Chelmer
Consultancy Services
'Groundbreaking Services'

Geo-Environmental Interpretive Report

Site	2 Chalcot Square London NW1 8YB
Client	Elite Designers
Date	26th January 2015
Our Ref	GENV/4915

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APPENDICES

1.0 EXECUTIVE SUMMARY

Item	Comments	Risk
Site	**2 Chalcot Square, London, NW1 8YB**	
Ground Conditions	The current work encountered MADE GROUND to a maximum depth of 1.70m below existing ground level. The MADE GROUND was found to be underlain by CLAY of the Weathered London Clay formation to a maximum borehole termination depth of 8.00m below existing ground level.	Low
Swelling/ Shrinking	The Weathered London Clay encountered beneath the site has been confirmed to possess 'high' volume change potential in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards.	Low
Root Activity	Roots of live appearance up to 1mm in diameter were observed within borehole BH1 to a maximum depth of 2.30m below existing ground level.	Moderate
Groundwater (GW)	No groundwater was encountered during the drilling process of the current site investigation. However, groundwater was encountered during the return gas/groundwater monitoring visits within borehole BH1 on 18th November 2014 and 4th December 2014 and encountered standing water at depths of 5.63m and 4.10m below existing ground level respectively.	Moderate
Landborne Gas	Carbon dioxide concentrations were recorded up to 9.3%v/v within BH1. In accordance with CIRIA Publication C665 "Assessing Risks posed by Hazardous Ground gases to Buildings (Revised 2007 and the NHBC "Traffic Light" system, we would consider that the current site would be classified as **AMBER1** or **Characteristic Situation 2**.	Moderate
Soil Chemical Analysis	An elevated concentrations of lead was identified within the MADE GROUND in BH1. However, due to the basement development and the entire front garden being excavated, the risk to future site residents is therefore 'low'. We would recommend that standard Health and Safety precautions be taken with regard to ground workers at this site.	Low
WAC Tests	The result of the WAC test indicates that this sample would probably be classified as "Inert" material. This is considered to represent the typical MADE GROUND across the site.	Low
Basement Construction	It is assumed that the proposed slab will be set at a depth of 3.10m below existing ground level (approximately 1.05m below existing vault floor level). In this case the Weathered London Clay appears to have relatively 'good' load bearing characteristics, with the results of the in-situ and laboratory testing, in conjunction with research undertaken by Skempton, indicating a maximum safe (design) bearing pressure of approximately 175 kN/m^2 at a depth of 3.10m below existing ground level. These values are considered appropriate for RC rafts and monolithic upstand RC walls at basement floor level with a minimum founding width of 600mm, and for possible mass concrete pad foundations supporting temporary loads relating to the in-situ superstructure.	Low
Piled Foundations	If due to the 'high' volume change potential of Weathered London Clay and its well documented potential to swell/shrink, the magnitude of the anticipated loads, or for any other economic reason that shallow foundations are not deemed acceptable, as an alternative, the installation of a combination of secant/contiguous piles around the perimeter of the site in order to construct the basement could be undertaken. It is assumed that the pile heads would be restrained in the permanent condition by a pile cap that will be formed of reinforced concrete and the pile walls will have a concrete inner liner wall.	Moderate
Settlement	Settlements of such piles can be expected to be small, typically less than 5-10mm	Low
Retaining Structures	The full design of temporary and permanent retaining structures is beyond the scope of this report. However, values have been given as a guide to assist in the design of these structures at this site.	Moderate
Buried Concrete	The results of the BRE Standard Digest 1:2005 test indicates that the samples collected and tested would fall into Class AC-3 of the Building Research Establishments (BRE) classification system Special Digest Part 1:2005 "Concrete in aggressive ground". The results of the pH and Sulphate tests undertaken on samples collected and tested from borehole BH1 indicate that the samples would fall into Class DS-1.	Low
Additional Work	Due to the concentrations of carbon dioxide detected during the return ground gas monitoring visits, ground gas protective measures are recommended to be incorporated within the proposed development. These would help mitigate the ground gas risk to future residents. Ground gas protection measures would include; • A ventilated sub floor void; • The installation of a ground gas resistant membrane, and; • Service entry points appropriately sealed.	N/A

2.0 INTRODUCTION & SCOPE OF WORKS

2.1 This report has been prepared by Chelmer Site Investigation Laboratories Limited (CSI) to the instructions of the designers for the project, Indigo Design Associates.

2.2 The client for the project is Opulen Investments Ltd.

2.3 At the time of the current site investigation the site was found to be occupied by a three storey residential building, including lower ground floor level, with a small front and rear garden. There are also two vaults beneath the front garden.

2.4 It is understood that the proposed development will comprise the extension of vaults, both extending forwards to the front boundary of the property and lowering the existing floor level. *Existing and Proposed Development Plans* have been appended to this report.

2.5 A Phase I *Non-Intrusive* investigation into the site was not required by the Client.

2.6 This *Intrusive* site investigation has now been commissioned to provide information on the sub-soil conditions of the site together with laboratory testing and reporting, in order to enable future foundations to be designed together with associated environmental reporting.

2.7 In addition, a limited gas/groundwater monitoring survey was also carried out within the borehole which was drilled during the current intrusive investigation work, together with a ***preliminary contamination assessment***.

2.8 This report presents the work carried out and discusses the findings.

3.0 FIELDWORK & FINDINGS

3.1 All fieldwork was generally executed in accordance with the recommendations given in British Standard BS 5930:1999+A2:2010, "Code of Practice for Site Investigations". Contamination sampling was undertaken in accordance with BS 10175 : 2011, "Code of Practice for the Investigation of Potentially Contaminated Sites".

3.2 The borehole and trial pit locations were chosen by Chelmer Site Investigation and are indicated on the appended *Sketch Fieldwork Location Plan*.

3.3 Fieldwork was undertaken on 30th October 2014 and comprised the following elements:

C.f.a. Borehole

3.4 A single c.f.a. borehole (BH1) was undertaken to the front of the existing property at the position indicated on the *Sketch Fieldwork Location Plan.* Borehole BH1 was advanced to a depth of 8.00m below existing ground level.

3.5 Discrete disturbed samples were taken from the borehole at regular depth intervals within each stratum and when a change of strata was encountered.

3.6 Shear Vane and Mackintosh Probe tests provided additional information on the consistency of the material encountered.

3.7 Upon completion of borehole BH1 a combined groundwater/gas monitoring standpipe was installed to a depth of 8.00m below existing ground level.

3.8 Full details of the borehole findings are given on the appended borehole record sheet.

Hand Excavated Trial Pits

3.9 In addition to the above, the scope of works for the current project also involved excavating two trial pits (TP1 & TP2) at the site in order to establish the foundation details of the existing building. The trial pit locations are indicated on the *Sketch Fieldwork Location Plan.*

3.10 Trial pit TP1 was excavated internally at lower ground floor level within the vaults at the front of the property and adjacent to both the front wall of the vaults and the party wall shared with No.1. The foundations of both the front and party wall were found to be very similar and found at a similar depth. The brick wall was found to be stepped with a single step of 75mm thickness at a depth of 50mm below the existing basement floor level. The brick wall was found to rest directly within CLAY at a depth of 125mm below existing basement floor level.

3.11 Trial pit TP2 was excavated internally in the east corner of the vaults adjacent to both the front and side wall. The foundations of both the front and side wall were found to be very similar and found at a similar depth. The existing brick wall was found to rest on a concrete foundation at a depth of 150mm below existing lower ground floor level. The concrete foundation was found to be 50mm thick and rest within CLAY at a depth of 200mm below existing lower ground floor level.

3.12 Full details of the trial pit findings are given on the appended trial pit record sheets.

Landborne Gas Emissions Monitoring

3.13 Following the initial site work, two return gas/groundwater monitoring visits were undertaken to the installation fitted within borehole BH1 on 18th November 2014 and 4th December 2014.

3.14 The barometric pressure was recorded together with the level of Carbon Dioxide, Oxygen and Methane within the borehole. In addition, gas flow measurements were taken and the depth to groundwater recorded.

3.15 Full details of the readings are included on the appended Gas/Groundwater Monitoring Record Sheet.

4.0 GROUND CONDITIONS

4.1 According to information published by the British Geological Survey the underlying geology at this site is shown as the London Clay Formation with no superficial deposits indicated.

London Clay

4.2 It is thought that the London Clay Formation was deposited during a period of sea inundation in the area up to 200m in depth. The London Clay can be up to 150m thick beneath south Essex thinning across London to about 90m near Reading. The formation consists of mainly dark blue-grey to brown-grey clay containing variable amounts of fine-grained sand and silt. London Clay generally weathers to an orange-brown colour with pockets of silty fine sand. The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes and is commonly intensely fissured. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation.

When exposed to the weathering process the upper regions of the London Clay oxidise to brown in colour. It usually contains selenite crystals, often grouped in bands or layers, which are thought to have originated from the decomposition of shell fragments. London Clay contains clay minerals in the form of illite, kaolinite and smectite. The presence of smectite renders the London Clay particularly susceptible to heave caused by alternate wetting and drying near the surface. In addition, weathering and possible slight transportation of semi-frozen material "en-masse" in glacial or peri-glacial regions can occur. This action often completely destroys the structure of the material and can involve a serious loss of strength. As the materials are based on local constituents, the lithology of the deposit is often similar to that of the parent strata.

4.3 Full details of the ground conditions encountered are presented on the borehole records appended to this report and can be summarised as follows:

Depth From GL (m)	Depth To From GL (m)	Description
0.00	0.10	TARMAC / CONCRETE
0.10	1.70	MADE GROUND
1.70	8.00+	Weathered London Clay

4.4 It should be noted that the MADE GROUND depths recorded above are those encountered within the borehole undertaken during the current work. However, owing to the variable nature and unknown deposition criteria of MADE GROUND it is possible that deeper or more extensive areas of MADE GROUND may exist at this site which have not been revealed by the current work.

4.5 No groundwater was encountered during the drilling process of the current site investigation. However, groundwater was encountered during the return gas/groundwater monitoring visits within borehole BH1 on 18th November 2014 and 4th December 2014 and encountered standing water at depths of 5.63m and 4.10m below existing ground level respectively.

4.6 Roots of live appearance up to 1mm in diameter were observed within borehole BH1 to a maximum depth of 2.30m below existing ground level.

5.0 LABORATORY TESTING

5.1 The following geotechnical tests have been carried out on samples recovered from the borehole and trial pits drilled across this site.

5.2 Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with the recommendations given in British Standard 1377:1990, "Methods of Test for Soils for Civil Engineering Purposes".

5.3 The chemical testing was carried out in accordance with standard industry methods in a UKAS approved laboratory which is also currently accredited in accordance with MCERTS for the majority of its testing. Further information regarding this accreditation is available on request together with a full list of test methods if required.

5.4 *Atterberg Limits and Moisture Content Tests*

The Atterberg Limit and moisture contents have been determined for five samples collected and tested from the Weathered London Clay stratum.

The liquid limit (LL) was found to range between 74% and 78%, the plastic limit (PL) was found to range between 17% and 18%, and the modified plasticity index (PI) was found to range between 54% and 60%. The moisture contents of these samples were found to range between 29% and 31%.

These results indicate that the samples tested would be classified as Clay of 'very high' (CV) plasticity in accordance with the Casagrande Geotechnical classification system.

In addition, the samples would fall into the "high" volume change potential category of the National House Building Council's (NHBC) classification system given in Part 4 of their Standards.

5.5 *pH and Sulphate Tests*

The pH and sulphate content has been determined for two samples of Weathered London Clay recovered at depths of 2.00m and 4.00m below existing ground level from borehole BH1.

The pH values were found to vary between 7.3 and 7.6 with the sulphate content, on a 2:1 water:soil extract was found to vary between 0.14 and 0.54 g/l.

5.6 *BRE Special Digest 1:2005 Concrete Classification Tests*

Three samples taken from borehole BH1 were selected and tested to assess the aggressive chemical environment for concrete (ACEC) within the site. A single sample of MADE GROUND at a depth of 1.00m below existing ground level and two samples of Weathered London Clay at depths of 3.00m and 8.00m below existing ground level were analysed.

The pH values of these samples were found to range between 8.0 and 8.2.

Full details of the results are given on the appended result sheets.

5.7 *Chemical Analysis*

Three representative samples of the MADE GROUND encountered across the site were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

A contamination suite was undertaken on the selected samples which included heavy metals, speciated PolyAromatic Hydrocarbon (PAH) and speciated Total Petroleum Hydrocarbon (TPH).

5.8 *Waste Classification Tests*

A sample of the MADE GROUND was collected from borehole BH1 and tested for Waste Acceptance Criteria (WAC) in accordance with BS EN 12457 Part 3.

Full details of the results are given on the appended results sheets.

5.9 *Soil Samples*

All soil samples will be kept for a period of 28 days after the date of the invoice for this project unless otherwise notified to Chelmer Site Investigation Laboratories Limited in writing. Should samples be required to be stored for longer than 28 days then a storage charge will be levied.

