Chelmer
Consultancy Services
'Groundbreaking Services'

Geo-environmental Interpretative Report

Site	22 Fortess Grove Kentish Town London NW5 2HD
Client	Mr L Borek
Date	September 2015
Our Ref	GENV/5575

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Chelmer Consultancy Services
'Groundbreaking Services'

Mr Les Borek
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11th September 2015

CCS Ref: GENV/5575

Dear Sirs,

GEO-ENVIRONMENTAL INVESTIGATION AT
22 FORTESS GROVE, KENTISH TOWN, LONDON NW5 2HD

1.0 INTRODUCTION & SCOPE OF WORKS

At the request of the Structural Engineer, Ellis and Moore, a site investigation has been undertaken at 22 Fortess Grove, Kentish Town, London NW5 2HD. The approximate Ordnance Survey grid reference (OSNGR) of the site is 529039E, 185383N.

The current site investigation was commissioned to provide information on the sub-soil conditions of the site in order to provide information to support foundation design, together with preliminary contamination assessment, testing for waste disposal purposes and a preliminary ground gas risk assessment.

A Phase I Desk Top Study was not requested by the client.

It is understood that the proposed development will comprise the construction of a single storey basement beneath 22 Fortess Grove, extending beneath the entire footprint of the existing property *Existing and Proposed Development Plans* are appended to this report.

2.0 SITE WORKS

All fieldwork and contamination sampling was generally executed in accordance with applicable British Standard and accepted industry good practice (Ref 1 & 2).

The work at this site was undertaken on the 22nd July 2015 and comprised the drilling of a single c.f.a. borehole and excavation of three trial pits. The location of the borehole and trial pits are indicated on the appended *Sketch Fieldwork Location Plans*.

C.f.a. Borehole

A single c.f.a. borehole (BH1) was drilled at the position indicated on the appended *Sketch Fieldwork Location Plan (sheet 1 of 2)*. Borehole BH1 was undertaken in the courtyard of the existing property and advanced to a depth of 10.00m below existing ground level.

Disturbed samples were taken from the borehole at regular depth intervals as the borehole was advanced, within each stratum and when a change of stratum was encountered.

Shear Vane tests were also undertaken throughout the borehole in order to provide additional information on the consistency and strength of the material encountered.

Upon completion of borehole BH1 a standpipe was installed to a depth of 6.00m below existing ground level.

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

Hand Excavated Trial Pits

In addition to the above the scope of works also included the excavation of three trial pits (TP1-TP3). The locations of trial pits TP1-TP3 can be seen on the *Sketch Fieldwork Location Plans*.

Trial pit TP1 was undertaken externally adjacent to the rear western boundary wall of the courtyard. TP1 found the brick wall to rest onto a brick corbel. The brick corbel was found to be 70mm thick and rest within Made Ground at a depth of 0.77m below existing ground level.

Trial pit TP2 was undertaken internally in the south east corner of the kitchen, adjacent to the two external walls. The trial pit had to be terminated at 700mm bgl due to suspected concrete encased drainage.

Trial pit TP3 was undertaken internally in the north west corner of the living room, adjacent to the two external walls. TP3 found the brick wall to be set onto a brick corbel foundation. The corbel foundation was found to be 160mm thick and rest within Made Ground at a depth of 0.56m below existing ground level.

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

Groundwater & Ground Gas Monitoring

Following the initial site work, a single monitoring visit was undertaken on 21st August 2015 to measure groundwater and ground gas within the site using the installation fitted within borehole BH1.

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 depth to groundwater recorded.

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

3.0 GEOLOGY

According to information published by the British Geological Survey (BGS) the underlying geology at this site is shown as the London Clay Formation. No superficial deposits were recorded.

4.0 SUMMARY OF GROUND CONDITIONS

Full details of the ground conditions encountered at this site can be found on the accompanying borehole and trial pit record sheet and can be summarised as follows:

Depth From (m bgl)	Depth To (m bgl)	Description
0.00	0.10/0.20	CONCRETE
0.10/0.20	0.76/0.97	MADE GROUND
0.80	1.20	Reworked Ground – *firm, light brown, slightly sandy slightly gravelly silty CLAY*
1.20	10.00+	Weathered London Clay – *firm to very stiff, brown, slightly sandy silty CLAY*

It should be noted that the MADE GROUND depths recorded above are those encountered within the borehole and trial pits undertaken during the current work. Owing to the variable nature and unknown provenance 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.

The Reworked Ground material is assumed to be reworked Weathered London Clay. This is natural ground but should be treated as MADE GROUND.

In-situ shear vane testing within the Weathered London Clay indicated that this material is 'firm' to 'very stiff' in consistency.

No groundwater was encountered during the drilling process of the current investigation. During the return monitoring visit groundwater was recorded at a depth of 3.97m below existing ground level.

No roots were observed during the current investigation.

5.0 LABORATORY TESTING

The following geotechnical and contamination testing has been carried out on samples recovered from the borehole and trial pits undertaken at this site.

Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with applicable British Standard (Ref 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.

Atterberg Limits and Moisture Content Tests

The Atterberg Limits and moisture content have been determined for a single sample of Reworked Ground and five samples of Weathered London Clay.

Reworked Ground

For the sample tested, the liquid limit (LL) was found to be 43%, the plastic limit (PL) was found to be 16%, the plasticity index 27% and the modified plasticity index 15%. The moisture content of this sample was found to be 17%.

These results indicate that the sample tested would be classified as Clay of 'intermediate' plasticity (CI) in accordance with the Casagrande Geotechnical classification system.

Weathered London Clay

For the samples tested, the liquid limit (LL) was found to range between 67% and 71%, the plastic limit (PL) was found to range between 23% and 26%, the plasticity index between 44% and 46% and the modified plasticity index between 41% and 44%. The moisture content of these samples was found to range between 28% and 31%.

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

pH and Sulphate Tests

The pH and sulphate content has been determined for seven samples recovered from the site.

The pH value was found range between 8.0 and 9.7 with the sulphate content, on a 2:1 water:soil extract found to vary between 72 and 3000 mg/l.

Chemical Analysis

4 Nº. representative samples of the Made Ground encountered across the site were selected and tested for a suite of key chemical species used to identify and assess the nature of the soil in the context of it being contaminated and potentially presenting a risk to end users of the site, building fabric and the wider environment.

The testing suite applied included selected critical heavy metals, US EPA 16 priority Polycyclic Aromatic Hydrocarbons (PAH), speciated Total Petroleum Hydrocarbons in accordance with TPHCWG recommended carbon bandings for both aliphatic and aromatic compounds, BTEX (benzene, toluene, ethylbenzene, xylene) and MTBE (Methyl tertiary-butyl ether).

No groundwater samples were obtained or tested during the current investigation.

Waste Classification Test

In order to assist with the classification of soils in the context of their possible off-site disposal, 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.

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 Ltd in writing. Should samples be required to be stored for longer than 28 days then a storage charge will be levied.

6.0 GEOTECHNICAL ASSESSMENT

It is understood that the proposed development will comprise the construction of a single storey basement beneath 22 Fortess Grove, extending beneath the entire footprint of the existing property *Existing and Proposed Development Plans* are appended to this report.

Full details of the proposed construction are not yet developed and it assumed that they will be subject to the findings of this investigation. As a consequence the foundation design discussed below is, by necessity, general in nature ad is subject to confirmation following the results of this investigation and further design.

Should ground conditions during construction be found to differ significantly from those described in our report 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.

Foundations

The basement structure is anticipated to be set at a depth of approximately 3.00m below existing ground level. At this depth the basement floor slab will be set within ‘firm’ Weathered London Clay.

Based on results of the in-situ and laboratory testing, in conjunction with empirical correlations (Bjerrum, 1972) the clay at a depth of 3.00m below existing ground level is estimated to have an undrained shear strength (c_u) of around 55 kPa. Based on the estimated shear strength, the maximum bearing capacity of the Weathered London Clay at this depth is 280 kPa. Applying a global safety factor of 3 and given the observed groundwater it is recommended that an allowable bearing pressure not exceeding 45 kPa is adopted for foundation design, at which settlements are expected to be within normal acceptable tolerances.

In the event that shallow foundations are not suitable for the proposed development piles extending into the London Clay will offer a suitable alternative.

Given the nature of the ground conditions encountered and the proximity to adjacent residential buildings, a non-displacement pile type (e.g. bored cast-in-place, hollow stem auger CFA, or similar) is considered most appropriate. This type of pile construction will generate pile arisings and therefore the piling technique should be selected to minimise spoil and otherwise the arisings will need to appropriately managed.

It is beyond the scope of this investigation to provide a full and detailed pile design and the advice of a specialist piling contractor should be sought in this respect. However, the following soil engineering parameters listed below are given for guidance purposes only. These soil parameters/assumptions relate to "static design" for vertically loaded single piles:

Made Ground	
Bulk unit weight, γ_b	18 kN/m^3
Effective angle of internal friction, φ'	0
Undrained shear strength, Su	0
Weathered London Clay	
Bulk unit weight, γ_b	20 kN/m^3
Effective angle of internal friction, φ'	18-22°
Undrained shear strength, Su	50-100 kN/m^2 (based on in situ testing)
Pile Shaft adhesion factor, α	0.45 (subject to pile type and design methodology)

The following are estimated safe working loads (axial capacity) for a range of typical diameters for single bored piles extending to 8.00m and 10.00m below existing ground level.

