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Basement Impact Assessment: Hydrology and Geology Report

at
Flat 1, 28 John Street, Camden, London WC1N 2ES

for
Gideon Barnett

Reference: 15616/BIA_Rev1.04
September 2016

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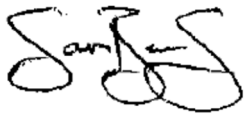

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

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

Commission

Gideon Barnett commissioned Soils Limited to undertake a Basement Impact Assessment (BIA): Hydrology and Geology Report on land at Flat 1, 28 John Street, Camden, London WC1N 2ES. The scope of the investigation was outlined in the Soils Limited quotation reference Q17466 dated 12th February 2016.

This document comprises the Basement Impact Assessment and incorporates the results, discussion and conclusions.

Standards

The site works were undertaken in accordance with the following standards:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7
- BS EN ISO 14688-1:2002+A1:2013
- BS EN ISO 14688-2:2004+A1:2013

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

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

The chemical analyses were undertaken by QTS Environmental Limited in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

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

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Section 1 Introduction

1.1 Objective of Investigation

Gideon Barnett commissioned Soils Limited to undertake a Basement Impact Assessment Hydrology and Geology Report. The objective of this investigation was to establish the impact and risk of the proposed basement at Flat 1, 28 John Street, Camden, London WC1N 2ES.

The report provides details on the ground and groundwater conditions onsite and presents calculations to determine the potential impact of the proposed development on neighbouring properties. In addition, the report provides a qualitative risk assessment of the potential impacts the proposed development might have on groundwater levels, surface water flows and flooding.

It is recognised that any Basement Impact Assessment is a live document and that further detailed assessments will be ongoing, if appropriate, as the design and construction progresses.

1.2 Limitations and Disclaimers

Gideon Barnett commissioned Soils Limited to undertake a Basement Impact Assessment Hydrology and Geology Report to supply a risk based impact assessment with regard to hydrology, hydrogeology and land stability.

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

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

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

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

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 to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Section 2 Site Context

2.1 Location

The site was located at Flat 1, 28 John Street, Camden, London WC1N 2ES. The approximate O.S Land Ranger Grid Reference was TQ 308 820.

The site location plan is given in Figure 1.

2.2 Site Details

The site comprised a residential property forming the ground floor and basement of a five-storey building. The property was of brick construction, with a small courtyard open to the front aspect at basement level, accessed via steps directly from John Street. Four vaults were accessible from the courtyard area, being located under the existing pavement of John Street. The building was an end of terrace property with adjoining property to the north (right, looking from John Street) and Northington Street immediately to the south. The surrounding area was predominately residential with a school and occasional commercial and industrial land-use interspersed.

The site was fully occupied by the property and did not include any areas of soft landscaping. A single semi-mature tree (5-6m height) was noted to front of the property, within the pavement of John Street.

2.2.1 Site History

Historical maps available online (oldmapsonline.org, accessed September 2016) suggest the site was open fields in 1794, although nearby areas were developed, with housing noted immediately south and east. Other land uses noted at this time included ‘Foundling Hospital’ and adjacent ‘Burying Grounds’, located approximately 300m north of the site.

In 1854 the site is shown to be developed along with the surrounding areas as housing. Whilst the exact layout of the property on site is not clear on this map, the OS London Map of 1893-96 does show the footprint of the property to be very similar to that of today.

In summary, the site appears to have remained undeveloped until the current property was built on it in the first half of the 19th century, with only minor changes to the footprint noted since. The immediate surrounding area also appears to be predominately residential.

2.3 Proposed Development

The proposed redevelopment is to comprise the lowering of the existing vaults beneath the John Street pavement and adjoin to the basement of the property via the courtyard area to the front aspect of the property. Vault 4 is to be lowered by 1.00m and vaults 1 to

3 by 2.40m, with basement formation level proposed at ~2.80m below the existing vault floor. The southern half of the courtyard will remain to act as a lightwell to both basement and vaults.

The existing and proposed plans showed no areas of soft landscaping.

In compiling this report reliance was placed on a series of architectural drawings, numbers 20 100-104 and 30 100-106, dated February 2016 and prepared by P-U-R-A Ltd. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

The proposed development layout as provided by the client is included in Appendix D.

2.4 Topography

The site was flat-lying at a level of approximately 20m AOD, with the wider topography sloping at a shallow gradient downward in a northeast direction, with an average gradient of <1°.

2.5 Published Geological Data

The 1:50,000 BGS map showed the site to be located on bedrock of the London Clay Formation with overlying superficial geology of the Lynch Hill Gravel Member.

The soils of the Lambeth Group were underlying the London Clay Formation, with the Thanet Sand Formation below and the Lewes Nodular, Seaford and Newhaven Chalk Formation underlying that, likely to be recorded at a depth of approximately 75m bgl.

2.5.1 Lynch Hill Gravel Member

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

The Lynch Hill Gravel approximates to the third level terrace gravel. The composition of the River Terrace Gravel varies greatly, depending on the source material available in the river's catchment. Deposits generally consist of sand and gravel of roughly bedded flint or chert gravel commonly in a matrix of silt and clay.

2.5.2 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, and precautions against sulphate attack to concrete are sometimes required.

The lowest part of the formation, known as the Harwich Formation (formerly the Basement Beds), comprises sandy beds with black rounded gravel and occasional layers of sandstone.

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

2.5.3 Lambeth Group

The Lambeth Group, formerly known as the Woolwich and Reading Beds, occurs in the London and Hampshire Basins, where it directly overlies the Chalk or Thanet Sand Formation, and is succeeded by the Harwich and London Clay Formation. Although generally less than 50 metres thick, its lithological variability and position beneath much of London has concerned tunnelling engineers since the early 19th century.
The relationship between the different depositional environments is seen in central and south-east London, where deposits of fine-grained sand, flint gravel beds, mottled clay, shell beds and altered beds form a complex interdigitating sequence, which is divided into three formations and several informal lithological units.

2.6 Unpublished Geology

The British Geological Survey website was reviewed for further details on local geology. A borehole record (BGS Ref: TQ38SW143) was drilled directly to the front of the site to a depth of 6.39m below ground level (bgl). The borehole recorded an underlying basement to a depth of 3.35m bgl, with underlying ground conditions comprising Made Ground to a depth of 5.48m bgl, underlain by loamy sand and gravel to the base of the borehole, at 6.39m bgl, likely to represent the Lynch Hill Gravel Member.

2.6.1 Groundwater

Groundwater was not recorded on the log of the BGS borehole to a maximum drilled depth of 6.39m bgl.

Groundwater levels are typically at their annual maximum (i.e. highest) elevation around March and minimum (i.e. lowest) around September.

2.7 Hydrology

The nearest surface water feature was the River Thames, recorded ~1.28km to south of the site.

The site was recorded at an elevation of approximately 20m AOD, and the River Thames was at approximately 1m AOD.

2.8 Hydrogeology

The hydrogeological regime consists of a deep aquifer and a variable shallow aquifer. The deep aquifer comprises the Chalk and the basal sands (Thanet Sand Formation and the Upnor Formation of the Lambeth Group). The shallow aquifer comprises the River Terrace Deposits. In the site area the two aquifers are separated by an aquiclude consisting of the low permeability units of the Lambeth Group and the overlying London Clay Formation.

The Environment Agency has produced an aquifer designation system consistent with the requirements of the Water Framework Directive. The designations have been set for superficial and bedrock geology and are based on the importance of aquifers for potable water supply and their role in supporting water bodies and wetland ecosystems.

Information presented by the Environment Agency classifies the Lynch Hill Gravel Member as Secondary A Aquifer and would be able to support water supplies at a local rather than strategic scale, therefore acting as a “shallow” groundwater body.

The London Clay Formation bedrock is classified as an unproductive stratum.

Any water infiltrating the London Clay Formation will generally tend to flow vertically downwards at a very slow rate. Due to the predominantly cohesive nature of the soils, the groundwater flow rate will be very slow. Published permeability data for the London Clay Formation indicates the horizontal permeability to generally range between 10^{-10}m/s and 10^{-8}m/s, with an even lower vertical permeability.

The shallow aquifer was considered to be relevant to the proposed development and basement impact assessment.

The geological maps showed the site to be located directly on the soils of the Lynch Hill Gravel Member, with shallow groundwater anticipated to be perched within. The clayey silty SAND and GRAVEL of the Lynch Hill Gravel Member would typically have permeability between of 10^{-4} m/s to 10^{-6} m/s.

2.9 Flood Risk

The site does not lie within a flood risk zone. The EA also notes the presence of very low surface water flood risks associated with drainage in the area. A zone of extreme flooding is located approximately 1km south of the site. The source of the flooding is the River Thames located at its nearest point approximately 1.28km to the south

2.10 Underground Infrastructure

There is no known information with regards to buried infrastructure in close proximity to the site.

There are no reported Network Rail or London Underground Limited assets within the site's vicinity.

2.11 Radon Gas

The site was not situated within an area where protection or risk assessment against the ingress of radon was required. No radon protection measures will need to be installed within the proposed new development. It is not possible in the course of a survey or inspection to determine whether radon gas is present as the gas is colourless and odourless. Tests can be undertaken to assess the concentration of radon in existing structures.

Section 3 Screening

3.1 Introduction

The Ove Arup 2008 Scoping Study prepared for the London Borough of Camden requires that any development proposal that includes a subterranean basement should be screened to determine whether or not a full BIA is required.

A number of screening tools are included in the Arup document (Ref: Camden geological, hydrogeological and hydrological study, Issue01/November 2010), which includes a series of questions within a screening flowchart for three categories; surface water flow, groundwater flow and land stability. Responses to the questions are tabulated below.