6.0 DISCUSSION

PROPOSED DEVELOPMENT & SCOPE OF WORKS

6.1 As discussed in Section 2 above, it is understood that the proposed development will comprise the extension of vaults, both extending forwards to the front boundary of the property and lowering the existing floor level. *Existing and Proposed Development Plans* have been appended to this report.

6.2 A Phase I *Non-Intrusive* investigation into the site was not requested by the Client.

6.3 This *Intrusive* site investigation has now been commissioned to provide information on the sub-soil conditions of the site together with laboratory testing and reporting, in order to enable future foundations to be designed together with associated environmental reporting.

6.4 In addition, a limited gas/groundwater monitoring survey was also carried out within the borehole which was drilled during the current intrusive investigation work, together with a ***preliminary contamination assessment***.

6.5 At the time of the current investigation, as no detailed information is available regarding the precise loadings associated with proposed new development, the foundation design discussed below is, by necessity, general in nature.

6.6 This report presents the work carried out and discusses the findings.

FOUNDATION DESIGN

6.7 The current work encountered MADE GROUND to a maximum depth of 1.70m below existing ground level. The MADE GROUND was found to be underlain by CLAY of the Weathered London Clay formation to a maximum borehole termination depth of 8.00m below existing ground level.

6.8 No groundwater was encountered during the drilling process of the current site investigation. However, groundwater was encountered during the return gas/groundwater monitoring visits within borehole BH1 on 18th November 2014 and 4th December 2014 at depths of 5.63m and 4.10m below existing ground level respectively.

6.9 Roots of live appearance up to 1mm in diameter were observed within borehole BH1 to a maximum depth of 2.30m below existing ground level.

6.10 The Weathered London Clay encountered beneath the site has been confirmed to possess 'high' volume change potential in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards.

6.11 It is assumed that the proposed slab will be set at a depth of 3.10m below existing ground level (approximately 1.05m below existing vault floor level). At this depth the basement slab will most likely be set within the 'stiff' Weathered London Clay stratum, which has demonstrated 'good' load-bearing characteristics according to the in-situ testing.

6.12 In this case the Weathered London Clay appears to have relatively 'good' load bearing characteristics, with the results of the in-situ and laboratory testing, in conjunction with research undertaken by Skempton, indicating a maximum safe (design) bearing pressure of approximately 175 kN/m^2 at a depth of 3.10m below existing ground level. These values are considered appropriate for RC rafts and monolithic upstand RC walls at basement floor level with a minimum founding width of 600mm, and for possible mass concrete pad foundations supporting temporary loads relating to the in-situ superstructure.

6.13 London Clay is a particularly challenging material in which to dig and construct. London Clay is an overconsolidated material. Aeons ago it was thickly covered in deposits that compressed it, making it stiff and typically almost impermeable. The clay resists further compression under loading. Below a depth of about 50m this clay gives way to substantial amounts of water-bearing silt and sand. When the clay is unloaded by deep excavations compressive stress is relieved and it expands. After excavation the small immediate rebound is lost in the excavation process. However, this is not the end of the story, as the material then continues to swell, producing significant uplift at the surface within 50 years or so. If the total load of the building and basement matches or exceeds the weight of soil excavated, and the loads from the building are distributed uniformly (as far as that is possible) across the basement slab then this uplift can be minimised. Swelling clay would try to lift up any foundation piles and if a floor slab is laid directly onto the clay without being structurally connected to the basement walls then it would be lifted. Lateral stress relief will also affect the basement side walls, and will need to be allowed for during detailed design, owing to the high 'at rest' earth pressures in these over-consolidated clays.

6.14 The construction would be required to resist pressures arising from the assumed groundwater regime, which is likely to be more onerous than those indicated during the current investigation.

6.15 Once the basement construction has been completed, there is always a possibility that this will act as a local "sump" for surface groundwater and run-off. Therefore, we would recommend that the basement construction is designed to minimise any ingress of groundwater. Detailed recommendations for the waterproofing system are beyond the scope of this report although it is noted that, as a minimum, it would be prudent for the system to be designed in compliance with the requirements of BS8102:2009.

6.16 It should be noted that should ground conditions differing significantly from those described in our report be encountered during foundation excavation, then Chelmer Site Investigation Laboratories Limited should be contacted immediately and that the below noted allowable bearing pressures or recommended foundation type may need to be altered accordingly.

PILED FOUNDATIONS

6.17 If due to the 'high' volume change potential of Weathered London Clay and its well documented potential to swell/shrink, the magnitude of the anticipated loads, or for any other economic reason that shallow foundations are not deemed acceptable, as an alternative, the installation of a combination of secant/contiguous piles around the perimeter of the development in order to construct the basement could be undertaken. It is assumed that the pile heads would be restrained in the permanent condition by a pile cap that will be formed of reinforced concrete and the pile walls will have a concrete inner liner wall.

6.18 At this site the piles could be bored or driven to support foundation loads mainly in adhesion within the underlying London Clay Formation. Given the nature of the ground conditions encountered, and the proximity to adjacent residential buildings, a bored pile solution would appear the most appropriate. However, we do not recommend c.f.a. solid auger piles at this site as these would leave piles sides unsupported prior to placing of concrete.

6.19 It is beyond our brief to provide a full and detailed pile design and the advice of a specialist piling contractor should be sought in this respect. All pile design is of course the responsibility of the selected piling contractor, and thus the soil parameters/assumptions listed below are given for guidance purposes only. These soil parameters/assumptions relate to "static design" for vertically loaded single bored/cfa piles:-

Made Ground

Bulk unit weight, γ_b –	19 kN/m^3
Effective angle of internal friction, φ'	Zero
Undrained shear strength, Su/Cu	Zero

London Clay

Bulk unit weight, γ_b -	20kN/m^3
Undrained shear strength, Su/Cu	Approximately 130 kN/m^2 (from shear vane results)
Adhesion Factor, α	Piling contractor's advice, but within the range 0.45 to 0.60
Effective angle of internal friction, φ' -	18-22°
Bearing Capacity Factor, Nc	9

6.20 In addition, we have assumed that the top 2 to 3 metres of each pile is 'sleeved' to prevent 'heave' forces developing on the shaft. It was also assumed that the London Clay stratum extended beneath the maximum investigated depth of 8.00m.

6.21 The following table gives typical working loads for isolated bored piles to 8.00m below existing ground level.

Pile Type	Depth below existing ground level (m)	Diameter (m)	Working Load (tonnes)
Bored	8.00	0.30	10-15
Bored	8.00	0.45	20-25
Bored	8.00	0.60	30-35

6.22 Again, it is recommended that the advice of competent piling contractors is sought as to the most suitable pile type at this site and for confirmation of the order of working load achievable given the ground conditions encountered and the proprietary pile type selected.

6.23 Settlements of such piles can be expected to be small, typically less than 5-10mm.

6.24 Depending on pile spacing, the ultimate capacity of a pile group may be less than the sum of the ultimate capacities for the individual piles.

6.25 With regard to the possible downward migration of contaminants the recommendations given in the Environment Agency Document *"Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination : Guidance on Pollution Prevention"* National Groundwater and Contaminated Land Centre Report NC/99/73, May 2001, or similar updated guidance, should be followed when assessing pile design at this site.

RETAINING STRUCTURES

6.26 The calculation of permanent lateral pressures against the sides should relate to long-term (effective) stress analysis using critical state soil parameters (based on particle size distributions, in conjunction with Table 3 of BS8002:1994 for granular soils (the relevant Code of Practice), plus research by Peck, Hanson & Thorburn). However, the following preliminary guidelines are accordingly considered appropriate:-

Made Ground

Bulk unit weight, γ_b -	19 kN/m^3
Effective cohesion, c' -	Zero
Effective angle of internal friction, φ' -	25º

London Clay Formation

Bulk unit weight, γ_b -	20 kN/m^3
Effective cohesion, c' -	Zero
Effective angle of internal friction, φ' -	22º
Coefficient of earth pressure at rest, k_0:	1.0, after the likely existing higher stresses have been released by the excavations.

6.27 For Surcharge loading it is necessary that the analyses take account of all lateral loadings arising from potential vehicle loading and any adjacent existing foundations.

6.28 Soil strengths and loads/actions should be factored in accordance with design code adopted.

BASEMENT CONSTRUCTION

6.29 Potential uplift movements relating to the proposed overburden removal are expected considering the amount of material that will be excavated in order to form the proposed basement. The construction would also be required to resist pressures arising from the assumed groundwater regime, which is likely to be more onerous than those indicated during the current investigation.

6.30 No groundwater was encountered during the drilling process of the current site investigation. However, groundwater was encountered during the return gas/groundwater monitoring visits within borehole BH1 on 18th November 2014 and 4th December 2014 at depths of 5.63m and 4.10m below existing ground level respectively.

6.31 Current geotechnical design standards require use of a 'worst credible' approach to selection of groundwater pressures. On sites such as this where high plasticity clays are present close to surface, the groundwater table (or phreatic surface) may rise into the overlying Made Ground, at least in the wettest winters, unless mitigation measures such as land drainage can be installed. No acceptable disposal location exists for such water (because there is no accessible watercourse nearby, and Thames Water will not allow disposal of groundwater to the mains drainage system). As a result, use of a provisional design groundwater level within the Made Ground equal to ground level in the lightwell and 1.0m below ground level on the front side of the basement is recommended. The hydrology and geohydrology aspects of this project are further discussed in detail within the associated Basement Impact Assessment produced by CSI ref BIA/4915.

BURIED CONCRETE

6.32 The results of the BRE Standard Digest 1:2005 test indicates that the samples collected and tested would fall into Class AC-3 of the Building Research Establishments (BRE) classification system Special Digest Part 1:2005 "Concrete in aggressive ground".

6.33 The results of the pH and Sulphate tests undertaken on samples collected and tested from borehole BH1 indicate that the samples would fall into Class DS-1.

6.34 The National Planning Policy Framework contains the legislative framework for the regulation of Development on a site which "is affected by contamination or land stability issues". This legislation states that decisions should ensure that "the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation" and that "adequate site investigation information, prepared by a competent person, is presented." A Competent Person is defined as "a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation". Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the "developer and/or landowner." It also states that "all investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 (2001)."

6.35 For this ***Preliminary Contamination Assessment*** the site has been modelled using the Source-Pathway-Receptor approach to produce a Conceptual Site Model.

Source	(substances or potential contaminants which may cause harm)
Pathway	(a linkage route between the source and receptor)
Receptor	(something which may be harmed by the source e.g. humans, plant, groundwater etc.)

Sources

6.36 No Desk Top Study was requested by the Client. Based on the site works that were undertaken, MADE GROUND was identified to a depth of 1.70m below existing ground level. This is considered likely to be due to the construction of the existing on-site building. No other potential on-site or off-site sources were noted during site works, however, these may be present.

Pathways

6.37 Any contamination could reach the receptors by a number of routes, although the most likely would be by direct contact with the soils via ingestion, inhalation or dermal contact.

6.38 Due to the low permeability of the underlying London Clay formation, ground gas vertical and lateral migrations are considered an unlikely pathway. Migration via preferential pathways may present a pathway for ground gases. No information was available for historic or current services although these are likely to exist.

6.39 Plastic potable water supply pipelines may also provide a pathway for the ingestion of organics via permeation of pipes.

6.40 During the construction phase, dust suppression measures may be required to minimise potential inhalation of dust by construction workers and neighbours.

Receptors

6.41 From the results of the desk study and the intended end site use the following potential receptors have been identified. The following potential receptors have been identified:

- *Construction workers on the site likely to come into contact with the soils.*
- *Structures/Services*
- *Neighbours*
- *Controlled Waters*
- *Future occupants of the proposed development.*

6.42 It should be noted that the CLEA software has limited functionality and contains algorithms, which the EA has publicly expressed its intention to update. As a consequence of this, some of the screening values generated by the CLEA software may not adequately reflect specific site conditions and in some instances are unduly conservative. In addition, it should also be noted that the figures given in the appended table are based on a 6% soil organic matter content.

6.43 The DEFRA/EA model has been developed on the basis of many critical assumptions about possible exposure to soil contamination and the development of conceptual exposure models to describe different land uses as follows:

Residential with plant uptake	Mainly refers to residential gardens in which vegetables are grown.
Residential without plant uptake	Refers to areas which have gardens (e.g. blocks of flats) but without vegetable uptake.
Open Spaces	Areas of open space only – not allocated for any specific usage.
Commercial/Industrial	Commercial/industrial usage where there are open areas which are not hard surfaced.

6.44 The Contaminated Land Exposure Assessment (CLEA) model was originally published in March 2002 as joint DEFRA/EA publications; Contaminated Land Research (CLR) Report CLR 11, with Report CLR7 as a supporting document, providing toxicity data and human tolerable daily intake (TDI) data to be used with this model. This model enabled the derivation of more site-specific values for contaminants present on a site, rather than the use of 'generic' values, which were previously used.

6.45 DEFRA/EA previously published a number of Soil Guideline Values (SGVs) for certain determinands, (common toxic metals), which were generic guideline criteria for assessing the risks to human health from chronic exposure to soil contamination for standard land-use functions. However, these were withdrawn in late 2008 and DEFRA/EA have now issued a new set of guidance documents. With regard to the Chelmer Site Investigations Laboratories Limited standard suite of tests, currently SGV figures have only been issued for Arsenic, Cadmium, Mercury, Nickel, Phenols and Selenium.

