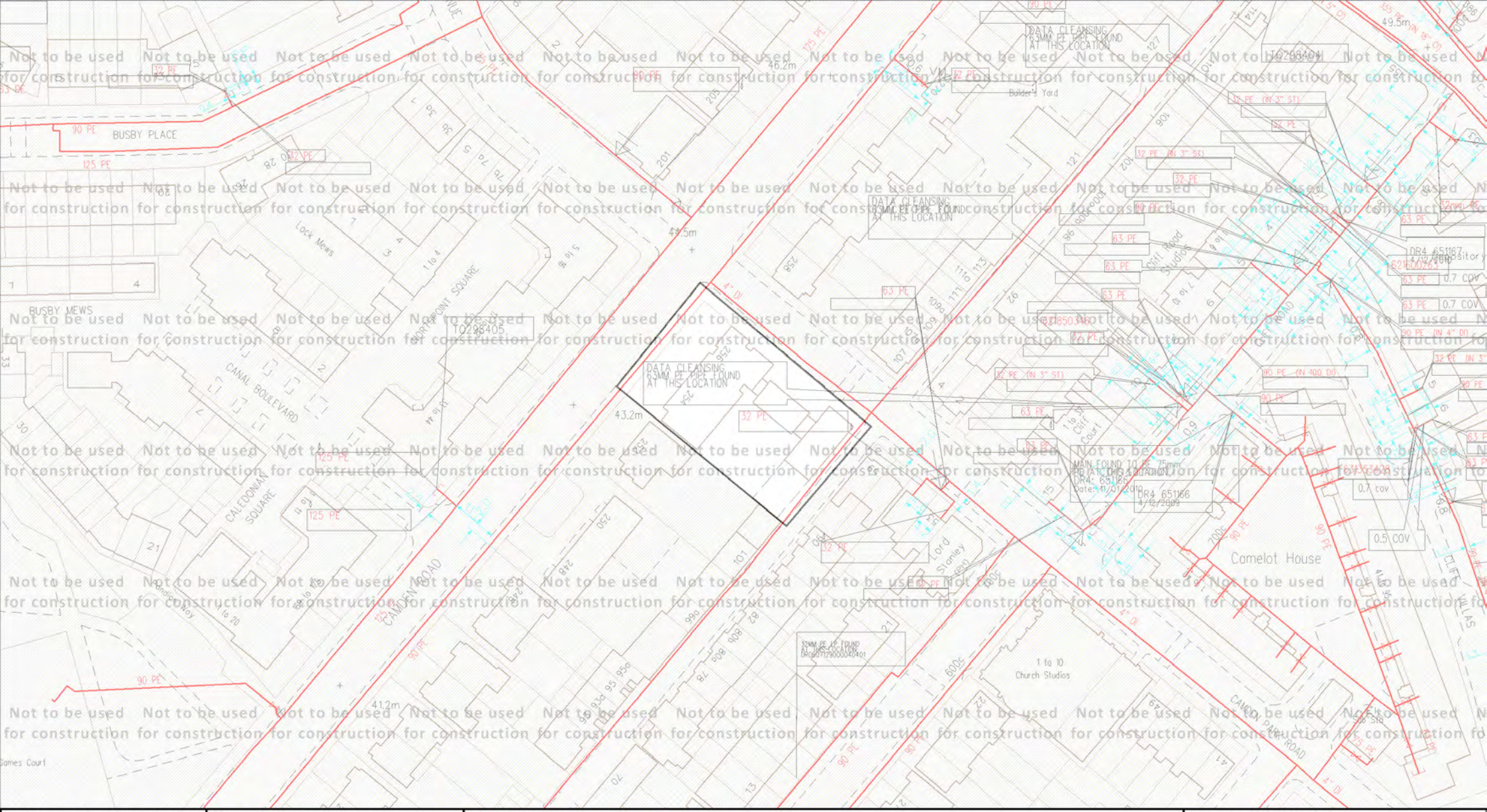


ID: NL_TE_Z5_3SWP_158721	View extent: 361m, 196m	Map not to be used for construction
USER: Oliver.Smith	LP MAINS MP MAINS IP MAINS LHP MAINS NHP MAINS	This plan shows those pipes owned by National Grid Gas plc in its role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc., are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by National Grid Gas plc or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue.
DATE: 09/06/2015		
DATA DATE: 07/06/2015		
REF: 254 - 256 Camden Road (OS)		
MAP REF: TQ2984 CENTRE: 529737, 184835	0m 25m Approximate scale 1:1250 on A4 Colour Landscape	

Valve | Depth of Cover | Syphon | Diameter Change | Material Change

Map 1 of 2 (GAS)

MAPS Plot Server Version 1.8.0

nationalgrid

Requested by: CampbellReith Consulting Engineers

ID: NL_TE_Z5_3SWP_158721	View extent: 723m, 393m	Map not to be used for construction	Map 2 of 2 (ELECTRIC)
USER: Oliver.Smith	Underground cables Overhead lines	This plan shows those cables owned by National Grid Electricity Transmission plc in its role as a Licensed Electricity Transporter (ET). Electricity cables owned by other ETs, or otherwise privately owned, may be present in this area. Information with regard to such cables should be obtained from the relevant owners The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Ancillary equipment such as cooling systems and communication cables are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by National Grid Electricity Transmission plc or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of cables and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near electricity apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue.	MAPS Plot Server Version 1.8.0
DATE: 09/06/2015			nationalgrid
DATA DATE: 23/01/2015			Requested by: CampbellReith Consulting Engineers
REF: 254 - 256 Camden Road (OS)			
MAP REF: TQ2984 CENTRE: 529737, 184835	0m 50m Approximate scale 1:2500 on A4 Colour Landscape		

ENQUIRY SUMMARY

Received Date
04/06/2015

Your Reference
254 - 256 Camden Road (OS)

Location
Centre Point: 529737, 184835
X Extent: 62
Y Extent: 60
Postcode: NW1 9HF
Location Description: NW1 9HF, Ashton Court 254 - 256 Camden Road, London

Map Options
Paper Size: A4
Orientation: LANDSCAPE
Requested Scale: 500
Actual Scale: 1:1250 (GAS), 1:2500 (ELECTRIC)
Real World Extents: 361m x 196m (GAS), 723m x 393m (ELECTRIC)

Recipients
pprsteam@nationalgrid.com

Enquirer Details
Organisation Name: CampbelllReith Consulting Engineers
Contact Name: Fatima Drammeh
Email Address: FatimaDrammeh@campbellreith.com
Telephone: 020 7340 1700
Address: Friars Bridge Court, 41-45 Blackfriars Road, London, SE1 8NZ

Description of Works
The proposed development is the demolition of the flats in the rear of the property and the construction of a three storey building with a single storey basement. The proposed works involves the construction of a basement with anticipated excavation depth of 3m below ground level. Exclusion zones associated with National Grid assets required.

Enquiry Type
Proposed Works

Activity Type
Development Project

Work Types
Work Type: Change to Ground Level
Work Type: Deep Excavation (greater than or equal to 0.3m)
Work Type: Demolition (non-explosive)
Work Type: Permanent Structures

Appendix C: Ground Investigation Data

GROUND ENGINEERING

Newark Road
Peterborough PE1 5UA
Tel: 01733 566566
Fax: 01733 315280

GROUND INVESTIGATION REPORT

ASHTON COURT
CAMDEN ROAD
LONDON NW1

Report Reference C13480

On behalf of:-

Origin Housing Developments Limited
St. Richard's House
110 Eversholt Street
London
NW1 1BS

March 2015

ORIGIN HOUSING DEVELOPMENTS LIMITED

ROBERT LOMBARDELLI PARTNERSHIP LIMITED

GROUND INVESTIGATION REPORT

FOR

PROPOSED DEVELOPMENT

AT

ASHTON COURT

CAMDEN ROAD

LONDON NW1

Report Reference No. C13480 **March 2015**

INTRODUCTION

The client, Origin Housing Developments Limited, proposes to replace a 2-storey building at Ashton Court, between Camden Road and Camden Mews in London NW1, with four mews houses which may have at least a partial basement. The proposed building loads were not known at the time of report writing.