3.2 Surface Flow and Flooding Screening Assessment

The response to the Surface Flow and Flood Screening Assessment is given in Table 3.1.

Table 3.1 – Surface Flow and Flooding Screening

Question	Response
1. Is the site within the catchment of the pond chains of Hampstead Heath?	**No** – The site is not in the catchment of the pond chains of Hampstead Heath.
2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	**No** – Drainage will be taken to combined sewers in public highway.
3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	**No** – Overall proportions of hard standing would not change as the site is already surfaced entirely by hardstanding.
4. Will the proposed basement development result in changes to the profile of the inflows (instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?	**No** – Overall proportions of hard standing would not change so surface water inflow profiles will not be altered.
5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No** – Overall proportions of hard standing would not significantly change. Additionally, there were no Surface Water Features within a radius of 200m, which could be affected by the development.
6. Is the site in an area known to be at risk from surface water flooding?	**No** – Environment Agency maps show the site be at no risk from flooding.

3.3 Subterranean (Groundwater) Screening Assessment

The response to the Subterranean (Groundwater) Screening Assessment is given in Table 3.2.

Table 3.2 – Subterranean (Groundwater) Screening

Question	Response
1a. Is the site located directly above an aquifer?	**Yes** – Geological maps show the site located on the Lynch Hill Gravel Member, which is classed as a Secondary 'A' Aquifer.
1b. Will the proposed basement extend beneath the water table surface?	**Unknown** – This will need to be confirmed by a ground investigation, as locally shallow groundwater could be present within the Lynch Hill Gravel Member. The nearby BGS borehole suggests greater than 6m depth.
2. Is the site within 100 m of a watercourse, well (used/ disused) or potential spring line?	**No** – The nearest Surface Water Feature, the River Thames is located ~1.28km to the south of the site.
3. Is the site within the catchment of the pond chains of Hampstead Heath?	**No** – The site is not in the catchment of the pond chains of Hampstead Heath.
4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	**No** – Overall proportions of hard standing would not change as the site is already surfaced entirely by hardstanding.
5. As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	**No** – Proportion of hard surfaced / paved areas are to remain similar and no soakaway or permeable surfacing planned.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than, the mean water level in any local pond or spring line?	**No** – The nearest Surface Water Feature, the River Thames is located ~1.28km to the south of the site at an elevation of approximately 1m AOD. The site is situated at an elevation of approximately 20m AOD.

3.4 Stability Screening Assessment

The response to the Stability Screening Assessment is given in Table 3.3.

Table 3.3 – Stability Screening

Question	Response
1. Does the existing site include slopes, natural or manmade, greater than 7°?	**No** – Site sloping in a north easterly direction by <1°.
2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7°?	**No** – The proposed basement will not alter the existing site landscaping elevations.
3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	**No** – The development is in a heavily built-up area with no significant slopes in the vicinity.

Question	Response
4. Is the site within a wider hillside setting in which the general slope is greater than 7°?	**No** – The development is in a heavily built-up area with no significant slopes in the vicinity.
5. Is the London Clay the shallowest strata at the site?	**No** – Lynch Hill Gravel Member is the shallowest strata.
6. Will any trees be felled as part of the proposed development and / or are any works proposed within any tree protection zones where trees are to be retained?	**No** – There are no trees on the actual development site, so no trees will be felled during the development.
7. Is there a history of seasonal shrink-swell subsidence in the local area and / or evidence of such effects at the site?	**No** – There was no history of seasonal shrink-swell subsidence in local area or visual evidence of subsidence at the site.
8. Is the site within 100 m of a watercourse or potential spring line?	**No** – The nearest Surface Water Feature, the River Thames is located ~1.28km south of the site.
9. Is the site within an area of previously worked ground?	**No** – The relevant geological map did not show any Made Ground or Worked Ground within or in close proximity to the site.
10. Is the site within an aquifer?	**Yes** – Geological maps show the site located on the Lynch Hill Gravel Member, which is classed as a Secondary 'A' Aquifer.
11. Is the site within 50 m of the Hampstead Heath ponds?	**No** – The site was not located within 50m of the Hampstead Heath ponds.
12. Is the site within 5 m of a highway or pedestrian right of way?	**Yes** – The site is located on the corner of John Street and Northington Street. The proposal involves deepening existing vaults underneath the pavement of John Street.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	**No** – The proposal involves deepening existing vaults underneath the pavement of John Street, which are assumed not to be adjacent to other properties.
14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	**Unknown** – but given its location this is considered unlikely**.**

3.5 Summary

Based on the screening exercise, further stages of the basement impact assessment are required. A summary of the basement impact assessment requirements has been provided in Table 3.4, Table 3.5 and Table 3.6.

Table 3.4 – Surface Flow and Flooding

Item	Description
	No issues were highlighted during the screening exercise with regard to surface flow and flooding.

Table 3.5 – Subterranean (Groundwater Flow)

Item	Description
Q1a.	Site shown to be underlain by a Secondary 'A' Aquifer associated with Lynch Hill Gravel Member.
Q1b.	Whether the basement will extend beneath the water table will be dependent on Q1a and ground investigation.

Table 3.6 – Ground Movement (Land stability)

Item	Description
Q10.	Site shown to be underlain by a Secondary 'A' Aquifer associated with Lynch Hill Gravel Member. Ground investigation to confirm.
Q12.	The proposed basement is located within 5m of John Street and Northington Street.
Q14.	Unknown whether tunnels may be present underlying the site, but considered unlikely.

Section 4 Intrusive Investigation

4.1 Ground Conditions

The scoping intrusive investigation was carried out on the 8th June 2016 and comprised one windowless sampler borehole (WS1) and five foundation exposures (FE1 to FE5), as agreed with the Client. A groundwater monitoring well was installed into the windowless sampler borehole, although its depth was limited by the ground conditions encountered.

This investigation was limited by accessibility to the site and the presence of underground services within the areas that were accessible. As a result, we were not able to carry out a dynamic probe test, as originally planned.

The trial hole locations are presented in Figure 3.

Table 4.1 outlines the depths of each trial-hole.

Table 4.1 – Investigatory Depths of Trial-holes

Trial-hole (WS/DP)	Final Depth (m bgl)	Trial-hole (FE)	Final Depth (m bgl)
WS1	2.65	FE3	0.24
FE1	0.24	FE4	0.18
FE2	0.24	FE5	0.15

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

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the *in-situ* weathering profile, it has been described as Topsoil both on the logs and within this report. Where the soil has, in general, been found to have the same composition as the 'Topsoil' but also incorporated a minor constituent, e.g. less than an estimated 5%, of possibly non-naturally occurring material, or is of uncertain origin, the soil has been described as Topsoil/Made Ground both on the log and within this report. Where man has clearly either placed the soil, or the composition has been altered to a degree greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the logs and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial-holes, in descending order, are:

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

*Please note the London Clay Formation was not encountered during the investigation.

Table 4.2 summarises the ground conditions encountered, based on WS1 only.

Table 4.2 – Ground Conditions

Stratum	Epoch	Depth Range (m bgl)		Thickness (m)	Description
		Top	Bottom		
MG	Recent	GL	2.40	2.40	Soft dark brown and grey sandy gravelly silty CLAY with fragments of brick, concrete, glass, plastic and porcelain. Gravel is fine and medium sub-angular flint.
LHGR	Wolstonian	2.40	2.65[1]	Not proven	Soft dark grey mottled olive green slightly gravelly sandy silty CLAY with occasional decomposed material and possible black hydrocarbon staining. Gravel is fine and medium sub-angular flint.
LCF	Ypresian				Not encountered.

Notes: [1]Base of trial hole

BGS borehole records (Ref: TQ38SW143) suggest the Made Ground was recorded to 2.13m below the 'basement level' and recorded loamy sand and gravel (Lynch Hill Gravel Member) to 0.91m below that. WS1 refused at 2.65m below basement level, indicative of very dense granular soils that are typical of the Lynch Hill Gravel Member. The above borehole record also stops at a similar depth, which suggests it potentially refused on dense ground as well.

4.1.1 Made Ground

Made Ground was encountered to a depth of 2.40m bgl and comprised soft dark brown and grey sandy gravelly silty CLAY with fragments of brick, concrete, glass, plastic and porcelain. Gravel is fine and medium sub-angular flint.

4.1.2 Lynch Hill Gravel Member

Soils described on the logs as Lynch Hill Gravel Member were found directly beneath the and comprised soft dark grey mottled olive green slightly gravelly sandy silty CLAY with occasional decomposed material and possible black hydrocarbon staining. Gravel is fine and medium sub-angular flint.

It should be noted that the soils of the Lynch Hill Gravel Member can vary significantly, but it is anticipated that the soils underlying those encountered would be granular (likely sandy GRAVEL), given the refusal of the borehole.

4.1.3 London Clay Formation

The London Clay Formation was not encountered during the investigation.

4.1.4 Roots

Roots were not encountered during the investigation.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

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

4.1.5 Groundwater

Groundwater equilibrium conditions may only be conclusively established if a series of observations are made via groundwater monitoring wells. A groundwater monitoring well was installed into the windowless sampler borehole to 2.65m bgl.

Groundwater was encountered during drilling at a depth of 1.20m bgl. It was also recorded during the subsequent monitoring undertaken on 27th June 2016 at a depth of 0.80m bgl. It is likely that this is shallow groundwater within granular horizons found in the Made Ground or the underlying Lynch Hill Gravel Member. Where these deposits are laterally extensive, the higher permeabilities may lead to substantial flows into excavations.

The intrusive investigation and monitoring visit were conducted in June (2016), when groundwater levels should be falling from their annual maximum (i.e. highest) elevation, which typically occurs around March.