6.46 In the absence of currently published SGV values for the remaining contaminants, Messrs. W. S. Atkins have derived ATRISK^{soil} Soil Screening Values (SSVs) based on the new 2009 guidance (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report)) for commercial/industrial, residential without homegrown produce, residential with homegrown produce and allotment land uses. These have been based on the default assumptions provided in the CLEA report which it is understand will be used in the development of future Soil Guideline Values by DEFRA and the Environment Agency. Atkins SSVs have been derived in line with the new guidance using CLEA model v1.04. As the inhalation of vapour pathway contributes less than ten percent of total exposure, this is unlikely to significantly affect the combined assessment criterion and the SSV values used are the combined assessment criterion given by CLEA if free product is not observed.

6.47 Neither CLEA or ATRISK currently publish values for Hexavalent Chromium. Therefore, both Total Chromium and Hexavalent Chromium values have been compared against the Land Quality Management/Chartered Institute of Environmental Health (LQM/CIEH) Generic Assessment Criteria published in 2009 and based on CLEA v1.04 with Total Chromium values based on Chromium III.

6.48 The SGV and SSV levels represent "intervention" levels above which the levels of contamination may pose an unacceptable risk to the health of site-users such that further investigation and/or remediation is required.

6.49 Total Petroleum Hydrocarbons are considered in accordance with the fractions proposed by The Environment Agency, drawing on the TPHCWG methodology. These are contained in Table 4.2 – Petroleum hydrocarbon fractions for use in UK human health risk assessment, based on Equivalent Carbon (EC) number, contained in Science Report P5-080/TR3, *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils.*

6.50 The proposed development will comprise a new basement underneath the existing property and front and rear gardens. *Proposed Development Plans* have been appended.

6.51 Considering the end usage of the site, the chemical results would generally be compared against the ***Residential with Plant Uptake*** criteria.

ASSESSMENT OF RESULTS

Soils

6.52 A lead concentration of 507mg/kg from BH1 at 0.50m bgl exceeded the ATRISK Contaminated Land Screening Values (SSVs) of 322mg/kg.

A mean value test was therefore undertaken for lead. The mean value test generated a result of 627mg/kg normalised upper bound (95th percentile) and therefore ***further action is required***. The results of the SSV Mean Value Test are appended.

6.53 No other constituents within the soil exceed the criteria set out by the ATRISK Contaminated Land Screening Values (SSVs), the CLEA Soil Guideline Values (SGVs) and the LQM/CIEH Generic Assessment Criteria (GAC) for *Residential with plant uptake* criteria.

6.54 An elevated concentration of lead was identified within the MADE GROUND in BH1. However, due to the basement development and the entire front garden being excavated, the risk to future site residents is considered to be '**low**'.

Landborne Gas Emissions

6.55 During the return gas/groundwater monitoring visits, methane concentrations did not exceed 0.1%v/v. The maximum carbon dioxide concentration was recorded at 9.3%v/v in BH1. The associated flow rates were recorded as negative.

6.56 Although the Gas Screening Values (GSVs) calculated are low, due to the associated negative flow rates, carbon dioxide concentrations were recorded up to 9.3%v/v within BH1. In accordance with CIRIA Publication C665 "Assessing Risks posed by Hazardous Ground gases to Buildings (Revised 2007and the NHBC "Traffic Light" system, we would consider that the current site would be classified as **AMBER1** or **Characteristic Situation 2**.

6.57 The Gas/Groundwater Monitoring Results Sheet is appended to this report.

WASTE ACCEPTANCE CRITERIA

6.58 A EN 14473/02 Waste Acceptance Criteria (WAC) test was undertaken to classify for waste disposal purposes. A single sample was collected and tested from borehole BH1 at a depth of 1.00m bgl.

6.59 The results of the WAC test indicated that the sample would probably be classified as "Inert" material. This is considered to be representative of MADE GROUND across the site. Full details of the results are given on the appended results sheets.

6.60 However, it should be noted that Chelmer Site Investigation Laboratories Ltd are not a licensed landfill operator and we therefore strongly recommend that the WAC data should be presented to potential Waste Management Companies in order for them to confirm the waste classification of surplus soils to be removed from this site and to determine its acceptability at appropriate landfill sites for disposal/treatment.

UPDATED CONCEPTUAL MODEL

6.61 The following diagram summaries the potential pollution linkages identified for this site in the form of an updated diagrammatic Conceptual Model.

CIRIA Contaminated Land Risk Assessment Table

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

*Extracted from CIRIA Publication C552 Contaminated Land Risk Assessment

Source	Potential Contaminants	Receptors	Pathways	Associated Hazard (Severity)	Likelihood of occurrence	Potential Risk	Notes
MADE GROUND	Heavy Metals TPHs PAHs Ground Gases	Sites Users (including young children)	Direct contact, ingestion	Medium	Unlikely	Low	Removal of source
			Inhalation of vapours (acute)	Severe	Likely	High	Possible risk present
		Neighbours	Inhalation of vapours (chronic)	Medium	Likely	Moderate	Possible risk present
			Ingestion of contaminated water through water main pipework	Medium	Low likelihood	Moderate/Low	Possible risk present
		Constriction Workers	Direct contact, ingestion	Medium	Likely	Moderate	Possible risk present
		Surface Water	Leaching, lateral migration of shallow groundwater	Medium	Unlikely	Low	No surface water nearby
		Groundwater	Leaching, migration through granular material	Medium	Unlikely	Low	Underlying impermeable geology reduces risk
		Services	Direct contact	Medium	Low likelihood	Moderate/Low	Possible risk present

7.0 ENVIRONMENTAL RECOMMENDATIONS

7.1 An elevated lead concentration was identified at 0.50m below ground level within BH1 in the front garden of the property. The proposed development comprises the extension of the pre-existing single storey basement underneath the entire front garden. The development will involve the excavations and removal of soils from the site, thus removing the contaminant source. It is therefore considered that the soils pose a **'low'** risk to future resident of the site, given the proposed end usage.

7.2 However, due to the elevated concentrations of lead identified, any excavated material at this site may pose a hazard to ground workers as far as Health and Safety is concerned. We would therefore recommend that standard Health and Safety precautions be taken with regard to ground workers at this site. These should include PPE equipment such as gloves, overalls etc. to prevent dermal contact with the soils. Washing facilities should be made available on-site to reduce extended contact with site soils. During the construction phase, dust suppression measures may be required to minimise potential inhalation of dust by neighbours or ground workers.

7.3 All MADE GROUND excavated during the development of the site should be removed off-site to an appropriate landfill for disposal/treatment. The results of the WAC tests indicate that the MADE GROUND would probably be classified as "Inert" material.

7.4 Due to the concentrations of carbon dioxide detected during the return ground gas monitoring visits, ground gas protective measures are recommended to be incorporated within the proposed development. These would help mitigate the ground gas risk to future residents.

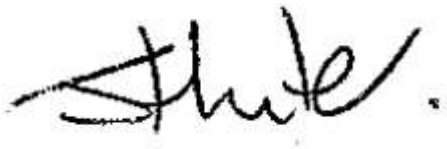
Ground gas protection measures would include;

- A ventilated sub floor void;
- The installation of a ground gas resistant membrane, and;
- Service entry points appropriately sealed.

7.5 With regard to the installation of any future water supply pipe work, reference should be made to the Water Regulations Advisory Service (WRAS) information and guidance note, The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land. It is recommended that the results of the contamination testing undertaken on the site should be provided to the water supplier in order to ensure that any pipe provided complies with their requirements. Barrier pipe should be given consideration if water pipes are to be laid in MADE GROUND.

Additional Comments

7.6 As always, the above recommendations are based on a selected number of representative samples and further testing may be required if any other contamination is suspected or encountered during future ground works.



Prepared By : Jack Hunter BSc (Hons)
Geo-environmental Engineer

Prepared By : Michael Jones MSci (Hons) FGS
Graduate Engineering Geologist

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b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
d) Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, CSI has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
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f) The content of this report represents the professional opinion of experienced environmental consultants. CSI does not provide specialist legal advice and the advice of lawyers may be required.
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h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data, which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
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Chelmer Site Investigations
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Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client: Opulen Investments Ltd	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Weather:** Overcast	**Date:** 30.10.14
Site: 2 Chalcot Square, London, N1	**Job No:** 4915	**Borehole No:** 1	**Boring method:** CFA 100mmØ Secondman	

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L. 0.03	TARMAC	0.03							
0.1	CONCRETE	0.07					Roots of live appearance to 1mmØ to 2.3m.		
	MADE GROUND: medium compact, slightly pungent, dark brown, gravelly sandy clay with numerous brick fragments.	1.6		D					0.5
				D	M	25 28 30 31			1.0
				D					1.5
1.7							No roots observed below 2.3m.		
	Stiff, mid brown, grey veined, silty CLAY with partings of brown and orange silt and fine sand.			D	V	102 104			2.0
				D					2.5
				D	V	122 126			3.0
				D					3.5
	Becoming very stiff from 4.0m.			D	V	130+ 130+			4.0
				D					4.5
		6.3		D	V	130+ 130+			5.0
				D					5.5
				D	V	130+ 130+			6.0
				D	V	130+ 130+			7.0
8.0				D	V	130+ 130+			8.0
	Borehole ends at 8.0m								

Drawn by: jp **Approved by:** ME

Remarks: *Borehole dry and open on completion.*
Plastic standpipe installed to 8.0m.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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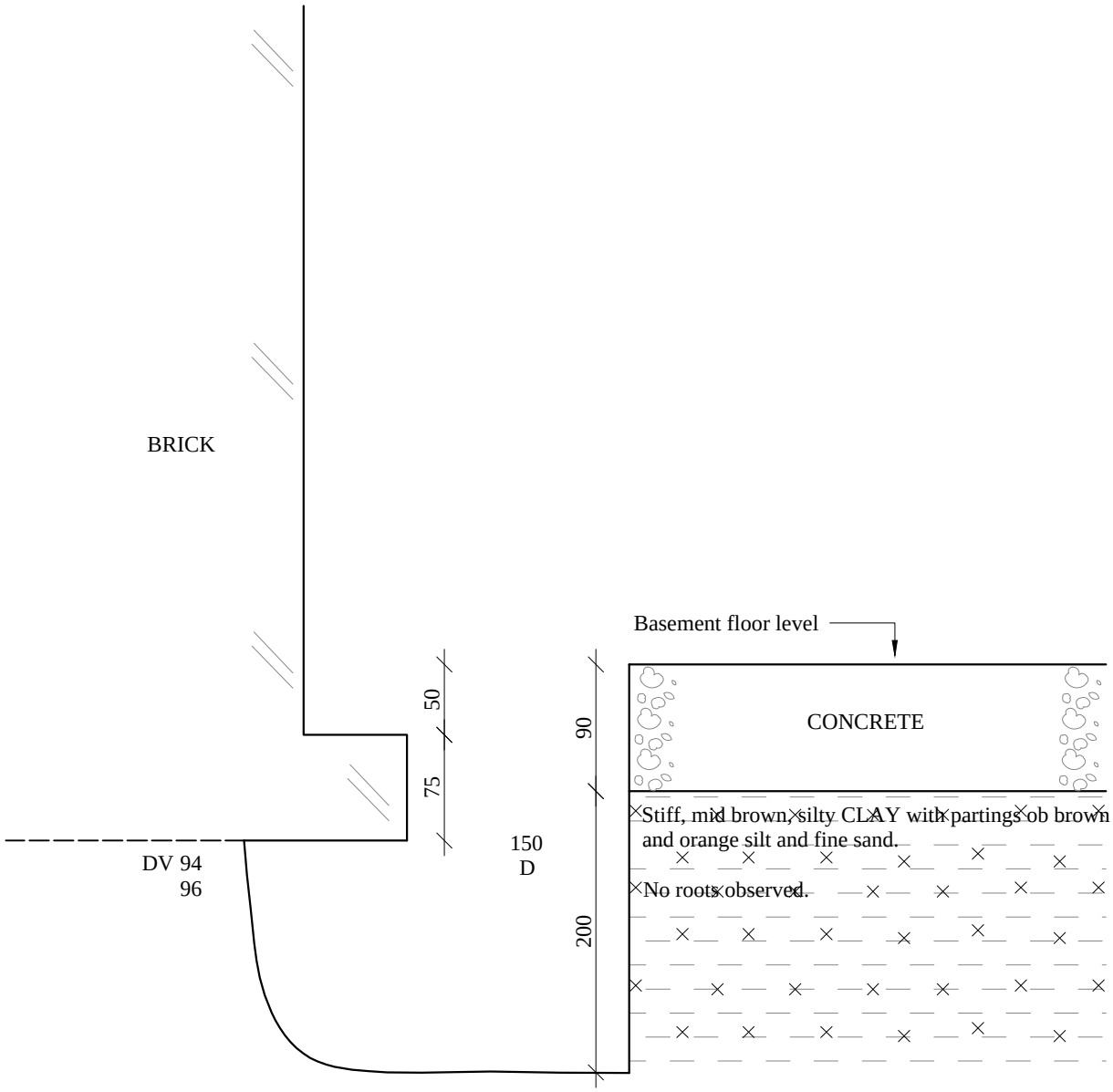
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client: Opulen Investments Ltd	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Date:** 30.10.14
Location: 2 Chalcot Square, London, N1	**Job No:** 4915	**Trial Pit No:** 1	**Weather:** Internal
Excavation Method: Hand tools		**Drawn by:** JP	**Checked by:** ME