Ground Engineering Limited was commissioned by the client, under the direction of Robert Lombardelli Partnership Limited, to carry out a ground investigation to determine the nature and geotechnical properties of the underlying soils, in relation to the design and construction of the foundations. A desk study and contamination assessment were not required within the scope of this report.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The site is located at Ashton Court, Camden Road (A503), London NW1. Ashton Court is bounded by Camden Road to the north-west, Camden Park Road (A5200) to the north-east, and Camden Mews to the south-east. The area of the proposed redevelopment is the southern part of the site fronting Camden Mews. The National Grid Reference for the centre of the site is TQ 2974 8482 and its location is shown on a plan following this report text.

At the time of the investigation in January 2015 the southern part of the site fronting Camden Mews contained a two-storey building, with partial under-croft parking. A single-storey Common Room with paved area fronted Camden Park Road to the north-east, and a three-storey block fronted Camden Road to the north-west. The site of the proposed redevelopment was approximately 29m wide fronting Camden Mews at its junction with Camden Park Road to the east, and extended north-west by approximately 8m. An under-croft car park was present fronting Camden Mews south-east of the site, which had a security gate to the rear, leading to an enclosed garden which contained a lawn, decked area, trees and shrubs.

An approximately 12m high Ash tree and a 10m high Cherry tree were present in the garden, approximately 4m and 11m to the north of the proposed mews houses. An approximately 12m high London Plane tree was present in the paved area fronting Camden Park Road pavement, which was approximately 4m north of the proposed mews houses.

This part of Camden stands at about 45mOD, on ground sloping down gently to the south-west.

The geological map, London sheet V NW (1935) at 1:10,560 scale, shows the site to be underlain by solid geology London Clay. Approximately 10m east of the site superficial Boyn Hill Gravel is shown covering the London Clay. The more recent geological map, sheet 256 (2006) at 1:50,000 scale, shows the site directly underlain by the solid geology of the London Clay Formation.

SITE WORK

The site work conducted on 14th January 2015 comprised one window sampled borehole (WS1). The borehole position is shown on the exploratory hole location plan following this report text.

Public utility service drawings were sourced and consulted prior to determining the exploratory hole positions. These drawings are available from Ground Engineering Limited on request. Prior to excavation, a service scan was made at each position using a CAT (Cable Avoidance Tool) to check for the absence of detectable buried services that may otherwise have been damaged by the investigation.

The exploratory hole record, presented following the plans, gives the descriptions and depths of the various strata encountered, details of all samples taken, installation details and the groundwater conditions observed during and on completion of boring and excavation, and during subsequent monitoring of the installation.

Window Sample Borehole

A window sample borehole (WS1) was sunk to a depth of 10.00m below ground level. A hand excavated inspection pit was undertaken to 1.20m depth at the borehole position in order to confirm the absence of any buried services prior to boring.

Representative small disturbed samples of soil were taken at regular intervals throughout the depth of the inspection pit.

The borehole was formed by a small track mounted window sampling and super heavy dynamic probing rig. The window sampling equipment consisted of drive-in sample tubes of specially constructed and strengthened steel, lined with a plastic core-liner. The barrels were initially of 87mm internal diameter and were reduced in diameter with successive barrels with increasing depth. Upon extraction, a continuous 'undisturbed' profile of the soil was obtained within the plastic liners. The plastic liners were subsequently split by a geotechnical engineer who sub-sampled them, with the remaining samples re-sealed within the plastic liners.

An immediate assessment of the apparent shear strength of clay was made within the liners using a hand shear vane, the average of three readings for each test depth have been recorded and presented on the borehole record in kilopascals (kPa), up to a maximum 130kPa. The apparent cohesion results have been plotted against depth in Figure 2.

On completion of borehole WS1, a gas and groundwater monitoring standpipe was installed to a depth of 7.00m. The pipes was perforated to within 1.00m of ground level and the annulus backfilled with pea gravel. A bentonite seal was placed from ground surface to 1.00m depth and a gas tap fitted. A protective stopcock cover was concreted in place at ground level above the installation.

Gas and Groundwater Monitoring Visits

As part of this investigation one return visit was made to site on 3rd February 2015, when the standpipe installed within borehole WS1 was monitored for a standing groundwater level and for landfill type gases using a Gasdata GFM430 analyser. The results of the monitoring visit are presented following the exploratory hole record.

LABORATORY WORK

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the borehole record. The soil descriptions have been made in accordance with BS5930:1999. The geotechnical test results, undertaken in accordance with BS1377:1990, are presented following the exploratory hole records.

The moisture content of selected samples were determined. The moisture content results have been plotted against depth in Figure 1.

The index properties of a selected soil sample was determined as a guide to soil classification and behaviour. The liquid limit was determined by a cone penetrometer.

Test specimens were prepared at full diameter from selected undisturbed samples. Immediate undrained triaxial compression tests were performed under single-stage confining cell pressures. The moisture content and bulk density of each specimen was also determined. The apparent cohesion results have been plotted against depth with the hand vane results in Figure 2.

An indication of the swelling characteristics of selected undisturbed samples were obtained from tests in the consolidation apparatus or oedometer. These tests were performed on 75mm diameter and 50mm diameter samples, approximately 19mm thick, contained in steel rings. The specimens were saturated and both the swelling pressure and amount of swell measured.

Selected samples of soil were analysed to determine the concentration of soluble sulphate. The pH values was also determined.

GROUND CONDITIONS

The ground conditions encountered comprised made ground to a depth of 1.50m, which rested on the expected solid geology London Clay. The London Clay was found to at least the base of the borehole at 10.00m depth.

Made Ground

Made ground was encountered to a depth of 1.50m

From surface, yellow brown and brown, gravelly sand fill, was encountered to a depth of 0.50m. The gravel fraction comprised angular and sub-angular flint, limestone and wood fragments.

Beneath the gravelly sand fill, very stiff, dark brown and grey, sandy, gravelly clay fill, was encountered to a depths of 1.10m. From 1.10m to 1.50m depth, firm, brown and dark brown, slightly sandy, slightly gravelly clay fill was encountered. The gravel fraction comprised very angular to sub-rounded flint, chalk, shells, ash, brick, concrete and asphalt fragments.

London Clay Formation

Underlying the made ground at 1.50m depth, the anticipated London Clay Formation was encountered.

The London Clay initially comprised stiff, closely fissured, brown, orange brown and grey, clay with partings of sand to 7.00m below which the fissured clay was grey. The London Clay Formation was encountered to at least the base of the boreholes at 10.00m depth.

Roots

Live roots were observed to a depth of 4.00m, which was bored close to the Ash tree in the southern part of the site.

Groundwater

Borehole WS1 was dry during boring and on completion. During monitoring of the standpipe installed in WS1 on 3rd February 2015, water was recorded at 5.23m below ground level.

COMMENTS ON THE GROUND CONDITIONS IN RELATION TO FOUNDATION DESIGN AND CONSTRUCTION

The investigation confirmed the site to be underlain by made ground resting on solid geology London Clay. The made ground soils had variable bearing properties and were found to a maximum depth of 1.50m. The made ground should be avoided as a bearing stratum and would be penetrated by any proposed basement structure. The proposed building loads and foundation levels were not known at the time of report writing. The underlying London Clay Formation could offer adequate support for the proposed new foundations. Excavations to around 5.00m depth would be anticipated to be dry based on the findings of this investigation. The basement floor slab could be ground bearing.

Traditional Foundations

Large scale processes of natural sedimentation allow a certain degree of confidence to be placed in the absence of important variation of the engineering properties of natural soils across sites. By contrast, made ground whose history is not completely known, must, despite any amount of investigation, present the possibility of conditions existing which could not be accepted when considering the material as a bearing stratum.

