GROUND INVESTIGATION REPORT

for the site at

50 ROCHESTER PLACE, CAMDEN, LONDON NW1 9JX

on behalf of

MICHAEL ANASTASSIADES

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1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Michael Anastassiades on the 18th June 2015 to undertake a Ground Investigation on 50 Rochester Place, Camden, London NW1 9JX. The scope of the investigation was detailed within the Ground and Water Limited fee proposal ref.: GWQ2500, dated 18th June 2015.

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.

The requirements of the London Borough of Camden, Camden Geological, Hydrogeological and Hydrological Study, Guidance for Subterranean Development (November 2010) was reviewed with respect to this report.

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 ~100m^2 rectangular shaped plot of land, orientated in a north-east to south-west direction, located on the north-eastern side of Rochester Place, ~100m north-west of its junction with Wilmot Place. The site was located in Camden Town/Kentish Town, north-west London, within the London Borough of Camden.

The national grid reference for the centre of the site was approximately TQ 29108 84487. A site location plan is given within Figure 1. A plan showing the site area is given within Figure 2.

2.2 Site Description

The site comprised a single storey terraced mews type property which was occupied by MD Motors, a garage/MOT/servicing and repairs centre. Rochester Place comprised a cobbled single carriage lane, with an up and over garage door allowing vehicular access to the property. A concrete floor was noted to cover the entire site.

An aerial view of the site is provided within Figure 3.

2.3 Proposed Development

At the time of reporting, August 2015, it is understood the proposed development will comprise the construction of a basement beneath the property. A plan and section view of the proposed development can be seen in Figure 4. The basement is anticipated to be formed at 3.00 – 3.50m bgl.

2.4 Geology

The BGS Geological Map (Solid and Drift) for the North London area (Sheet No. 256), and Figure 3 and 4 of the Camden Geological, Hydrogeological and Hydrological Study, revealed that the site was underlain by the London Clay Formation.

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.

A BGS borehole ~300m north-west of the site revealed 1.10m of fill over a brown gravelly sandy silty clay (Head Deposits) to 1.90m bgl. Brown sandy silty clays, becoming grey with depth, were then proved.

No areas of Made Ground or Worked Ground were noted within a 250m radius of the site.

2.5 Slope Stability and Subterranean Developments

The site was not situated within an area where a natural or man-made slope of greater than 7^o was present (Figure 16 Camden Geological, Hydrogeological and Hydrological Study).

Figure 17 of the Camden Geological, Hydrogeological and Hydrological Study indicated that the site was not situated within an area prone to landslides.

Figure 18 of the Camden Geological, Hydrogeological and Hydrological Study indicated that the Northern Underground Line was situated ~200m west of the site, running south to north. No other major subterranean infrastructures (including existing and proposed tunnels) were noted within close proximity to the site.

2.6 Hydrogeology and Hydrology

A study of the aquifer maps on the Environment Agency website, and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, revealed the site to be located on **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. No designation was given for any superficial deposits due to their likely 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.

Examination of the Environment Agency records, and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, 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.

No surface water features were noted within a 250m radius of the site. The Regents Canal was noted ~450m south of the site. Examination of Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, showed that the site was located in close proximity of the lost River Fleet.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at depth (>10m below existing ground level (bgl)) and it was considered that the groundwater was flowing in a south-westerly direction in alignment with the local topography.

Examination of the Environment Agency records showed that the site was **not** situated within flood zone or flood warning area. Figure 15 of the Camden Geological, Hydrogeological and Hydrological Study indicated that historic flood events in 1975 and 2002 did not affect the site. Kentish Town Road, ~130m north-west of the site, was understood to be at risk of surface water flooding.

2.7 Radon

BRE 211 (2007) Map 5 of the London, Sussex and west Kent area revealed the site was located within an area where mandatory protection measures against the ingress of Radon were **unlikely to be** required. The site **was not** located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Fieldwork was undertaken on the 27th June 2015 and comprised the drilling of one Hand Held Window Sampler Borehole (BH1) to a depth of 6.00m bgl and the hand excavation of one trial pit foundation exposure (TP/FE1). A Heavy Dynamic Probe (HDP) (DP1) was undertaken adjacent to WS1 to a depth of 10.00m bgl.

A small diameter combined bio-gas and groundwater monitoring well was installed within WS1 to 5.00m bgl. The construction of the well installed can be seen tabulated below.

Combined Bio-gas and Groundwater Monitoring Well Construction				
Trial Hole	**Depth of Installation (m bgl)**	**Depth of slotted piping with gravel filter pack (m)**	**Depth of plain piping with bentonite seal (m bgl)**	**Piping external diameter (mm)**
BH1	5.00	4.00	1.00	19

The approximate locations of the trial holes can be seen within Figure 5.

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 0.5m 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

All exploratory holes were logged by Roger Foord 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 constructed on the site generally conformed to that anticipated from examination of the geology map. Made Ground was noted to overlie Head Deposits and then the London Clay Formation.

The ground conditions encountered during the investigation are described in this section. For more complete information about the Made Ground, Head Deposits and 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 5.

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

Made Ground
Head Deposits
London Clay Formation

Made Ground

Made Ground was encountered from ground level to 1.20m within BH1. The Made Ground comprised a 0.14m thick concrete slab overlying a grey brown very gravelly sandy clay to 0.60m bgl. The sand was fine to medium grained. The gravel was occasional to abundant, fine to coarse, sub-angular to sub-rounded flint, brick and concrete fragments. From 0.60m to 1.20m bgl the Made Ground comprised a grey brown slightly gravelly silty clay. The gravel was noted to be rare, fine, sub-angular to sub-rounded flint and brick.

Head Deposits

Soils described as representative of Head Deposits were encountered underlying the Made Ground to 2.30m bgl. The deposits were described as orange brown, with occasional grey mottling, silty clay with pockets of fine orange brown sand.

London Clay Formation

Soils described as representative of the London Clay Formation were encountered from 2.30m bgl and were proved for the remaining depth of the trial hole, a maximum of 6.00m bgl. The deposits were described as a brown and grey mottled silty clay with rare fine selenite crystals and pockets of orange silt.

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix B.

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.

TP/FE1

Trial pit foundation exposure TP/FE1 was hand excavated within the building from ground level on the buildings south-eastern wall, its party wall with No. 48. The exact location of the trial hole can be seen in Figure 5 with a section drawing of the foundation encountered in Figure 6.

The foundation layout encountered consisted of a brick wall to ground level. The brick wall continued from ground level to a depth of 0.18m bgl and was noted to lie on two brick steps. The brick steps were 0.05 - 0.08m in thickness and stepped out from the wall by 0.04 - 0.08m. The brick steps rested upon a concrete footing which stepped out a further 0.21m and was 0.35m in thickness. The base of the concrete footing was at a depth of 0.66m bgl. The ground conditions encountered directly surrounding the foundation are shown in Figure 6. The footing was noted to rest on soils described as Head Deposits, comprising a soft grey/brown gravelly silty clay.

4.3 Roots Encountered

Roots were noted to 2.00m bgl within WS1.

It must be noted that the chance of determining actual depth of root penetration through a 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

No groundwater was encountered within the trial holes. The standing groundwater level noted within the well installed on site on the 13th August 2015 can be seen tabulated below.

Groundwater Observations					
Project Ref	Site Location	Borehole Ref.	Groundwater reading (m bgl)	Depth to base of borehole (m bgl)	Date
GWPR1315	50 Rochester Place, Camden, London NW1 9JX	BH1	1.05	5.00	13/08/2015

Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site. It should be noted that changes in groundwater level do occur for a number of reasons including seasonal effects and variations in drainage.