TP1 ENDS AT 290mm

Remarks: *Both foundations are similar.*

Key:
D Small disturbed sample
B Bulk disturbed sample
U Undisturbed sample (U100)
N Standard Penetration Test Blow Count
J Jar sample
V Pilcon Vane (kPa)
M Mackintosh Probe
W Water Sample

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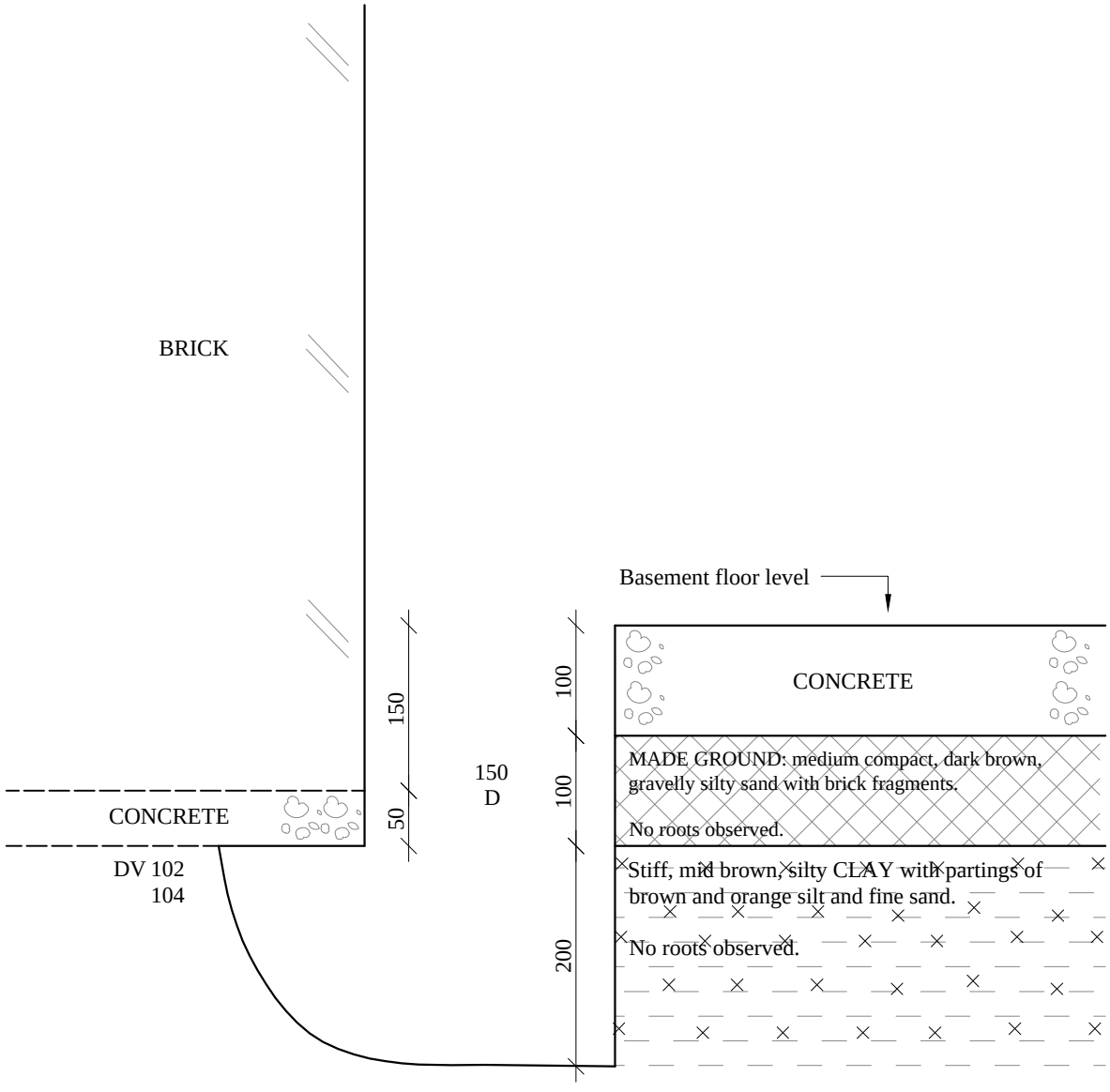
Chelmer Site Investigations

Client: Opulen Investments Ltd	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Date:** 30.10.14
Location: 2 Chalcot Square, London, N1	**Job No:** 4915	**Trial Pit No:** 2	**Weather:** Internal
Excavation Method: Hand tools		**Drawn by:** JP	**Checked by:** ME



TP2 ENDS AT 400mm

Remarks: *Both foundations are similar.*

Key:
D Small disturbed sample
B Bulk disturbed sample
U Undisturbed sample (U100)
N Standard Penetration Test Blow Count
J Jar sample
V Pilcon Vane (kPa)
M Mackintosh Probe
W Water Sample

UKAS TESTING
8284

Chelmer Geotechnical Laboratories

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Telephone: 01245 400 930 **Fax:** 01245 400 933

Email: info@siteinvestigations.co.uk **Website**: www.soillabs.co.uk

Geotechnical Testing

Client : Opulen Investiments Ltd

Site Name : 2 Chalcot Square, London, N1

Client Reference : CSI4915

CGL Reference : CGL04475

Date of Completion : 07-Nov-14

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Chelmer Geotechnical Laboratories

Content Summary

This report contains all test results indicated on the attached test instruction/summary (Q17).

CGL Reference :	CGL04475
Client Reference :	CSI4915
For the attention of :	Opulen Investiments Ltd
This report comprises of the following :	1 Page(s) of Results
	1 Moisture/Shear Strength Chart
	1 Plasticity Chart
	4 Pages BRE SD1 Results
	8 Pages of WAC & ENV Results

Notes :

General

Please refer to report summary notes for details pertaining to methods undertaken and their subsequent accreditations

Samples were supplied by Chelmer Site Investigations

All tests performed in-house unless otherwise stated

Deviant Samples

Samples were received in suitable containers	Yes
A date and time of sampling was provided	Yes
Arrived damaged and/or denatured	No

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories

Job Number : CGL04475
Client : Opulen Investiments Ltd
Client Reference : CSI4915
Site Name : 2 Chalcot Square, London, N1

Date Received : 04/11/2014
Date Testing Started : 05/11/2014
Date Testing Completed : 07/11/2014
Laboratory Used : Chelmer Geotechnical, CM3 8AB

Sample Ref			Sample Type	*Moisture Content (%) [1]	*Soil Faction > 0.425mm (%) [2]	*Liquid Limit (%) [3]	*Plastic Limit (%) [4]	*Plasticity Index (%) [5]	*Liquidity Index (%) [5]	*Modified Plasticity Index (%) [6]	*Soil Class [7]	Filter Paper Contact Time (h) [8]	*Soil Sample Suction (kPa)	Insitu Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	*pH Value [11]	*Sulphate Content (g/l)		
BH/TP/WS	Depth (m)	UID															SO_3 [12]	SO_4 [13]	Class [14]
BH1	2.0	58300	D	31	6	75	18	57	0.23	54	CV			103		7.3	0.12	0.14	DS-1
BH1	3.0	58301	D	31	<5	78	18	60	0.21	60	CV			124					
BH1	4.0	58302	D	30	<5	78	18	60	0.21	60	CV			>130		7.6	0.45	0.54	DS-1
BH1	6.0	58303	D	31	<5	76	18	58	0.22	58	CV			>130					
BH1	8.0	58304	D	29	<5	74	17	56	0.22	56	CV			>130					
	4.0																		

Notes :- *UKAS Accredited Tests

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method S9a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by Chelmer Site Investigations using a Pilcon hand vane or Geonor vane (GV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005

Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

D - Disturbed sample
B - Bulk sample
U - U100 (undisturbed sample)
W - Water sample
ENP - Essentially Non-Plastic
U/S - Underside Foundation

UKAS TESTING
8284

Comments :-

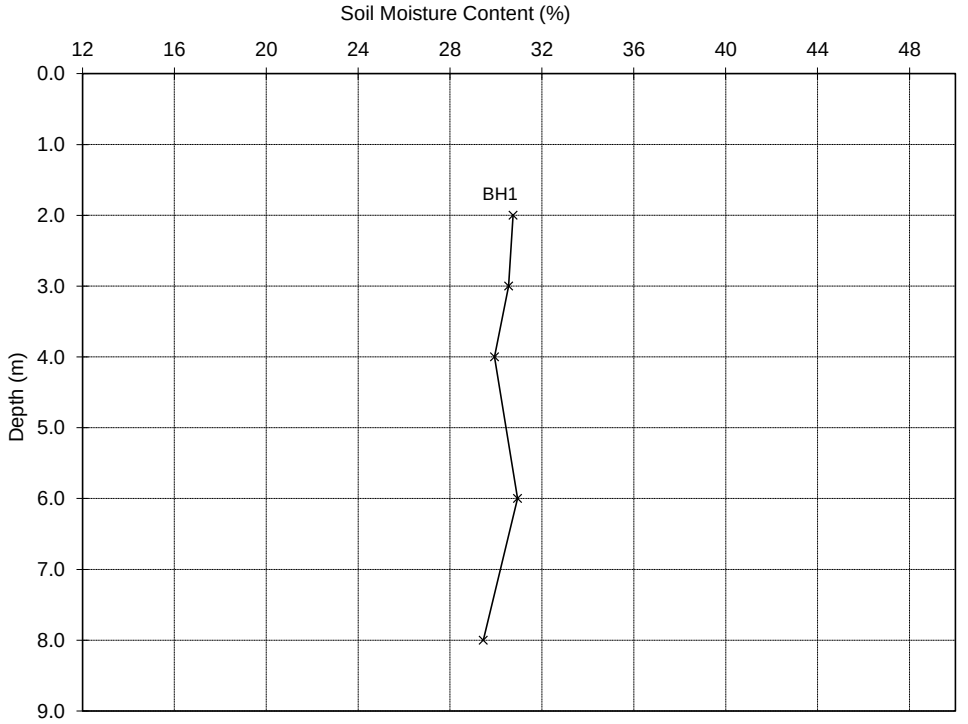
Technician :- HS/MT
Checked By :- MC
Date Checked :- 07-Nov-14

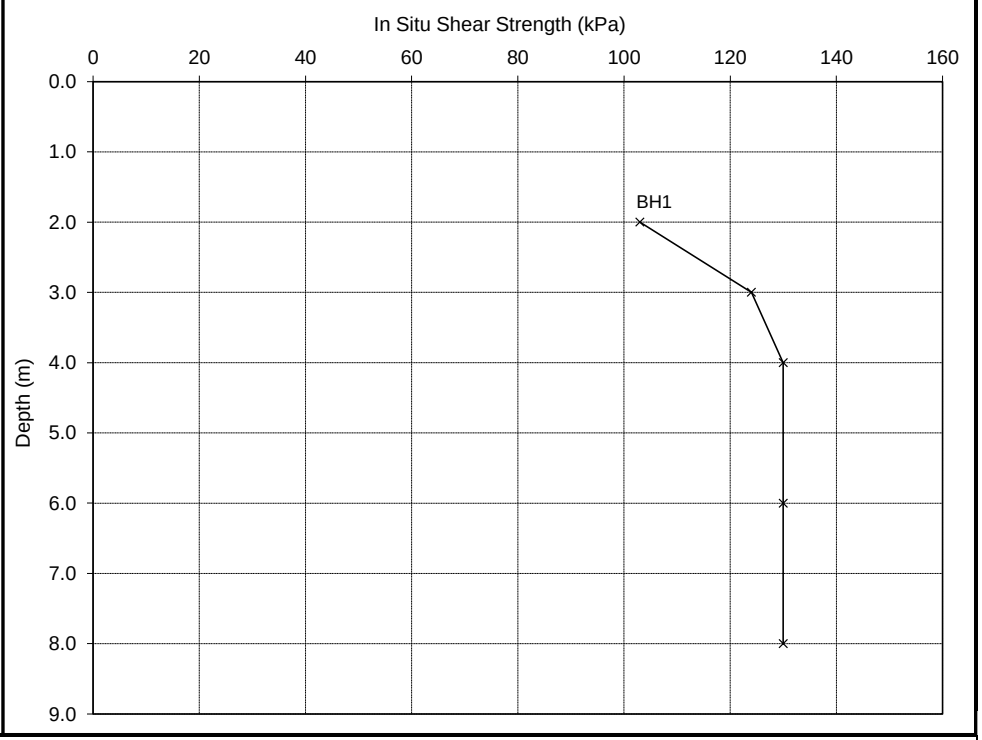
Laboratory Testing Results

Moisture Content/Shear Strength Profile

Chelmer Geotechnical Laboratories

Job Number :	CGL04475	Date Received :	04/11/2014
Client :	Opulen Investiments Ltd	Date Testing Started :	05/11/2014
Client Reference :	CSI4915	Date Testing Completed :	07/11/2014
Site Name :	2 Chalcot Square, London, N1	Laboratory :	Chelmer Geotechnical Laboratories, CM3 8AB





Notes :-

1. If the Soil Fraction > 0.425mm exceeds 5% the Equivalent Moisture Content of the remainder (calculated in accordance with BS 1377: Part 2 : 1990, cl.3.2.4 note 1) is also plotted and the alternative profile additionally shown as an appropriately coloured broken line.
2. If plotted, 0.4 LL and PL+2 (after Driscoll, 1983) should only be applied to London Clay (and similarly over consolidated clays) at shallow depths.

