS2) and 2No. hand excavated trial pits (TP1 and TP2) were undertaken. On the 15<sup>th</sup> December 2014, 1No hand excavated trial pit (TP3) was undertaken, and between 19<sup>th</sup> and 21<sup>st</sup> December 2014, 1No 25m borehole (BH1) was drilled with 7.0m well installation. The intrusive investigations undertaken on the site as itemised in section 3.1.1.

The details of the investigatory depths are presented in Table 3.1

Table 3.1 - Investigatory Depths Of Trial-holes	
Trial Hole	Final Depth (m bgl)
BH1	25.00
WS1	6.50
WS2	6.00
TP1	0.50
TP2	0.90
TP3	1.30
DP1	8.00
DP2	10.00

Note: (m bgl) = metres below lower ground level, about 2.0m below street level. BH=Demountable cable percussive borehole, WS=Window sampler borehole, DP=Dynamic probe holes, TP=Hand excavated trial pit

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the borehole logs and quoted in this report were measured from ground level directly adjacent to the boreholes.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the *in-situ* weathering profile, it has been described as Topsoil both on the logs and within this report. Where the soil has, in general, been found to have the same composition as the 'Topsoil' but also incorporated a minor constituent, e.g. less



than an estimated 5%, of possibly non-naturally occurring material, or is of uncertain origin, the soil has been described as Topsoil/Made Ground both on the log and within this report. Where man has clearly either placed the soil, or the composition altered with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the logs and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion the succession of conditions encountered in the boreholes in descending order can be summarised as in Table 3.2. The soils of the London Clay Formation were not encountered within the boreholes.

**Made Ground (MG)  
Lynch Hill Gravel Member (LHGR)  
London Clay Formation (LCF)**

The ground conditions encountered in the boreholes are summarised in Table 3.2.

Table 3.2 - Ground Conditions					
Strata	Age	Depth Encountered (m bgl)		Typical Thickness (m)	Description
		Top	Bottom		
MG	Recent	LGL	0.50*-6.50*	2.28	Concrete over dark brown, dark grey and dark brown black slightly clayey to clayey sandy gravelly SILT, slightly sandy clayey GRAVEL, slightly sandy silty CLAY and gravelly silty SAND, with occasional to abundant brick fragment and concrete. Gravel is fine to coarse and sub-angular to sub-rounded.
LHGR	Pleistocene	4.50	6.90	2.40	Medium dense brown and pale brown very gravelly coarse SAND. Gravel is fine to coarse and angular to rounded.
LCF	Eocene	6.90	25.00*	Not proved	Firm to stiff becoming very stiff medium to very high strength slightly fissured to fissured brown to dark grey silty CLAY.

**Note - \*Full depth of borehole, LGL = lower ground level**

### 3.3.1 Made Ground

Made Ground was encountered in each of the trial holes and comprised concrete over dark brown, dark grey and dark brown black slightly clayey to clayey sandy gravelly SILT, slightly sandy clayey GRAVEL, slightly sandy silty CLAY and gravelly silty SAND, with occasional to abundant brick fragment and concrete. Gravel is fine to coarse and sub-angular to sub-rounded.

The Made Ground was encountered to a depth of 4.50m bgl in BH1, and to the full depths of the remaining trial holes at depths of between 0.50m bgl in TP1 and 6.50m bgl in WS1.

The depths of Made Ground as encountered in the trial holes are given in Table 3.3.



Table 3.3 - Depth Made Ground

Trial Hole	Depth (m blgl)
BH1	4.50
WS1	6.50* (4.00)**
WS2	6.00* (4.10)**
TP1	0.50*
TP2	0.90
TP3	1.30

Note: \*Full depth of trial hole \*\*Based on inferred depths of MG in DP. It was likely that the holes were collapsing in the process of drilling and that might have masked the boundary between the MG and LHGR.