The site investigation was conducted in June 2015, when groundwater levels should be near their annual minimum (i.e. lowest). The long-term groundwater elevation might increase at some time in the future due to seasonal fluctuation in weather conditions. 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 construction of the trial holes.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

A Heavy Dynamic Probe (HDP) (DP1) was undertaken adjacent to BH1 to a depth of 10.00m bgl. The test results are presented with the borehole logs within Appendix B.

Windowless Sampler Boreholes provide samples of the ground for assessment but they do not give any engineering data.

Heavy Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 50.0kg hammer onto the top of the rods through a set height (500mm), thus ensuring a consistent energy input. The numbers of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. (The Dynamic Probe 'Heavy' (HDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).

The cohesive soils of the Head Deposits and the London Formation were classified based on the table below.

Undrained Shear Strength from Field Inspection/equivalent 'SPT's derived from HDP results Cohesive Soils (EN ISO 14688-2:2004 & Stroud (1974))		
Classification	**Undrained Shear Strength (kPa)**	**Field Indications**
Extremely High	>300	-
Very High	150 – 300	Brittle or very tough
High	75 – 150	Cannot be moulded in the fingers
Medium	40 – 75	Can be moulded in the fingers by strong pressure
Low	20 – 40	Easily moulded in the fingers
Very Low	10 – 20	Exudes between fingers when squeezed in the fist
Extremely Low	<10	-

An interpretation of the in-situ geotechnical testing results is given in the table overleaf.

Interpretation of In-situ Geotechnical Testing Results (DP1)					
Strata	Equivalent 'SPT's derived from HDP results	Equivalent Undrained Shear Strength (kPa) Cohesive Soils	Soil Type		Trial Hole/s
			Cohesive	Granular	
Head Deposits	4 – 14	20 – 70	Very Low/Low – Medium	-	BH/DP1 (1.30 – 2.30m bgl)
London Clay Formation	4 – 14	20 – 70	Very Low/Low – Medium	-	BH/DP1(2.30m – 6.00m bgl)
Assumed London Clay Formation*	16 – 30	80 – 150	High – High/Very High	-	DP1 (6.00 – 10.00m bgl)

*Based on the results of the dynamic probing.

It must be noted that field measurements of undrained shear strength are dependent on a number of variables including disturbance of sample, method of investigation and also the size of specimen or test zone etc.

The test results are presented on the trial hole log 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 London Clay Formation. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:1990.

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	BS1377:1990:Part 2:Clauses 3.2, 4.3 & 5	4
Natural Moisture Content Tests	BS1377:1990:Part 2:Clauses 3.2	10
Water Soluble Sulphate & pH	BS1377:1990: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 Atterberg Limit Tests undertaken on one sample of the Head Deposits and three samples of the London Clay Formation can be seen tabulated overleaf.

Atterberg Limit Tests Results Summary							
Stratum/Trial Hole/Depth (m bgl)	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						BRE	NHBC
Head Deposits BH1/1.50m bgl (Brown and blue grey slightly fine sandy silty CLAY with rare fine gravel)	20	99	52.47	CV	1.09 (Very Stiff)	High	High
London Clay Formation BH1/2.50m bgl (Brown slightly fine sandy silty CLAY)	29	100	49.00	CV	0.94 (Stiff)	High	High
London Clay Formation BH1/3.50m bgl (Brown and blue grey slightly fine sandy silty CLAY)	30	100	51.00	CV	0.94 (Stiff)	High	High
London Clay Formation BH1/4.50m bgl. (Brown and blue grey slightly find sandy silty CLAY with traces of selenite crystals).	29	100	50.00	CV	0.96 (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 Comparison of Soil's Moisture Content with Index Properties

5.2.2.1 Liquidity Index Analyses

The results of the Atterberg Limit tests undertaken on one sample of the Head Deposits and three samples of the London Clay Formation were analysed to determine the Liquidity Index of the samples. This gives an indication as to whether the samples recovered showed a moisture deficit and their degree of consolidation. The results are tabulated below.

The test results are presented within Appendix C.

Liquidity Index Calculations Summary					
Stratum/Trial Hole/Depth	Moisture Content (%)	Plastic Limit (%)	Modified Plasticity Index (%)	Liquidity Index	Result
Head Deposits BH1/1.50m bgl (Brown and blue grey slightly fine sandy silty CLAY with rare fine gravel)	20	24	52.47	-0.08	**Potential Moisture Deficit.**
London Clay Formation BH1/2.50m bgl (Brown slightly fine sandy silty CLAY)	29	26	49.00	0.06	Heavily Overconsolidated
London Clay Formation BH1/3.50m bgl (Brown and blue grey slightly fine sandy silty CLAY)	30	27	51.00	0.06	Heavily Overconsolidated
London Clay Formation BH1/4.50m bgl. (Brown and blue grey slightly find sandy silty CLAY with traces of selenite crystals).	29	27	50.00	0.04	Heavily Overconsolidated

The results in the table above indicated that a potential moisture deficit was noted in the one samples of the Head Deposits tests, BH1 at 1.50m bgl.

The sample was described as a brown and blue grey slightly fine sandy silty clay

with rare gravel. Roots were noted to 2.00m bgl. Therefore the potential moisture deficit could be caused by the presence of sand and gravel within the lithology or the moisture demand from nearby trees.

No potential moisture deficit was noted within the three samples of the London Clay Formation tests.

5.2.2.2 Liquid Limit

A comparison of the soil moisture content and the liquid limit can be seen tabulated below.

Moisture Content vs. Liquid Limit				
Strata/Trial Hole/Depth/Soil Description	**Moisture Content (MC) (%)**	**Liquid Limit (LL) (%)**	**40% Liquid Limit (LL)**	**Result**
Head Deposits BH1/1.50m bgl (Brown and blue grey slightly fine sandy silty CLAY with rare fine gravel)	20	77	30.8	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**
London Clay Formation BH1/2.50m bgl (Brown slightly fine sandy silty CLAY)	29	75	30.0	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**
London Clay Formation BH1/3.50m bgl (Brown and blue grey slightly fine sandy silty CLAY)	30	78	31.2	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**
London Clay Formation BH1/4.50m bgl. (Brown and blue grey slightly find sandy silty CLAY with traces of selenite crystals).	29	77	30.8	**MC < 0.4 x LL (Potential Significant Moisture Deficit)**

The results in the table above indicated that all samples tests showed a potential significant moisture deficit.

The sample of Head Deposits from BH1 at 1.50m bgl was described as a brown and blue grey slightly fine sandy silty clay with rare gravel. Roots were noted to 2.00m bgl. Therefore the potential moisture deficit could be caused by the presence of sand and gravel within the lithology or the moisture demand from nearby trees.

The three samples of the London Clay Formation were taken from below the depth of root penetration noted. The deposits were described as a brown slightly sandy silty clay with traces of selenite crystals. The deposits were noted to be heavily overconsolidated. Therefore the significant moisture deficit noted was considered likely to be due to the lithology (heavily overconsolidated with fine sand and selenite crystals) rather than the moisture demand from roots and nearby trees.

5.2.3 Moisture Content Profiling

Moisture content versus depth plots for BH1 can be seen within Figure 7. A potential moisture deficit was noted within Figure 7 to ~2.00m bgl with the moisture content profile at deeper depth showing minor variation in moisture content likely to be associated with subtle change in lithology.