Unless otherwise stated, values of Shear Strength were determined in situ by Chelmer Site Investigations using a Pilcon Hand Vane the calibration of which is limited to a maximum reading of 140 kPa.

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8284

Comments :-

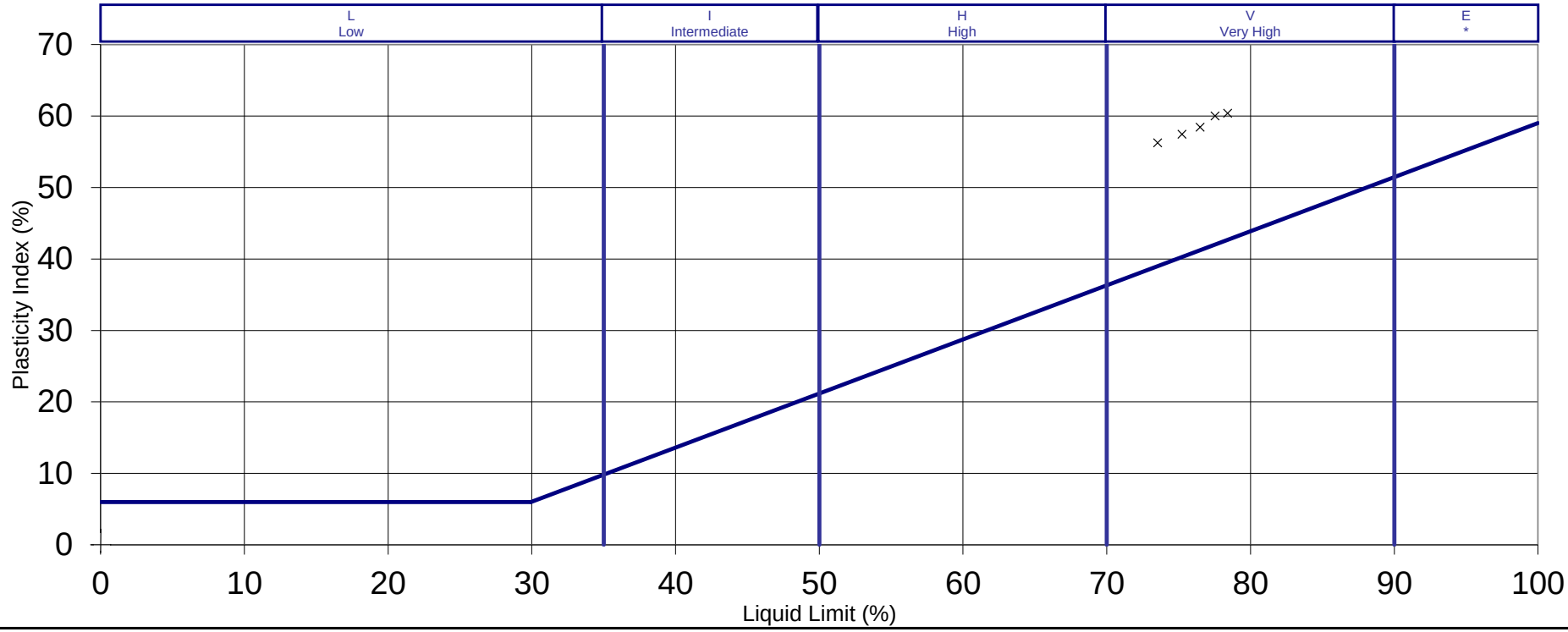
Checked By :- MC Date Checked :- 07-Nov-14

Laboratory Testing Results

Plasticity Chart for the classification of fine soils and the finer part of coarse soils
In Compliance with BS5930 : 1999

Chelmer Geotechnical Laboratories

Job Number :	CGL04475	Date Received :	04/11/2014
Client :	Opulen Investiments Ltd	Date Testing Started :	05/11/2014
Client Reference :	CSI4915	Date Testing Completed :	07/11/2014
Site Name :	2 Chalcot Square, London, N1	Laboratory :	Chelmer Geotechnical Laboratories, CM3 8AB



Notes :-

SILT (M-SOIL), M, plots below A-Line
CLAY, C, plots above A-Line }M and C may be combined as FINE SOIL, F.

Key :- BH1

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8284

Comments :-

Checked By :- MC Date Checked :- 07-Nov-14

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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: 14-26382

Site Reference:	2 Chalcot Square, London, N1
Project / Job Ref:	CSI4915
Order No:	MC/4915/3252/MC
Sample Receipt Date:	06/11/2014
Sample Scheduled Date:	07/11/2014
Report Issue Number:	1
Reporting Date:	13/11/2014

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

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

4480

Soil Analysis Certificate							
QTS Environmental Report No: 14-26382	**Date Sampled**	30/10/14	30/10/14	30/10/14		
Chelmer Site Investigation Laboratories Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 2 Chalcot Square, London, N1	**TP / BH No**	58299	58301	58304		
Project / Job Ref: CSI4915	**Additional Refs**	BH1	BH1	BH1		
Order No: MC/4915/3252/MC	**Depth (m)**	1.00	3.00	8.00		
Reporting Date: 13/11/2014	**QTSE Sample No**	125094	125095	125096		

Determinand	**Unit**	**RL**	**Accreditation**					
pH	pH Units	N/a	**MCERTS**	8.2	8.1	8.0		
Total Sulphate as SO_4	mg/kg	< 200	NONE	746	1090	11190		
W/S Sulphate as SO4 (2:1)	g/l	< 0.01	**MCERTS**	0.36	0.32	2.19		
Total Sulphur	mg/kg	< 200	NONE	349	370	3778		
Ammonium as NH_4	mg/kg	< 0.5	NONE	2.6	1.9	5.5		
W/S Chloride (2:1)	mg/kg	< 1	**MCERTS**	48	82	98		
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	**MCERTS**	36	18	5		
W/S Magnesium	g/l	< 0.0001	NONE	0.0058	0.0423	0.0305		

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

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

Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
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Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 14-26382	
Chelmer Site Investigation Laboratories Ltd	
Site Reference: 2 Chalcot Square, London, N1	
Project / Job Ref: CSI4915	
Order No: MC/4915/3252/MC	
Reporting Date: 13/11/2014	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
125094	58299	BH1	1.00	20.8	Brown clayey gravel
125095	58301	BH1	3.00	18.8	Light brown clay
125096	58304	BH1	8.00	19.3	Light brown clay

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

Insufficient Sample I/S

Unsuitable Sample U/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 - Methodology & Miscellaneous Information
QTS Environmental Report No: 14-26382
Chelmer Site Investigation Laboratories Ltd
Site Reference: 2 Chalcot Square, London, N1
Project / Job Ref: CSI4915
Order No: MC/4915/3252/MC
Reporting Date: 13/11/2014

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	Determination of acetone/hexane extractable hydrocarbons by GC-FID	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	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried
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QTS Environmental Report No: 14-26260

Site Reference:	2 Chalcot Square, London, N1
Project / Job Ref:	CSI4915
Order No:	MC/4867/3221/MC
Sample Receipt Date:	05/11/2014
Sample Scheduled Date:	05/11/2014
Report Issue Number:	1
Reporting Date:	11/11/2014

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

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UKAS TESTING 4480

Soil Analysis Certificate							
QTS Environmental Report No: 14-26260	**Date Sampled**	30/10/14	30/10/14	30/10/14		
Chelmer Site Investigation Laboratories Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 2 Chalcot Square, London, N1	**TP / BH No**	58248	58249	58250		
Project / Job Ref: CSI4915	**Additional Refs**	BH1	BH1	BH1		
Order No: MC/4867/3221/MC	**Depth (m)**	0.50	1.00	1.50		
Reporting Date: 11/11/2014	**QTSE Sample No**	124636	124637	124638		

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.5	7.5	7.3		
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2		
Total Sulphate as SO_4	mg/kg	< 200	NONE	663	857	538		
W/S Sulphate as SO4 (2:1)	g/l	< 0.01	MCERTS	0.07	0.14	0.88		
Elemental Sulphur	mg/kg	< 10	NONE	< 10	< 10	< 10		
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5		
Arsenic (As)	mg/kg	< 2	MCERTS	10	9	5		
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5		
Chromium (Cr)	mg/kg	< 2	MCERTS	29	31	39		
Copper (Cu)	mg/kg	< 4	MCERTS	56	69	32		
Lead (Pb)	mg/kg	< 3	MCERTS	507	315	145		
Mercury (Hg)	mg/kg	< 1	NONE	1.1	1.1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	19	20	28		
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3		
Zinc (Zn)	mg/kg	< 3	MCERTS	89	86	77		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2		

Analytical results are expressed on a dry weight basis where samples are dried at less than 30^{O}C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis $^{(S)}$

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Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 14-26260	**Date Sampled**	30/10/14	30/10/14	30/10/14		
Chelmer Site Investigation Laboratories Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 2 Chalcot Square, London, N1	**TP / BH No**	58248	58249	58250		
Project / Job Ref: CSI4915	**Additional Refs**	BH1	BH1	BH1		
Order No: MC/4867/3221/MC	**Depth (m)**	0.50	1.00	1.50		
Reporting Date: 11/11/2014	**QTSE Sample No**	124636	124637	124638		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	0.31	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	0.87	0.12	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	0.73	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.39	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	0.44	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.48	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.22	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.37	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.25	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.23	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	4.3	< 1.6	< 1.6		

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

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Soil Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 14-26260	**Date Sampled**	30/10/14	30/10/14	30/10/14		
Chelmer Site Investigation Laboratories Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 2 Chalcot Square, London, N1	**TP / BH No**	58248	58249	58250		
Project / Job Ref: CSI4915	**Additional Refs**	BH1	BH1	BH1		
Order No: MC/4867/3221/MC	**Depth (m)**	0.50	1.00	1.50		
Reporting Date: 11/11/2014	**QTSE Sample No**	124636	124637	124638		

Determinand	**Unit**	**RL**	**Accreditation**					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C21 - C34	mg/kg	< 6	NONE	< 6	< 6	< 6		
Aliphatic (C5 - C34)	mg/kg	< 12	NONE	< 12	< 12	< 12		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aromatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aromatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aromatic >C16 - C21	mg/kg	< 1	NONE	2	< 1	< 1		
Aromatic >C21 - C35	mg/kg	< 6	NONE	< 6	< 6	< 6		
Aromatic (C5 - C35)	mg/kg	< 12	NONE	< 12	< 12	< 12		
Total >C5 - C35	mg/kg	< 24	NONE	< 24	< 24	< 24		

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

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Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 14-26260	**Date Sampled**	30/10/14	30/10/14	30/10/14		
Chelmer Site Investigation Laboratories Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 2 Chalcot Square, London, N1	**TP / BH No**	58248	58249	58250		
Project / Job Ref: CSI4915	**Additional Refs**	BH1	BH1	BH1		
Order No: MC/4867/3221/MC	**Depth (m)**	0.50	1.00	1.50		
Reporting Date: 11/11/2014	**QTSE Sample No**	124636	124637	124638		

Determinand	**Unit**	**RL**	**Accreditation**					
Benzene	ug/kg	< 2	**MCERTS**	< 2	< 2	< 2		
Toluene	ug/kg	< 5	**MCERTS**	< 5	< 5	< 5		
Ethylbenzene	ug/kg	< 10	**MCERTS**	< 10	< 10	< 10		
p & m-xylene	ug/kg	< 10	**MCERTS**	< 10	< 10	< 10		
o-xylene	ug/kg	< 10	**MCERTS**	< 10	< 10	< 10		
MTBE	ug/kg	< 5	**MCERTS**	< 5	< 5	< 5		

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

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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3

QTS Environmental Report No: 14-26260	**Date Sampled**	30/10/14	
Chelmer Site Investigation Laboratories Ltd	**Time Sampled**	None Supplied	
Site Reference: 2 Chalcot Square, London, N1	**TP / BH No**	58249	
Project / Job Ref: CSI4915	**Additional Refs**	BH1	
Order No: MC/4867/3221/MC	**Depth (m)**	1.00	
Reporting Date: 11/11/2014	**QTSE Sample No**	124637	