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

4.2 Foundation Design

This intrusive investigation was limited by accessibility to the site and the presence of underground services within the areas that were accessible. As a result, we were not able to carry out a dynamic probe test and the windowless sampler borehole refused on hard ground at 2.65m below the existing basement floor level (within the courtyard area).

Given the underlying soils were from the Lynch Hill Gravel Member, it is considered likely that the WS refused on dense sands and gravels of this unit, although these materials were not recovered. These soils, if proven to be present, are likely to provide sufficient bearing capacity for the proposed development. A provisional bearing capacity of

200kPa "net" (BS 8004:1986) is considered suitable, although further assessment must be undertaken to confirm this. Given the current site constraints this may have to be undertaken during the development phase.

For the allowable bearing value given above, settlements **should not** exceed **25mm**, provided that excavation bases are carefully bottomed out and blinded, or concreted as soon after excavation as is possible and kept dry. Settlements may be taken as proportional to the applied foundation pressure for the given size of the foundations.

Special care **must** be taken during foundation excavation in order to establish that any soft/loose spots found within the soils are removed from the base of excavations.

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

The cohesive soils of the Lynch Hill Gravel Member that were recovered had a **low volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

The Lynch Hill Gravel Member is anticipated to be predominately granular. Whilst the soils recovered were cohesive, they are likely to represent a thin horizon at the top of the unit, which is typical of river terrace deposits. As such heave is unlikely to be an issue in respect of the Lynch Hill Gravel Member, subject to confirmation of thickness of the cohesive soils.

The London Clay Formation, which underlies the Lynch Hill Gravel Member, may be subject to heave, but its depth and properties would need to be ascertained to make this assessment. Heave will need to be considered where the depth of the London Clay Formation from founding level is less than four times the width of the proposed footing. I.e. for a strip footing of 0.75m width, if the London Clay Formation in encountered at a depth of less than 3m below founding level then heave precautions are likely to be required.

Based on the typical composition of the Lynch Hill Gravel Member (sandy gravels), a bulk density of 19kN/m^3 and an effective angle of shearing resistance of 36° can be adopted for design of lateral earth pressures on the basement walls, subject to confirmation of the ground conditions.

It is proposed to use an L-shaped reinforced concrete underpin acting as a retaining wall. Additional ground movement analysis will be required to account for the proposed foundation type, the soils and their associated properties, following additional investigation at the site.

4.2.1 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts fell into Class **DS-1** of the BRE Special Digest 1 2005, 'Concrete in Aggressive Ground'. Table C2 of the

Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-1**. The pH of the soils tested ranged between 7.6 and 7.7. The classification given was determined using the mobile groundwater case, in view of groundwater being encountered. The laboratory results are presented in Appendix B.3.

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 any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.3 Contamination Assessment

Two soil samples were selected and tested for a suite of contaminants, as requested by the Client, and detailed in Table 4.3. All chemical laboratory results are presented in Appendix C.

Table 4.3 Contaminant Testing Suite

Substance	Locations: Depths (m bgl)	
	TP1: 0.24	BH1: 0.50
Asbestos Screen	✓	✓
Total Phenols	✓	✓
Total Cyanide	✓	✓
Organic Matter	✓	✓
pH	✓	✓
Metals	✓	✓
Metalloids	✓	✓
Organics	✓	✓
PAHs	✓	✓

Notes: **metals**: Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, V. **metalloids**: As. **organics**: USEPA 16 speciated PAH, TPH-CWG (speciated TPH), BTEX. **Asbestos screening** was undertaken in accordance with HSG 248.

The results of the comparison of the representative contaminants concentration for human health receptor to the Soil Guideline Values (SGV), Category 4 Screening Levels (C4SL's) or Suitable 4 Use Level (S4UL) are presented in 4.4.

The guideline values are assessed against the "Residential without Plant Uptake" land-use scenario, which was considered the most appropriate land-use scenario, given the type of the proposed redevelopment.

Table 4.4 Summary of Chemical Analysis of Soils Samples

Substance	Sample location where SGV, C4SL or S4UL adopted were exceeded for the 'Residential without Plant Uptake' land-use scenario
Lead	553mg/kg against 200mg/kg, C4SL (TP1:0.24)
PAHs	4No. PAHs above C4SL or S4UL (TP1:0.24)

In summary, Lead and four PAHs were recorded above the relevant “Residential without Plant Uptake” end-use screening values.

However, this material will be removed from site during the proposed basement excavations beneath the existing vaults, so there will be no residual risk. In addition, the entire site will be covered by hardstanding or buildings and therefore no pathway to the human health receptor (end-user) will exist.

4.3.1 Waste Acceptance Criteria Analysis

One sample was tested for WAC analysis (BH1:0.50m bgl). The results indicated that the material would be classified as Stable Non-reactive Hazardous waste in non-hazardous Landfill, due to the concentration of Antimony recorded. Confirmation of this classification from the receiving landfill is recommended.

Section 5 Conclusions and Recommendations

5.1 General

The findings of this report are informed by site investigation data and information taken from the BGS website.

Made Ground was recorded to a depth of 2.40m bgl with WS1, which was drilled from the courtyard at the existing floor level of the vaults. It is proposed to lower vaults 1 to 3 by 2.40m, meaning the formation level of the basement would be approximately 2.80m below the existing ground level and therefore constructed within the Lynch Hill Gravel Member, below the groundwater level monitored on site. This was recorded in June (2016), when groundwater levels should be falling from their annual maximum (i.e. highest) elevation, which typically occurs around March.

It is proposed to lower Vault 4 by 1.00m, meaning the proposed floor level would be within the Made Ground. Foundations **must not** be constructed within any Made Ground due to the likely variability and potential for large load induced settlements both total and differential. As such, deepened strip footing or piled foundation solution will need to be considered. Deepened strip footings would need to be taken into the Lynch Hill Gravel Member approximately 2.80m below the existing ground level, as recommended for vaults 1 to 3. A similar provisional bearing capacity could be adopted in this case, as outlined in Section 4.2.

Additional site investigation in this area will be required to inform these options: dynamic probing and windowless sampling for deepened strip footings and a 15m deep borehole for piled foundations.

The groundwater recorded on site is believed to be perched / shallow groundwater within the Made Ground and superficial deposits. Given that the proposed basement will be approximately 0.40m into the natural strata of the Lynch Hill Gravel Member, the impact on local groundwater conditions within natural soils is considered to be minimal.

There will be no change in the proportion of hardstanding and the proposed basement will therefore have a negligible effect on surface water flow or flooding.

The analysis is based on limited site investigation data and further investigation is recommended in order to confirm the suitability of the parameters used.

As the formation level of the basement will be below the water level recorded on site, groundwater control measures will be required to keep isolated underpin excavations dry prior to concrete placement.

It is understood the neighbouring property also has similar vaults to the front of the property. The proposed use of L-shaped RC underpins and adequate temporary works will be sufficient to mitigate any potential impact on these structures as well as the

overlying pavement and roadway of John Street from the proposed deepening. Consideration must be given to underground services, which will be laid in Made Ground and vulnerable to movement in the surrounding ground. Appropriate movement analysis in respect of the proposed development must be undertaken. It is recommended that all perimeter wall foundations are propped prior to excavation commencing below them. The underpins must also be propped at regular intervals as construction progresses. This is required to control horizontal deflection and prevent rotation and sliding of underpins prior to the basement and ground floor slab being cast.

It is proposed that an appropriate monitoring regime must be adopted to manage risk and potential damage to the neighbouring structures as construction progresses onsite.