Pile Type	***Depth (m bgl)***	***Diameter (m)***	***Estimated safe pile capacity (kN)***
Bored	8.00	0.30	50-100
Bored	8.00	0.45	150-200
Bored	8.00	0.60	200-250
Bored	10.00	0.30	100-150
Bored	10.00	0.45	200-250
Bored	10.00	0.60	300-350

It is recommended that the advice of competent piling contractors be 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 pile type selected.

London Clay is generally overconsolidated and may be subject to heave when excavated during basement construction. Therefore in order to mitigate the effect of heave on pile shaft

and concomitant reduction in pile capacity, it is recommended that the top 2 to 3m of each pile is 'sleeved', subject to confirmation of type of pile constructed.

Made Ground has been identified within this site which should always be viewed as being a potential source of contamination. With regard to the possible downward migration of contaminants the recommendations given in the Environment Agency in respect of piling in contaminated land should be followed.

Retaining Wall and Basement Construction

Excavation of the basement within London Clay will result in stress release and the soil will naturally have a tendency to swell and undergo heave within the excavation. The degree of movement (heave) will be a function of depth of excavation, the characteristics of the soils and the response of the soil to the combination of imposed loads from the foundations and structure. This movement should be quantitatively assessed and the ground bearing floor slab may need to be designed to resist uplift forces imposed from heave within the exposed clay.

The full design of temporary and permanent retaining structures is beyond the scope of this investigation. Retaining structures and basements should be designed in accordance with accepted good practice such as that set out within CIRIA guidance C580 (Ref 4) or similar (e.g. BRE GBG72). The calculation of permanent lateral pressures against the sides should relate to long-term (effective) stress analysis.

Based on the findings of the site investigation undertaken the following soil parameters are recommended for use in the retaining wall design:

Made Ground	
Bulk unit weight, γ_b	18 kN/m^3
Earth pressure coefficient at rest, K_0	0.3-0.4
Undrained shear strength, Su	0
Effective shear strength, c'	0
Effective angle of internal friction, φ'	20°
Weathered London Clay	
Bulk unit weight, γ_b	20 kN/m^3
Earth pressure coefficient at rest, K_0	2-2.5
Undrained shear strength, Su	50-100 kN/m^2 (based on in situ testing)
Effective shear strength, c'	15 kN/m^2
Effective angle of internal friction, φ'	18-22°

No groundwater was encountered during the drilling process of the current investigation. During the return monitoring visit groundwater was recorded at a depth of 3.97m below existing ground level. Groundwater may be subject to seasonal variation and may be present at higher levels within the site at other times of the year or under different circumstances to those prevailing at the time of investigation.

Design of the retaining walls should include allowance for groundwater in accordance with accepted good design practice and allowance for hydrostatic forces to both the ground bearing floor slab and retaining walls should be based on site specific hydrological and hydrogeological assessment. In addition the basement design should include appropriate waterproofing systems compliant with current standards and good practice (BS8102:2009 and applicable NHBC guidance) compatible with the retaining wall and foundation design.

Allowance should be made for appropriate groundwater control during construction cognisant of the prevailing site conditions.

Groundwater/surface water should be prevented from accumulating at the base of foundation excavations. It is important that the base of foundation excavations is kept dry and the exposed formation is protected to prevent softening by exposure to surface water. In the event that the formation is exposed, the material should be inspected immediately prior to floor slab construction and any soft spots are excavated and materials replaced and compacted prior to pouring foundation concrete. Alternatively 'blinding' concrete may be used to preserve the formation prior to foundation being constructed.

Anticipated Ground Movements

London Clay can be a particularly challenging soil. It is an overconsolidated material, making it stiff and typically almost impermeable. The clay is generally competent and resists further compression under compressional 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 excavations in-situ stress is relieved and it has a potential to expand. Any immediate rebound is generally small in magnitude and is 'lost' in the excavation process. However following excavation the material has a potential to continue to swell. This can produce significant uplift at excavated formation level. The uplift forces need to be properly assessed and accounted for within the structural design of the basement.

Similarly, lateral stress release in the ground surrounding the excavation by both foundation construction and excavation in front of the retaining structure will manifest itself in lateral and associated vertical ground movement at the edge of excavation and line of foundations/retaining structure and extending back from the edge of the excavation/line of basement wall. The magnitude of lateral and vertical movement and the limit of its extent beyond the excavation will depend on the nature of the soils, the foundation system, and the construction methodology. There is published empirical data available to predict the degree of movement that can be expected (CIRIA C580) (Ref 4).

It is important to ensure that the construction sequence and construction method statement (CMS) is developed based on the specific development system proposed and with full recognition of anticipated ground movements as assessed from site specific Ground Movement Analysis (GMA) (in preparation at the time of writing this report). It is implicit within this that good standards of workmanship will be maintained throughout so as to minimise and otherwise ameliorate the effects of ground movement associated with basement construction. This may include, inter alia, control on pile installation, sequencing of installation to minimise ground movement, use of necessary temporary support, and adequate control of groundwater.

The London Clay encountered beneath the site has been confirmed to possess 'high' volume change potential in response to changes in moisture content. In this regard additional lateral loading conditions may need to be considered in the design of the retaining structures and in this regard guidance provided by NHBC should be followed (Ref 5). The Reworked Ground has been confirmed to possess 'low' volume change potential.

Buried Concrete

Chemical testing has been carried out to determine the nature of the soils in the context of the durability of buried concrete. Based on the available test data the soluble sulphate content of the soils is noted to be variable and ranges between 72 and 3000 mg/l (measured as soluble SO_4) with a pH of 8.0 to 9.7. Taking the worst case data, the soils are classified as DS-3 in accordance with BRE guidance (Ref 6) with a corresponding ACEC class of AC-3.

Recommendations for Further Work

A Basement Impact Assessment should be considered in order to fully understand the Hydrology/Hydrogeology beneath the site.

7.0 PRELIMINARY CONTAMINATION ASSESSMENT

BACKGROUND AND TERMS OF REFERENCE

In the UK, contaminated land is assessed and managed through a number of integrated policies and guidance. Contaminated land is defined in legislation enacted under Part IIA of the Environmental Protection Act 1990 and guidance issued by DEFRA under CLR11 and sister documentation published in 2012 advises on how the legislative framework dealing with contaminated land should be implemented.

Distinct from the strict and onerous legal definition and classification of land as being contaminated but a corollary to the legislation and associated statutory guidance, the National Planning Policy Framework (NPPF) makes provision or assessing and managing contaminated land in the context of redevelopment which is subject to planning control. Earlier published guidance (PPS23) identified contamination as being a material consideration within any planning application and current policy under NPPF states that land which "*is affected by contamination or land stability issues*" must be correctly assessed such that planning 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*".

The assessment process requires that "*adequate site investigation information, prepared by a competent person, is presented*." The guidance provided in NPPF also states that "*all investigations of land potentially affected by contamination should be carried out in accordance with established procedures, such as BS10175 (2001)*."

The NPPF and statutory provisions for dealing with contaminated land are clear in ensuring that where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the "*developer and/or landowner*."

Fundamental to the assessment of contaminated land is the development of a Conceptual Site Model (CSM). This is an evaluation of the site conditions and its particular characteristics with respect to so called Source-Pathway-Receptor relationships, or plausible pollutant linkages. The CSM can then be used to assess and define risk and in turn it provides a basis for determining the condition of the land in the context of the proposed development and what, if any, action needs to be taken to allow the proposed development to proceed safely and without detrimental impact to the site itself or the wider environment.

A plausible pollutant linkage is defined by three elements;

Source A hazard which exists within the site or its environs which has the potential to cause harm (e.g. contaminated soil, ground gas, unstable ground, etc.)

Receptor Something associated with the site (e.g. end-user, building, off-site feature, etc.) which can be harmed.

Pathway A plausible linkage between the Source and Receptor such that harm can be realised (e.g. end-user coming into direct contact with contaminated soil, mobile contamination adversely impacting groundwater, etc.).

By definition a pollutant linkage can only exist where the three elements, source-pathway-receptor, are present and co-exist. If one of the elements that make up the pollutant linkage are not present then it follows that there can be no related risk. The breaking of pollutant linkages is a fundamental principal in the management of contaminated land risk and where the risk is identified and deemed to be unacceptable the appropriate action taken be "breaking" the pollutant linkage in some way.

Risk in the context of contaminated land is considered in terms of its significance and this is qualitatively assessed on the basis of magnitude of harm that may occur and likelihood of that harm occurring. The risk assessment follows the general principles as set out within BS10175:2001 and CIRIA C552.

The CSM is used to provide both a context and framework for undertaking any intrusive site investigation which may be deemed necessary to characterise the site with respect to contamination. Where a pollutant linkage is identified further investigation may be needed to confirm or quantify specific conditions, validate the existence of the pollutant linkage and thereby confirm and quantify the degree of risk. This is an important element of the assessment process and under the principles of risk assessment constitutes "*hazard identification*" and "*hazard assessment*".

CONCEPTUAL SITE MODEL & PLAUSIBLE POLLUTANT LINKAGES

Hazards

Made Ground was identified during the current investigation to a maximum depth of 0.97m bgl. Made Ground should always be viewed as being a potential source of contamination which may have adverse impacts to a number of different receptors.