Determinand	**Unit**	**MDL**		**Landfill Waste Acceptance Criteria Limits**		
				Inert Waste Landfill	**Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
TOC	%	< 0.1	1.7	3%	5%	6%
Loss on Ignition	%	< 0.01	6.20	--	--	10%
BTEX[MU]	mg/kg	< 0.05	< 0.05	6	--	--
Sum of PCBs	mg/kg	< 0.7	< 0.7	1	--	--
Mineral Oil	mg/kg	< 6	< 6	500	--	--
Total PAH[MU]	mg/kg	< 1.7	< 1.7	100	--	--
pH[MU]	pH Units	N/a	7.5	--	>6	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1	--	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	< 0.01	< 0.01		< 0.2	0.5	2	25
Barium	0.04	< 0.02		0.2	20	100	300
Cadmium	< 0.0005	< 0.0005		< 0.02	0.04	1	5
Chromium	< 0.005	< 0.005		< 0.20	0.5	10	70
Copper	< 0.01	< 0.01		< 0.5	2	50	100
Mercury	< 0.005	< 0.005		< 0.01	0.01	0.2	2
Molybdenum	0.011	0.006		< 0.1	0.5	10	30
Nickel	< 0.007	< 0.007		< 0.2	0.4	10	40
Lead	< 0.005	< 0.005		< 0.2	0.5	10	50
Antimony	< 0.005	< 0.005		< 0.06	0.06	0.7	5
Selenium	< 0.005	< 0.005		< 0.1	0.1	0.5	7
Zinc	< 0.005	< 0.005		< 0.2	4	50	200
Chloride[U]	5	1		13	800	15000	25000
Fluoride[U]	0.7	0.6		5.8	10	150	500
Sulphate[U]	46	7		89	1000	20000	50000
TDS	145	69		728	4000	60000	100000
Phenol Index	< 0.01	< 0.01		< 0.5	1	-	-
DOC	50.2	16.8		185	500	800	1000
Leach Test Information							
Sample Mass (kg)	0.20						
Dry Matter (%)	87.7						
Moisture (%)	14.2						
Stage 1							
Volume Eluate L2 (litres)	0.33						
Filtered Eluate VE1 (litres)	0.09						

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: 14-26260	
Chelmer Site Investigation Laboratories Ltd	
Site Reference: 2 Chalcot Square, London, N1	
Project / Job Ref: CSI4915	
Order No: MC/4867/3221/MC	
Reporting Date: 11/11/2014	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
124636	58248	BH1	0.50	15.4	Brown clay with brick
124637	58249	BH1	1.00	12.3	Brown clay with stones
124638	58250	BH1	1.50	17.3	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: 14-26260
Chelmer Site Investigation Laboratories Ltd
Site Reference: 2 Chalcot Square, London, N1
Project / Job Ref: CSI4915
Order No: MC/4867/3221/MC
Reporting Date: 11/11/2014

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	Determination of acetone/hexane extractable hydrocarbons by GC-FID	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	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001

D Dried
AR As Received

8284

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Where our involvement consists exclusively of testing samples, the results and comments (if provided) relate only to the samples tested.

Any samples that are deemed to be subject to deviation will be recorded as such within the test summary.

Chelmer Consultancy Services
'Groundbreaking Services'

Contamination Test Results on Soil Samples

Location: 2 Chalcot Square		Job No. : 4915	Sheet 1 of 1

Borehole No.	Units	BH1	BH1	BH1	ATRISK Contaminated Land Screening Values (SSV) derived using CLEA v1.04 for 6% SOM			
Sample No.		124636	124637	124638				
Depth (m)		0.50	1.00	1.50				
Material Type		MADE GROUND	MADE GROUND	MADE GROUND	Residential with plant uptake	Residential without plant uptake	Allotments	Commercial/ Industrial
Aromatic Hydrocarbons (mg/kg)	>C5-C7	< 0.01	< 0.01	< 0.01	0.06	0.07	0.07	7.37
	>C7-C8	< 0.05	< 0.05	< 0.05	14.9	15.2	106	1780
	>C8-C10	< 1	< 1	< 1	23.7	24.1	53.2	2700
	>C10-C12	< 1	< 1	< 1	132	147	71.3	36800
	>C12-C16	< 1	< 1	< 1	452	700	132	38000
	>C16-C21	2	< 1	< 1	804	1330	288	28400
	>C21-C35	< 6	< 6	< 6	1220	1330	1550	28400
Aliphatic Hydrocarbons (mg/kg)	>C5-C6	< 0.01	< 0.01	< 0.01	26.1	26.1	4250	>1000000
	>C6-C8	< 0.05	< 0.05	< 0.05	87.8	87.9	13900	>100000
	>C8-C10	< 1	< 1	< 1	14.5	14.5	1780	86700
	>C10-C12	< 1	< 1	< 1	87.7	87.8	7460	94600
	>C12-C16	< 1	< 1	< 1	4010	4050	13300	95300
	>C16-C21	< 1	< 1	< 1	88200	88900	281000	>1000000
	>C21-C35	< 6	< 6	< 6	88200	88900	281000	>1000000
Naphthalene	mg/kg	< 0.1	< 0.1	< 0.1	8.71	9.22	23.4	22700
Acenaphthylene	mg/kg	< 0.1	< 0.1	< 0.1	-	-	-	-
Acenaphthene	mg/kg	< 0.1	< 0.1	< 0.1	2130	4770	612	106000
Fluorene	mg/kg	< 0.1	< 0.1	< 0.1	1930	3100	725	72100
Phenanthrene	mg/kg	0.31	< 0.1	< 0.1	-	-	-	-
Anthracene	mg/kg	< 0.1	< 0.1	< 0.1	18300	24000	10400	545000
Fluoranthene	mg/kg	0.87	0.12	< 0.1	2160	3210	924	72700
Pyrene	mg/kg	0.73	< 0.1	< 0.1	1550	2400	620	54500
Benzo(a)anthracene	mg/kg	0.39	< 0.1	< 0.1	18	18.2	76.8	218
Chrysene	mg/kg	0.44	< 0.1	< 0.1	2280	2330	6350	22000
Benzo(b)fluoranthene	mg/kg	0.48	< 0.1	< 0.1	24.1	24.4	93	223
Benzo(k)fluoranthene	mg/kg	0.22	< 0.1	< 0.1	244	246	1100	2240
Benzo(a)pyrene	mg/kg	0.37	< 0.1	< 0.1	2.43	2.46	10.3	22.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.25	< 0.1	< 0.1	23.9	24.3	84.9	222
Dibenz(a,h)anthracene	mg/kg	< 0.1	< 0.1	< 0.1	2.4	2.42	12.3	22.4
Benzo(ghi)perylene	mg/kg	0.23	< 0.1	< 0.1	248	249	1630	2250
TOTAL PAH	mg/kg	4.3	< 1.6	< 1.6				
Cyanide (Free)	mg/kg	< 2	< 2	< 2	34	34	34	34
pH	unit	7.5	7.5	7.3	-	-	-	-
Copper (Total)	mg/kg	56	69	32	4020	8370	1110	109000
Lead (Total)	mg/kg	507	315	145	322	444	160	6830
Zinc (Total)	mg/kg	89	86	77	17200	46800	3990	917000
					LQM/CIEH Generic Assessment Criteria			
Chromium (Total)	mg/kg	29	31	39	3000	3000	34600	30400
					CLEA Soil Guideline Values (SGV)			
Arsenic (Total)	mg/kg	10	9	5	32	32	43	640
Cadmium (Total)	mg/kg	< 0.5	< 0.5	< 0.5	10	10	1.8	230
Mercury (Total)	mg/kg	1.1	1.1	< 1	170	170	80	3600
Nickel (Total)	mg/kg	19	20	28	130	130	230	1800
Phenols (Total)	mg/kg	< 2	< 2	< 2	420	420	280	3200
Selenium (Total)	mg/kg	89	86	77	350	350	120	13000
Total Sulphate as SO4	mg/kg	663	857	538	-	-	-	-
W/S Sulphate as SO4 (2:1)	g/l	0.07	0.14	0.88				
Elemental Sulphur	mg/kg	< 10	< 10	< 10	-	-	-	-
Sulphide	mg/kg	< 5	< 5	< 5	-	-	-	-

Key

PAH - Polyaromatic Hydrocarbons
TPH - Total Petroleum Hydrocarbons
- Not determined

Result exceeds ATRISK screening value
Result exceeds EQS/CIEH generic assessment criteria
Result exceeds CLEA Soil Guideline Value (SGV)

Chelmer Consultancy Services
'Groundbreaking Services'

Job No.	**4915**
Location	**2 Chalcot Square**
Date	**January 2015**
Number of Made Ground Samples	**3**
t value	**2.92**
Determinand	**Lead**
ATRISK (SSV) Residential With Plant Uptake	**322**

Contaminant Concentration (mg/kg)	x^2
507.00	257049.00
315.00	99225.00
145.00	21025.00
967.00	

Mean	**322.3333333**
Sum of x^2	**377299.00**
Standard Deviation^2 =	**32801.333**
Standard Deviation =	**181.111**

Normalised Upper Bound	**627.66**

Is Action still required in the averaging area based on the mean value test after DEFRA R & D Publication CLR 7 methodology

Yes

Chelmer Consultancy Services
Unit 15, East Hanningfield Industrial Estate, Old Church Road
East Hanningfield, Essex CM3 8AB
Telephone: 01245 400 930 Fax: 01245 400 933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Landborne Gas Assessment

Site Ref: 4915
Site Name: 2 Chalcot Square, London, NW1 8YB

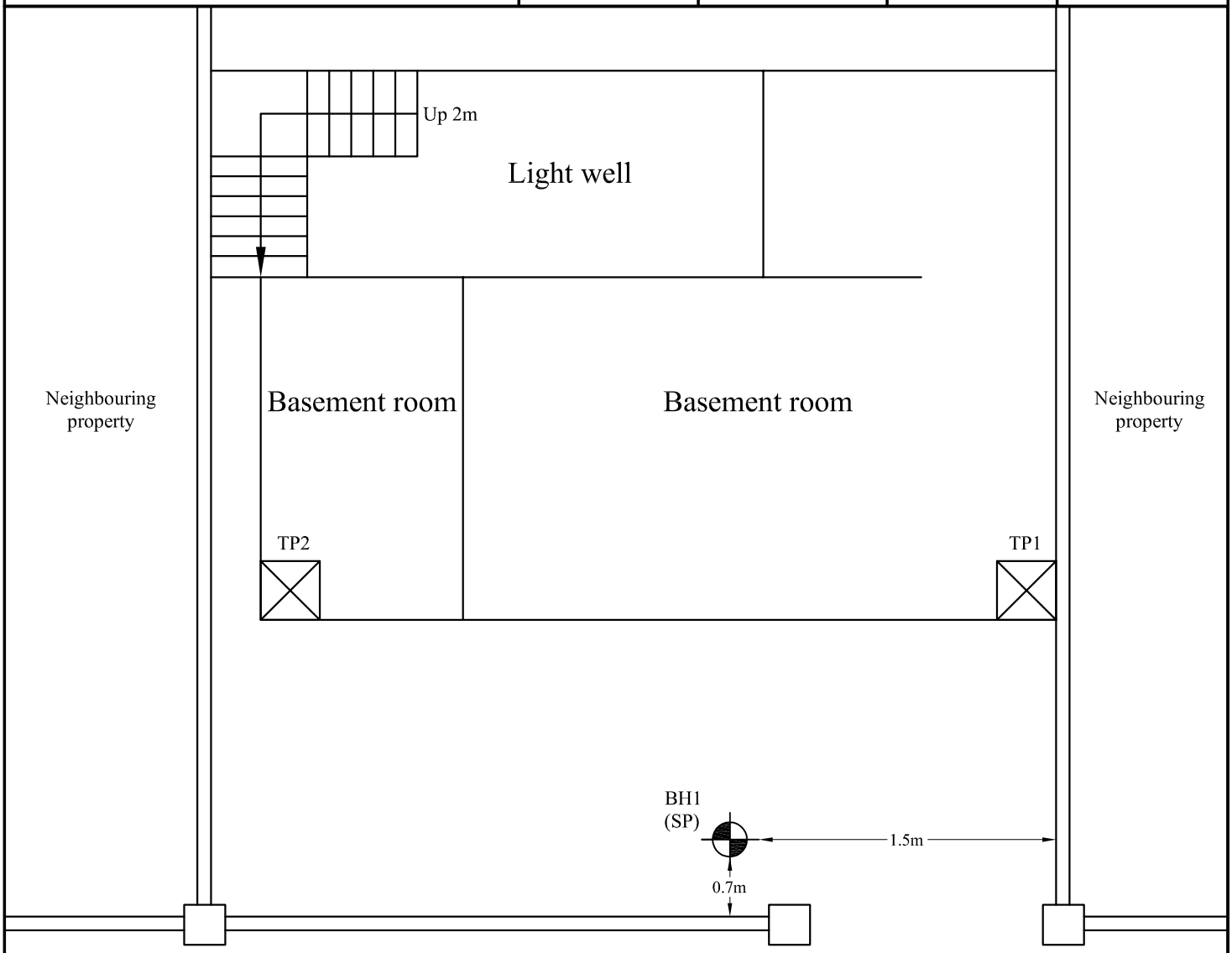
Well	Date	Methane Peak	Methane Steady	Methane GSV	Carbon Dioxide Peak	Carbon Dioxide Steady	Carbon Dioxide GSV	Oxygen	Atmos.	Flow	Response Zone	Depth to Water	CO	H2S
		%v/v	%v/v	l/hr	%v/v	%v/v	l/hr	%v/v	mbar	l/hr	m bgl	m bgl	ppm	ppm
BH1	18/11/2014	0.1	0.1	-0.0005	0.1	0.1	-0.0005	20.8	1004	-0.5	1.00-8.00	5.63	0	0
	04/12/2014	0.2	0.2	-0.0240	9.3	9.3	-1.1160	9.1	1011	-12.0		4.10	1	1