### 3.3.2 Lynch Hill Gravel Member

Soils of the Lynch Hill Gravel Member were encountered underlying the Made Ground and comprised medium dense brown and pale brown very gravelly coarse SAND. Gravel is fine to coarse and angular to rounded.

The Lynch Hill Gravel Member was encountered to a depth of 6.90m blgl in BH1, and inferred in DP1 and DP1 to depths of 7.20m and 7.30m blgl respectively.

Table 3.4 outlines the trial holes the depth to which the Lynch Hill Gravel Member was encountered.

Table 3.4 - Depth of LHGR

Trial Hole	Depth (m blgl)
BH1	6.90
DP1	7.20*
DP2	7.30*

Note: \*Inferred depths in dynamic probe

### 3.3.3 London Clay Formation

Soils of the London Clay Formation were encountered underlying the Lynch Hill Gravel Member and comprised firm to stiff becoming very stiff medium to very high strength slightly fissured to fissured brown to dark grey silty CLAY.

The London Clay Formation was encountered to the full depths of the borehole at 25.00m blgl in BH1, and inferred in DP1 and DP2 at 10.00m blgl.

Table 3.5 outlines the trial hole the depth to which the London Clay Formation was encountered.

Table 3.5 - Depth of London Clay Formation	
Trial Hole	Depth (m bbl)
BH1	25.00*
DP1	8.00**
DP2	10.00**

Note - \*Full depth of trial hole \*\* Inferred in dynamic probe

### 3.3.4 Roots

No roots were observed in the samples recovered from the boreholes and within the trial holes as given in Table 3.6.

Table 3.6 - Root Record	
Trial Hole	Depth (m bbl)
BH1	None observed
WS1-WS2	None observed
TP1-TP3	None observed

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

Roots may be found to greater depth 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.

### 3.4 Groundwater

Groundwater was encountered within boreholes BH1 and WS2 during the course of the investigation and the monitoring visits to date, as given in Table 3.7.

Table 3.7 - Groundwater Observations		
Trial-hole	Date	Depth (m blgl)
BH1 (Well installed to 7.00m blgl)	23.12.14	Drilling masked water strike
	07.01.15	3.95
	16.01.15	3.94*
WS1	26.11.14	None noted
WS2 (Well installed to 3.60m blgl)	26.11.14	Water strike at 2.01
	09.12.15	1.98
	07.01.15	2.40
	16.01.15	2.18*
TP1-TP3	24-26.11 & 15.12.14	Dry

Note - \*The wells were baled out and allowed to recover. BH1 returned to the same level immediately, but WS2 did not and was at 1.90 after 1hour. Therefore, the level in BH1 is the true groundwater level, and WS2 was perched. The boreholes were effectively drilled from the same level and in close proximity to each other.



Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in December (2014) and January (2015), when groundwater levels should be rising from their annual minimum (i.e. lowest) elevation, which is typically around September.

2014 has been the driest on record and may result in significantly lower groundwater levels than were typical.

Groundwater equilibrium conditions may only be conclusively established by means of a series of measurements made in a standpipe, or piezometer installed in the ground after completion of the site works.

Groundwater wells were installed in BH1 and WS1, to enable soil gas and groundwater monitoring to be undertaken by the Soils Limited. According to MLM, 6No. readings are required in a monthly intervals starting from January 2015.

Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site or perched on impermeable strata where encountered.

### 3.5 Foundation Sections and Configuration

3No trial pits (TP1-TP3) were hand excavated to enable the recording of the foundation configurations of the existing building and walls on site.

The foundation sections for TP1-TP3 are given in Figures 3.2-3.4 respectively. The dimensions are in metres.