List of Figures

List of Appendices

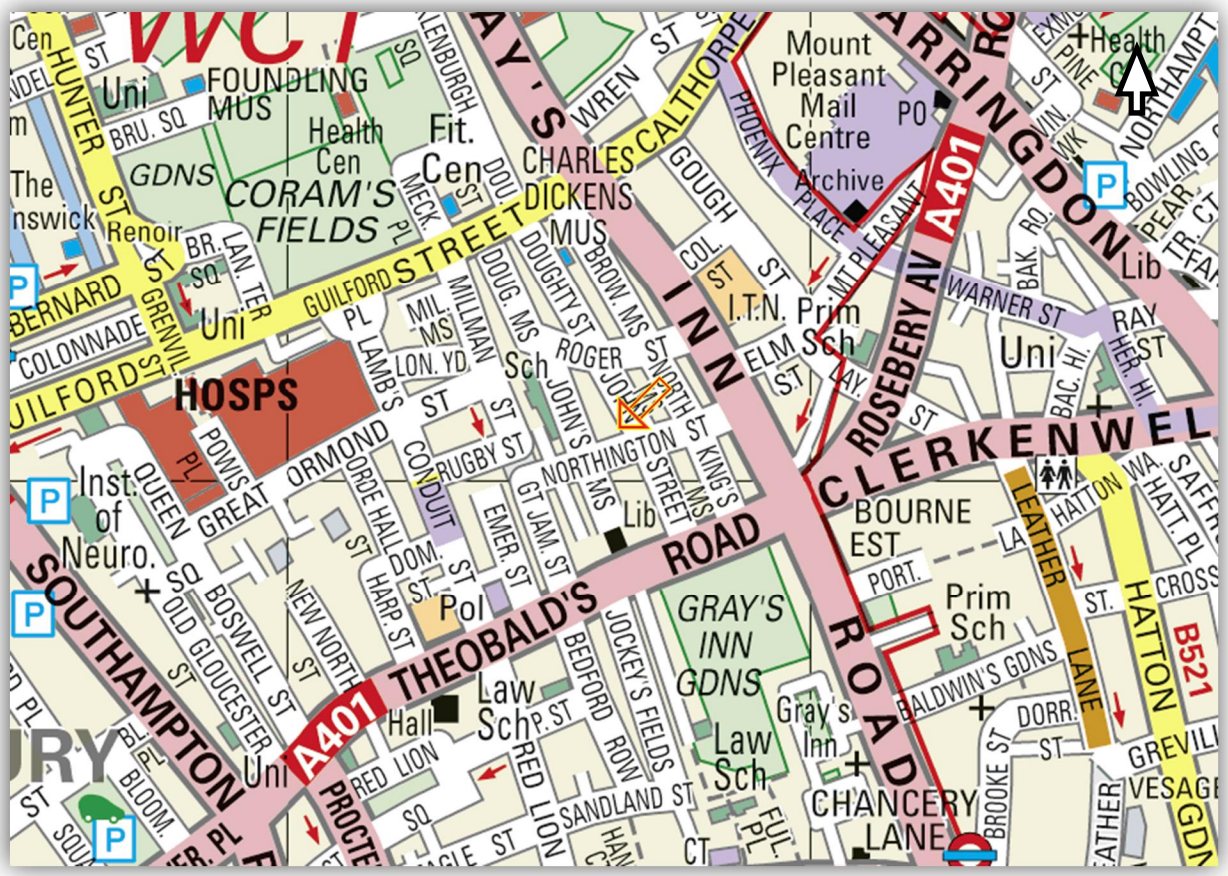


Figure number	Title
1	Site Location Map

Project	Date
Flat 1, 28 John Street, Camden, London WC1N 2ES	September 2016

Client	Job Number
Gideon Barnett	15616

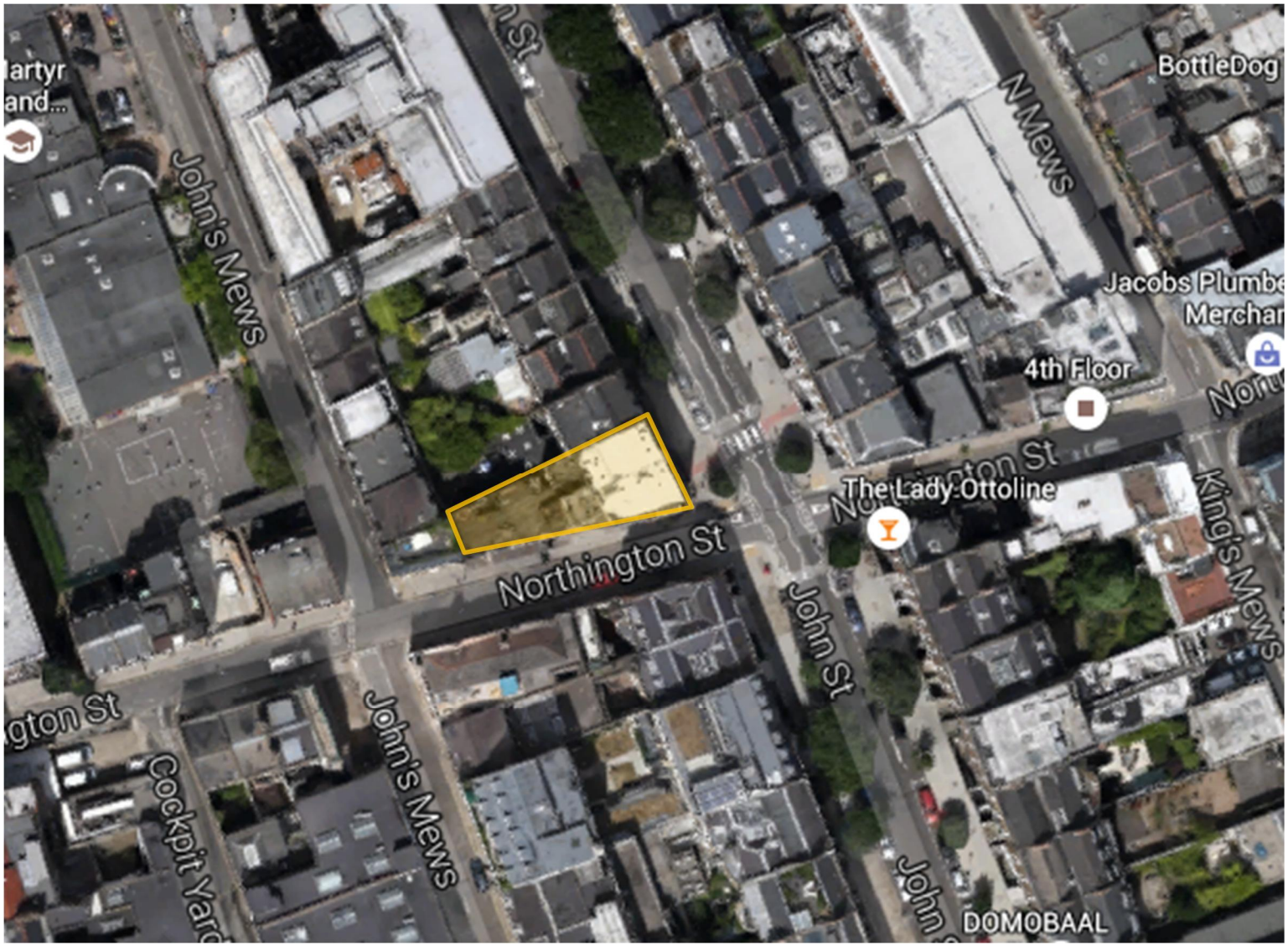


Figure number
2

Project
Flat 1, 28 John Street, Camden, London WC1N 2ES

Client
Gideon Barnett

Title
Aerial Photograph

Date
September 2016

Job Number
15616

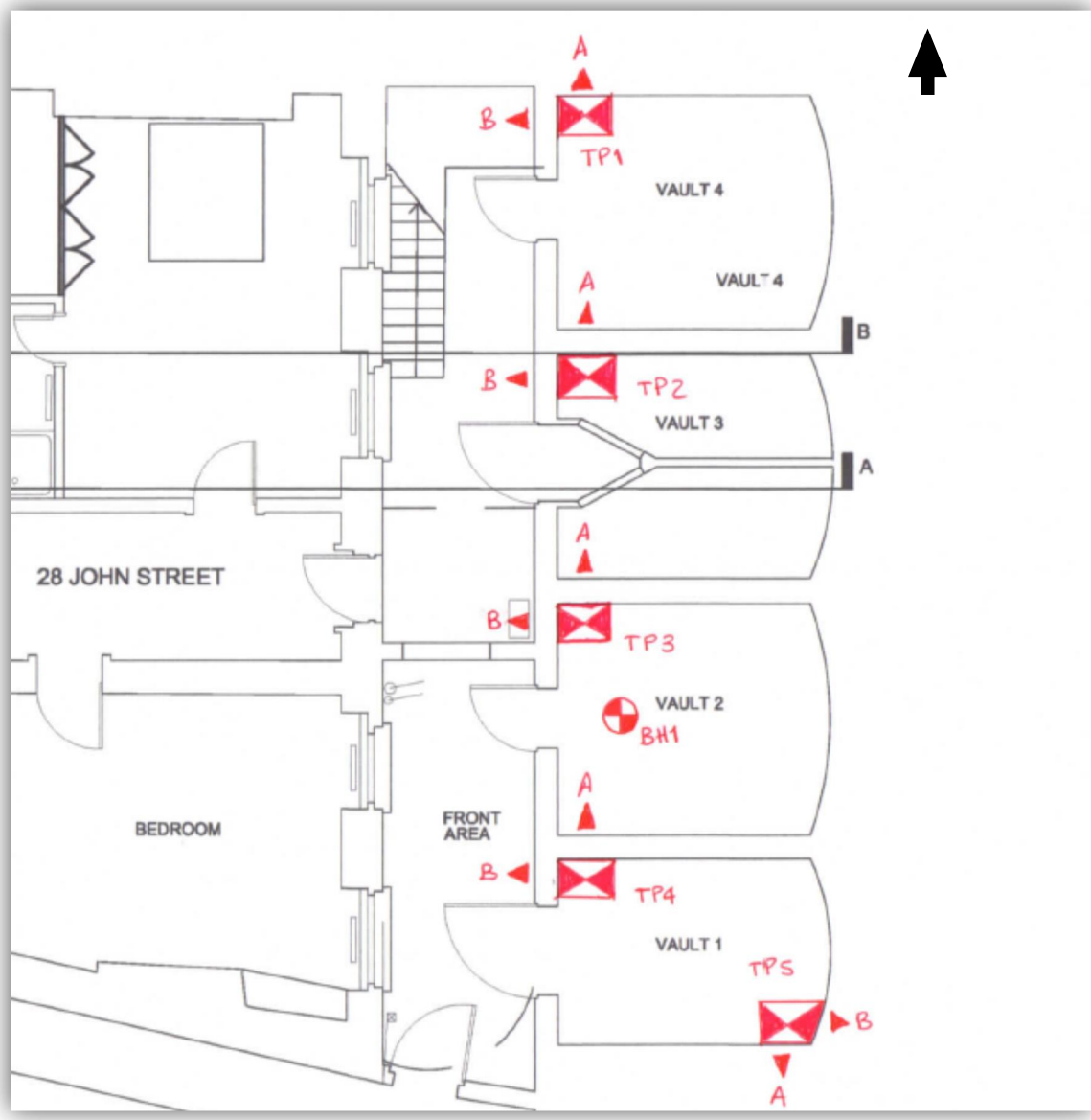


Figure number
3

Project
Flat 1, 28 John Street, Camden, London WC1N 2ES

Client
Gideon Barnett

Title
Trial Hole Location Map

Date
September 2016

Job Number
15616

Appendix A Field Work

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Borehole Log

Borehole No. **WS1**
Sheet 1 of 1

Project Name: Flat 1, 28 John Street, Camden	Project No.: 15616	Co-ords:	Hole Type WS
Location: London WC1N 2ES		Level:	Scale 1:50
Client:		Dates: 08/06/2016	Logged By OK