Ground gas (carbon dioxide, methane, and possibly other related gases and vapours) are ubiquitous within the subsoil environment. Low concentration of either, or both, carbon dioxide and methane may not be problematic. However, elevated concentrations of ground gas and/or conditions where ground gas is being actively generated (e.g. filled ground, landfill, organic rich natural soils, etc.) may present a significant hazard to the site development or the wider environment. Ground gas may be present from sources either within the site itself or maybe being generated from an off-site source and migrating on to the site.

Groundwater present within a site may itself be contaminated or may liberate and be a source of (and pathway for) mobile contamination. Contaminated groundwater can impact on various receptors but most notably controlled waters either on the site or offsite.

Receptors

From the intended end site use the following potential receptors have been identified.

- *Construction workers on the site during development.*
- *Neighbouring sites and site users*
- *Controlled Waters both within the site and off-site*
- *Future residents/users of the proposed development, including young children.*
- *Vegetation within proposed development (landscaping).*
- *Building fabric for the proposed development.*

Pathways

Contamination within the soil could reach receptors by direct contact with the soils where there is a potential for contamination to be ingested by some means (direct ingestion, inhalation, dermal contact). This is most acute during site development although contact, albeit limited, is also possible for current site users and future site users. The proposed end-use is residential and as such represents a sensitive type of end-use.

Mobile contamination, present either within the groundwater or otherwise liberated by contact with groundwater (leachable contaminants), may exist, especially given the identified permeable underlying geology.

Ground gas may migrate through or on/offsite through preferential pathways most likely in the superficial Made Ground.

Elements of the building fabric for the proposed development may be in direct contact with contamination which may have adverse impacts. Plastic potable water supply pipelines may be susceptible to certain organic contamination if present.

SOIL CONTAMINATION EVALUATION

In accordance with current good practice (DEFRA guidance and CLR11) a Tier 1 assessment has been undertaken to determine the significance of the contamination present within the site in the context of the CSM. In this regard the contamination present within the soils sampled and determined from the program of chemical testing (see paragraph 5) has been compared to published guidance either UK Soil Guideline Values (SGV) as derived from current CLEA publications or other generic assessment criteria (GAC) derived from other applicable and relevant sources.

It should be noted SGV criteria is derived from a risk-based modelling software which has limited functionality, is based on assumptions and contains algorithms which the DEFRA and Environment Agency (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.

DEFRA/EA previously published a number of Soil Guideline Values (SGVs) for certain determinands, (common toxic metals) 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. Currently SGV figures have only been issued for Arsenic, Cadmium, Mercury, Nickel, Phenols and Selenium.

In the absence of currently published SGV values for the remaining contaminants, GAC screening values have been used. In this regard 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 a 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.

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.

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.

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.*

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

ASSESSMENT OF CONTAMINATION RESULTS

Soils

The chemical testing identified an elevated concentration of benzo(a)pyrene of 1.78mg/kg within the Made Ground of TP1, when compared against the ATRISK Contaminated Land Screening Values (SSVs) for *Residential with plant uptake* criteria.

The chemical testing identified two elevated concentrations of lead (340mg/kg and 592mg/kg) within the Made Ground of BH1 and TP3 respectively, when compared against the ATRISK Contaminated Land Screening Values (SSVs) for *Residential with plant uptake* criteria.

Based on the results of the chemical testing the contamination present within the site is modest and is not considered to present a significant impact or constraint to the proposed development, however further remedial works will be required with the areas of soft landscaping (see CSM table).

8.0 SOIL DISPOSAL & WASTE ACCEPTANCE CRITERIA

A single EN 14473/02 Waste Acceptance Criteria (WAC) test has been undertaken to classify for waste disposal purposes, from a sample collects from BH1 at 0.50m bgl.

The results of the WAC tests indicate that the samples of Made Ground from BH1 would probably be classified as “stable non-reactive”.

However, acceptance of any waste stream is the responsibility of the 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.

9.0 GROUND GAS ASSESSMENT

During the return gas/groundwater monitoring visits, the maximum concentration of methane was recorded at 0.1%v/v and the maximum carbon dioxide concentration was recorded at 5.0%v/v. A maximum flow rate of 0.7l/hr was recorded. The full land-borne gas assessment details are appended.

Although the gas concentrations recorded do not exceed Characteristic Situation 1 (following modified Wilson & Card Methodology) (Ref 7) criteria, the concentrations recorded are on the boundary limit. We would therefore recommend that further ground gas monitoring visits are undertaken, to fully assess any risks from ground gases.

The following diagram summaries the potential pollution linkages identified for this site in the form of a 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

Source	Pathway	Receptor	Assessment of Risk	Comments
Contaminated soil	Dermal contact with contaminated soils and inhalation/ingestion of soil vapours, soil derived dust and other airborne particulates	Site-end users	Moderate/Low	Elevated concentrations of benzo(a)pyrene and lead were identified within the Made Ground. However, following development much of the site will be covered by the footprint of buildings or areas of hardstanding, removing the risk of harm to site end users via human health exposure pathways. The risk will remain in gardens/ areas of open space if the Made Ground remains on site and is not covered by building footprint. In these areas consideration should be given to providing a suitable clean cover layer of topsoil/subsoil. In view of the contamination Made Ground should not be reused within the site as part of the development.
		Construction /maintenance workers	Very Low	As a preventative measure, appropriate Personal Protective Equipment (PPE) and other measures (e.g. good standards of hygiene, washing facilities) are utilised to mitigate the risk.
	Leaching	Surface water and groundwater	Very Low	Deep groundwater encountered during the site investigation and given the relatively insoluble nature of the identified lead within the Made Ground, the risks are considered very low if not negligible.
	Plant uptake	Vegetation (not for consumption)	Low	The soil at this site is considered to present a phytotoxic risk to new vegetation (not for consumption).
	Direct contact	Construction materials	Moderate/Low	In accordance with BRE Special Digest 1 2005 (Concrete in Aggressive Ground) the site is given an overall Design Sulphate Classification of DS-3 and an ACEC Classification of AC-3.
Contaminated surface water or groundwater	Direct contact	Site end users / Construction /maintenance workers	Very Low	Deep groundwater encountered during the site investigation and given the relatively insoluble nature of the identified lead and the Made Ground, the risks are considered very low if not negligible.
	Direct contact	Construction materials	Very Low	
	Vertical /lateral migration	Controlled waters / Adjacent properties	Very Low	
	Surface water run-off	Controlled waters / Adjacent Properties	Very Low	
Ground Gas and Vapour	Migration	Proposed development and adjacent sites	Low/Moderate	The gas monitoring data indicates Characteristic Situation 1 (Low Risk), however further return monitoring visits are recommended to confirm.
	Inhalation of vapours	Site end users/ Construction and future maintenance workers	Low/Moderate	The gas monitoring data indicates Characteristic Situation 1 (Low Risk), however further return monitoring visits are recommended to confirm. Very low concentrations of hydrocarbons have been identified there the volatilisation risks are considered very low if not negligible.

10.0 CONTAMINATION RECOMMENDATIONS

The chemical testing identified a single elevated benzo(a)pyrene and two elevated concentrations of lead within the Made Ground when compared against the ATRISK Contaminated Land Screening Values (SSVs) for *Residential with plant uptake* criteria. Further action is therefore required to reduce the risk to future residents, especially within areas of proposed soft landscaping.

A clean cover system may be adopted within any soft landscaping areas. This will involve excavation of the existing site soils to an agreed depth and be replaced with clean soils. This will effectively break the contamination pathway between the source and receptor and thus reduce the risk to future residents. A Remediation Method Statement may be required to be submitted and approved by the Local Authority under planning, along with verification and validation of the remedial works.

We would recommend that Health and Safety precautions be taken with regard to any ground workers/future maintenance at this site. These should include suitable PPE (gloves, overalls, dust masks etc.) to prevent dermal contact and inhalation of the soils/dust. Washing facilities should be made available on-site to reduce extended contact with site soils.

With regard to the installation of any future water supply pipe work, reference should be made to the UK Water Industry Research (UKWIR) published "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21; the 'UKWIR Guidance'). This publication supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land", which has been withdrawn. It is recommended that the results of the soil chemical analyses undertaken on the site should be provided to the potable water supply company in order to ensure that any pipe provided complies with their requirements.

As always, it must be noted that 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 groundworks.

We trust that you will find the enclosed information of value but should you have any queries please do not hesitate to contact the writer at the above noted address.

Yours sincerely,

Alexandra Ash MEng (Hons)
Graduate Geotechnical Engineer

Jack Hunter BSc (Hons)
Geo-Environmental Engineer

for CHELMER SITE INVESTIGATION LABORATORIES LIMITED

References

1. BS 5930:1999+A2:2010 (2010) Code of practice for site investigations.
2. BS 10175:2011 (2011) Code of Practice for the Investigation of Potentially Contaminated Sites.
3. BS 1377:1990 (1990) Methods of Test for Soils for Civil Engineering Purposes.
4. CIRIA (2003) C580. Embedded Retaining Walls – Guidance for Economic Design
5. NHBC (2011) NHBC Standards
6. BRE (2005). Concrete in aggressive ground. Special Digest 1.
7. CIRIA (2007). Assessing risks posed by hazardous ground gases in buildings.