Notes

NR = Not recorded
Values in Bold exceed the CO_2 Building Regulations threshold (>1.5%)
Values in Red exceed the Buildings Regulations Action Level (CO_2 >5.0% and CH_4 >1.5%)

Chelmer Site Investigations
Unit 15 East Hanningfield Industrial Estate
Old Church Road, East Hanningfield, Essex CM3 8AB
Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

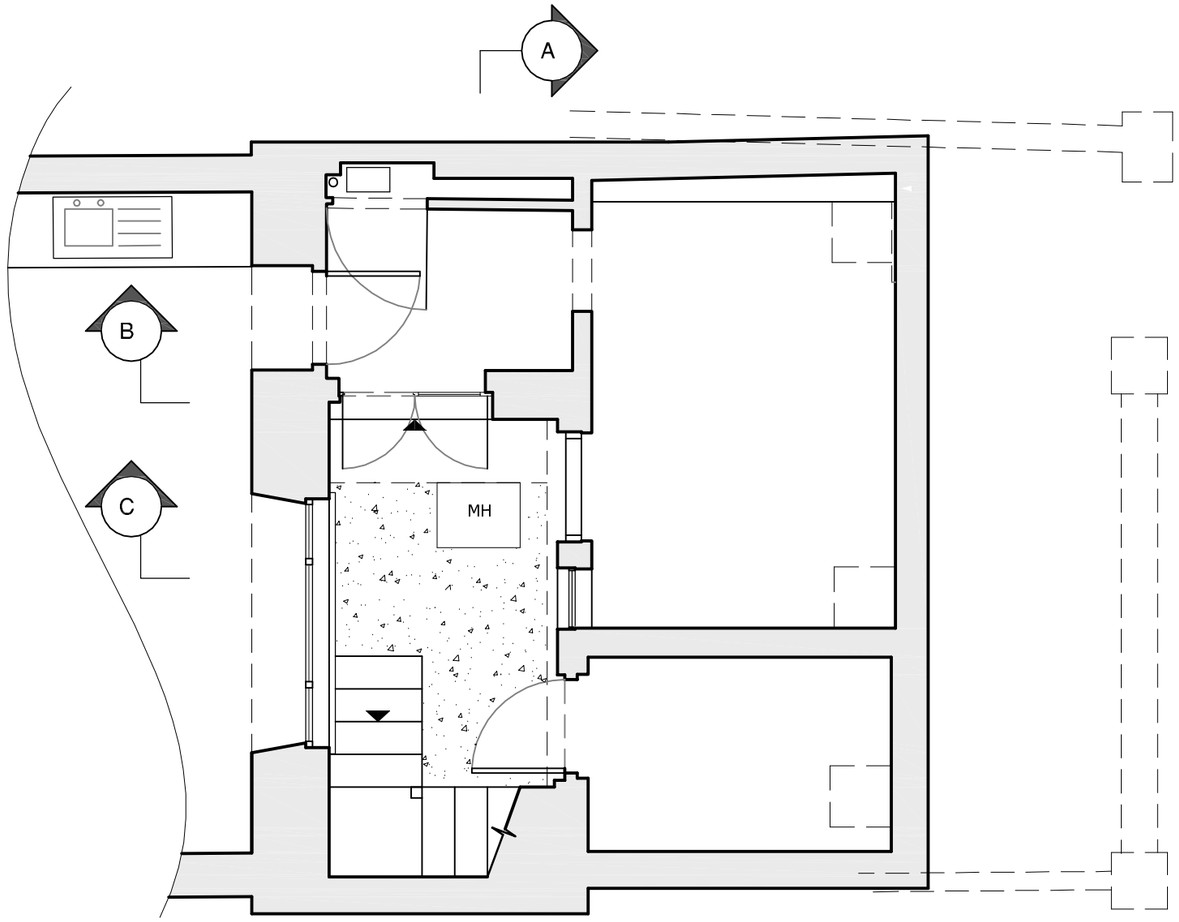
Client: Opulen Investments Ltd	**Scale:** N.T.S.	**Sheet:** 1 of 1	**Date:** 30.10.14	
Location: 2 Chalcot Square, London, N1	**Job No:** 4915	**Weather:** Overcast	**Drawn by: JP**	**Checked by: ME**



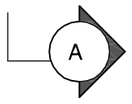
Notes: *On site tree identification for guidance only. Not authenticated.*

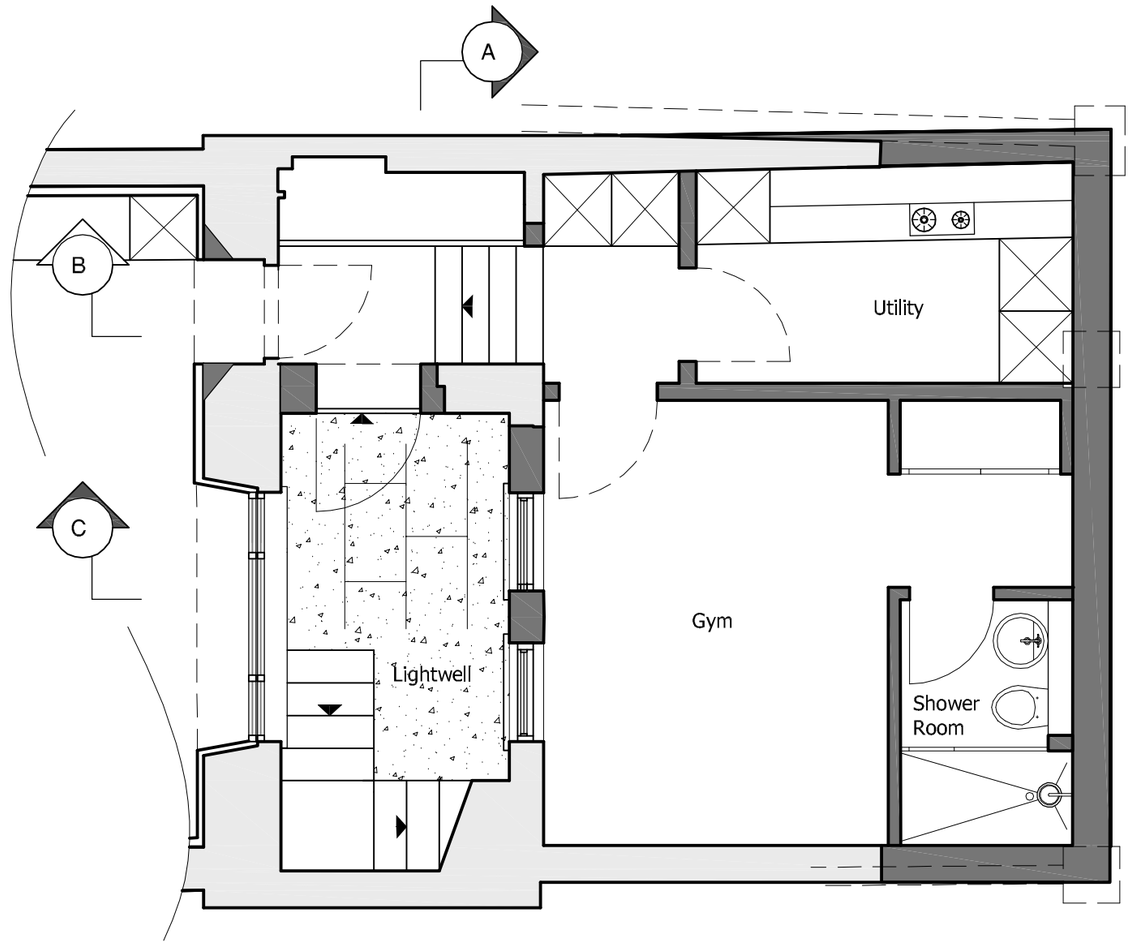
Key:

Tree/Shrub | Borehole | Trial Pit | G Gully | Tree Stump | Rain Water/ Soil Pipe | MH Manhole

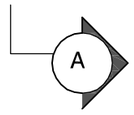


EXISTING LOWER GROUND, FRONT ONLY





PROPOSED LOWER GROUND, FRONT ONLY



M 1:50
0 0,5 1,0 5,0 [m]

I N D I G O
DESIGN ASSOCIATES
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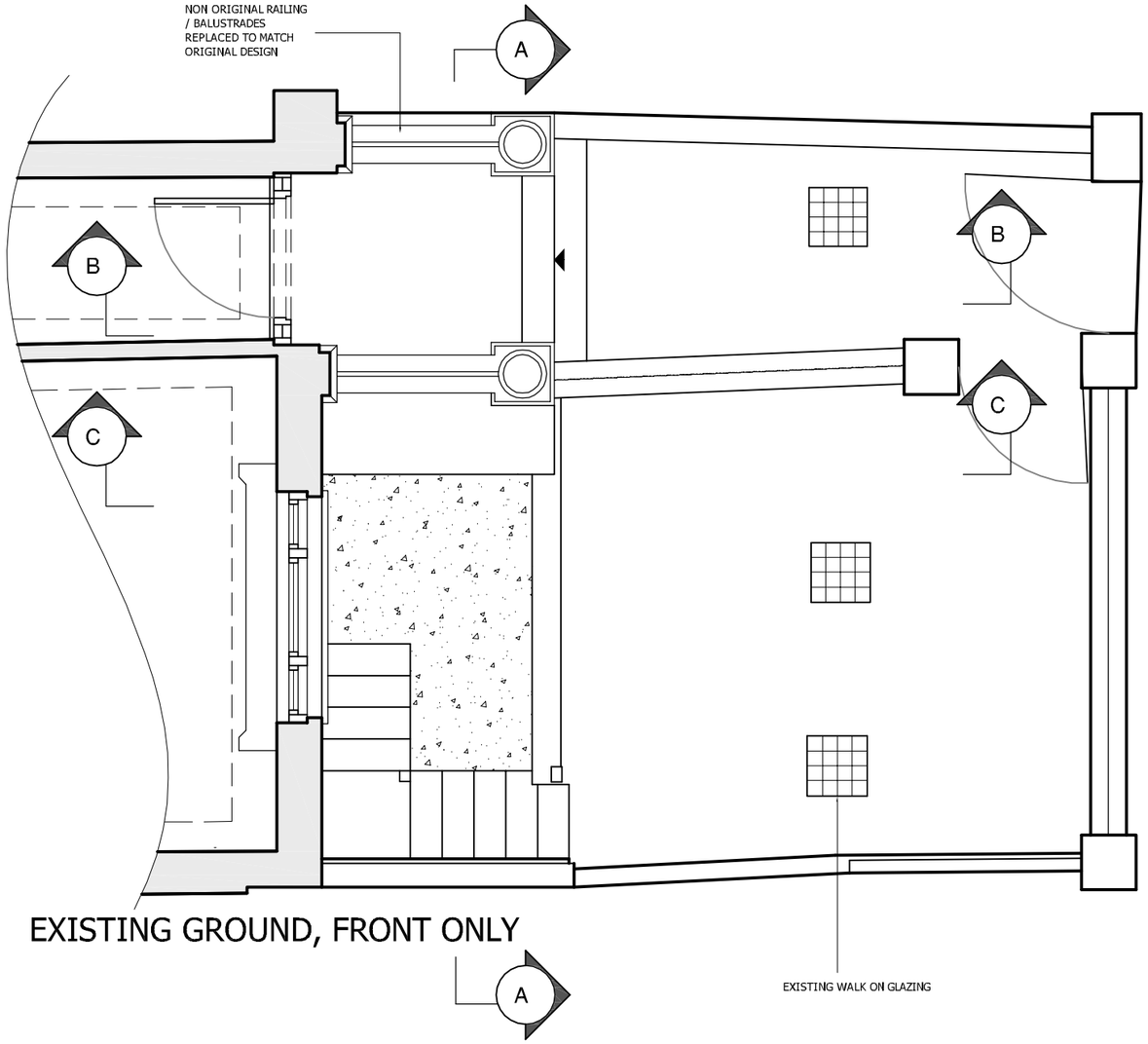
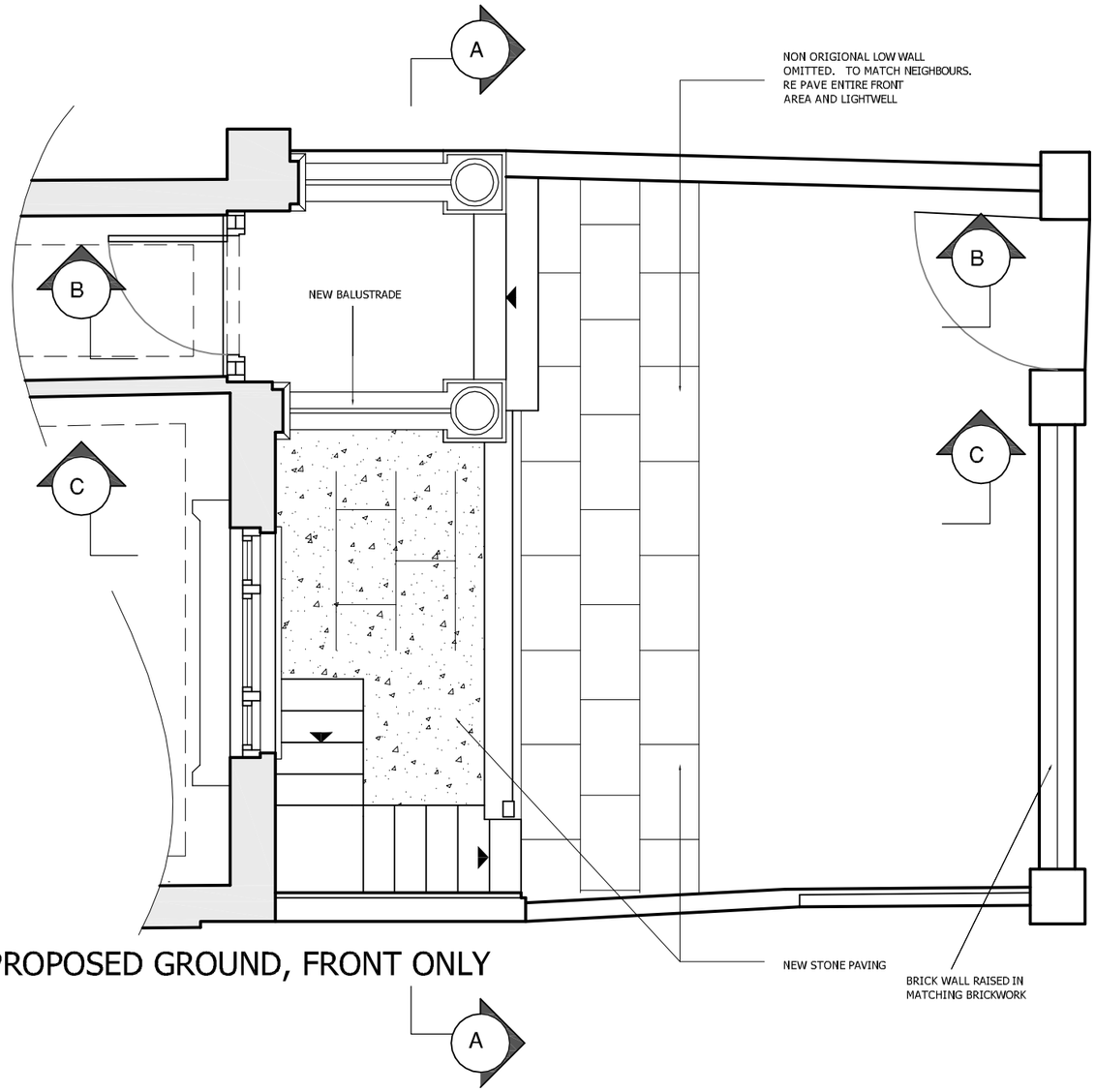
7A FILMER MEWS, 75 FILMER ROAD
LONDON, SW6 7JF
TEL: 020 7610 6122 FAX: 020 7610 6941
www.indigo.gb.net mail@indigo.gb.net