The made ground initially comprised sand and gravel fill, covering layers of very stiff becoming firm, sandy, gravelly clay fill. The potential for variability within the made ground means that it should be avoided as a bearing stratum. In any case foundations for a basement would be extended through any made ground, which was found to extend locally to 1.50m depth.

A sample of the London Clay Formation had a modified plasticity index of 56%, and the result indicates the clay has a high volume change potential based on NHBC Standards Chapter 4.2 'Building near trees' (2014). If no basement is constructed, on an open site, away from the influence of trees, a minimum foundation depth of 1.00m below current or proposed ground level, whichever is deeper, would be required within the naturally deposited clays, if

present at such a depth, in order to be below the zone of seasonal volume change in accordance with the NHBC Standards.

The proposed buildings are within influencing distances of deciduous trees where clay soils are present, with an Ash tree in the garden, and London Plane tree noted in a paved area, approximately 4m north of the location of the proposed building. There is also a Cherry tree in the garden onsite 11m north of the proposed building. Based on moderate water demand mature Ash and London Plane trees, at a distance of 4m from proposed foundations, minimum foundation depths would locally need to be 2.15m in these clay soils based on NHBC Standards, however excavations for any proposed basement structure will penetrate and remove any desiccated clays. If no basement is proposed, for the adoption of the minimum foundation depth of 1.00m on this site in clay soils, foundations would need to be at least 18m from fully mature Ash trees and at least 20m from the fully mature London Plane. Within these distances, foundation depths will depend on the proximity of trees to new foundations and depths should be determined using the NHBC Standards.

Tree species within the site and along the site boundaries, and distances to the proposed buildings should be verified, before determining foundation depths based on NHBC Standards.

Some desiccation of the clay soils was noted in WS1, to approximately 2.60m depth (Figure 1), which was close to the existing Ash tree in the south of the site. Foundations should be taken at least 0.50m below the last vestiges of live roots in clay soils. Live roots were encountered to a maximum depth of 4.00m within WS1. Strip footings could be 'stepped' up along the length of wall runs where foundation depths vary due to the influence of trees, although stepped foundations are likely to suffer differential settlements. Steps should not exceed 0.50m and further guidance is provided in the aforementioned NHBC document.

Swelling pressures of 101kN/m^2 at 2.90m depth and 107kN/m^2 at 3.90m depth also indicated the presence of desiccated clay, which gives an estimated heave of 25mm per 1.00m of desiccated clay. Potentially damaging swelling pressures could be generated following removal of nearby trees as any desiccated clay is allowed to become saturated. Incorporation of

some void forming or compressible material against the sides of the foundations or basement walls, may also be required within the zones of influence of the existing trees in the shallow clay soils, especially where trees have been or are to be removed, in order to accommodate any vertical and horizontal movements caused by future heave of the clay.

Recommendations for foundation depths related to proposed tree planting are also provided in the NHBC Standards and the volume change potential should be considered for any proposed landscaping within a residential scheme on the site.

Bearing Capacity

The stiff clays of the London Clay Formation, where encountered at a depth of 1.00m have a net safe bearing capacity of 170kN/m^2 beneath a strip footing up to 0.60m wide, and 185kN/m^2 for a square pad foundation 1.20m by 1.20m in size. At 2.50m depth, the clays have a net safe bearing capacity of 185kN/m^2 based on strip foundations up to 0.60m wide, and 200kN/m^2 for a square pad foundation 1.20m by 1.20m in size. These bearing capacities incorporate a factor of safety of 3.0 against shear failure and should be sufficient to support the proposed buildings.

Basement Foundations

Foundations at estimated basement floor level (around 3.00m below ground level) would be within the London Clay and a basement raft foundation could be considered to support the column loads with a bearing pressure of 100kN/m^2 beneath a basement slab up to 8m wide. This does not consider any net effect of base heave. This bearing pressure incorporates a factor of safety of 3.0 against shear failure within the underlying clays.

A reinforced basement floor or basement raft could be cast on the excavated surface following proof rolling and careful inspection.

Piled Foundations

Alternatively piled foundations may be used to support the proposed mews houses, and may be incorporated into any basement construction. The underlying London Clay would provide a suitable pile bearing stratum. The advice of a specialist piling contractor should be sought with regard to suitable methods of pile installation. Installation of either single bored, CFA or interlocking sheet piles or contiguous bored piles are likely to be best suited to these ground conditions. Vibrations from driven piles could be potentially damaging to neighbouring structures, particularly where they are supported by shallow footings.

Preliminary working loads for a single bored pile may be estimated for preliminary cost and design purposes using the pile bearing coefficients given below, which are based on the following assumptions;

1. The ultimate load on a pile would be the sum of the adhesion in clay, acting on the shaft of the pile together with the end bearing load.
2. The adhesion acting on the shaft of a pile is a function of the values of apparent cohesion within the clay, presented on the laboratory summary sheets and in Figure 2.
3. The end bearing load would be a function (9.0) of the average cohesion of the clay at the level of the pile base (Figure 2).
4. A factor of safety of at least 2.0 would be used to assess the working load and if test loading of selected piles were not practical, the factor of safety (F) would be increased to at least 2.5.

Item	**Ultimate Pile Bearing Value (kN/m^2)**
Friction/adhesion in made ground	Ignored
Adhesion in London Clay, 3.00m to 6.00m	50
Adhesion in London Clay, below 6.00m	60
End bearing in London Clay, 6.00m to 10.00m	1,100

Based on these coefficients it is estimated that a single 300mm diameter bored pile installed to 6m depth within the London Clay, would have a working load of 85kN (F=2.5). Similarly, the same size pile extended to a depth of 10m within the London Clay would have a working load of 175kN (F=2.5).

Larger diameter piles would have increased working loads. For example, the same 6m and 10m length piles at 450mm diameter would have working loads of 155kN (F=2.5) and 290kN (F=2.5) respectively.

The final design of piles should be undertaken by a piling specialist.

Retaining Structures

The walls of the proposed basement will act as retaining walls and will need to be designed accordingly, together with allowance for potential swelling pressures in the upper clay soils. For a permanent retaining wall analysis effective stress parameters would be appropriate, however, in the absence of effective stress testing on samples from this site, published parameters and in-situ test results could be used as a conservative approach. The design of retaining walls may be based on the parameters in Table 1 below.

Table 1: Basement Retaining Walls

Soil Type	Bulk Density (Mg/m^3) γ_B	Angle of Shearing Resistance (degrees) ϕ'	Shear Strength (kPa) c_u	Effective Shear Strength (kPa) c'
Made Ground (Clay fill)	1.80	23	35	0
London Clay to 4.00m depth	2.00	23-26	80	0-2

Excavations

The made ground together with the underlying soils should be easily removed within foundation excavations for the proposed development, although former foundations are

likely to be more difficult to remove and require a breaker. The sides of excavations within the made ground soils are likely to be unstable and excavations should not be relied upon to stand unsupported.

If basements are proposed, following the installation of either interlocking sheet piles or contiguous bored piles, excavations for the basements should be fairly easily achieved within them in both made ground and stiff fissured clay alike, by means of modern mechanical plant.

Calculations based on the oedometer test results suggest that some theoretical heave is possible. The basement excavation will result in the relief of approximately 60kPa of overburden pressure, and the resulting heave within the London Clay is calculated to be in the order of 45mm in the centre of the 8m wide and 3.00m deep unconfined excavation, reducing towards the edges of the excavation. Heave within the London Clay would begin to take place soon after excavation but would be confined by the basement floor once it had been constructed and further by any load carried by it.

Excavations could be expected to remain dry to 5.00m depth based on the findings of this investigation, however it is recommended that the water level in the standpipe is rechecked nearer the proposed construction date. Care should be taken not to excavate below the water table in the absence of suitable groundwater control and side support, such as dewatering via screened sumps. Care should be taken to keep the excavations dry.

Attention should be given where personnel are to enter deep excavations, when sides should either be safely battered back, or close side support provided, in order to comply with statutory safety requirements and prevent sidewall collapse.

The basement structure should be completed with a water-proof membrane around its outer surface to ensure future water tightness with regard to percolating water, perched groundwater and any future water table fluctuations.