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.01			Tile. MADE GROUND
		0.50	J&D		0.50			Soft dark orange brown sandy SILT with occasional to frequent fine to medium brick / concrete fragments, occasional fine to medium sub-angular to angular gravel and rare glass fragments. MADE GROUND
	▼	1.30	J&D					Very soft dark grey gravelly sandy CLAY. Sand is fine to medium. Gravel is fine to medium sub-angular flint and fine to coarse brick with small plastic pieces. Saturated sample. MADE GROUND (D BAG)
		1.80	J&D		1.70			Saturated sample
		2.20	J&D		2.00			Very soft dark grey gravelly sandy silty CLAY. Sand is fine to medium. Gravel is fine to coarse sub-angular flint and brick, a coarse porcelain fragment at 1.40m bgl and occasional decomposed material. MADE GROUND.
		2.60	J&D		2.40			Very soft dark grey gravelly sandy silty CLAY. Sand is fine to medium. Gravel is fine to coarse sub-angular flint and brick, rare fine to coarse chalk fragments, a coarse shell fragments at 2.20m bgl and occasional decomposed material. MADE GROUND
					2.65			Orgnaic odour
								Soft dark grey mottled olive green sandy silty CLAY with very rare fine to medium sub-angular flint gravel. Sand is fine. Occasional decomposed material and occasional black staining between 2.50-2.65m bgl. LYNCH HILL GRAVEL MEMBER
								Weak hydrocarbon type odour
								End of Borehole at 2.65m

General Remarks:
Bouncing at 2.65m bgl. Groundwater strike at 1.20m bgl.

Groundwater Remarks:

Borehole Type
CP: Cable Percussive
WS: Windowless Sampler
RC: Rotary Cored

Sample Types
D: Disturbed
B: Bulk
J: Jar
W: Water
U: Undisturbed

In-Situ Testing
SPT: Split spoon - Standard Penetration Test
CPT: Cone - Standard Penetration Test

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No. **TP1A/B** Sheet 1 of 1

Project Name: Flat 1, 28 John Street,	Project No.: 15616	Method:	Hole Type TP
Location: London WC1		Plant:	
		Support:	Scale 1:25
Client:	Trial Pit Length: m	Trial Pit Width: m	
Dates: 08-06-2016	Level:	Co-ords:	Logged By GB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.10			CONCRETE
	0.24	D		0.24			Soft dark orange brown sandy SILT with occasional fine brick/ concrete fragments, occasional fine to medium sub-angular to angular gravel and rare glass fragments. MADE GROUND
							End of Pit at 0.24m

1 2 3 4 5

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No. **TP2A/B**
Sheet 1 of 1

Project Name: Flat 1, 28 John Street,	Project No.: 15616	Method:	Hole Type: TP
Location: London WC1		Plant:	Scale: 1:25
Client:	Trial Pit Length: m	Trial Pit Width: m	Support:
Dates: 08-06-2016	Level:	Co-ords:	Logged By: GB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.10			CONCRETE
	0.24	D		0.24			Soft dark orange brown sandy SILT with occasional fine brick/ concrete fragments, occasional fine to medium sub-angular to angular gravel and rare glass fragments. MADE GROUND
							End of Pit at 0.24m

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No. **TP3A/B** Sheet 1 of 1

Project Name: Flat 1, 28 John Street,	Project No.: 15616	Method:	Hole Type TP
Location: London WC1		Plant:	
		Support:	Scale 1:25
Client:	Trial Pit Length: m	Trial Pit Width: m	
Dates: 08-06-2016	Level:	Co-ords:	Logged By GB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.10			CONCRETE
	0.24	D		0.24			Soft dark orange brown sandy SILT with occasional to frequent fine to medium brick / concrete fragments, occasional fine to medium sub-angular to angular gravel and rare glass fragments. MADE GROUND
							End of Pit at 0.24m

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
TP4A/B
Sheet 1 of 1

Project Name: Flat 1, 28 John Street,	Project No.: 15616	Method:	Hole Type TP
Location: London WC1		Plant:	
		Support:	Scale 1:25
Client:	Trial Pit Length: m	Trial Pit Width: m	
Dates: 08-06-2016	Level:	Co-ords:	Logged By GB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.18	D		0.10			CONCRETE
				0.18			Soft dark orange brown sandy SILT with occasional to frequent fine to medium brick / concrete fragments, occasional fine to medium sub-angular to angular gravel and rare glass fragments. MADE GROUND
							End of Pit at 0.18m

1
2
3
4
5

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

soils LIMITED Geotechnical & Environmental Consultants

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No. **TP5A/B** Sheet 1 of 1

Project Name: Flat 1, 28 John Street,	Project No.: 15616	Method:	Hole Type TP
Location: London WC1		Plant:	
		Support:	Scale 1:25
Client:	Trial Pit Length: m	Trial Pit Width: m	
Dates: 08-06-2016	Level:	Co-ords:	Logged By GB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.15	D		0.10 0.15			CONCRETE
							Soft dark orange brown sandy SILT with occasional to frequent fine to medium brick / concrete fragments, occasional fine to medium sub-angular to angular gravel and rare glass fragments. MADE GROUND
							End of Pit at 0.15m

1 2 3 4 5

General Remarks:
No roots observed. No groundwater encountered.

Groundwater Remarks:

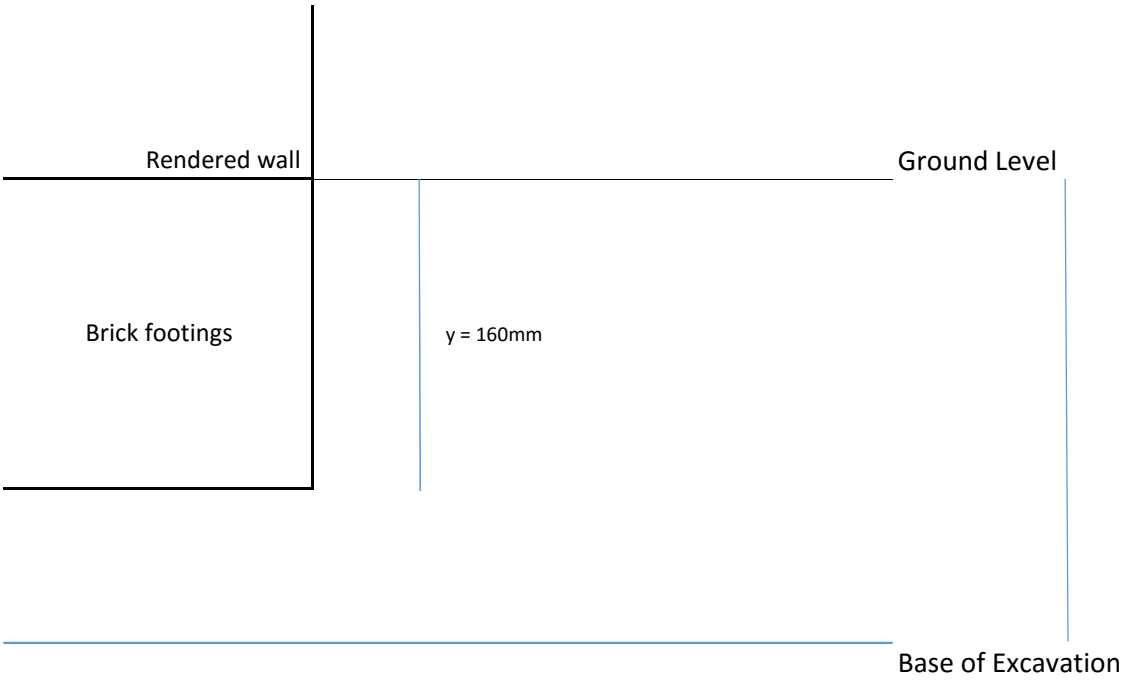
Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Project: Flat 1, 28 John Street, Camden, WC1N 2ES
Client: Chapero Marsh
Date: Jul-16
Ref: 15616

soils LIMITED
Geotechnical & Environmental Consultants

Foundation Exposure Pit Profiles

Trial Hole Number: FE1A + B

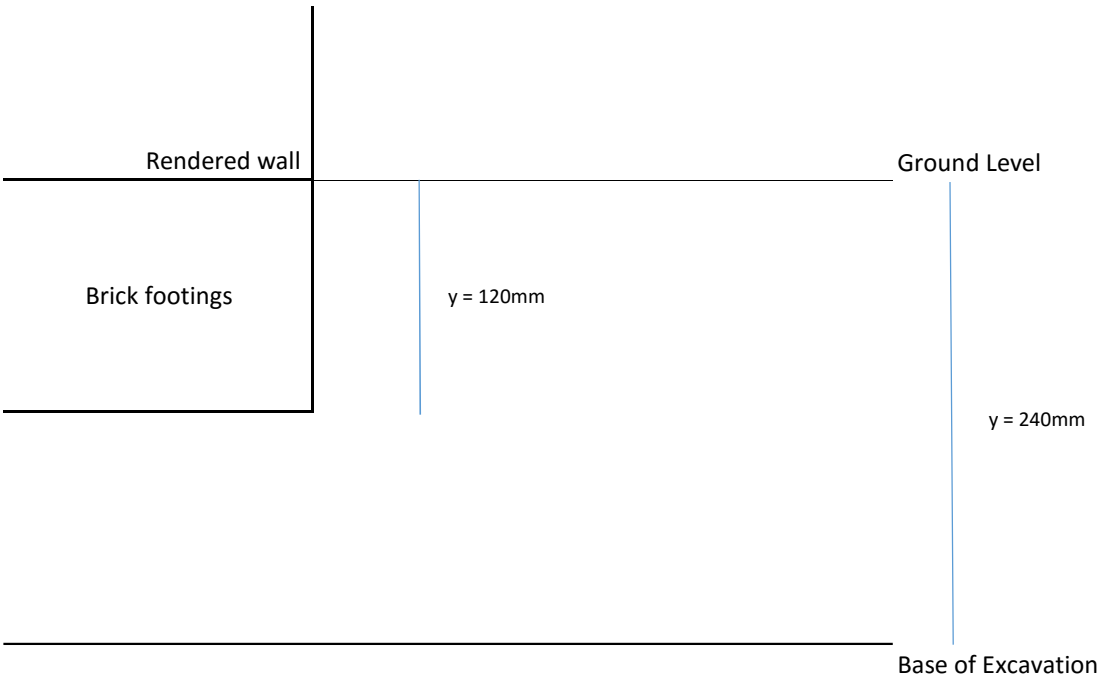


Project: Flat 1, 28 John Street, Camden, WC1N 2ES
Client: Chapero Marsh
Date: Jul-16
Ref: 15616