Chelmer Site Investigations 'Groundbreaking Services'

Client: Les Property Development	Scale: N.T.S.	Sheet No: 1 of 1	Weather: Fine	Date: 22.07.15
Site: 22 Fortess Grove, Kentish Town, NW5 2HD	Job No: 5575	Borehole No: 1	Boring method: CFA 100mmØ Secondman	

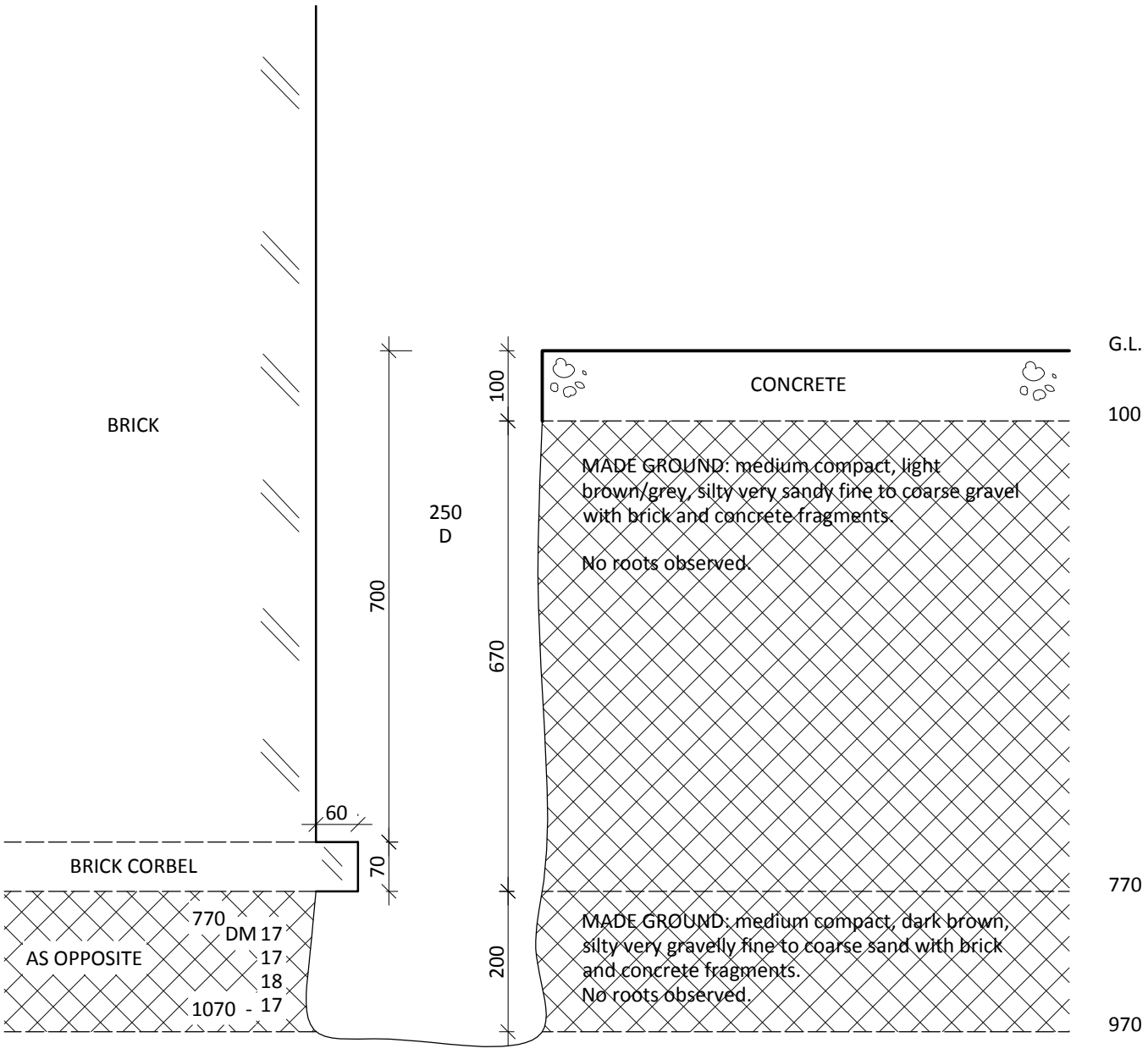
Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L.	CONCRETE	0.1							
0.1	MADE GROUND: Medium compact, dark brown/grey, silty very sandy fine to coarse gravel with brick and concrete fragments.	0.66		D			No roots observed		0.25 0.5
0.76	MADE GROUND: medium compact, dark brown, silty very clayey fine to coarse sand with occasional brick and concrete fragments.	0.04		D	V	62 62			1.0
0.8	REWORKED GROUND: firm, light brown, slightly sandy slightly gravelly silty clay.	0.4		D					1.5
1.2	Firm,brown, slightly sandy silty CLAY.			D	V	68 66			2.0
				D					2.5
				D	V	70 72			3.0
				D					3.5
	Becoming stiff from 4.0m.			D	V	78 76			4.0
				D					4.5
				D	V	82 82			5.0
				D					5.5
				D	V	94 96			6.0
		8.8		D	V	108 110			7.0
	Becoming very stiff from 8.0 m			D	V	120+ 120+			8.0
				D	V	120+ 120+			9.0
10.0	Borehole ends at 10.0m			D	V	120+ 120+			10.0

Drawn by: TP **Approved by:** JH

Remarks: *Borehole dry and open on completion. Standpipe installed to 6.0m.*

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

Client: Les Property Development	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Date:** 22.07.15
Location: 22 Fortess Grove, Kentish Town, NW5 2HD	**Job No:** 5575	**Trial Pit No:** 1	**Weather:** Overcast
Excavation Method: Hand Tools		**Drawn by:** TP	**Checked by:** JH



TP1 ENDS AT 970mm

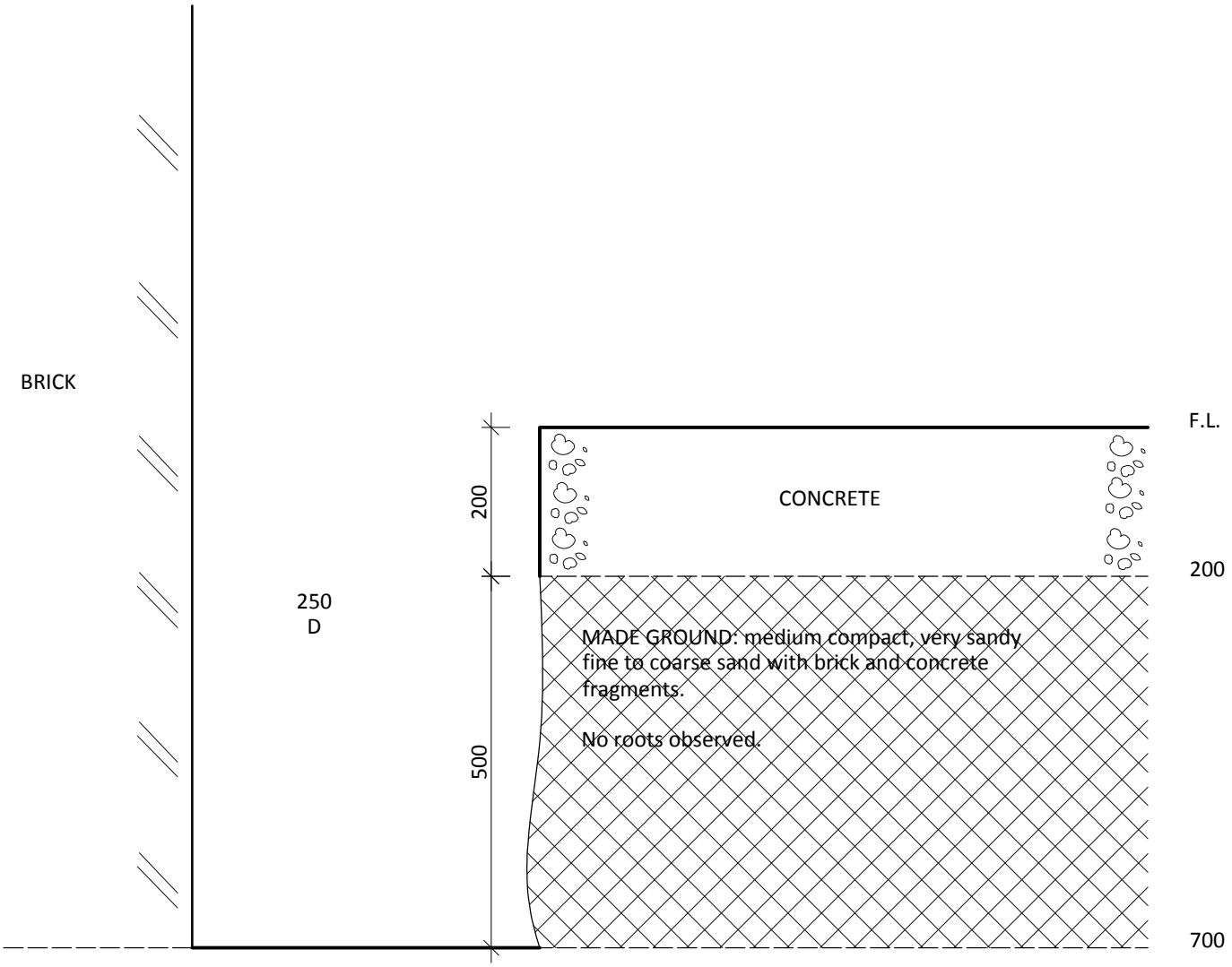
Remarks:

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

Chelmer Site Investigations
'Groundbreaking Services'