The neighbouring structures should be protected from ground movements particularly if excavations are to be undertaken prior to installation of side support and care should be taken to avoid the undermining of existing footings.

Floor Slabs

A ground bearing floor slab should not be adopted in areas underlain by a significant thickness of made ground. Consolidation within the made ground beneath a ground bearing floor slab would be differential to the main building structure. It is therefore recommended that the floor slab is suspended, are supported on its own foundations, or the made ground is reengineered. If basements are to be constructed, a reinforced basement floor or basement raft could be cast on the excavated surface following proof rolling and careful inspection.

Similarly, where the floor slabs are in clay soils within the zones of influence of trees, either extant or recently removed, the root affected clay should be removed and replaced with well compacted non-shrinkable material or the slabs suspended using the sub-floor gaps recommended in Tables 9 and 10 of the NHBC Standards Chapter 4.2 (2010), however excavations for any proposed basement structure will penetrate and remove any desiccated clays.

Soil Gas Monitoring

The monitoring of soil gasses (methane, carbon dioxide and oxygen) within the standpipe installed within borehole WS1, was undertaken on 3rd February 2015. The results of the monitoring are summarised in Table 2 below.

Table 2: Summary of Gas Monitoring Data

Hole Location	No. Visits	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Flow (l/hr)	Water Level (mbgl)	Atmospheric Pressure (mb)
WS1	1	<0.1	0.4	17.3	<0.1	5.23	1004

The results of the soil gas monitoring of the installation indicated less than 0.1% by volume methane and a maximum 0.4% by volume carbon dioxide, recorded during the monitoring visit. The in-situ measurements recorded a gas emission rate of less than 0.1l/hr.

Using a flow rate of 0.1l/hr, the detection limit of the equipment used, these in-situ measurements indicate a gas screening value (GSV) of 0.0004l/h. This GSV falls within the modified Wilson and Card Characteristic Situation 1 or 'Green' classification of the NHBC traffic light system, as defined by the Construction Industry Research and Information Association, CIRIA Report C665, 'Assessing risks posed by hazardous ground gasses to buildings'. These results indicate no gas precautions measures are necessary.

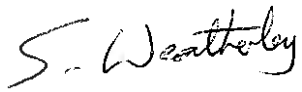
Sulphate Conditions

Sulphate analysis of selected samples of soil yielded soluble sulphate concentrations within Design Sulphate Classes DS-1, DS-2, DS-3 and DS-4, of the BRE Special Digest 1, Table C2 (2005), presented in Appendix 1. The pH results of samples ranged between 7.5 and 7.7, indicating alkaline conditions.

The London Clay Formation commonly contains sulphides, such as pyrite, and so following oxidation, after disturbance during excavation for the basement or foundations, there may be an increased total potential sulphate content. There was no visual evidence of pyrite in the London Clay.

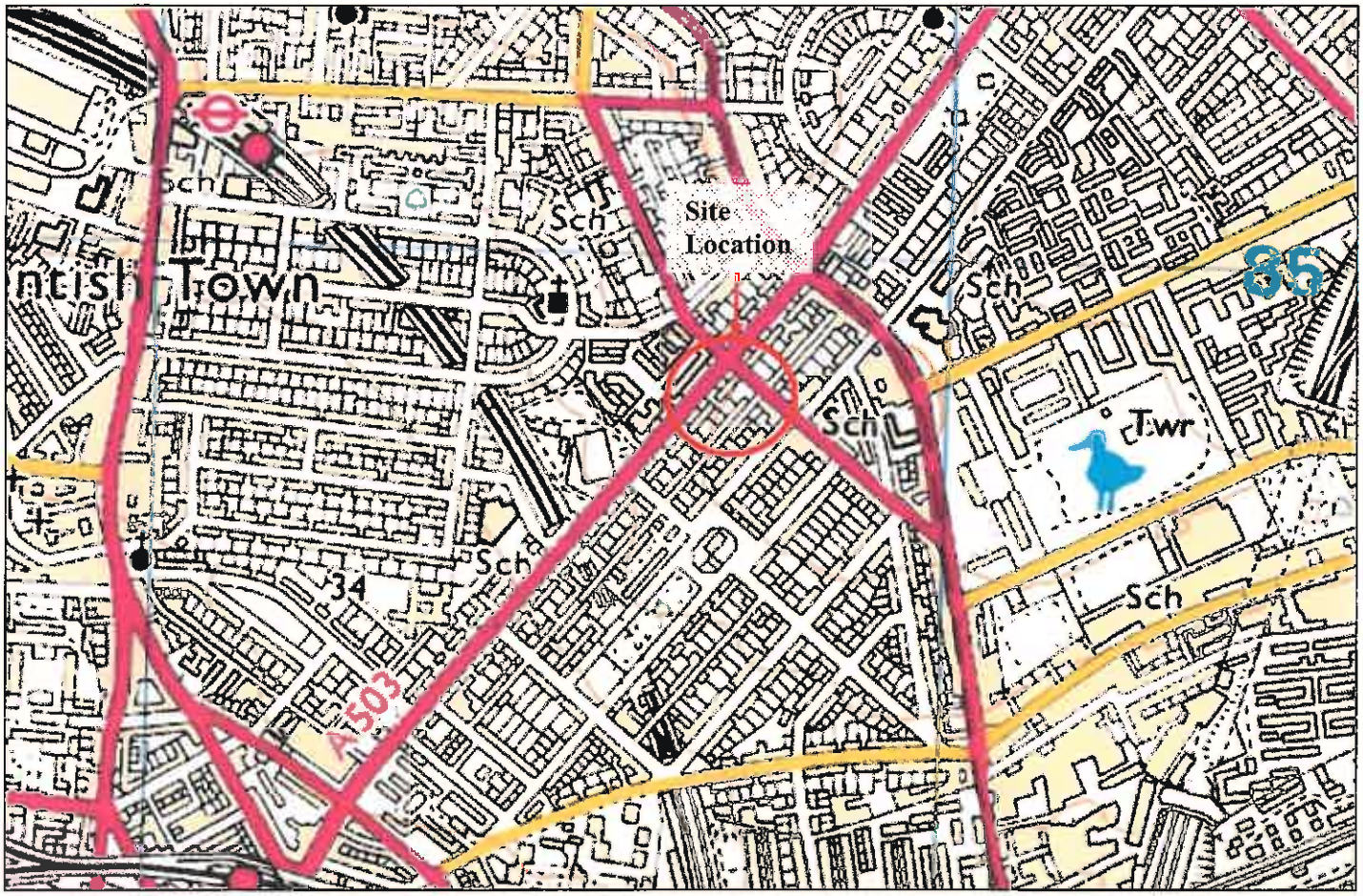
These results indicate an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-4 for buried concrete in shallow foundations. These ACEC Classes should be considered when specifying a Design Chemical Class (DC Class) for buried concrete on this site, as detailed in the above cited BRE document.