5.2.4 Sulphate and pH Tests

A Sulphate and pH test was undertaken on one sample from the Head Deposits (BH1/2.00m bgl). A sulphate concentration of 0.31g/l with a pH of 7.32 was determined.

5.2.5 BRE Special Digest 1

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground' (BRE, 2005) one sample of the Head Deposits (BH1/0.70m) and one sample of the London Clay Formation (BH1/3.00m bgl) were scheduled for laboratory analysis to determine parameters for concrete specification.

The results are given within Appendix C and a summary is tabulated below.

Summary of Results of BRE Special Digest Testing			
Determinand	**Unit**	**Minimum**	**Maximum**
pH	-	6.6	7.3
Ammonium as NH_4	mg/kg	7	15.5
Sulphur	%	0.03	0.07
Chloride (water soluble)	mg/kg	38	54
Magnesium (water soluble)	g/l	8.8	14
Nitrate (water soluble)	mg/kg	<3	6
Sulphate (water soluble)	mg/l	294	410
Sulphate (total)	%	0.09	0.15

6.0 ENGINEERING CONSIDERATIONS

6.1 Soil Characteristics and Geotechnical Parameters

Based on the results of the intrusive investigation and geotechnical laboratory testing the following interpretations have been made with respect to engineering considerations.

- Made Ground was encountered from ground level to 1.20m within BH1. As a result of the inherent variability of Made Ground, it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

  Made Ground may be found to deeper depth at other locations on the site, especially close to former structures/foundations and service runs.

- Soils described as representative of Head Deposits were encountered underlying the Made Ground to 2.30m bgl. The deposits encountered comprised very low/low to medium (20 – 70kpa) undrained shear strength orange brown, with occasional grey mottling, silty clay with pockets of fine orange brown sand.

  Geotechnical testing revealed the soils of the Head Deposits to have a **high volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2. Consistency Index calculations indicated these soils to be very stiff.

  A potential root exacerbated significant moisture deficit was noted within the samples of Head Deposits taken from BH1 at 1.50m bgl. Moisture content profiling showed a potential moisture deficit to 2.00m bgl within BH1.

  Given the depth of the Head Deposits (2.30m bgl) and proposed basement formation level (3.00 – 3.50m bgl), these soils are likely to be bypassed by foundations and therefore are not considered as a founding stratum in this report.

- Soils described as representative of the London Clay Formation were encountered from 2.30m bgl and were proved for the remaining depth of the trial hole, a maximum of 6.00m bgl. The deposits were described as a very low/low to medium (20 – 70kpa) brown and grey mottled silty clay with rare fine selenite crystals and pockets of orange silt. Based on the results of dynamic probing it was inferred that the high to high/very high undrained shear strength soils of the London Clay Formation (80 – 150kpa) were proved to at least 10.00m bgl.

  Geotechnical testing revealed the soils of the London Clay Formation to have a **high volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2. Consistency Index calculations indicated these soils to be stiff.

  Geotechnical analysis indicated a possible significant moisture deficit within all three samples of the London Clay Formation tests. This was considered to be due to the heavily overconsolidated nature of the soils, presence of silt bands and selenite crystals.

  The heavily overconsolidated cohesive soils of the London Clay Formation were considered a

suitable bearing stratum for moderately loaded footings/foundations. Settlements on loading are likely to be moderate.

The final design of foundations will need to take into account the volume change potential of the soil, the depth of root penetration and/or desiccation and the likely serviceability and settlement requirements of the proposed structure. These parameters for design are discussed in the next section of this report.

- No groundwater was encountered during the construction of the trial hole. The standing groundwater levels were recorded as 1.05m bgl during a return visit to the site on the 13th August 2015. This water level are likely to represent migrating perched water which has accumulated within the installed standpipe from the Made Ground, sand bands within the Head Deposits or silt bands within the London Clay Formation. Surface water migrating into the borehole is considered unlikely given the internal locations of the borehole.

- Roots were noted to 2.00m bgl.

6.2 Basement Foundations

At the time of reporting, August 2015, it is understood the proposed development will comprise the construction of a basement beneath the property. A plan and section view of the proposed development can be seen in Figure 4. The basement is anticipated to be formed at 3.00 – 3.50m bgl.

The proposed development is likely to fall within Geotechnical Design Category 2 in accordance with Eurocode 7. The proposed foundation loads were not known to Ground and Water Limited at the time of reporting but are likely to range from 75 – 150kN/m^2.

Foundations constructed within the soils of the Head Deposits and London Clay Formation should be designed in accordance with soils of **high volume change potential** in accordance with BRE Digest 240 and NHBC Chapter 4.2.

Given the cohesive nature of the shallow deposits, foundations must therefore **not** be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account (NHBC Standards Chapter 4.2). It is recommended that foundations are taken at least 300mm into non-root penetrated strata.

Roots were noted to 2.00m bgl, indicating a minimum foundation depth of 2.30m bgl. The proposed basement is understood to be formed at 3.00 – 3.50m bgl.

It is considered likely the proposed basements will be constructed with load bearing concrete retaining walls with semi-ground bearing concrete floors.

The following bearing capacities could be adopted for 5.0m long by 0.75m and 1.0m wide footings, or 1.50m by 1.50m pads at depths of 3.00m and 3.50m bgl. The bearing capacities are tabulated overleaf.

Limit State: Bearing Capacities Calculated (Based on DP1)		
Depth (m BGL)	**Foundation System**	**Limit Bearing Capacity (kN/m^2) (EC2)**
3.00m	5.00m by 0.75m Strip	145.01
	5.00m by 1.00m Strip	146.24
	1.50m by 1.50m Pad	154.72
3.50m	5.00m by 0.75m Strip	148.12
	5.00m by 1.00m Strip	149.35
	1.50m by 1.50m Pad	167.95

Serviceability State: Settlement Parameters Calculated (Based on DP1)			
Depth (m BGL)	**Foundation System**	**Limit Bearing Capacity (kN/m^2)**	**Settlement (mm)**
3.00m	5.00m by 0.75m Strip	140	<24
	5.00m by 1.00m Strip	125	<24
	1.50m by 1.50m Pad	130	<23
3.50m	5.00m by 0.75m Strip	145	<22
	5.00m by 1.00m Strip	145	<25
	1.50m by 1.50m Pad	145	<21

It must be noted that a bearing capacity of less than 50kN/m^2 and 60kN/m^2 at 3.00m and 3.50m bgl respectively could result in heave due to a reduction in effective stress at depth.

Excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate on the formation level for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced.

Groundwater was not encountered in either trial hole. No groundwater was encountered during the construction of the trial hole. The standing groundwater levels were recorded as 1.05m bgl during a return visits to the site on the 13th August 2015. This water level is likely to represent migrating perched water which has accumulated within the installed standpipe from the Made Ground, sand bands within the Head Deposits or silt bands within the London Clay Formation. Surface water migrating into the borehole is considered unlikely given the internal locations of the borehole.

Therefore, groundwater is unlikely to be encountered during excavation of the basement. However, perched water is likely to be encountered. The advice of a reputable dewatering contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the design of the excavation for the basement.

If the construction works take place during the winter months, when the groundwater level is expected to be at its higher elevation, additional perched water could accumulate.

General Recommendations for Spread Foundations:

- Foundation excavations must be carefully bottomed out and any loose soil or soft spots removed prior to the foundation concrete or blinding being placed. Failure to ensure that foundation excavations are suitably bottomed out could result in additional settlements.

- Inspection of foundation excavations, prior to concreting, must be made by a competent and suitably qualified person to check for any soft spots and to check for the presence of roots.