soils LIMITED
Geotechnical & Environmental Consultants

Foundation Exposure Pit Profiles

Trial Hole Number: FE2A



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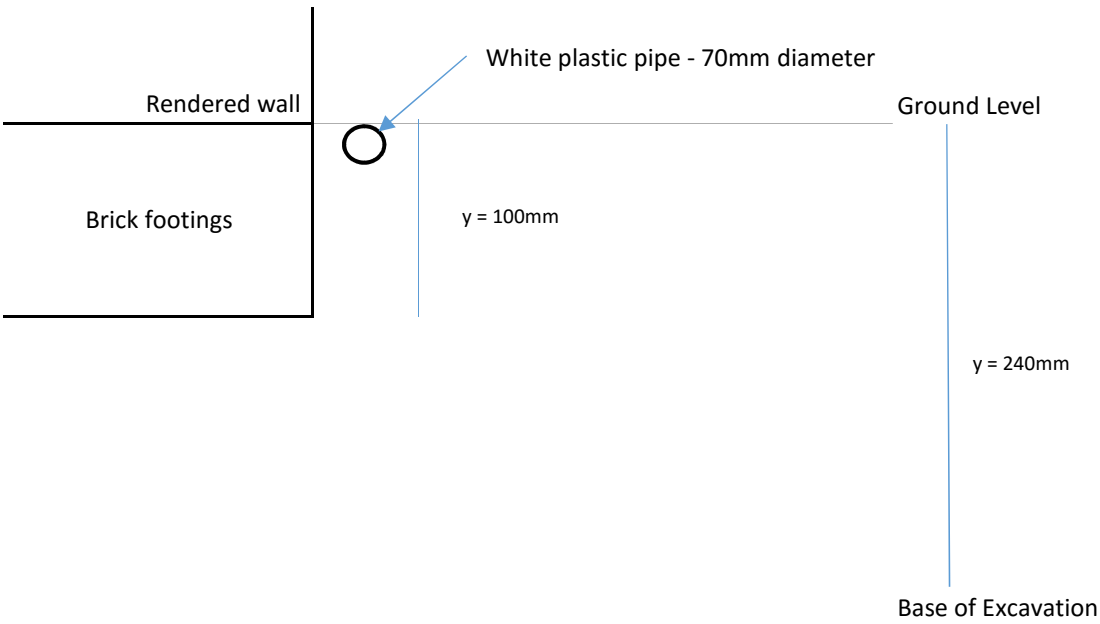
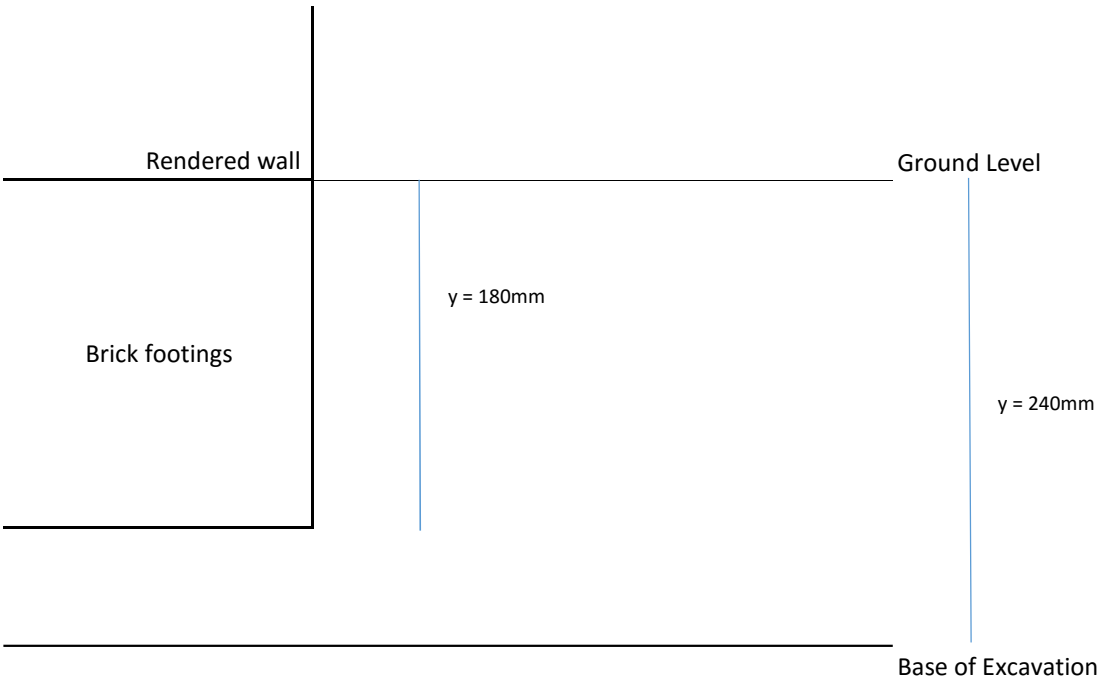


Project: Flat 1, 28 John Street, Camden, WC1N 2ES
Client: Chapero Marsh
Date: Jul-16
Ref: 15616

soils LIMITED
Geotechnical & Environmental Consultants

Foundation Exposure Pit Profiles

Trial Hole Number: FE3A



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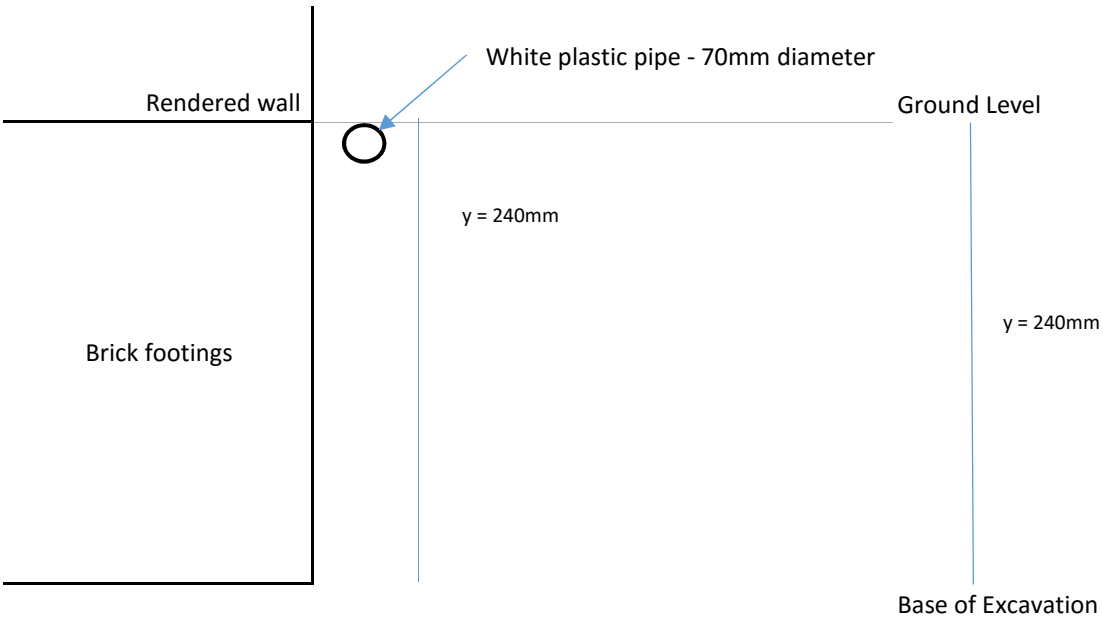
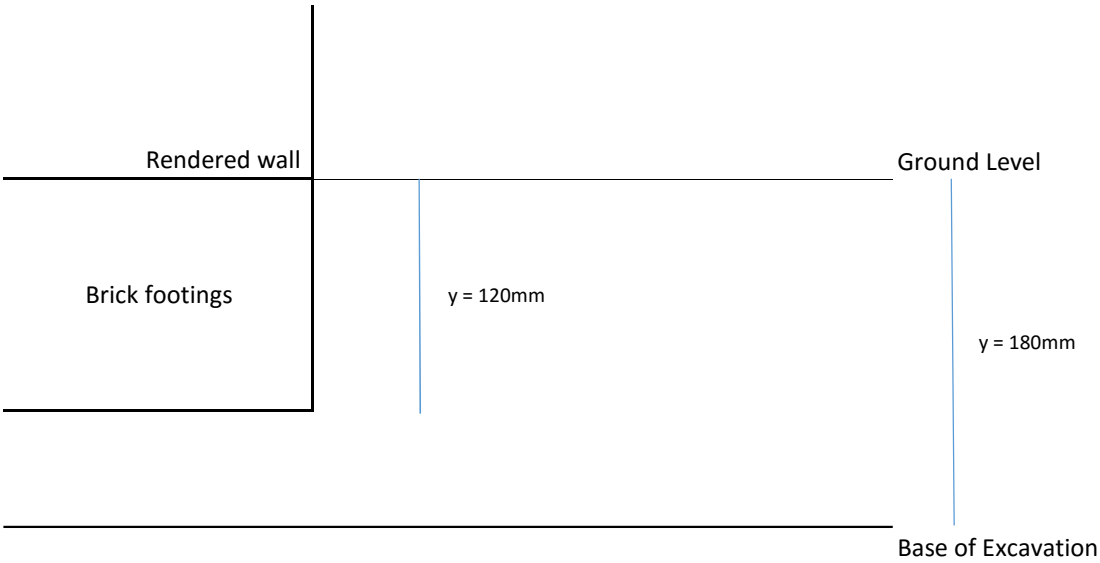