GROUND ENGINEERING LIMITED



S. WEATHERLEY	**C. M. J. EBELING**
B.Eng.(Hons.),	**M.Sc.(Eng.), M.A.E.G.,**
C.Geol., F.G.S.,	**C.Geol., F.G.S.,**
Senior Geo-Environmental Engineer	**Director**

Site Location Plan

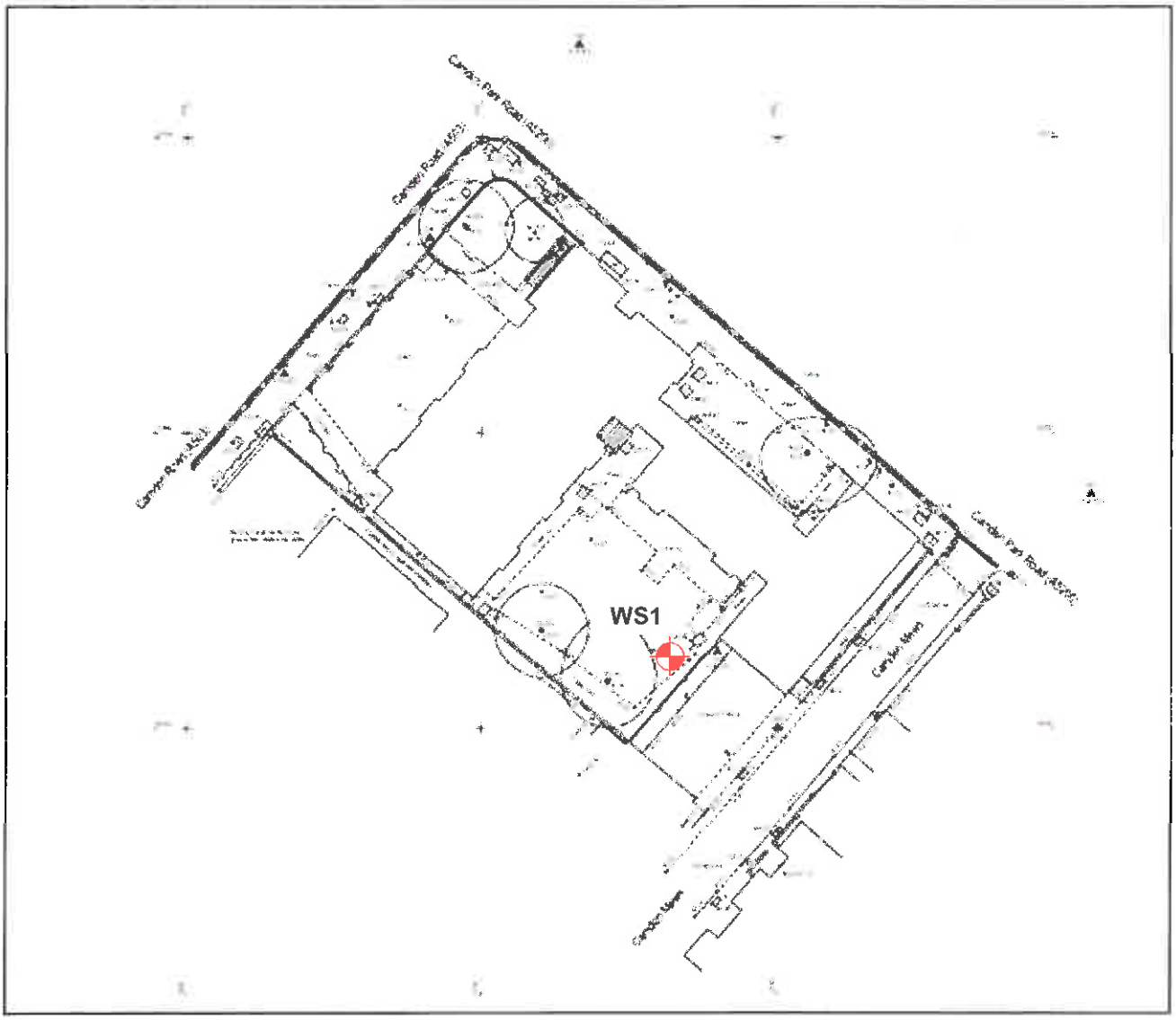


Not To Scale

Project : Ashton Court, Camden Road, London NW1 **Client : Origin Housing Developments Limited**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No.** **C13480**

Exploratory Hole Location Plan

Plan provided by Robert Lombardelli Partnership Limited



Project : Ashton Court, Camden Road, London NW1 **Client : Origin Housing Developments Limited**	**GROUND ENGINEERING LIMITED** Peterborough Tel : 01733 566566	**Project No. C13480**

GROUND ENGINEERING LIMITED

Tel: 01733-566566
www.groundengineering.co.uk

Site: **ASHTON COURT, CAMDEN ROAD, LONDON NW1**

WINDOW SAMPLE WS1

Date: 14/01/15

Hole Size: 87mm dia to 2.00m
77mm dia to 5.00m
57mm dia to 10.00m

Ground Level:

Samples and in-situ Tests			(Date) Water	Inst.	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result						
0.30	D1				MADE GROUND - Yellow brown and brown, gravelly SAND. Gravel is angular and sub-angular flint, limestone and wood.		0.50	
0.60	D2				MADE GROUND - Very stiff, dark brown and grey, sandy, gravelly CLAY. Gravel is very angular to sub-rounded flint, brick, concrete, asphalt, chaik and shell fragments.		1.10	
0.90	D3							
0.90	V1	(110)						
1.20	D4				MADE GROUND - Firm, brown and dark brown, slightly sandy, slightly gravelly CLAY. Gravel is angular to sub-rounded flint, ash and brick fragments.		1.50	
1.50	D5							
1.80	V2	(130+)			Stiff, closely fissured to firm, brown, orange brown and grey mottled CLAY with partings of sand.			
1.80-2.00	U1A							
2.20	D6							
2.50	D7							
2.50	V3	(117)						
2.60-2.90	U2A							
2.90	V4	(108)						
3.10	D8							
3.10	V5	(116)						
3.40	D9							
3.40	V6	(110)						
3.60-3.90	U3A				...Selenite crystals below 3.90m depth.			
3.90	V7	(108)						
4.20	D10							
4.20	V8	(104)						
4.50	D11							
4.50	V9	(117)						
4.70-5.00	U4A							
					(LONDON CLAY)			
5.20	D12		▼s					
5.20	V10	(130+)						
5.50	D13							
5.50	V11	(130+)						
5.80-6.00	U5A							
5.80	V12	(125)						
6.00-7.00	U6							
6.20	V13	(126)						
6.40	V14	(120)						
6.70	V15	(130+)					7.00	
				BENEATH INSTALLATION	Stiff, closely fissured, grey CLAY with selenite crystals.			
7.50	V16	(130+)		BENEATH INSTALLATION				
7.80-8.00	U7A			BENEATH INSTALLATION				
				BENEATH INSTALLATION	(LONDON CLAY)			
8.80-9.00	U8A			BENEATH INSTALLATION				
				BENEATH INSTALLATION				
9.80-10.00	U9A			BENEATH INSTALLATION			10.00	

REMARKS

Borehole completed at 10.00m depth

1. Starter pit excavated from GL to 1.20m depth
2. Live roots observed to 4.00m depth
3. Gas monitoring standpipe installed to 7.00m depth

Project No 13480

Scale 1:50 | Page 1/1

KEY

D - Disturbed Sample
B - Bulk Sample
U - Undisturbed Sample
W - Water Sample
▽ Water Strike
▼ Depth to Water on completion
J - Jar Sample
M - Mackintosh Probe
V - Vane Shear Test Cohesion ( ) kPa
P( ) - Hand Penetrometer Cohesion ( ) kPa
▼s Standpipe Level

Groundwater Strikes

No	Depth m Struck	Rose to	Rate	Cased	Sealed

Groundwater Observations

Date	Depth m Hole	Casing	Water
14/01/15	10.00	1.00	dry
03/02/15	7.00		5.23

Gas Monitoring Record

Site: **Ashton Court, Camden Road, London NW1**

Report Ref: **C13480**

Date	Borehole No.	Methane (% v/v)		Methane LEL %	Carbon Dioxide (% v/v)		Oxygen (% v/v)		Flow Rate (l/hr)	Atmospheric Pressure (mb)	Depth of Well (mbgl)	Depth to Groundwater (mbgl)
		Peak	Steady		Peak	Steady	Min.	Max.				
03/02/15	WS1	<0.1	<0.1	<0.1	0.4	0.4	17.3	17.3	<0.1	1004	7.00	5.23