Client: Les Property Development	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Date:** 22.07.15
Location: 22 Fortess Grove, Kentish Town, NW5 2HD	**Job No:** 5575	**Trial Pit No:** 2	**Weather:** Internal
Excavation Method: Hand Tools		**Drawn by:** TP	**Checked by:** JH

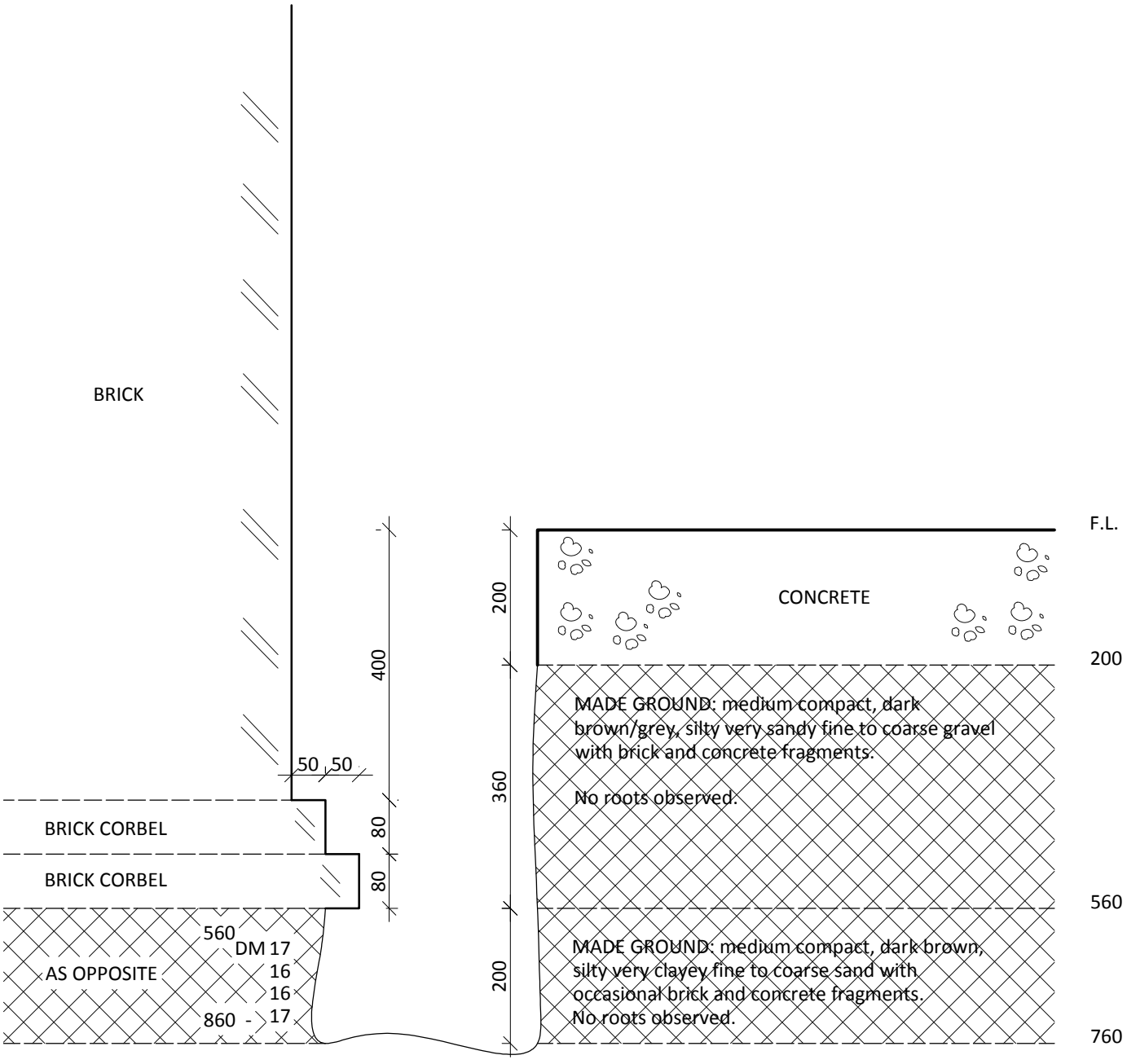


TP2 ABANDONED AT 700mm - DUE TO SUSPECT CONCRETE ENCASED DRAINAGE

Remarks: Section A and B are the same.

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

Client:	Les Property Development	**Scale:**	N.T.S.	**Sheet No:**	1 of 1	**Date:**	22.07.15
Location:	22 Fortess Grove, Kentish Town, NW5 2HD	**Job No:**	5575	**Trial Pit No:**	3	**Weather:**	Internal
Excavation Method:	Hand Tools			**Drawn by:**	TP	**Checked by:**	JH



TP3 ENDS AT 760mm

Remarks: Section A and B are the same.

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
'Groundbreaking Services'

Laboratory Report

Site	22 Fortess Grove, Kentish Town
Client	E/M
Date	30-Jul-15
Our Ref	CSI5575
CGL Ref	CGL5575

Chelmer Site Investigation Laboratories Ltd
Unit 15 East Hanningfield Industrial Estate, Old Church Road, East Hanningfield, Essex CM3 8AB
Essex: 01245 400930 | London: 0203 6409136 |info@siteinvestigations.co.uk | www.siteinvestigations.com

UKAS TESTING
8284

Chelmer Geotechnical Laboratories
'Groundbreaking Services'

Content Summary

This report contains all test results as indicated on the test instruction/summary.

CGL Reference : CGL5575

Client Reference : CSI5575

For the attention of : E/M

This report comprises of the following :

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 "Groundbreaking Services"

Job Number : CGL5575
Client : E/M
Client Reference : CSI5575
Site Name : 22 Fortess Grove, Kentish Town

Date Received : 24/07/2015
Date Testing Started : 28/07/2015
Date Testing Completed : 30/07/2015
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	1.0	64683	D	17	42	43	16	27	0.04	15	CI			62		8.0	0.06	0.08	DS-1
BH1	2.0	64684	D	28	<5	67	23	44	0.10	41	CH			67					
BH1	3.0	64685	D	29	<5	70	25	45	0.10	42	CH			71					
BH1	4.0	64686	D	31	<5	71	26	45	0.11	43	CV			77					
BH1	6.0	64687	D	30	<5	69	23	46	0.16	44	CH			95					
BH1	10.0	64688	D	30	<5	71	25	46	0.11	44	CV			120					

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 :- MT/HS
Checked By :- MC
Date Checked :- 31-Jul-15

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories "Groundbreaking Services"

Job Number : CGL5575
Client : E/M
Client Reference : CSI5575
Site Name : 22 Fortess Grove, Kentish Town

Date Received : 24/07/2015
Date Testing Started : 28/07/2015
Date Testing Completed : 30/07/2015
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]
TP1	0.7	64689	D		<5											9.2	2.22	2.67	DS-3

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 :- MT/HS
Checked By :- MC
Date Checked :- 31-Jul-15

Laboratory Testing Results

BS 1377 : 1990

Chelmer Geotechnical Laboratories "Groundbreaking Services"

Job Number : CGL5575
Client : E/M
Client Reference : CSI5575
Site Name : 22 Fortess Grove, Kentish Town

Date Received : 24/07/2015
Date Testing Started : 28/07/2015
Date Testing Completed : 30/07/2015
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]
TP2	0.3	64690	D		<5											9.7	0.79	0.95	DS-1

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 :-

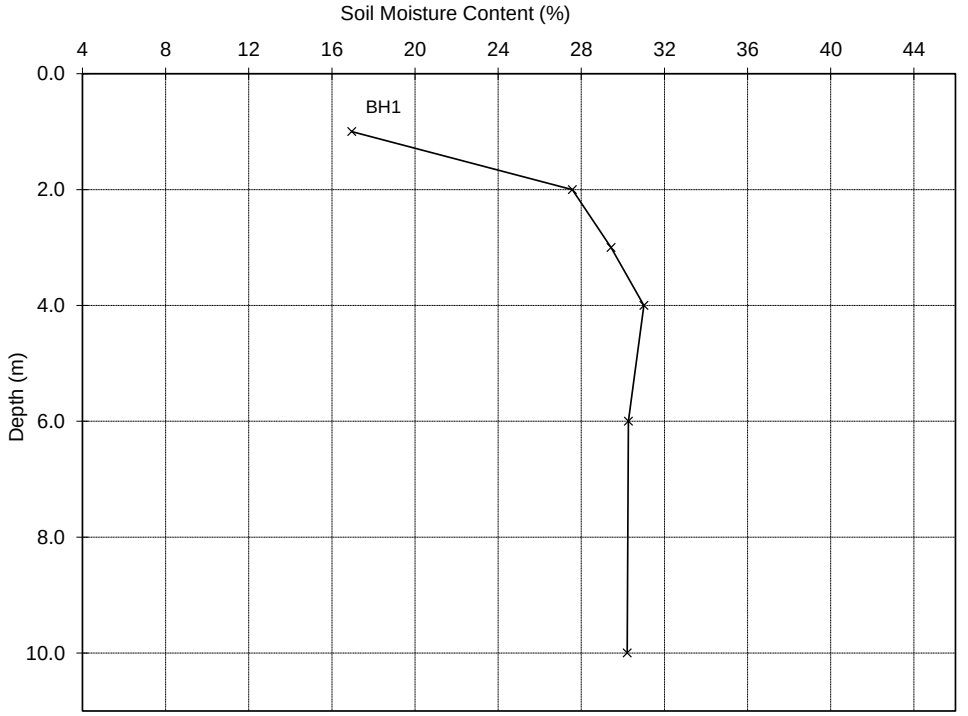
Technician :- MT/HS
Checked By :- MC
Date Checked :- 31-Jul-15