Project: Flat 1, 28 John Street, Camden, WC1N 2ES
Client: Chapero Marsh
Date: Jul-16
Ref: 15616

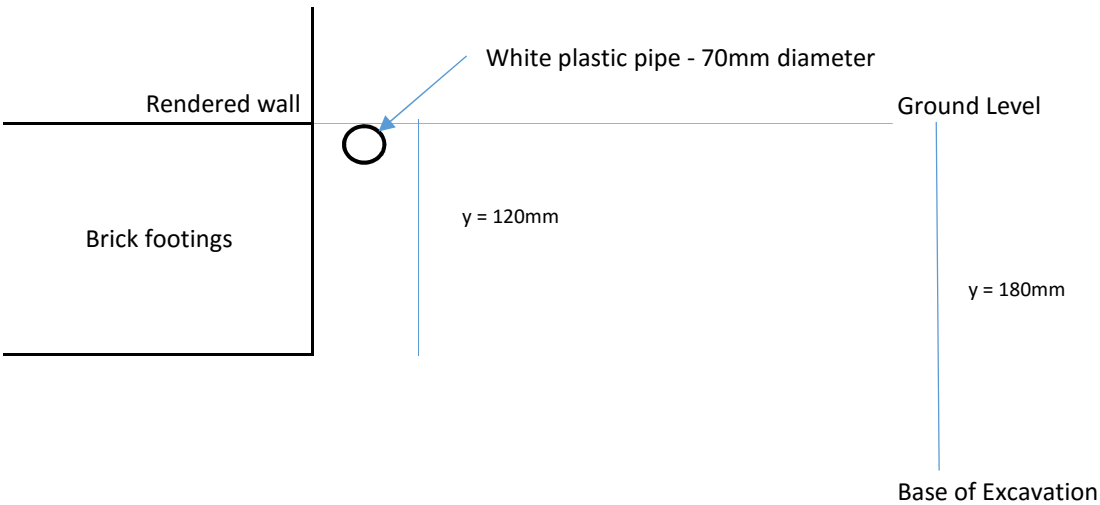
soils LIMITED
Geotechnical & Environmental Consultants

Foundation Exposure Pit Profiles

Trial Hole Number: FE4A



Trial Hole Number: FE4B

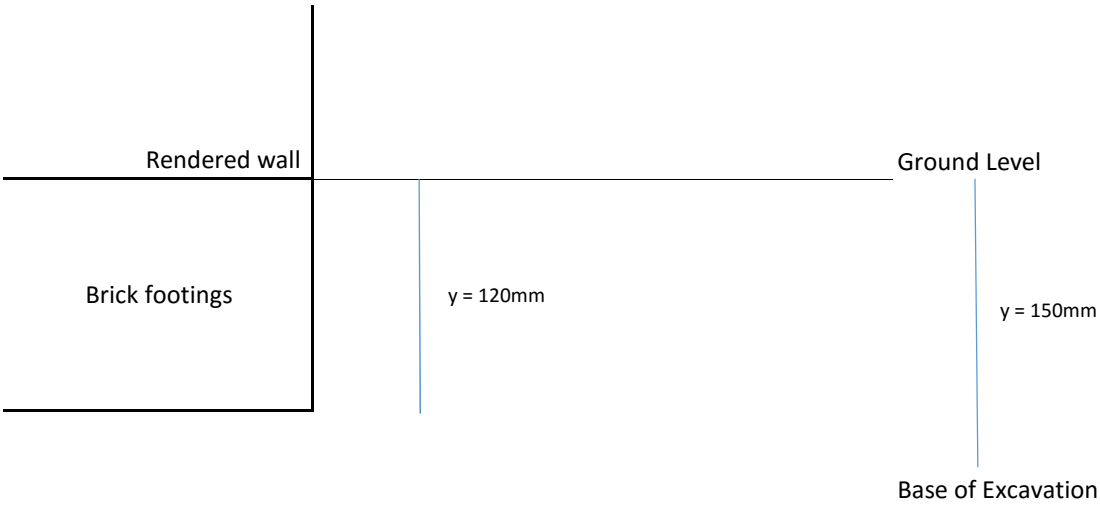


Project: Flat 1, 28 John Street, Camden, WC1N 2ES
Client: Chapero Marsh
Date: Jul-16
Ref: 15616

Geotechnical & Environmental Consultants

Foundation Exposure Pit Profiles

Trial Hole Number: FE5A + B



Appendix B Geotechnical Laboratory Results

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 31374

Client's Reference: **15616**

Report Date: **27-06-2016**

Client **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

Contract Title: **John Street**

For the attention of: **Sam Bevins**

Date Received: **20-06-2016**

Date Commenced: **20-06-2016**

Date Completed: **27-06-2016**

Test Description	Qty
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	1
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	1
Disposal of Samples on Project	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Jon Tatam (Administrative/Quality Assistant) - Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

Client ref: 15616

Location: John Street

Contract Number: 31374

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
BH1		D	2.60	Brown fine gravelly fine sandy silty CLAY.

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager)

Date: 27.6.16

UKAS TESTING
2788

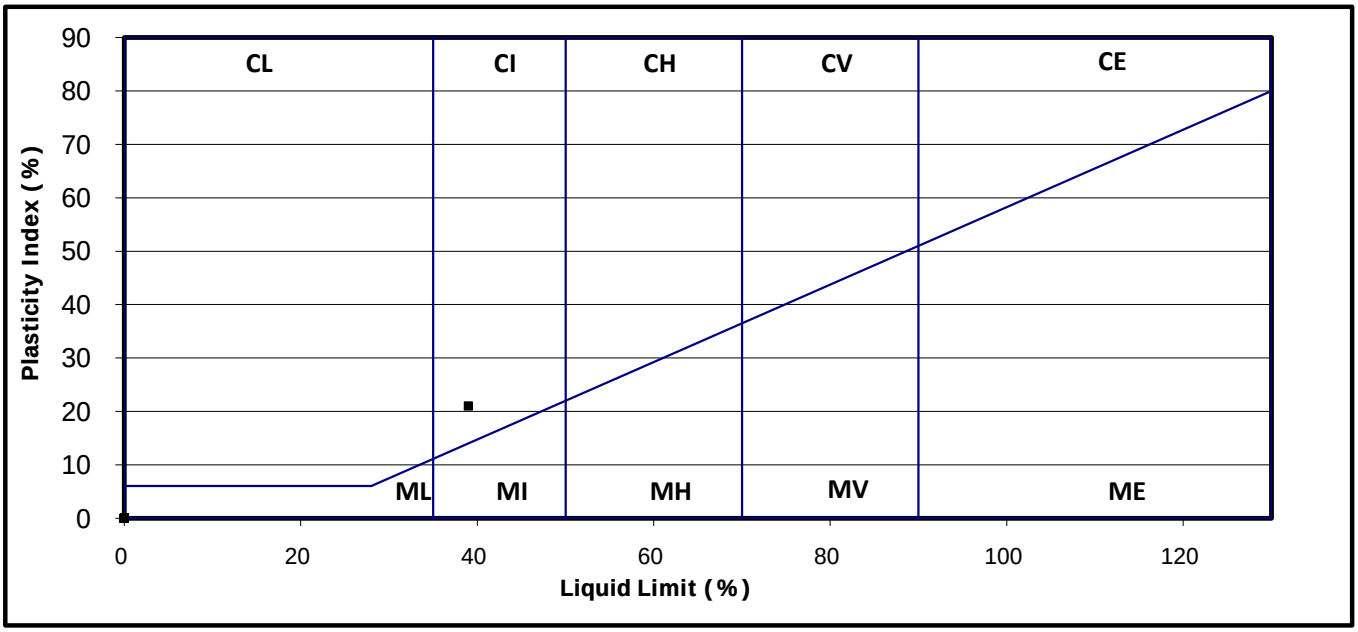
Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref: 15616
Location: John Street
Contract Number: 31374

Hole / Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
BH1	D	2.60	19	39	18	21	84	CI Intermediate Plasticity

Symbols: **NP : Non Plastic** **# : Liquid Limit and Plastic Limit Wet Sieved**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Ben Sharp (Contracts Manager)
Date: 27.6.16

UKAS TESTING
2788

Appendix C Chemical Laboratory Results

Sam Bevins
Soils Ltd
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

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: 16-45600

Site Reference:	John Street
Project / Job Ref:	15616
Order No:	15616/SB
Sample Receipt Date:	17/06/2016
Sample Scheduled Date:	17/06/2016
Report Issue Number:	1
Reporting Date:	22/06/2016