LEL – Lower Explosive Limit

LABORATORY TEST RESULTS

CONTRACT ASHTON COURT, CAMDEN ROAD, LONDON NW1

Bore-hole	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO_4)				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m^3	Dry Mg/m^3	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil: Total % Dry Wt.	Soil: Aqueous Extract mg/l	Water mg/l	pH	
WS1	D4	1.20				30												
	D5	1.50				27									424		7.7	
	U1A	1.80 - 2.00	81	24	57	25	2.04	1.64	Q	334	50	167	0					SOIL CLASSIFICATION = CV 2% retained on 425μm sieve
	D6	2.20				24												
	D7	2.50				26												
	U2A	2.60 - 2.90				30	1.97	1.51	Q	159	50	80	0		1285		7.7	
	D8	3.10				28												
	D9	3.40				29												
	U3A	3.60 - 3.90				32	1.99	1.51	Q	128	60	64	0		2508		7.5	
	D10	4.20				31												
	D11	4.50				29												
	U4A	4.70 - 5.00				32	1.88	1.42	Q	156	80	78	0					
	D12	5.20				29												

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

13480

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LABORATORY TEST RESULTS

CONTRACT ASHTON COURT, CAMDEN ROAD, LONDON NW1

Bore-hole	Sample	Depth m	Classification				Density		Triaxial Compression					Sulphates (SO_4)				Remarks
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Moisture Content %	Bulk Mg/m^3	Dry Mg/m^3	Type	Principal Stress Difference kPa	Cell Pressure kPa	Shear Strength kPa	Angle of Shear Resistance degrees	Soil: Total % Dry Wt.	Soil: Aqueous Extract mg/l	Water mg/l	pH	
WS1	D13	5.50				28									3014		7.5	
	U5A	5.80 - 6.00				30	1.91	1.47	Q	180	100	90	0					
	U7A	7.80 - 8.00				28	1.92	1.50	Q	243	130	122	0					
	U8A	8.80 - 9.00				29	2.01	1.56	Q	256	150	126	0					
	U9A	9.80 - 10.00				30	1.97	1.52	Q	260	170	130	0					

U - UNDISTURBED SAMPLE
D - DISTURBED SAMPLE
B - BULK SAMPLE
W - WATER SAMPLE

C.U. - CONSOLIDATED UNDRAINED
C.D. - CONSOLIDATED DRAINED
Q. - IMMEDIATE UNDRAINED
Q.M. - IMMEDIATE UNDRAINED MULTISTAGE

Aqueous Extract 2:1 Water:Soil

13480

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GROUND ENGINEERING

Newark Road Peterborough

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e: admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 : Part 5 1990)

Client:	Ground Engineering Ltd	Certificate Number:	PL4884-1-6/731
Client Address:	Newark Road	Client Reference Number:	C13480
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	21.01.2015
Postcode:	PE1 5UA	Date Tested:	22.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name:	Ashton Court	Certificate of Sampling:	N/A
Site Address:	London NW1	Sampled By:	Client

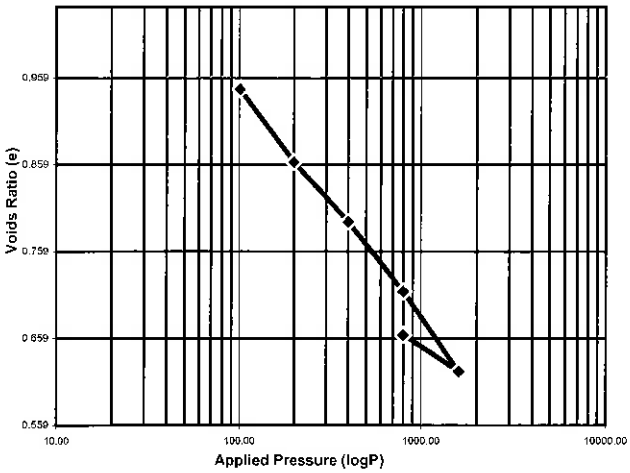
Test Details

Location:	WS1	
Sample Ref:	U2A	
Sample Description:	Stiff brown orange brown grey slightly silty CLAY	
Particle Density (Mg/m^3):	2.74	Assumed
Mean Lab Temp. (^{o}C):	22	
Variations from Standard:	None	
Lab Reference:	PL4884-1-6	
Depth (m):	2.90 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.95	16.19
Bulk Density (Mg/m^3):	1.85	2.11
Moisture Content (%):	31	28
Dry Density (Mg/m^3):	1.41	1.65
Voids Ratio:	0.946	0.663
Degree of Saturation (%):	91.2	116.0
Diameter (mm):	75.03	N/A
Swelling Pressure (kPa):	101	N/A
Method of time fitting used:	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m^2/MN)	Coefficient of Consolidation c_v (m^2/year)
101		
200	0.44	0.19
400	0.19	0.17
800	0.11	0.15
1600	0.07	0.22
800	0.03	---

Comments:

Approved Signatory: [x] M.Hartnup - Laboratory Manager
[ ] L.Petch - Team Leader

Signed:

for and on behalf of Ground Engineering Ltd

Date Reported: 02/02/2015

Registered in England Wales
Reg Number 6929574
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5UA

GROUND ENGINEERING

Newark Road Peterborough

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e: admin@groundengineering.co.uk

TEST CERTIFICATE

One-Dimensional Consolidation Properties

(Tested in accordance with BS1377 : Part 5 1990)

Client:	Ground Engineering Ltd	Certificate Number:	PL4884-1-9/731
Client Address:	Newark Road	Client Reference Number:	C13480
	Peterborough	Date Sampled:	Unknown
	Cambridgeshire	Date Received:	21.01.2015
Postcode:	PE1 5UA	Date Tested:	21.01.2015
Contact:	Simon Weatherley	Sampling Certificate No:	N/A
Site Name:	Ashton Court	Certificate of Sampling:	N/A
Site Address:	London NW1	Sampled By:	Client

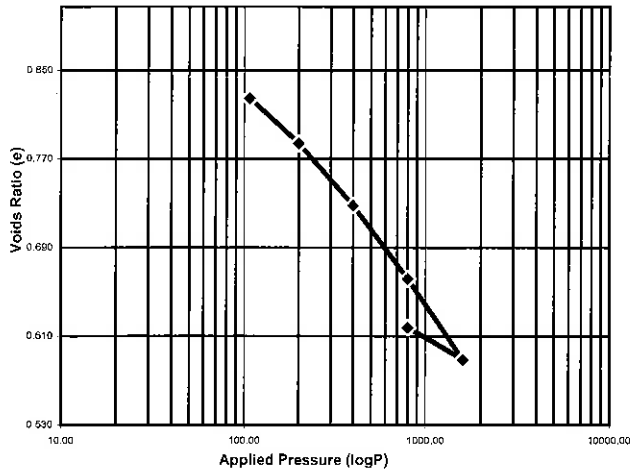
Test Details

Location:	WS1	
Sample Ref:	U3A	
Sample Description:	Stiff brown orange brown grey slightly silty CLAY	
Particle Density (Mg/m^3):	2.74	Assumed
Mean Lab Temp. (^{o}C):	22	
Variations from Standard:	None	
Lab Reference:	PL4884-1-9	
Depth (m):	3.90 m	

Specimen Details

	INITIAL	FINAL
Height (mm):	18.52	16.42
Bulk Density (Mg/m^3):	2.00	2.17
Moisture Content (%):	33	28
Dry Density (Mg/m^3):	1.50	1.69
Voids Ratio:	0.825	0.618
Degree of Saturation (%):	111.0	124.7
Diameter (mm):	50.00	N/A
Swelling Pressure (kPa):	107	N/A
Method of time fitting used:	Log Time	N/A

Voids Ratio against logarithm of Applied Pressure



Applied Pressure (kPa)	Coefficient of Compressibility m_v (m^2/MN)	Coefficient of Consolidation c_v (m^2/year)
107		
200	0.24	0.25
400	0.16	0.25
800	0.10	0.23
1600	0.06	0.22
800	0.02	---

Comments:

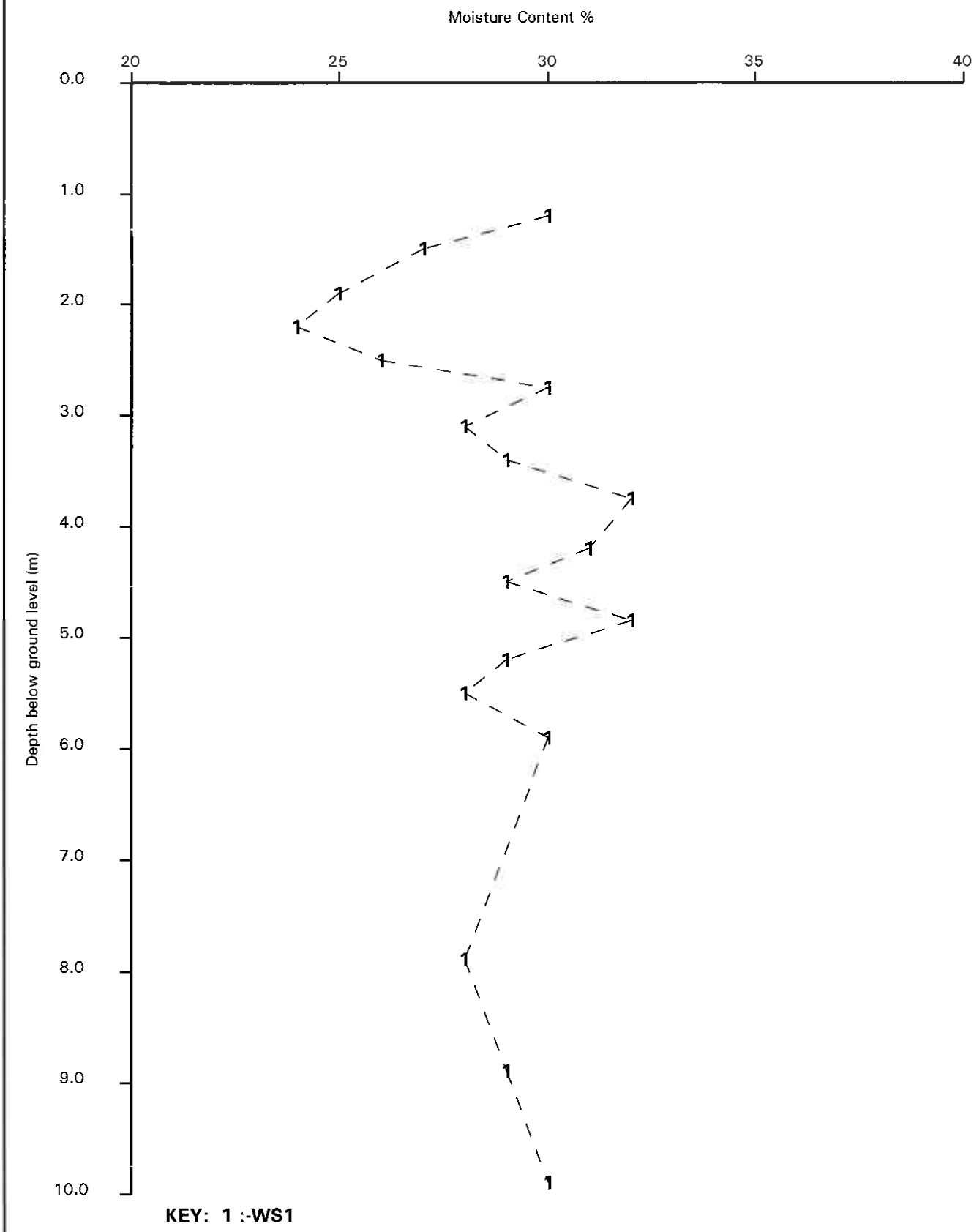
Approved Signatory: [x] M.Hartnup - Laboratory Manager
[ ] L.Petch - Team Leader

Signed:

for and on behalf of Ground Engineering Ltd

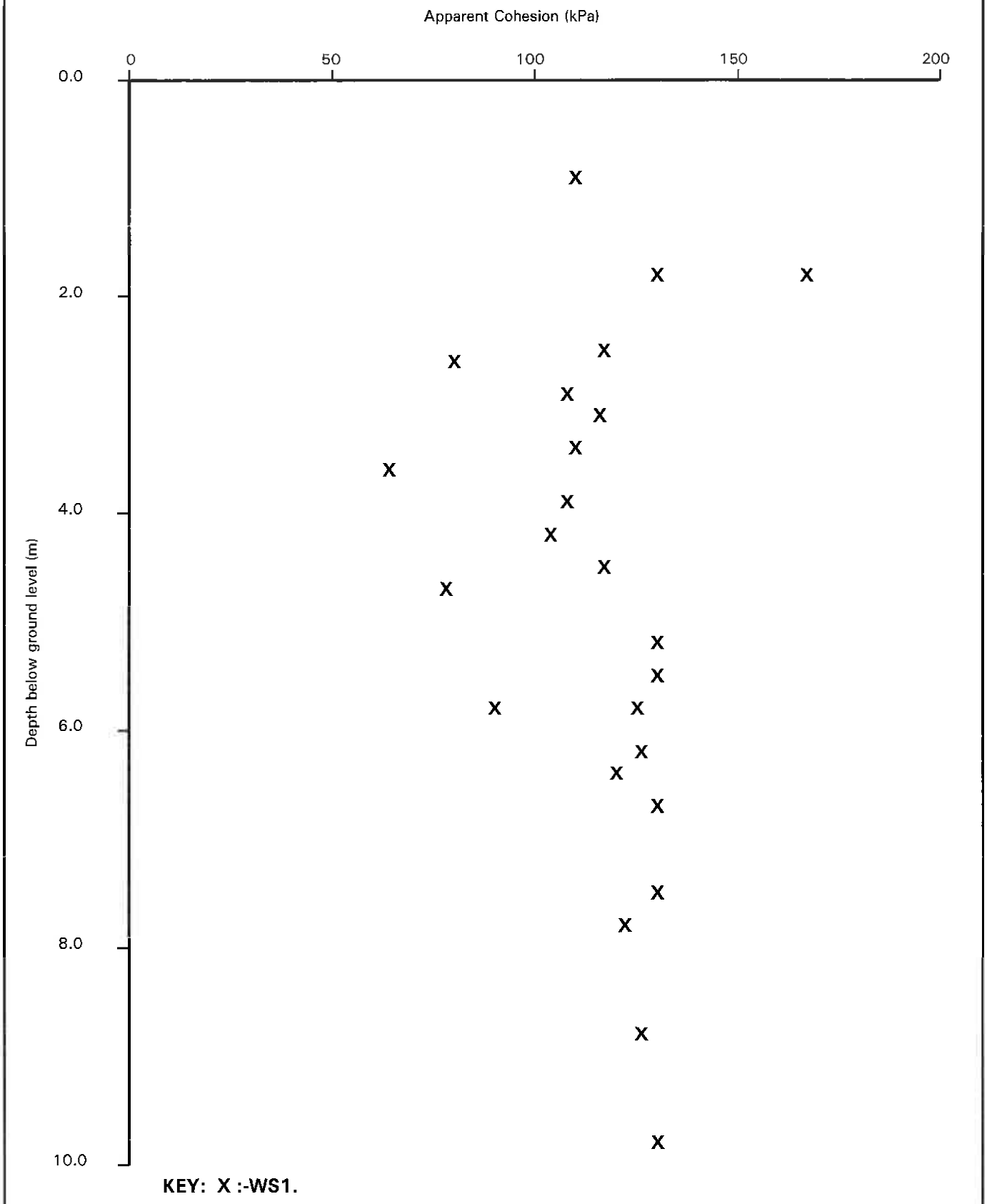
Date Reported: 02/02/2015

Registered in England Wales
Reg Number 6929574
Reg Office: Ground Engineering Ltd
Newark Rd
Peterborough PE1 5UA



Moisture Content % vs Depth below ground level (m).

SITE	ASHTON COURT, CAMDEN ROAD, LONDON NW1	
CLIENT	ORIGIN HOUSING DEVELOPMENT LIMITED	Contract Number 13480
GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk	Date 12/03/15	Figure 1



Apparent Cohesion (kPa) vs Depth below ground level (m).