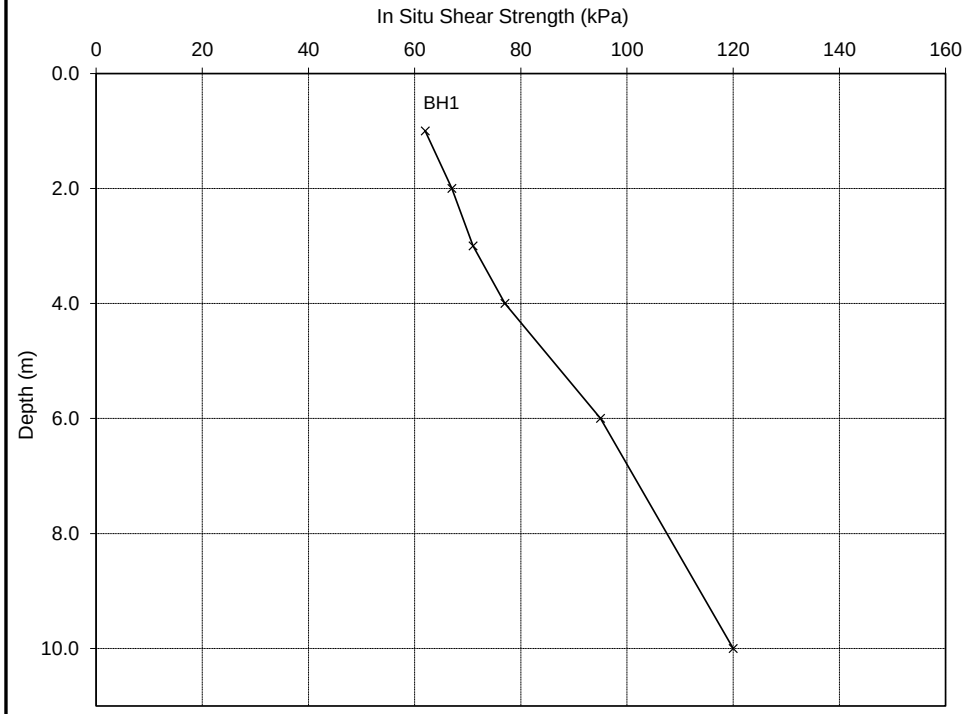
Laboratory Testing Results

Moisture Content/Shear Strength Profile

Chelmer Geotechnical Laboratories 'Groundbreaking Services'

Job Number :	CGL5575	Date Received :	24/07/2015
Client :	E/M	Date Testing Started :	28/07/2015
Client Reference :	CSI5575	Date Testing Completed :	30/07/2015
Site Name :	22 Fortess Grove, Kentish Town	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. (Not UKAS accredited)

UKAS TESTING 8284

Comments :-

Checked By :- MC Date Checked :- 31-Jul-15

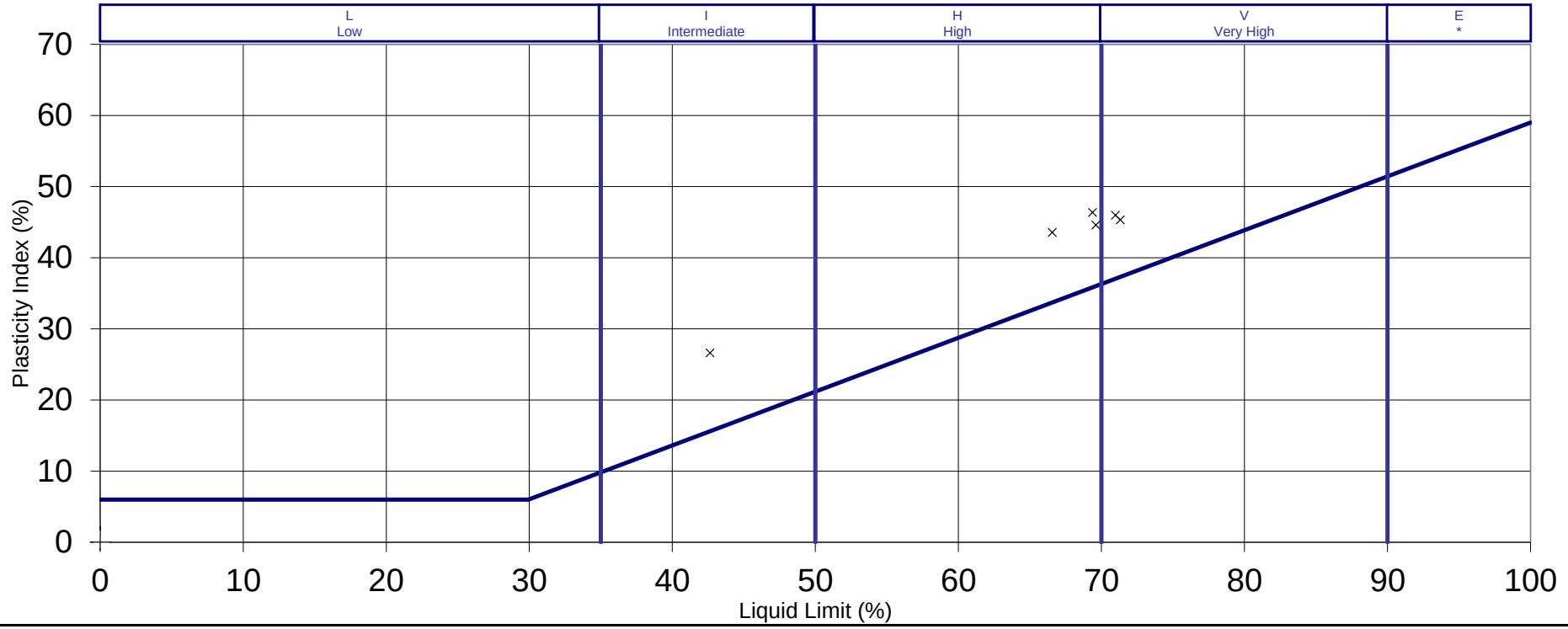
Laboratory Testing Results

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

Chelmer Geotechnical Laboratories
'Groundbreaking Services'

Job Number : CGL5575
Client : E/M
Client Reference : CSI5575
Site Name : 22 Fortess Grove, Kentish Town

Date Received : 24/07/2015
Date Testing Started : 28/07/2015
Date Testing Completed : 30/07/2015
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

UKAS TESTING
8284

Comments :-

Checked By :- MC

Date Checked :- 31-Jul-15

Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

Chelmer Site Investigations
Unit 15
East Hanningfield Industrial Estate
CM3 8AB

Analytical Test Report: L15/1511/CSI/001

Your Project Reference:	**CSI5575**	Samples Received on:	29.07.2015
Your Order Number:	PO4830	Testing Instruction Received:	29.07.2015
Report Issue Number:	1	Sample Tested:	29.07 to 04.08.2015
Samples Analysed:	4 Soils	Report issued:	04.08.2015

Signed

James Gane
Manager - Data Logistics
Nicholls Colton Analytical

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

With the exception of Sulphate and Sulpur which are crushed over the 2mm test sieve, concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve. As received samples have been corrected for moisture content but not stone content.

Samples were supplied by customer.

Deviant Samples

Samples were received in suitable containers	**Yes**
A date and time of sampling was provided	**Yes**
Sample handling times were exceeded prior to analysis of determinants	**Yes**

Where samples do not meet one or more of the above criteria they will be classed as deviant, this means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

L15/1511/CSI/001

Project Reference - CSI5575

Analytical Test Results - BRE Suite

NCA Reference			15-21051	15-21052	15-21053	15-21054
Client Sample Reference			BH1	BH1	BH1	TP3
Client Sample Location			64682	64686	64688	64691
Depth (m)			0.50	4.00	10.00	0.60
Date of Sampling			23.07.2015	23.07.2015	23.07.2015	23.07.2015
Time of Sampling			AM	AM	AM	AM
Sample Matrix			Clay	Clay	Clay	Sand
Determinant	**Units**	**Accreditation**				
Water soluble sulphate	(mg/l)	u	72	2600	3000	180
Acid Soluble Sulphate	(%)	u	0.06	0.99	1.30	0.23
Total Sulphur	(%)	u	0.03	0.30	0.38	0.09
pH Value	pH Units	MCERTS	8.8	9.7	8.5	9.3

Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

L15/1511/CSI/001

Project Reference - CSI5575

Sample Descriptions

NCA Reference	Client Sample Reference	Sample Location	Description	% Passing 2mm BS test sieve
15-21051	BH1	64682	Dark brown sandy gravelly clay with crushed rock.	86
15-21052	BH1	64686	Brown slightly sandy clay.	96
15-21053	BH1	64688	Brown sandy clay.	100
15-21054	TP3	64691	Dark brown gravelly sand with crushed rock and brick fragments. (Fill)	55

Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

L15/1511/CSI/001

Project Reference - CSI5575

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	pH	As Received	In house method statement - MS - CL - pH (Soil)
Soil	Sulphate	Air Dried	In house method statement - MS - CL - Anions (Aquakem)
Soil	Acid Sulphate	Air Dried	In house method statement - MS - CL - BRE
Soil	Total Sulphur	Air Dried	In house method statement - MS - CL - BRE

8284

This report is personal to the client, confidential and non assignable. It is issued with no admission of liability to any third party.