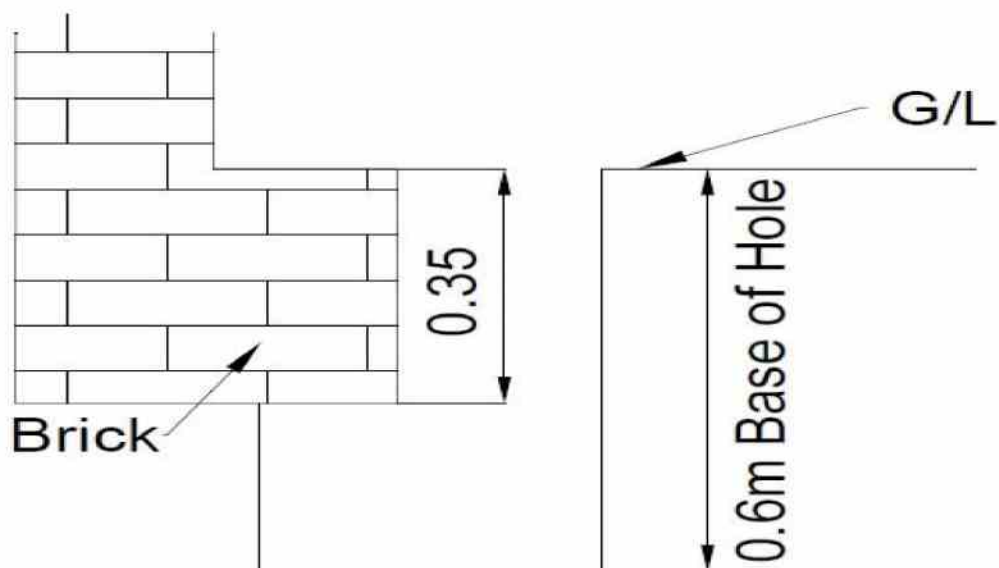


Figure 3.2 – Foundation Section (TP1)