- The excavation must be kept dry as accumulation of water could result in increased settlements.

- Foundations must not be cast over foundations of former structures and/or other hard spots.

- Any groundwater or surface water ingress must be prevented from entering foundation trenches.

- Isolated Pad Foundations must be at least 1.5 times the width of the widest pad apart to keep to the anticipated settlements.

- Special foundation precautions will be required to prevent possible future shrinkage/swelling within clay strata affecting the integrity of the ground beams. A void, void former or compressible layer must be provided to accommodate potential movement below all ground beams. Compressible material or a void former should also be provided against the inside faces of ground beams.

- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure and the developments proximity to former, present and proposed trees.

6.3 Piled Foundations

Based on the results of the investigation it was considered unlikely that a piled foundations scheme would be required at this site.

6.4 Basement Excavations and Stability

Shallow excavations in the Made Ground, Head Deposits and London Clay Formation are likely to be marginally stable at best. Long, deep excavations, through these strata are likely to become unstable.

The excavation of the basement must not affect the integrity of the adjacent structures beyond the boundaries. The excavation must be supported by suitably designed retaining walls. It is considered unlikely that battering the sides of the excavation, casting the retaining walls and then backfilling to the rear of the walls would be suitable given the close proximity of the party walls.

The retaining walls for the basement will need to be constructed based on cohesive soils with an appropriate angle of shear resistance (Φ') for the ground conditions encountered.

Based on the ground conditions encountered within DP1 the following parameters could be used in the design of retaining walls. These have been designed based the results of geotechnical classification tests and reference to literature.

Retaining Wall/Basement Design Parameters					
Strata	**Unit Volume Weight (kN/m^3)**	**Cohesion Intercept (c') (kPa)**	**Angle of Shearing Resistance (Ø)**	**Ka**	**Kp**
Made Ground	~15	0	12	0.66	1.52
Head Deposits/London Clay Formation	~20	0	24	0.42	2.37

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

6.5 Hydrogeological Effects

A study of the aquifer maps on the Environment Agency website revealed the site to be located on **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. No designation was given for any superficial deposits due to their likely absence.

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

Based on a visual appraisal of the soils encountered, the permeability of the cohesive London Clay Formation was considered to be low.

Groundwater was not encountered in either trial hole. No groundwater was encountered during the construction of the trial hole. The standing groundwater levels were recorded as 1.05m bgl during a return visit to the site on the 13th August 2015. This water level are likely to represent migrating perched water which has accumulated within the installed standpipe from the Made Ground, sand bands within the Head Deposits or silt bands within the London Clay Formation. Surface water migrating into the borehole is considered unlikely given the internal locations of the borehole.

Therefore, groundwater is unlikely to be encountered during excavation of the basement. However, perched water is likely to be encountered. The advice of a reputable dewatering contractor, familiar with the type of ground and groundwater conditions encountered on this site, should be sought prior to finalising the design of the excavation for the basement.

Based on the above it is considered unlikely that groundwater will be encountered during basement construction. However, perched water could accumulate during basement construction, especially after a period of prolongued rainfall.

Higher groundwater levels during winter months or during inclement weather may affect basement construction.

Once constructed, the Made Ground, Head Deposits and the London Clay Formation are unlikely to act as a porous medium for water to migrate through; therefore, additional drainage around the basement should be considered.

6.6 Sub-Surface Concrete

Sulphate concentrations were measured in 2:1 water/soil extracts taken from the London Clay Formation fell into class DS-1 of the BRE Special Digest 1, 2005, *'Concrete in Aggressive Ground'.*

Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1. For the classification given, the "mobile" and "natural" case was adopted given the geology, Head Deposits with sand bands over London Clay Formation with silt bands, presence of Made Ground and the residential use of the site. The sulphate concentration in the samples ranged from 294 - 410mg/l with a pH range of 6.60 – 7.32. The total potential sulphate concentrations ranged from 0.09 – 0.15%.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, *'Concrete in Aggressive Ground'* taking into account the pH of the soils.

It is prudent to note that pyrite nodules may be present within the London Clay Formation. Pyrite can oxidise to gypsum and this normally only occurs in the upper weathered layer, but excavation allows faster oxidation and water soluble sulphate values can rapidly increase during construction. Therefore rising sulphate values should be taken into account should ferruginous staining/pyrite nodules be encountered within the London Clay Formation.

6.7 Surface Water Disposal

Infiltration tests were beyond the scope of the investigation.

Soakaways constructed within the cohesive soils of the Head Deposits and London Clay Formation are unlikely to prove satisfactory due to low anticipated infiltration rates. Therefore an alternative method of surface water disposal is required.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources.

The principles of sustainable urban drainage system (SUDS) should be applied to reduce the risk of flooding from surface water ponding and collection associated with the construction of the basement.

6.8 Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation. For example, there may have been underground storage tanks (UST's) not identified during the Ground Investigation for which there is no historical or contemporary evidence.

Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

6.9 Waste Disposal

Foundation excavations on-site are likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all waste must be classified as;

- Inert;
- Non-hazardous, or;
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM2) document outlines the methodology for classifying wastes.

Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

INERT waste classification should be undertaken to determine if the proposed waste confirms to INERT or NON-HAZARDOUS Waste Acceptable Criteria (WAC).

6.10 Imported Material

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

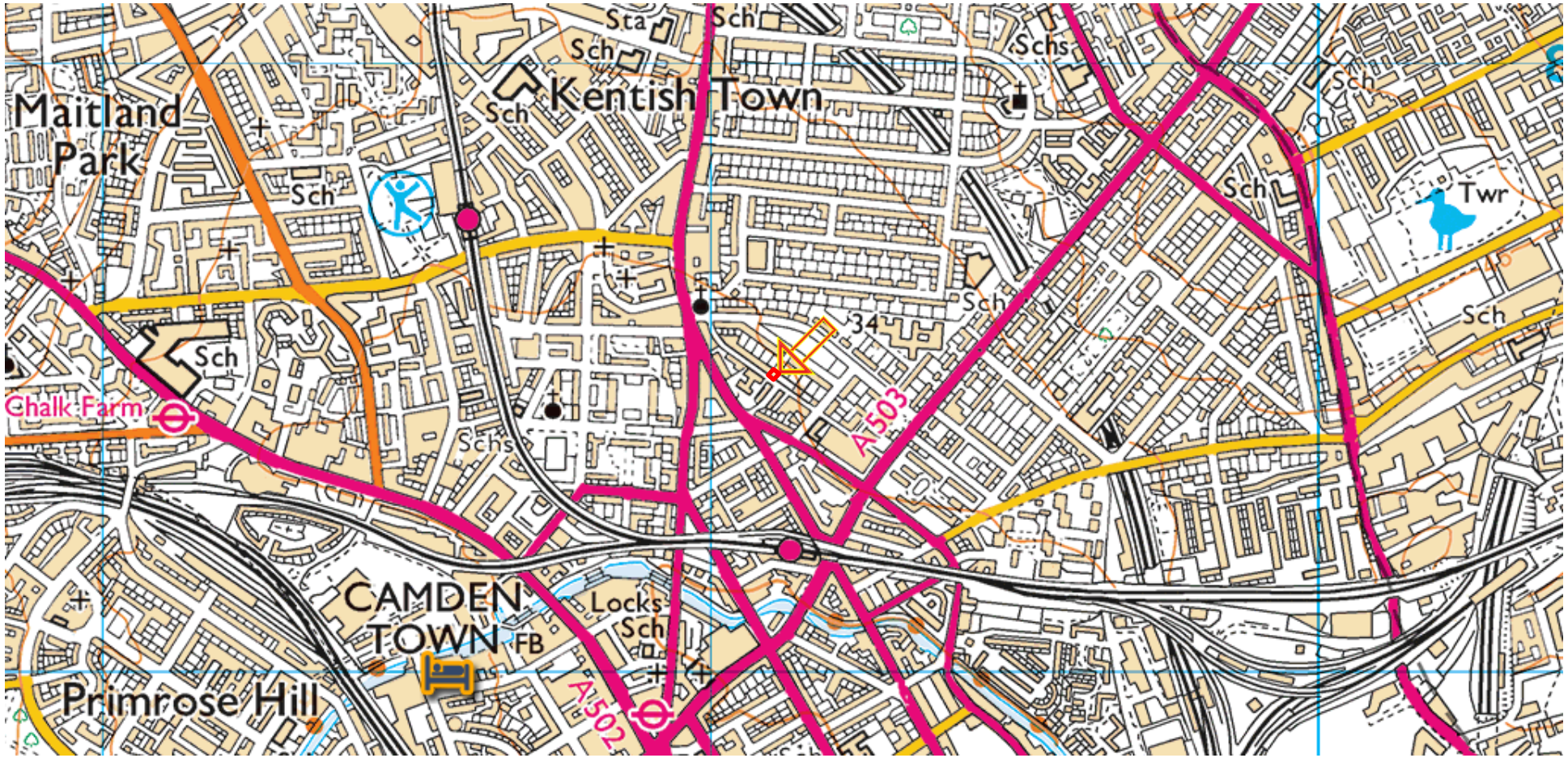
The Topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, either prior to placing (ideally) or after placing, to ensure that the human receptor cannot come into contact with compounds that could be detrimental to human health.