This report shall not be reproduced, except in full, without the written approval of Chelmer Site Investigations Laboratories Ltd.

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.

Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

Chelmer Site Investigations
Unit 15
East Hanningfield Industrial Estate
CM3 8AB

Analytical Test Report: L15/1527/CSI/001

Your Project Reference:	**CGL5575**	Samples Received on:	31.07.2015
Your Order Number:	PO4835	Testing Instruction Received:	31.07.2015
Report Issue Number:	1	Sample Tested:	31.07 to 10.08.2015
Samples Analysed:	5 Soils	Report issued:	11.08.2015

Signed

James Gane
Manager - Data Logistics
Nicholls Colton Analytical

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

With the exception of Sulphate, Sulpur and LoI which are crushed over the 2mm test sieve, concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve. As received samples have been corrected for moisture content but not stone content.

Samples were supplied by customer.

Deviant Samples

Samples were received in suitable containers	**Yes**
A date and time of sampling was provided	**Yes**
Sample handling times were exceeded prior to analysis of determinants	**Yes**

Where samples do not meet one or more of the above criteria they will be classed as deviant, this means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

WAC Testing

Samples were leached in accordance with BS EN 12457-2: 2002.

Eluate Results are reported as L/S 10. These results have been calculated in accordance with BS EN 12457-2:2002.

Comparative values are taken from the Environment Agency document "Guidance for waste destined for disposal in landfills", Version 2, June 2006.

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

L15/1527/CSI/001

Project Reference - CGL5575

Analytical Test Results - CSI Suite

NCA Reference			15-21273	15-21275	15-21276	15-21277
Client Sample Reference			BH1	TP1	TP2	TP3
Client Sample Location			64774	64776	64777	64778
Depth (m)			0.25	0.25	0.25	0.25
Date of Sampling			27.07.2015	27.07.2015	27.07.2015	27.07.2015
Time of Sampling			AM	AM	AM	AM
Sample Matrix			Clay	Sand	Sand	Loam
Determinant	**Units**	**Accreditation**				
Arsenic	(mg/kg)	MCERTS	14.2	10.5	< 10	18.6
Cadmium	(mg/kg)	MCERTS	0.5	0.6	0.4	0.7
Chromium (Total)	(mg/kg)	UKAS	23.0	17.6	15.5	27.7
Copper	(mg/kg)	MCERTS	52.9	38.3	152	86.7
Lead	(mg/kg)	MCERTS	340	186	173	592
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	18.6	15.3	13.5	20.9
Selenium	(mg/kg)	u	< 8	< 8	< 8	< 8
Zinc	(mg/kg)	MCERTS	88.5	83.2	120	226
Total Phenols	(mg/kg)	MCERTS	<1.1	<1.2	<1.0	<1.1
Cyanide (Total)	(mg/kg)	MCERTS	<1.1	<1.2	<1.0	<1.1
pH	pH Units	MCERTS	8.4	8.8	9.8	8.0
Sulphate	(mg/l)	u	88	1600	590	230
Sulphur	(%)	u	0.03	0.47	0.17	0.09
Sulphide	(mg/kg)	u	5.5	39.5	31	22
Acenaphthene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	0.05
Acenaphthylene	(mg/kg)	UKAS	0.03	0.07	<0.02	0.09
Anthracene	(mg/kg)	UKAS	0.03	0.12	<0.02	0.21
Benzo (a) anthracene	(mg/kg)	MCERTS	0.06	1.32	0.05	0.94
Benzo (a) pyrene	(mg/kg)	MCERTS	0.05	1.78	0.14	1.15
Benzo (b) fluoranthene	(mg/kg)	MCERTS	0.08	2.72	0.23	1.37
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.05	1.56	0.32	0.73
Benzo (k) fluoranthene	(mg/kg)	MCERTS	0.02	0.94	0.08	0.53
Chrysene	(mg/kg)	MCERTS	0.08	1.76	0.12	0.93
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	<0.02	0.55	0.07	0.27
Fluoranthene	(mg/kg)	MCERTS	0.06	1.42	0.09	1.15
Fluorene	(mg/kg)	MCERTS	<0.02	0.02	<0.02	0.05
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	0.05	1.74	0.29	0.89
Naphthalene	(mg/kg)	MCERTS	0.12	0.05	<0.02	0.20
Phenanthrene	(mg/kg)	MCERTS	0.15	0.60	0.06	0.67
Pyrene	(mg/kg)	MCERTS	0.07	1.19	0.07	1.03
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	0.92	15.90	1.63	10.30

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Leicester
LE1 4DH

L15/1527/CSI/001

Project Reference - CGL5575

Analytical Test Results - TPH CWG

NCA Reference			15-21273	15-21275	15-21276	15-21277
Client Sample Reference			BH1	TP1	TP2	TP3
Client Sample Location			64774	64776	64777	64778
Depth (m)			0.25	0.25	0.25	0.25
Date of Sampling			27.07.2015	27.07.2015	27.07.2015	27.07.2015
Time of Sampling			AM	AM	AM	AM
Sample Matrix			Clay	Sand	Sand	Loam
Determinant	**Units**	**Accreditation**				
Aliphatics						
>C_5 to C_6	(mg/kg)	None	<0.03	<0.03	<0.04	<0.03
>C_6 to C_8	(mg/kg)	None	0.08	0.12	0.28	<0.03
>C_8 to C_{10}	(mg/kg)	None	<0.03	<0.03	<0.04	<0.03
>C_{10} to C_{12}	(mg/kg)	None	<11	<11	<11	<12
>C_{12} to C_{16}	(mg/kg)	None	<11	<11	<11	<12
>C_{16} to C_{21}	(mg/kg)	None	<11	<11	<11	<12
>C_{21} to C_{35}	(mg/kg)	None	<11	12	12	14
Aromatics						
>C_5 to C_7	(mg/kg)	None	<0.03	<0.03	<0.04	<0.03
>C_7 to C_8	(mg/kg)	None	<0.03	<0.03	<0.04	<0.03
>C_8 to C_{10}	(mg/kg)	None	<0.03	<0.03	<0.04	<0.03
>C_{10} to C_{12}	(mg/kg)	None	<11	<11	<11	<12
>C_{12} to C_{16}	(mg/kg)	None	<11	<11	<11	<12
>C_{16} to C_{21}	(mg/kg)	None	<11	<11	<11	<12
>C_{21} to C_{35}	(mg/kg)	None	<11	40	24	22

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Project Reference - CGL5575

Certificate Of Analysis - WAC Suite

NCA Reference	15-21274
Client Sample Reference	BH1, 64774
Sample Description	Black slightly silty slightly sandy clay with crushed rock.
Depth (m)	0.5
Date of Sampling	27.07.2015
Time of Sampling	AM
Sample Matrix	Clay
Moisture Content (%)	12
Stone content (%)	35

			Determined Result	Inert Waste Landfill	Stable non reactive hazardous waste in a non hazardous landfill	Hazardous Waste Landfill
Solid Analysis						
Total Organic Carbon	%	MCERTS	3.7	3.0	5.0	6.0
Loss on Ignition	%	UKAS	8.5	-	-	10.0
BTEX	mg/kg	MCERTS	<0.3	6.00	-	-
PCB's (7 Congeners)	mg/kg	u	<0.03	1.00	-	-
Mineral Oil ($>C_{10}$ to C_{40})	mg/kg	u	48	500	-	-
PAH	mg/kg	u	1.7	100	-	-
pH	units	MCERTS	6.9	-	> 6	-
Eluate Analysis						
Arsenic	mg/kg	u	0.24	0.50	2	25
Barium	mg/kg	u	< 0.05	20	100	300
Cadmium	mg/kg	u	< 0.03	0.04	1	5
Chromium (total)	mg/kg	u	< 0.03	0.5	10	70
Copper	mg/kg	u	< 0.10	2.0	50	100
Mercury	mg/kg	u	< 0.01	0.01	0.2	2
Molybdenum	mg/kg	u	< 0.03	0.5	10.0	30
Nickel	mg/kg	u	< 0.03	0.4	10.0	40
Lead	mg/kg	u	< 0.10	0.5	10.0	50
Antimony	mg/kg	u	< 0.01	0.06	0.7	5
Selenium	mg/kg	u	< 0.10	0.1	0.5	7
Zinc	mg/kg	u	< 0.10	4	50	200
Chloride	mg/kg	u	739	800	15000	25000
Fluoride	mg/kg	u	7.2	10	150	500
Sulphate (as SO_4)	mg/kg	u	290	1000	20000	50000
Phenol Index	mg/kg	u	< 1.0	1	-	-
Dissolved Organic Carbon	mg/kg	u	150	500	800	1000

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Project Reference - CGL5575

Sample Descriptions

NCA Reference	Client Sample Reference	Sample Location	Description	Moisture Content (%)	Stone Content (%)
15-21273	BH1	64774	Black slightly silty slightly sandy clay with crused rock, glass and chalk fragments.	14	6.6
15-21275	TP1	64776	Brown gravelly sand with crushed rock.	10	16
15-21276	TP2	64777	Brown slightly silty sand with crushed rock and organic matter.	12	47
15-21277	TP3	64778	Brown slightly sandy silt with crushed rock and carbonaceous material.	16	24