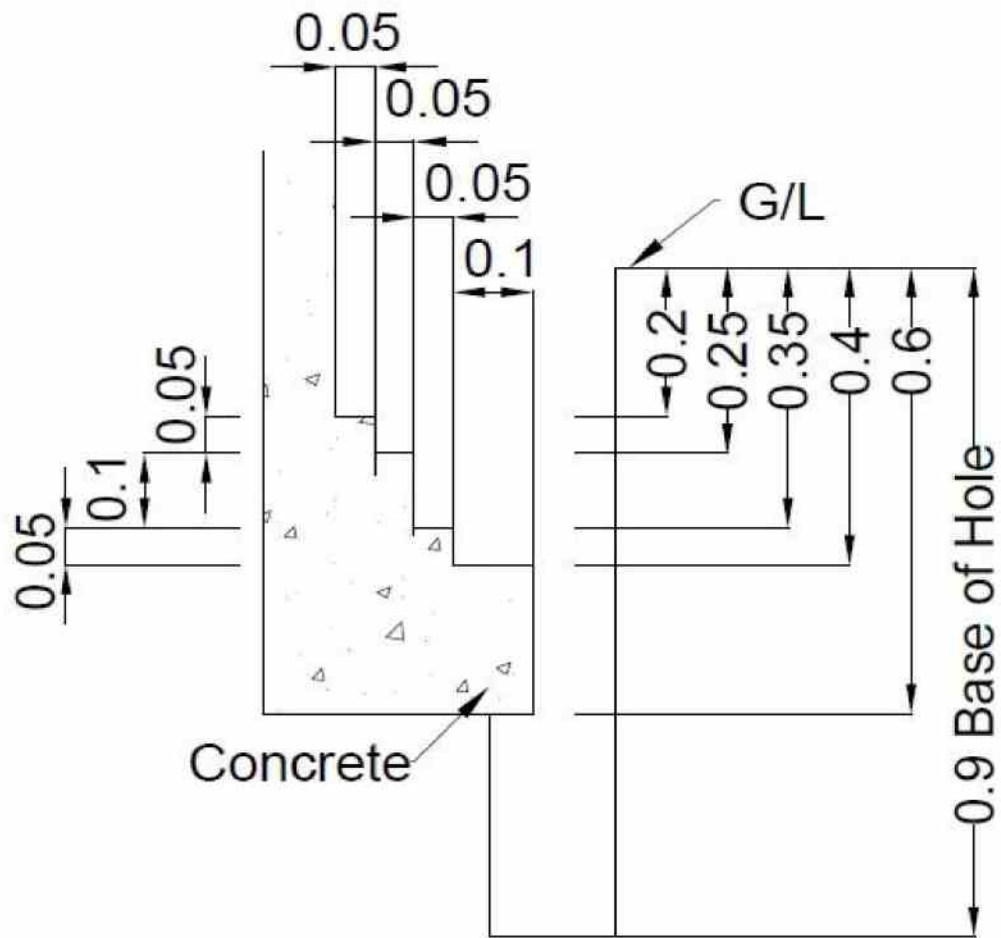


Figure 3.3 – Foundation Section (TP2)



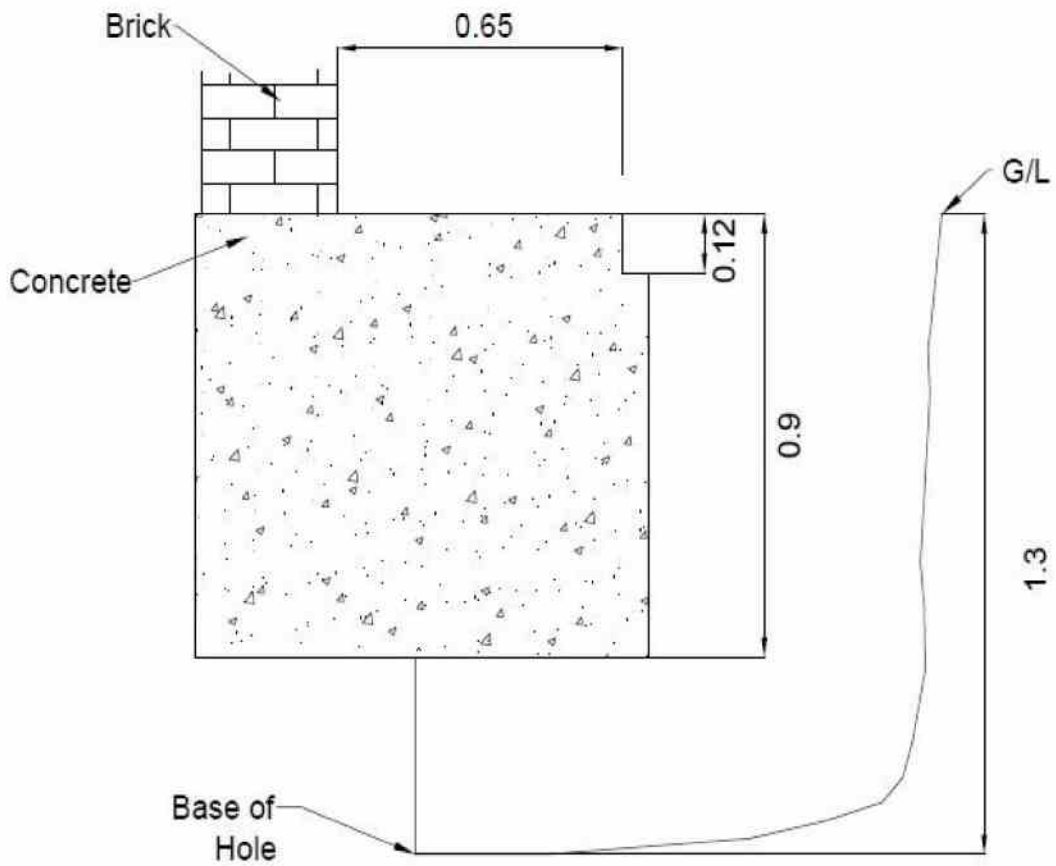


Figure 3.4 – Foundation Section (TP3)