6.11 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust were generated as a result of construction activities.

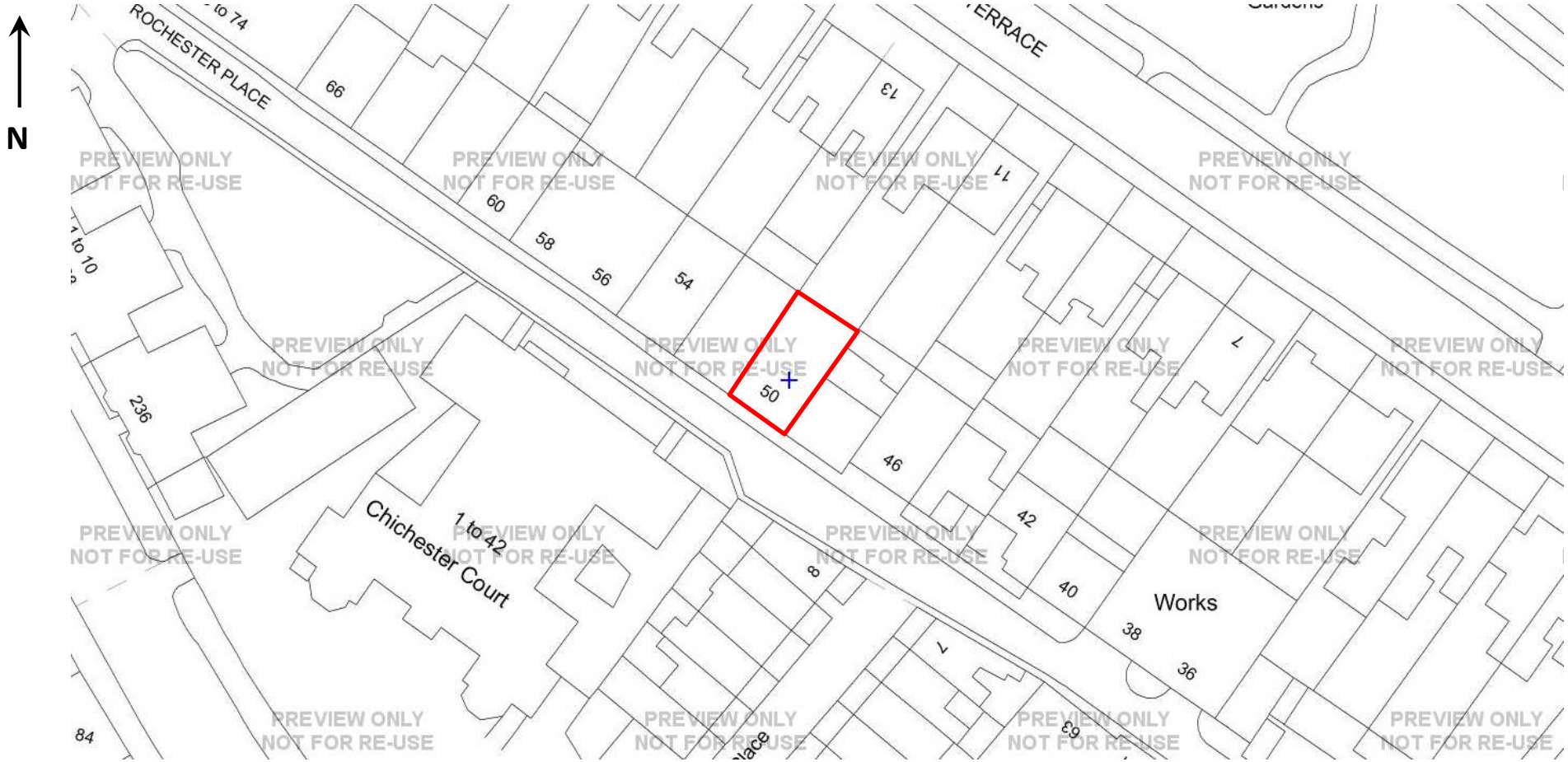
The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: 50 Rochester Place, Camden, London NW1 9JX		Figure 1
Client: Michael Anastassiades	Date: August 2015	ground&water
Site Location Plan	Ref: GWPR1315	



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

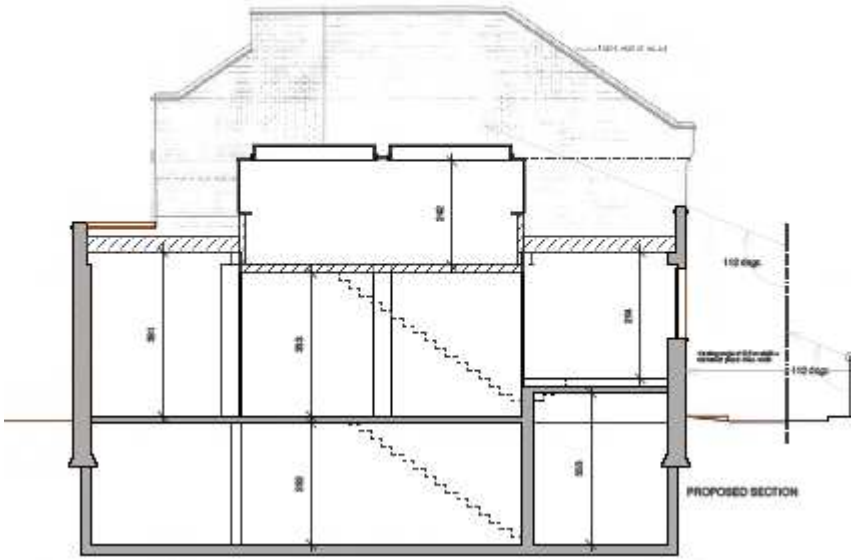
Project: 50 Rochester Place, Camden, London NW1 9JX		**Figure 2**
Client: Michael Anastassiades	**Date:** August 2015	ground&water
Site Development Area	**Ref:** GWPR1315	