SITE	ASHTON COURT, CAMDEN ROAD, LONDON NW1	
CLIENT	ORIGIN HOUSING DEVELOPMENTS LIMITED	Contract Number 13480
GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk	Date 12/03/15	Figure 2

APPENDIX 1

CLASSIFICATION OF AGGRESSIVE CHEMICAL ENVIRONMENT FOR BURIED CONCRETE

TABLE C2 – AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR BROWNFIELD LOCATIONS[a]

Table C2 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations

Sulfate and magnesium						Groundwater		ACEC
Design Sulfate Class for location	2:1 water/soil extract[b]		Groundwater		Total potential sulfate[c]	Static water	Mobile water	Class for location
1	2 (SO_4 mg/l)	3 (Mg mg/l)	4 (SO_4 mg/l)	5 (Mg mg/l)	6 (SO_4 %)	7 (pH)[d]	8 (pH)[d]	9
DS-1	< 500		< 400		< 0.24	≥ 2.5		AC-1s
							> 6.5[d]	AC-1
							5.5–6.5	AC-2z
							4.5–5.5	AC-3z
							2.5–4.5	AC-4z
DS-2	500–1500		400–1400		0.24–0.6	> 5.5		AC-1s
							> 6.5	AC-2
						2.5–5.5		AC-2s
							5.5–6.5	AC-3z
							4.5–5.5	AC-4z
							2.5–5.5	AC-5z
DS-3	1600–3000		1500–3000		0.7–1.2	> 5.5		AC-2s
							> 6.5	AC-3
						2.5–5.5		AC-3s
							5.5–6.5	AC-4
							2.5–5.5	AC-5
DS-4	3100–6000	≤ 1200	3100–6000	≤ 1000	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4
						2.5–5.5		AC-4s
							2.5–6.5	AC-5
DS-4m	3100–6000	> 1200[e]	3100–6000	> 1000[e]	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4m
						2.5–5.5		AC-4ms
							2.5–6.5	AC-5m
DS-5	> 6000	≤ 1200	> 6000	≤ 1000	> 2.4	> 5.5		AC-4s
						2.5–5.5	≥ 2.5	AC-5
DS-5m	> 6000	> 1200[e]	> 6000	> 1000[e]	> 2.4	> 5.5		AC-4ms
						2.5–5.5	≥ 2.5	AC-5m

Notes

a Brownfield locations are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).

b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered from previous Digests (Box C7).

c Applies only to locations where concrete will be exposed to sulfate ions (SO_4), which may result from the oxidation of sulfides such as pyrite, following ground disturbance (Appendix A1 and Box C8).

d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).

e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000 mg/l and 17 000 mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class

- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' have primarily to resist acid conditions and may be made with any of the cements in Table D2 on page 42.
- Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

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Site: **ASHTON COURT, CAMDEN ROAD, LONDON NW1**

TRIAL PIT TP1

Date: 29/04/15 to 01/05/15

Pit Size: 1.80m L x 0.80m W x 1.20m D.

Ground Level:

Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.20	D1			MADE GROUND - Soft, locally firm, dark brown, slightly sandy, slightly gravelly, silty CLAY with occasional cobbles of brick and concrete. Gravel is brick, concrete, flint, plastic, wood, clay pipe and mortar fragments.			
0.20	ES1					0.50	
0.55	D2			MADE GROUND - Light brown and brown, gravelly, silty SAND with occasional cobbles of brick, mortar and concrete. Gravel is flint, brick and ceramic tile fragments.			
0.55	ES2						
0.80	ES3A						
	ES3B						
0.80	D3A						
	D3B					1.20	
1.20	ES4						
1.20	D4			Pit completed at 1.20m depth			

KEY

- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- J - Jar Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS

1. Live roots observed to 0.65m depth
2. Pit sides stable
3. Pit dry
4. Pit probed down to 1.70m depth with bar in made ground
5. Probing beneath boundary wall found head deposit clay below 0.60m depth
6. ES = Environmental Sample

Project No	
13480A	
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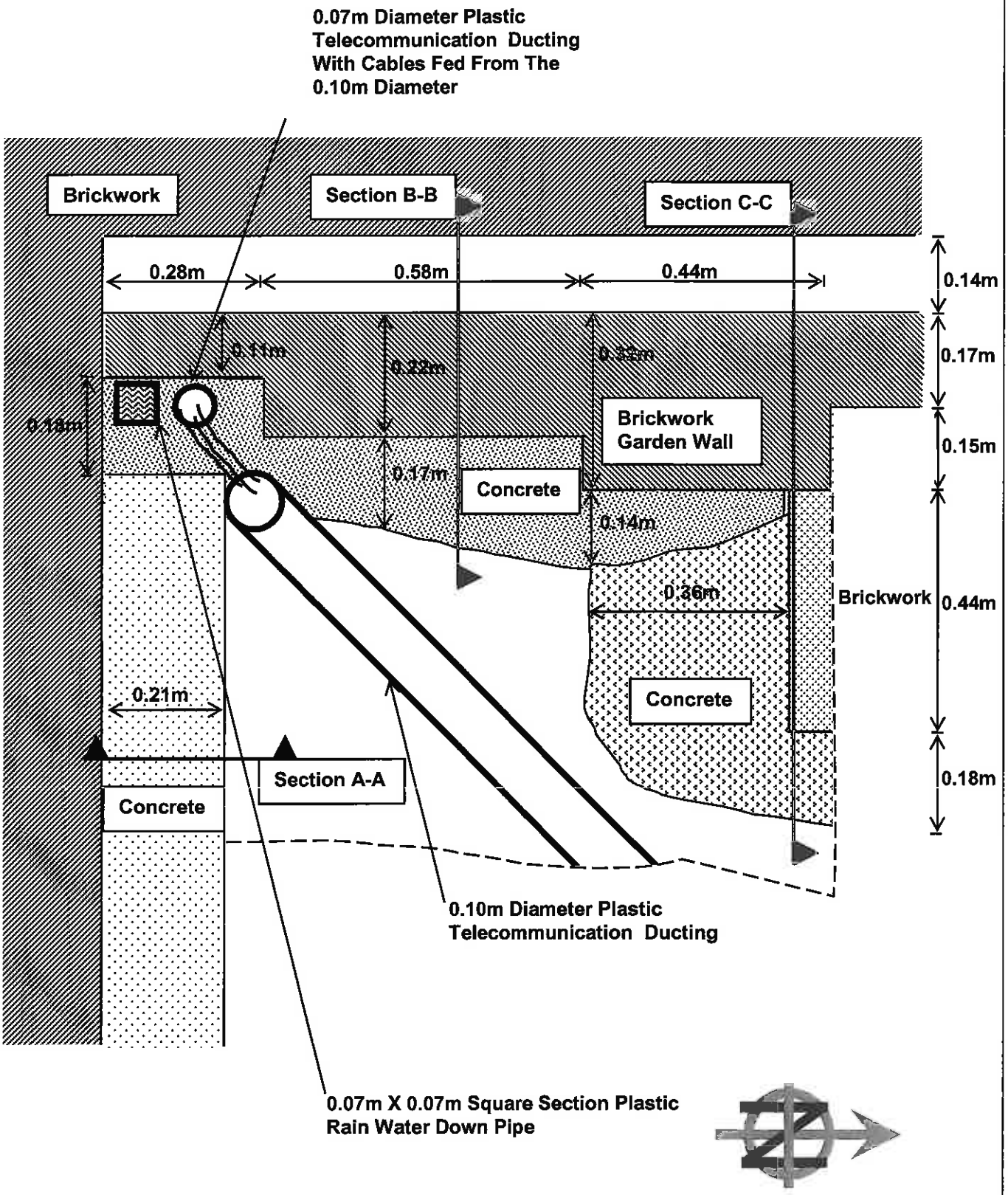
Trial Pit TP1
Plan



Not To Scale

Project : Ashton Court, Camden Road, London NW1 Client : Origin Housing Development Ltd.	GROUND ENGINEERING LIMITED Peterborough Tel : 01733 566566	Project No. C13480A