PROJECT	SCALE	DATE	DWG NO
2 CHALCOT SQUARE LONDON NW1	1:50 @ A3	SEP 2014	CS 01 FG
	REVISION		
EXISTING & PROPOSED LOWER GROUND			

PLANNING
FRONT GARDEN



EXISTING GROUND, FRONT ONLY



PROPOSED GROUND, FRONT ONLY

M 1:50

0 0,5 1,0 5,0 [m]

W N S E

PLANNING
FRONT GARDEN

I N D I G O
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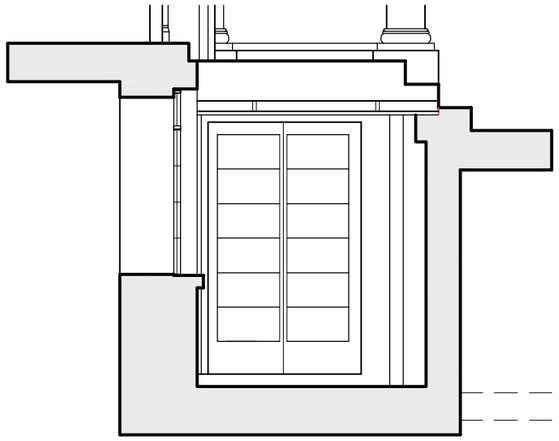
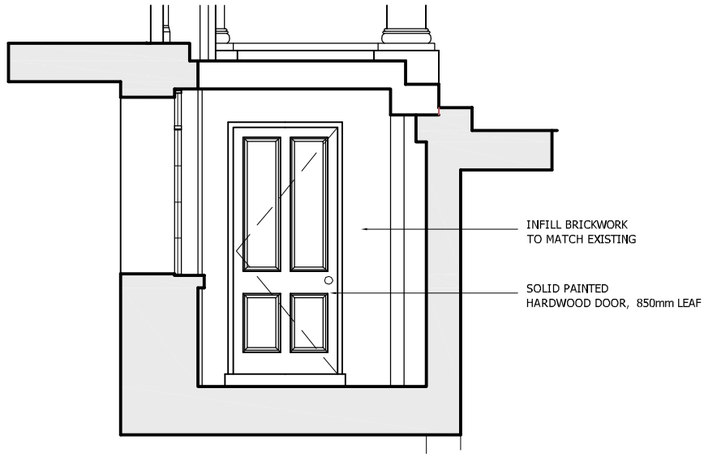
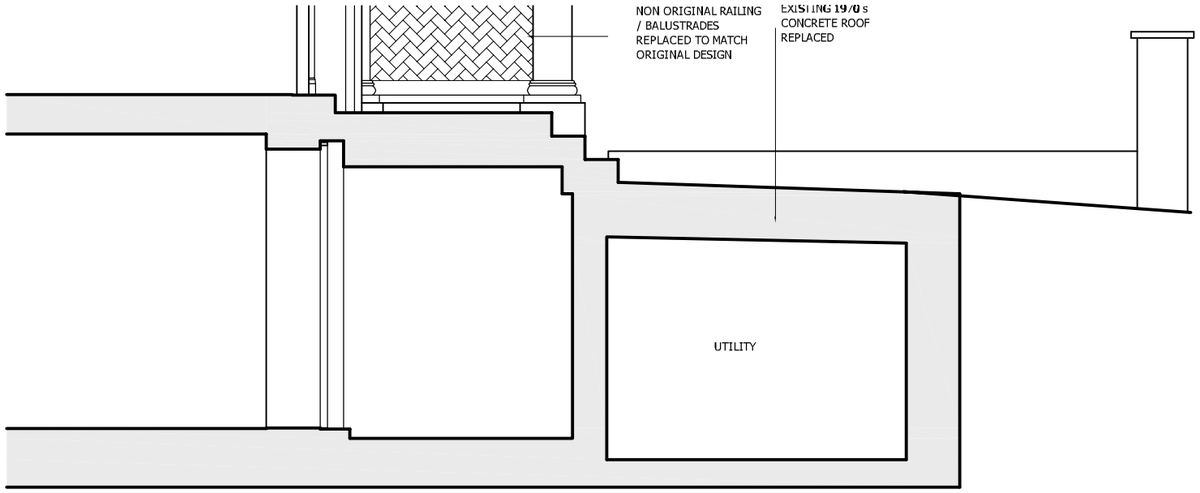
PROJECT	SCALE	DATE	DWG NO
2 CHALCOT SQUARE LONDON NW1 EXISTING & PROPOSED GROUND FLOOR	1:50 @ A3	SEP 2014	CS 02 PG
	REVISION		



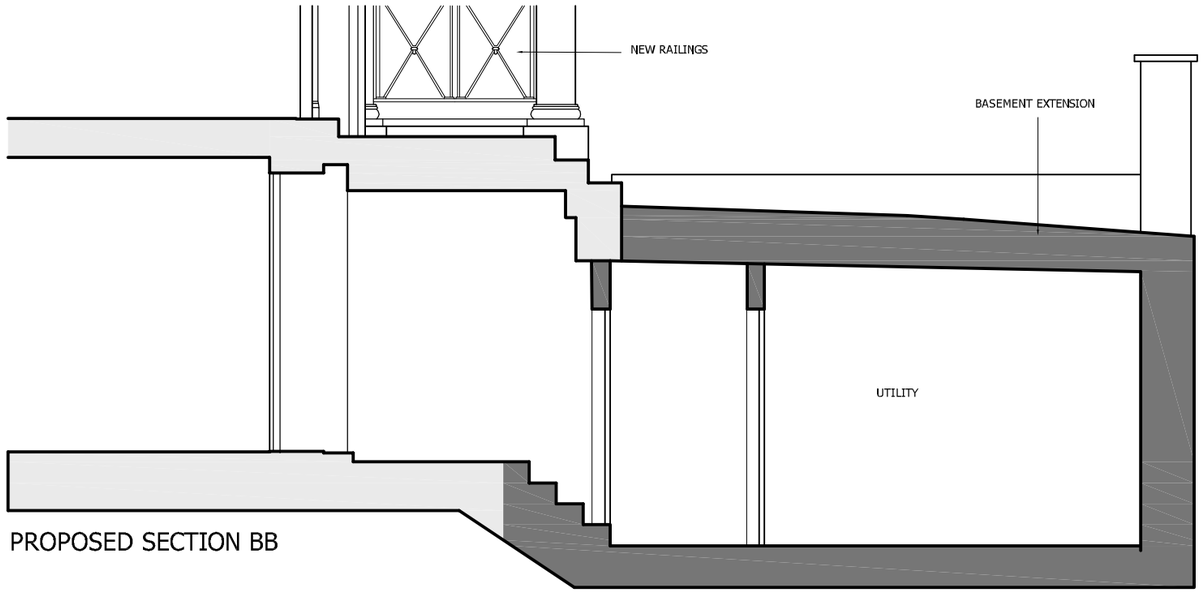
EXISTING SECTION CC



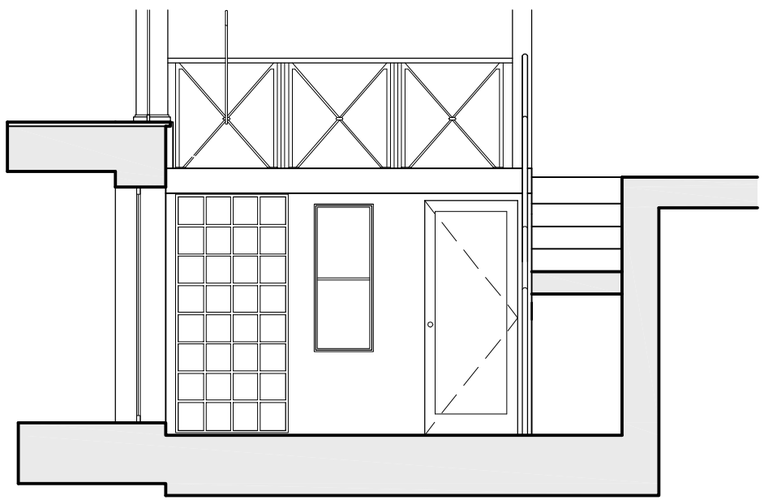
PROPOSED SECTION CC



EXISTING SECTION BB



PROPOSED SECTION BB



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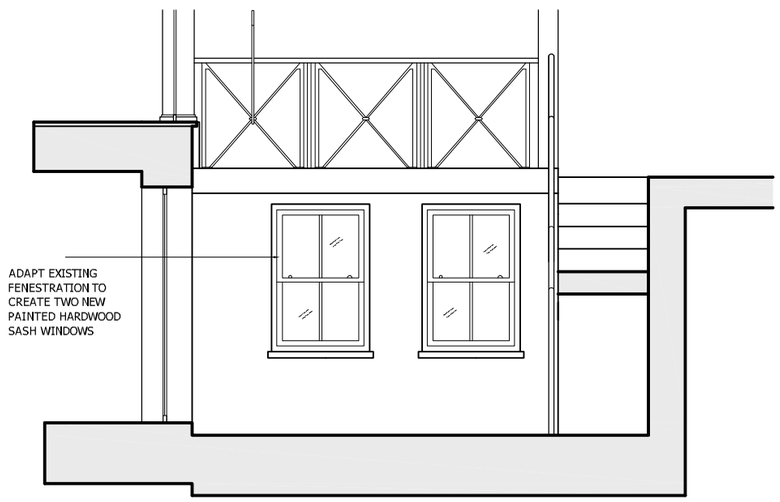

PROPOSED SECTION AA

PLANNING
FRONT GARDEN

M 1:50

0 0,5 1,0 5,0 [m]

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PROJECT	SCALE	DATE	DWG NO
2 CHALCOT SQUARE LONDON NW1 EXISTING & PROPOSED SECTIONS	1:50 @ A3	SEPT 2014	CS 03 FG
	REVISION		