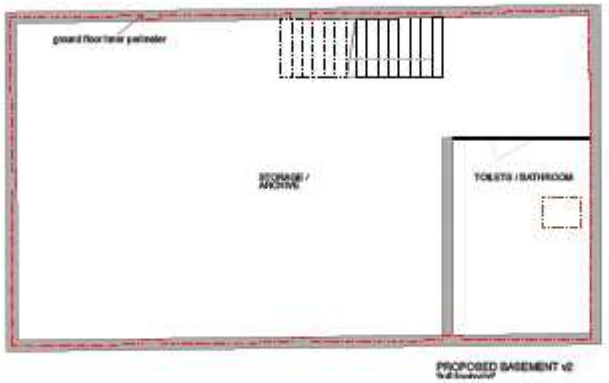
N

APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

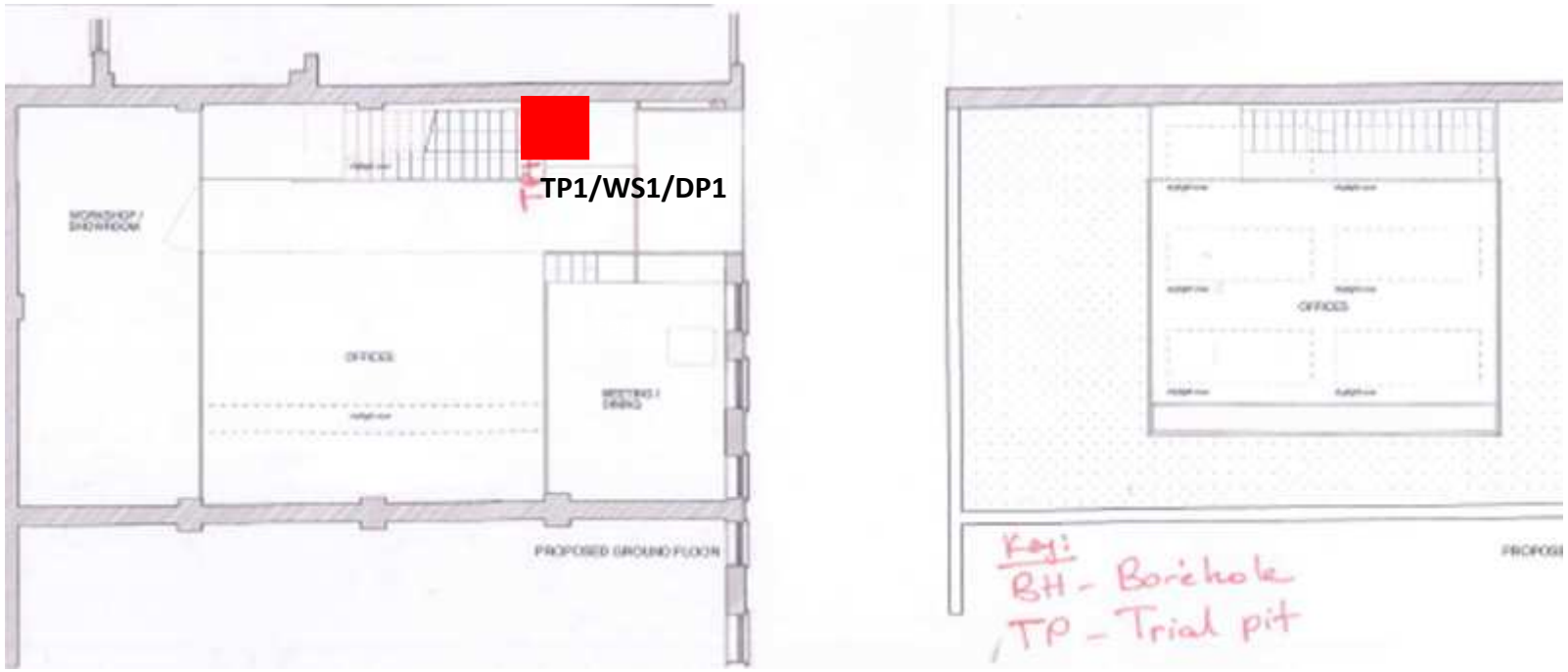
Project: 50 Rochester Place, Camden, London NW1 9JX		Figure 3
Client: Michael Anastassiades	Date: August 2015	ground&water
Aerial View of Site	Ref: GWPR1315	





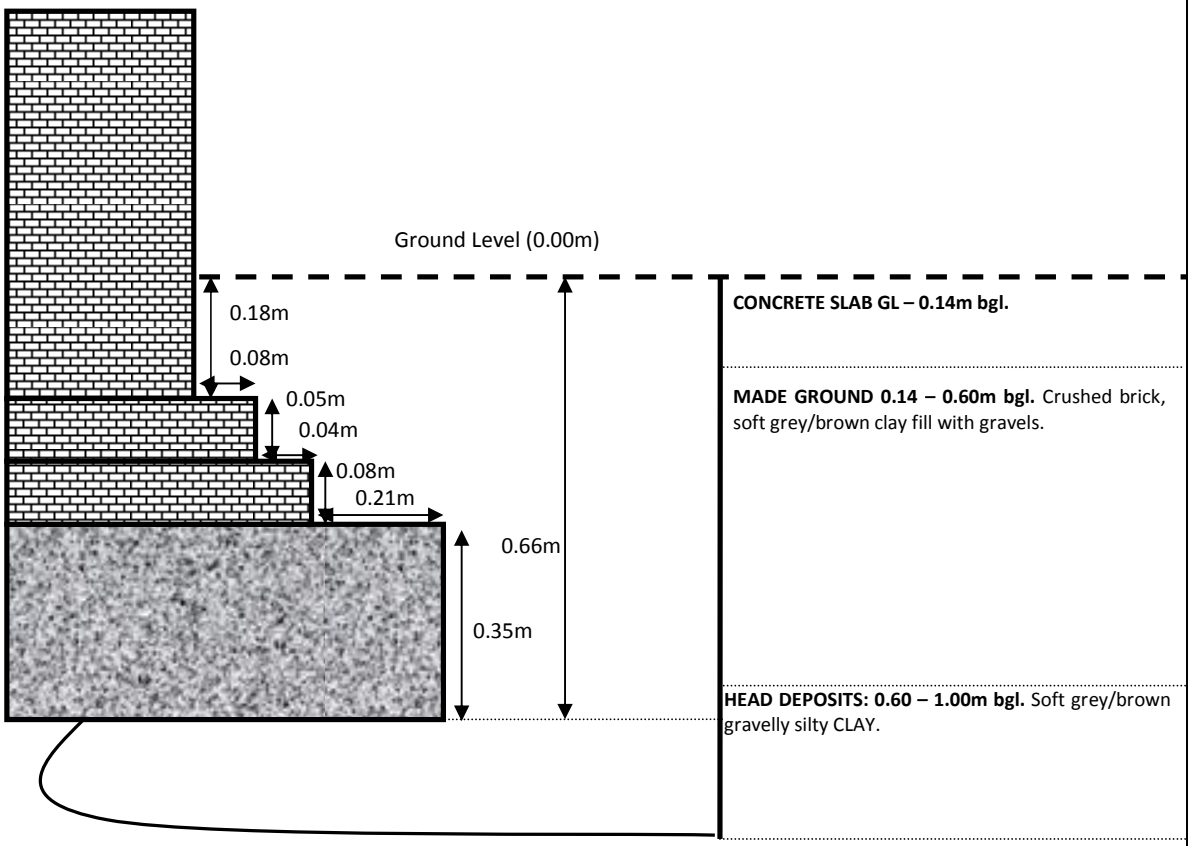
NOTE: NOT TO SCALE

Project: 50 Rochester Place, Camden, London NW1 9JX		**Figure 4**
Client: Michael Anastassiades	**Date:** August 2015	ground&water
Proposed Development – Plan and Section View	**Ref:** GWPR1315	