Authorised by:

Russell Jarvis
Associate Director of Client Services
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Associate Director of Laboratory
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: 16-45600	**Date Sampled**	08/06/16	08/06/16	08/06/16		
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: John Street	**TP / BH No**	TP1	BH1	BH1		
Project / Job Ref: 15616	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: 15616/SB	**Depth (m)**	0.24	0.50	2.60		
Reporting Date: 22/06/2016	**QTSE Sample No**	212579	212580	212581		

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	7.7	7.7	7.6		
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			
Total Sulphate as SO_4	mg/kg	< 200	NONE			747		
Total Sulphate as SO_4	%	< 0.02	NONE			0.07		
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	209	38	62		
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.21	0.04	0.06		
Total Sulphur	%	< 0.02	NONE			0.16		
Sulphide	mg/kg	< 5	NONE	< 5	< 5			
Organic Matter	%	< 0.1	MCERTS	7.6	0.7			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	4.4	0.4			
Ammonium as NH_4	mg/kg	< 0.5	NONE			107		
Ammonium as NH_4	mg/l	< 0.05	NONE			10.70		
W/S Chloride (2:1)	mg/kg	< 1	MCERTS			21		
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS			10.7		
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS			< 3		
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS			< 1.5		
Antimony (Sb)	mg/kg	< 1	NONE	3.5	1.4			
Arsenic (As)	mg/kg	< 2	MCERTS	26	6			
Beryllium (Be)	mg/kg	< 0.5	NONE	1.2	< 0.5			
W/S Boron	mg/kg	< 1	NONE	< 1	< 1			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	14	7			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	100	39			
Lead (Pb)	mg/kg	< 3	MCERTS	553	72			
W/S Magnesium	mg/l	< 0.1	NONE			0.9		
Mercury (Hg)	mg/kg	< 1	NONE	1.4	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	19	7			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Vanadium (V)	mg/kg	< 2	NONE	62	18			
Zinc (Zn)	mg/kg	< 3	MCERTS	150	31			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			

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

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Graham Revell

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

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 - Speciated PAHs						
QTS Environmental Report No: 16-45600	**Date Sampled**	08/06/16	08/06/16			
Soils Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: John Street	**TP / BH No**	TP1	BH1			
Project / Job Ref: 15616	**Additional Refs**	None Supplied	None Supplied			
Order No: 15616/SB	**Depth (m)**	0.24	0.50			
Reporting Date: 22/06/2016	**QTSE Sample No**	212579	212580			

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	0.95	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	2.34	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	0.42	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	0.78	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	22.50	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	5.02	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	58	< 0.1			
Pyrene	mg/kg	< 0.1	MCERTS	47.90	< 0.1			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	15.30	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	17.40	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	17.70	< 0.1			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	7.28	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	9.05	< 0.1			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	7.65	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.78	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	6.24	< 0.1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	219	< 1.6			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{o}C

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4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-45600	
Soils Ltd	
Site Reference: John Street	
Project / Job Ref: 15616	
Order No: 15616/SB	
Reporting Date: 22/06/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
212579	TP1	None Supplied	0.24	20.7	Brown clay with stones
212580	BH1	None Supplied	0.50	12.7	Brown clay with stones
212581	BH1	None Supplied	2.60	20	Brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 16-45600

Soils Ltd

Site Reference: John Street

Project / Job Ref: 15616

Order No: 15616/SB

Reporting Date: 22/06/2016

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

Sam Bevins
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Cross Road
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KT20 5SR

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QTS Environmental Report No: 16-46677

Site Reference:	John Street
Project / Job Ref:	15616
Order No:	15616/SB
Sample Receipt Date:	17/06/2016
Sample Scheduled Date:	13/07/2016
Report Issue Number:	1
Reporting Date:	19/07/2016

Authorised by:

Kevin Old
Associate Director of Laboratory

Authorised by:

Russell Jarvis
Associate Director of Client Services

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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3

					Landfill Waste Acceptance Criteria Limits		
QTS Environmental Report No: 16-46677	**Date Sampled**	08/06/16					
Soils Ltd	**Time Sampled**	None Supplied			**Inert Waste Landfill**	**Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Site Reference: John Street	**TP / BH No**	BH1					
Project / Job Ref: 15616	**Additional Refs**	None Supplied					
Order No: 15616/SB	**Depth (m)**	0.50					
Reporting Date: 19/07/2016	**QTSE Sample No**	217187					
Determinand	**Unit**	**MDL**					
TOC[MU]	%	< 0.1	2.4		3%	5%	6%
Loss on Ignition	%	< 0.01	10.10		--	--	**10%**
BTEX[MU]	mg/kg	< 0.05	< 0.05		6	--	--
Sum of PCBs	mg/kg	< 0.1	< 0.1		1	--	--
Mineral Oil[MU]	mg/kg	< 10	< 10		500	--	--
Total PAH[MU]	mg/kg	< 1.7	< 1.7		100	--	--
pH[MU]	pH Units	N/a	7.6		--	>6	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	1.8		--	To be evaluated	To be evaluated

Eluate Analysis	**2:1 mg/l**	**8:1 mg/l**		**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)**		
Arsenic[U]	< 0.01	< 0.01		< 0.2	0.5	2	25
Barium[U]	0.07	0.03		0.3	20	100	300
Cadmium[U]	< 0.0005	< 0.0005		< 0.02	0.04	1	5
Chromium[U]	< 0.005	< 0.005		< 0.20	0.5	10	70
Copper[U]	0.02	< 0.01		< 0.5	2	50	100
Mercury[U]	< 0.005	< 0.005		< 0.01	0.01	0.2	2
Molybdenum[U]	0.035	0.010		0.1	0.5	10	30
Nickel[U]	< 0.007	< 0.007		< 0.2	0.4	10	40
Lead[U]	< 0.005	< 0.005		< 0.2	0.5	10	50
Antimony[U]	0.018	0.010		0.10	**0.06**	0.7	5
Selenium[U]	< 0.005	< 0.005		< 0.1	0.1	0.5	7
Zinc[U]	< 0.005	< 0.005		< 0.2	4	50	200
Chloride[U]	26	4		56	800	15000	25000
Fluoride[U]	< 0.5	< 0.5		< 1	10	150	500
Sulphate[U]	117	18		256	1000	20000	50000
TDS	320	113		1284	4000	60000	100000
Phenol Index	< 0.01	< 0.01		< 0.5	1	-	-
DOC	22	9.3		102	500	800	1000
Leach Test Information							
Sample Mass (kg)	0.23						
Dry Matter (%)	75.5						
Moisture (%)	32.4						
Stage 1							
Volume Eluate L2 (litres)	0.29						
Filtered Eluate VE1 (litres)	0.13						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and QTS Environmental cannot be held responsible for any discrepencies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 16-46677	
Soils Ltd	
Site Reference: John Street	
Project / Job Ref: 15616	
Order No: 15616/SB	
Reporting Date: 19/07/2016	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 217187	BH1	None Supplied	0.50	24.5	Brown clay with stones

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

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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 16-46677

Soils Ltd

Site Reference: John Street

Project / Job Ref: 15616

Order No: 15616/SB

Reporting Date: 19/07/2016

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

Appendix D Information Provided by the Client

0 10 10 20 20 30 30 50 mm40 S/ 1:50 mm S/ 1:75 4 5m S/ 1:50

wardrobe

wardrobe

wardrobe

wardrobe

CREATE NEW OPENING

CREATE NEW OPENING

MASTERBEDROOM
qm
FFinish:

OTTOMAN

NICHE SHELVES

BEDROOM 1
qm
FFinish:

DOORS

CONSOLE

CREATE NEW OPENING

HALLWAY
qm
FFinish:

FROSTED GLASS ENCLOSURE

VAULT 4

EN SUITE BATHROOM
qm
FFinish:

VAULT 4 TO BE LOWERED BY 1000MM

VAULT 3

NEW GLASS ENCLOSURE

NEW STAIR

CREATE NEW OPENING

NEW CUPBOARD

SERVICES AS EXISTING

CONSOLE

NEW GLASS ENCLOSURE

VAULTS 1-3
sqm
FFinish:

VAULT 2

VAULTS 1-3 TO BE LOWERED BY 2200MM

UTILITY ROOM
qm
FFinish:

BEDROOM 2
qm
FFinish:

SHOWER

EN SUITE BATHROOM
qm
FFinish:

CREATE NEW OPENING

COURTYARD
qm
FFinish:

NEW GLASS SCREEN

CREATE NEW OPENING

CREATE NEW OPENING

NEW GLASS SCREEN

VAULT 1

REV	DATE.REV	WHO.REV		WHO.CHECK
REV	DATE	BY	DESCRIPTION	CHK
DRAWING STATUS:	INFORMATION			

CLIENT: CLIENT	PROJECT: Flat 1, 28 John Street, London	SCALE: 1:50	DESIGN/DRAWN: CH	CHECKED: CH	DATE: 15.02.2016	
LEAD DESIGNER: P-U-R-A. LTD	DRAWING TITLE: LOWERGROUNDFLOOR	FORMAT: A3	PROJECT No: 0998	DRAWING No: 20-104	REV: B	

- All dimensions in mm unless noted otherwise.
- All dimensions and levels to be checked on site. Their accuracy cannot by guaranteed and therefore cannot be used for fabrication, manufacture or construction.
- Contractor to verify and to be responsible for all requirements and restrictions due to local rules. Contractor to report if there is any discrepancy in the drawings to P-U-R-A LTD in time to specify alternatives.
- This drawing is to be read together with all other relevant drawings.
- Do not scale from this drawing.

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