NOT TO SCALE

Project: 50 Rochester Place, Camden, London NW1 9JX		**Figure 5**
Client: Michael Anastassiades	**Date:** August 2015	ground&water
Trial Hole Location Plan	**Ref:** GWPR1315	



NOTE: NOT TO SCALE

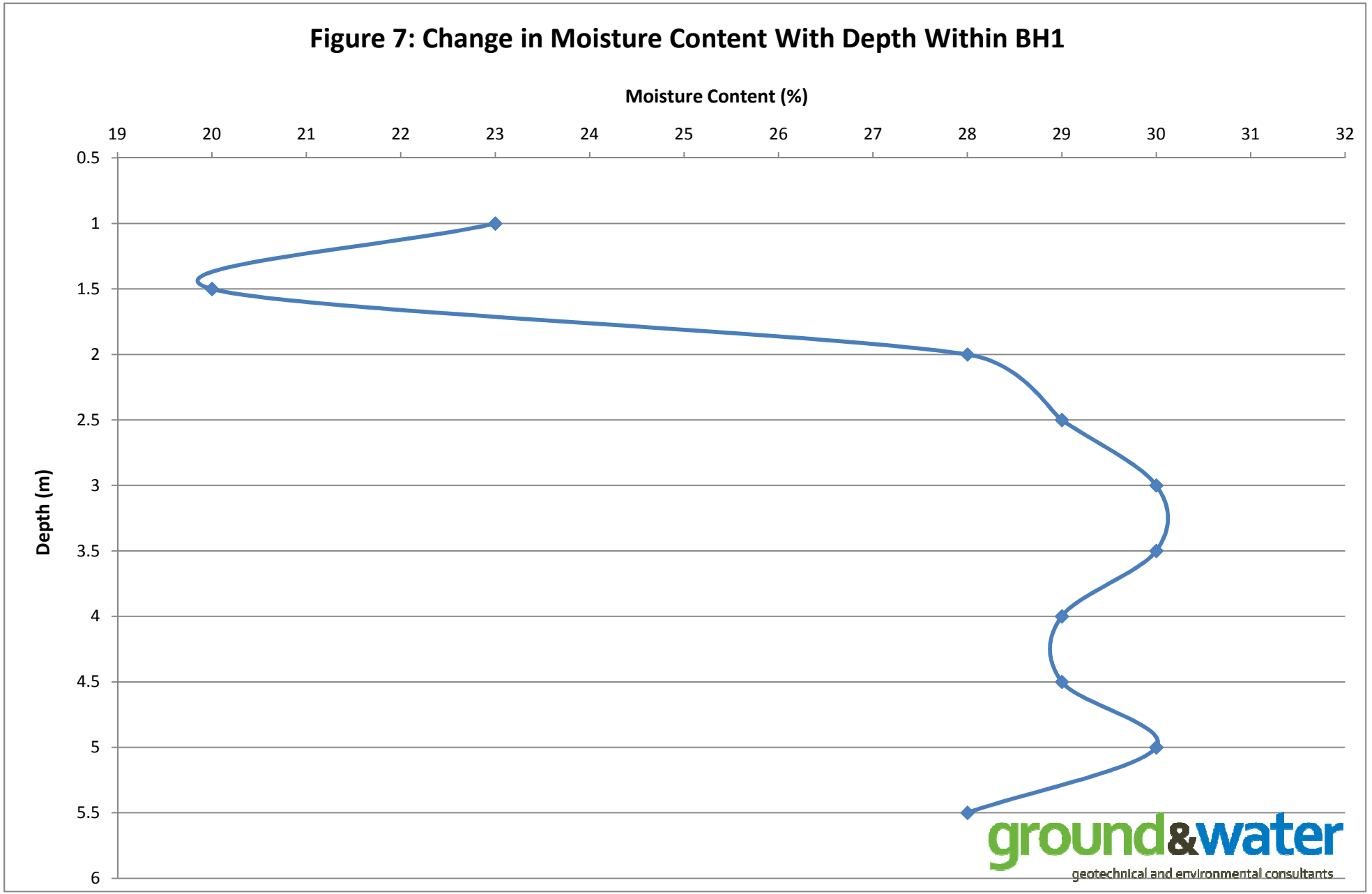
Brick

Concrete

Project: **50 Rochester Place, Camden, London NW1 9JX**	**Figure 6**
Client: **Michael Anastassiades**	**Date:** **August 2015**
Section Drawing: Foundation Exposure TP/FE1	**Ref:** **GWPR1315**

ground&water

Figure 7: Change in Moisture Content With Depth Within BH1



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 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.

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.

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 samples 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 50 Rochester Place, Camden, London NW1 9JX.

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
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Borehole No
WS1
Sheet 1 of 1

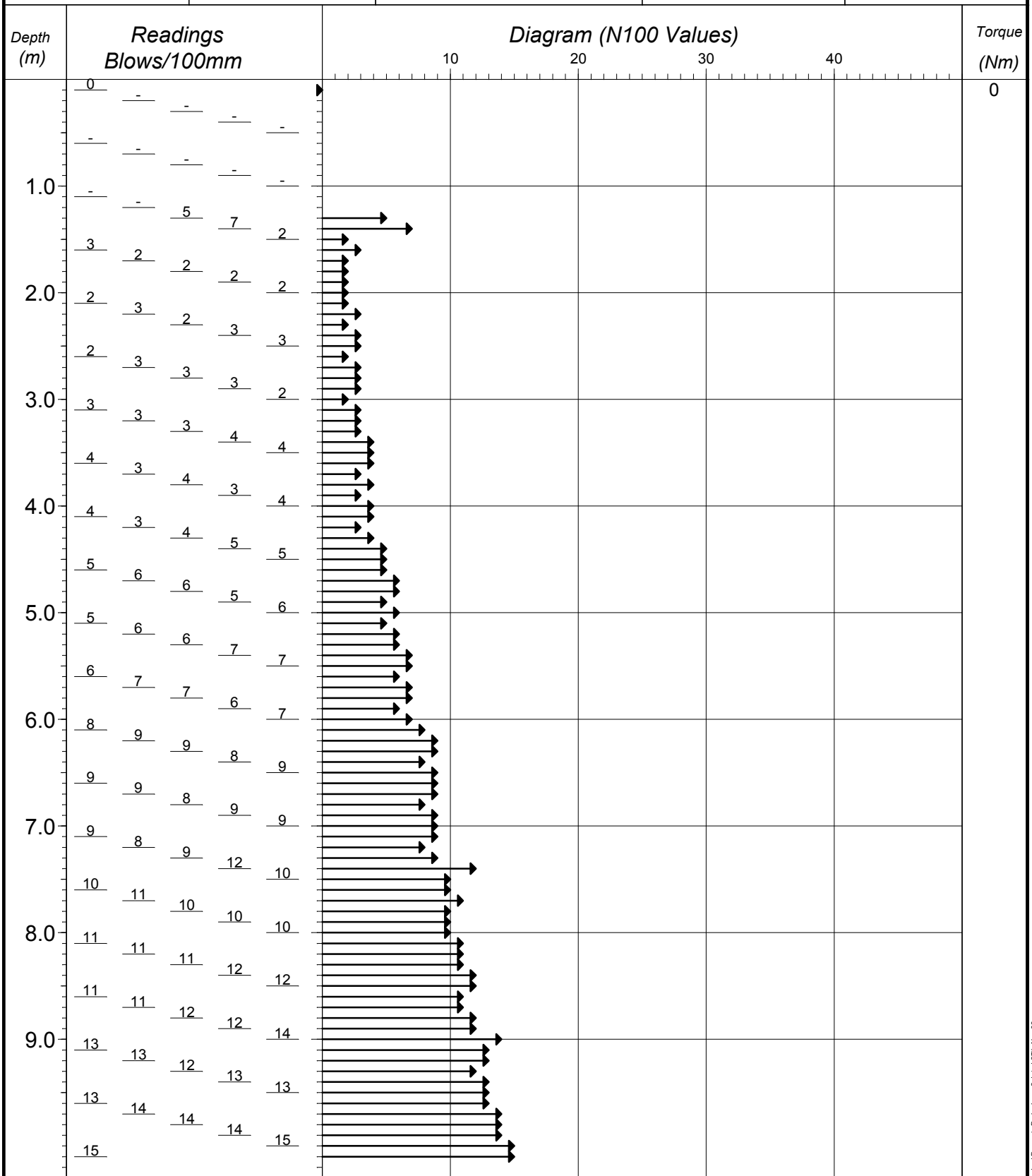
Project Name	Project No.	Co-ords: -	Hole Type
50 Rochester Place,	GWPR1315		WS
Location: Camden, London NW1 9JX		Level: -	Scale 1:50
Client: Michael Anastassiades		Dates: 27/06/2015	Logged By SJM

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.14			CONCRETE
		0.30	D					MADE GROUND: Soft grey/brown clay fill with gravel and brick fragments.
		0.50	D		0.60			HEAD DEPOSITS: Soft silty grey/brown gravelly silty CLAY.
		0.80	D					
		1.00	D					
					1.20			HEAD DEPOSITS: Soft to firm brown/grey gravelly silty CLAY with occasional fine roots.
		1.50	D					
		2.00	D					
					2.30			LONDON CLAY FORMATION: Firm brown/blue silty CLAY.
		2.50	D					
		3.00	D					
		3.50	D					
		4.00	D					
					4.20			LONDON CLAY FORMATION: Stiff brown/blue silty CLAY with occasional selenite crystals.
		4.50	D					
		5.00	D					
		5.50	D					
		6.00	D		6.00			End of Borehole at 6.00 m
			Type	Results				

Remarks: As drillers logs. Subject to engineer review.
No groundwater encountered.
Fine roots to 2.00m bgl.
19mm groundwater monitoring pipe installed to 5.00m bgl.

DYNAMIC PROBING

Probe No **DP1**			
Client **Michael Anastassiades**		Sheet 1 of 1	
Site **50 Rochester Place,**		Project No **GWPR1315**	
E -	N -	Level -	Date **27/06/2015** Logged by **SJM**



Fall Height **500**		Cone Base Diameter **43**	
Hammer Wt **50.00**		Final Depth **10.00**	
Probe Type **DPH**		Log Scale 1:50	

ground &water
geotechnical and environmental consultants

Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

AGS

APPENDIX C
Geotechnical Laboratory Test Results

Summary of Classification Test Results

Job No.	Project Name	Programme	
19194	50 Rochester Place, Camden, London NW1 9JX	Samples received	15/07/2015
		Schedule received	14/07/2015
Project No.	Client	Project started	16/07/2015
GWPR1315	Ground and Water Ltd	Testing Started	25/07/2015

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BH1		1.00		D	Brown, dark grey, orange brown and blue grey sandy gravelly silty CLAY (gravel is fm and sub-angular to angular)	23					
BH1		1.50		D	Brown and blue grey slightly fine sandy silty CLAY with rare fine gravel	20	99	77	24	53	
BH1		2.00		D	Brown and blue grey slightly sandy silty CLAY with rare fine gravel	28					
BH1		2.50		D	Brown slightly fine sandy silty CLAY	29	100	75	26	49	
BH1		3.00		D	Brown and blue grey slightly fine sandy silty CLAY	30					
BH1		3.50		D	Brown and blue grey slightly fine sandy silty CLAY	30	100	78	27	51	
BH1		4.00		D	Brown and blue grey slightly fine sandy silty CLAY with rare fine gravel	29					
BH1		4.50		D	Brown and blue grey slightly fine sandy silty CLAY with traces of selenite crystals	29	100	77	27	50	
BH1		5.00		D	Brown and blue grey slightly fine sandy silty CLAY	30					
BH1		5.50		D	Brown slightly fine sandy silty CLAY	28					

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: 27/07/2015

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	
19194	50 Rochester Place, Camden, London NW1 9JX	Samples received	15/07/2015
		Schedule received	14/07/2015
Project No.	Client	Project started	16/07/2015
GWPR1315	Ground and Water Ltd	Testing Started	22/07/2015

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top	Base	Type		%	g/l	g/l		
BH1		2.00		D	Brown and blue grey slightly sandy silty CLAY with rare fine gravel	100	0.26	0.31	7.32	

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: 27/07/2015

Francis Williams
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: 15-33480

Site Reference:	50 Rochester Place, Camden London NW1 9JX
Project / Job Ref:	GWPR1315
Order No:	None Supplied
Sample Receipt Date:	15/07/2015
Sample Scheduled Date:	15/07/2015
Report Issue Number:	1
Reporting Date:	20/07/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

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: 15-33480	**Date Sampled**	27/06/15	27/06/15				
Ground & Water Ltd	**Time Sampled**	None Supplied	None Supplied				
Site Reference: 50 Rochester Place, Camden London NW1 9JX	**TP / BH No**	BH1	BH1				
Project / Job Ref: GWPR1315	**Additional Refs**	None Supplied	None Supplied				
Order No: None Supplied	**Depth (m)**	0.70	3.00				
Reporting Date: 20/07/2015	**QTSE Sample No**	157502	157503				

Determinand	**Unit**	**RL**	**Accreditation**					
pH	pH Units	N/a	**MCERTS**	6.6	7.3			
Total Sulphate as SO_4	%	< 0.02	NONE	0.15	0.09			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	**MCERTS**	410	294			
Total Sulphur	%	< 0.02	NONE	0.07	0.03			
Ammonium as NH_4	mg/kg	< 0.5	NONE	15.5	7			
W/S Chloride (2:1)	mg/kg	< 1	**MCERTS**	54	38			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	**MCERTS**	6	< 3			
W/S Magnesium	mg/l	< 0.1	NONE	8.8	14			

Analytical results are expressed on a dry weight basis where samples are dried at less than $30^{O}C$
Analysis carried out on the dried sample is corrected for the stone content
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: 15-33480	
Ground & Water Ltd	
Site Reference: 50 Rochester Place, Camden London NW1 9JX	
Project / Job Ref: GWPR1315	
Order No: None Supplied	
Reporting Date: 20/07/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 157502	BH1	None Supplied	0.70	19.6	Brown clay
$ 157503	BH1	None Supplied	3.00	18.8	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

4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-33480
Ground & Water Ltd
Site Reference: 50 Rochester Place, Camden London NW1 9JX
Project / Job Ref: GWPR1315
Order No: None Supplied
Reporting Date: 20/07/2015

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