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Project Reference - CGL5575

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	Metals	Air Dried	In house method statement - MS - CL - ICP metals
Soil	PAH	Air Dried	In house method statement - MS - CL - PAH
Soil	Phenols	As Received	In house method statement - MS - CL - Phenols (Skalar)
Soil	Cyanide	As Received	In house method statement - MS - CL - Cyanide by Skalar
Soil	pH	As Received	In house method statement - MS - CL - pH (Soil)
Soil	Sulphate	Air Dried	In house method statement - MS - CL - Anions (Aquakem)
Soil	Total Sulphur	Air Dried	In house method statement - MS - CL - BRE
Soil	Sulphide	Air Dried	In house method statement - MS - CL - Sulphide
Soil	CWG	As Received	In house method statement - MS - CL - EPH and VPH

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Project Reference - CGL5575

WAC Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	TOC	Air Dried	In house method statement - MS - CL - TOC
Soil	LoI	Air Dried	BS 1377, Part 3, 1990
Soil	BTEX	As Received	In house method statement - MS - CL - VOC and BTEX
Soil	PCB	As Received	In house method statement - MS - CL - PCB
Soil	Mineral Oil	As Received	In house method statement - MS - CL - TPH
Soil	PAH	Air Dried	In house method statement - MS - CL - PAH
Soil	pH	Air Dried	In house method statement - MS - CL - pH (Soil)
Eluate	Metals	Leached	In house method statement - MS - CL - Water Metals
Eluate	Anions	Leached	In house method statement - MS - CL - Anions (Aquakem)
Eluate	Phenol Index	Leached	In house method statement - MS - CL - Phenols (Skalar)
Eluate	DOC	Leached	In house method statement - MS - CL - DOC

Chelmer Consultancy Services
'Groundbreaking Services'

Contamination Test Results on Soil Samples

Location: 22 Fortess Grove		Date : September 2015				Job No. : 5575		Sheet 1 of 1	
Borehole No.	**Units**	**BH1**	**TP1**	**TP2**	**TP3**	***ATRISK Contaminated Land Screening Values (SSV) derived using CLEA v1.04 for 6% SOM***			
Sample No.		**15-21273**	**15-21275**	**15-21276**	**15-21277**				
Depth (m)		**0.25**	**0.25**	**0.25**	**0.25**				
Material Type		**MADE GROUND**	**MADE GROUND**	**MADE GROUND**	**MADE GROUND**	***Residential with plant uptake***	***Residential without plant uptake***	***Allotments***	***Commercial/ Industrial***
Aromatic Hydrocarbons (mg/kg)	>C5-C7	<0.03	<0.03	<0.04	<0.03	*0.33*	*0.988*	*0.07*	*95*
	>C7-C8	<0.03	<0.03	<0.04	<0.03	*610*	*2710*	*120*	*420000*
	>C8-C10	<0.03	<0.03	<0.04	<0.03	*177*	*233*	*64.5*	*64100*
	>C10-C12	<11	<11	<11	<12	*389*	*1080*	*86.4*	*68300*
	>C12-C16	<11	<11	<11	<12	*687*	*2040*	*160*	*65600*
	>C16-C21	<11	<11	<11	<12	*804*	*1330*	*288*	*28400*
	>C21-C35	<11	40	24	22	*1220*	*1330*	*1550*	*28400*
Aliphatic Hydrocarbons (mg/kg)	>C5-C6	<0.03	<0.03	<0.04	<0.03	*259*	*261*	*5120*	*>1000000*
	>C6-C8	0.08	0.12	0.28	<0.03	*14700*	*49400*	*16600*	*>100000*
	>C8-C10	<0.03	<0.03	<0.04	<0.03	*144*	*144*	*2130*	*170000*
	>C10-C12	<11	<11	<11	<12	*4140*	*4340*	*8870*	*171000*
	>C12-C16	<11	<11	<11	<12	*5260*	*5310*	*15900*	*171000*
	>C16-C21	<11	<11	<11	<12	*88200*	*146000*	*462000*	*>1000000*
	>C21-C35	<11	12	12	14	*88200*	*146000*	*462000*	*>1000000*
Naphthalene	mg/kg	0.12	0.05	<0.02	0.20	*8.71*	*9.22*	*23.4*	*22700*
Acenaphthylene	mg/kg	0.03	0.07	<0.02	0.09	-	-	-	-
Acenaphthene	mg/kg	<0.02	<0.02	<0.02	0.05	*2130*	*4770*	*612*	*106000*
Fluorene	mg/kg	<0.02	0.02	<0.02	0.05	*1930*	*3100*	*725*	*72100*
Phenanthrene	mg/kg	0.15	0.60	0.06	0.67	-	-	-	-
Anthracene	mg/kg	0.03	0.12	<0.02	0.09	*18300*	*24000*	*10400*	*545000*
Fluoranthene	mg/kg	0.06	1.42	0.09	1.15	*2160*	*3210*	*924*	*72700*
Pyrene	mg/kg	0.07	1.19	0.07	1.03	*1550*	*2400*	*620*	*54500*
Benzo(a)anthracene	mg/kg	0.06	1.32	0.05	0.94	*8.54*	*9.04*	*15.1*	*142*
Chrysene	mg/kg	0.08	1.76	0.12	0.93	*927*	*1010*	*1170*	*14300*
Benzo(b)fluoranthene	mg/kg	0.08	2.72	0.23	1.37	*9.86*	*10.3*	*18.6*	*144*
Benzo(k)fluoranthene	mg/kg	0.02	0.94	0.08	0.53	*100*	*104*	*227*	*1440*
Benzo(a)pyrene	mg/kg	0.05	**1.78**	0.14	1.15	*0.998*	*1.04*	*2.10*	*14.4*
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	1.74	0.29	0.89	*9.75*	*10.3*	*16.6*	*144*
Dibenz(a,h)anthracene	mg/kg	<0.02	0.55	0.07	0.27	*1.00*	*1.03*	*2.57*	*14.4*
Benzo(ghi)perylene	mg/kg	0.05	1.56	0.32	0.73	*103*	*104*	*342*	*1450*
TOTAL PAH	mg/kg	0.92	15.90	1.63	10.30				
Cyanide (Free)	mg/kg	<1.1	<1.2	<1.0	<1.1	*34*	*34*	*34*	*34*
pH	unit	8.4	8.8	9.8	8	-	-	-	-
Copper (Total)	mg/kg	52.9	38.3	152	86.7	*4020*	*8370*	*1110*	*109000*
Lead (Total)	mg/kg	**340**	186	173	**592**	*200*	*310*	*80*	*2330*
Zinc (Total)	mg/kg	88.5	83.2	120	226	*17200*	*46800*	*3990*	*>1000000*
						LQM/CIEH Generic Assessment Criteria			
Chromium (Total)	mg/kg	23	17.6	15.5	27.7	*3000*	*3000*	*34600*	*30400*
						CLEA Soil Guideline Values (SGV)			
Arsenic (Total)	mg/kg	14.2	10.5	<10	18.6	*32*	*35*	*43*	*640*
Cadmium (Total)	mg/kg	0.5	0.6	0.4	0.7	*10*	*83.6*	*1.8*	*230*
Mercury (Total)	mg/kg	<2.5	<2.5	<2.5	<2.5	*170*	*238*	*80*	*3600*
Nickel (Total)	mg/kg	18.6	15.3	13.5	20.9	*130*	*130*	*230*	*1800*
Phenols (Total)	mg/kg	<1.1	<1.2	<1.0	<1.1	*420*	*519*	*280*	*3200*
Selenium (Total)	mg/kg	<8	<8	<8	<8	*350*	*595*	*120*	*13000*
Sulphate	mg/l	88	1600	590	230	-	-	-	-
Sulphur	%	0.03	0.47	0.17	0.09	-	-	-	-
Sulphide	mg/kg	5.5	39.5	31.0	22	-	-	-	-

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.	**5575**
Location	**22 Fortess Grove**
Date	**September 2015**
Number of Made Ground Samples	**4**
t value	**2.353**
Determinand	**Benzo(a)pyrene**
ATRISK (SSV) **Residential With Plant Uptake**	**0.998**

Contaminant Concentration (mg/kg)	x^2
0.1	0.00
1.8	3.17
0.1	0.02
1.2	1.32
3	

Mean	**0.78**
Sum of x^2	**4.51**
Standard Deviation^2 =	**0.693**
Standard Deviation =	**0.833**

Normalised Upper Bound	**1.76**

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
'Groundbreaking Services'

Job No.	**5575**
Location	**22 Fortess Grove**
Date	**September 2015**
Number of Made Ground Samples	**4**
t value	**2.353**
Determinand	**Lead**
ATRISK (SSV) **Residential With Plant Uptake**	**200**

Contaminant Concentration (mg/kg)	x^2
340	115600
186	34596
173	29929
592	350464
1291	

Mean	**322.75**
Sum of x^2	**530589.00**
Standard Deviation^2 =	**37972.917**
Standard Deviation =	**194.866**

Normalised Upper Bound	**552**

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

Yes

Groundwater/Ground Gas Monitoring Results Sheet

Site Ref: 5575
Site Name: 22 Fortess Grove

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	21/08/2015	0.1	0.1	0.0007	5.0	5.0	0.0350	16.7	1017	0.7	1.00-5.80	3.97	0	0

Notes

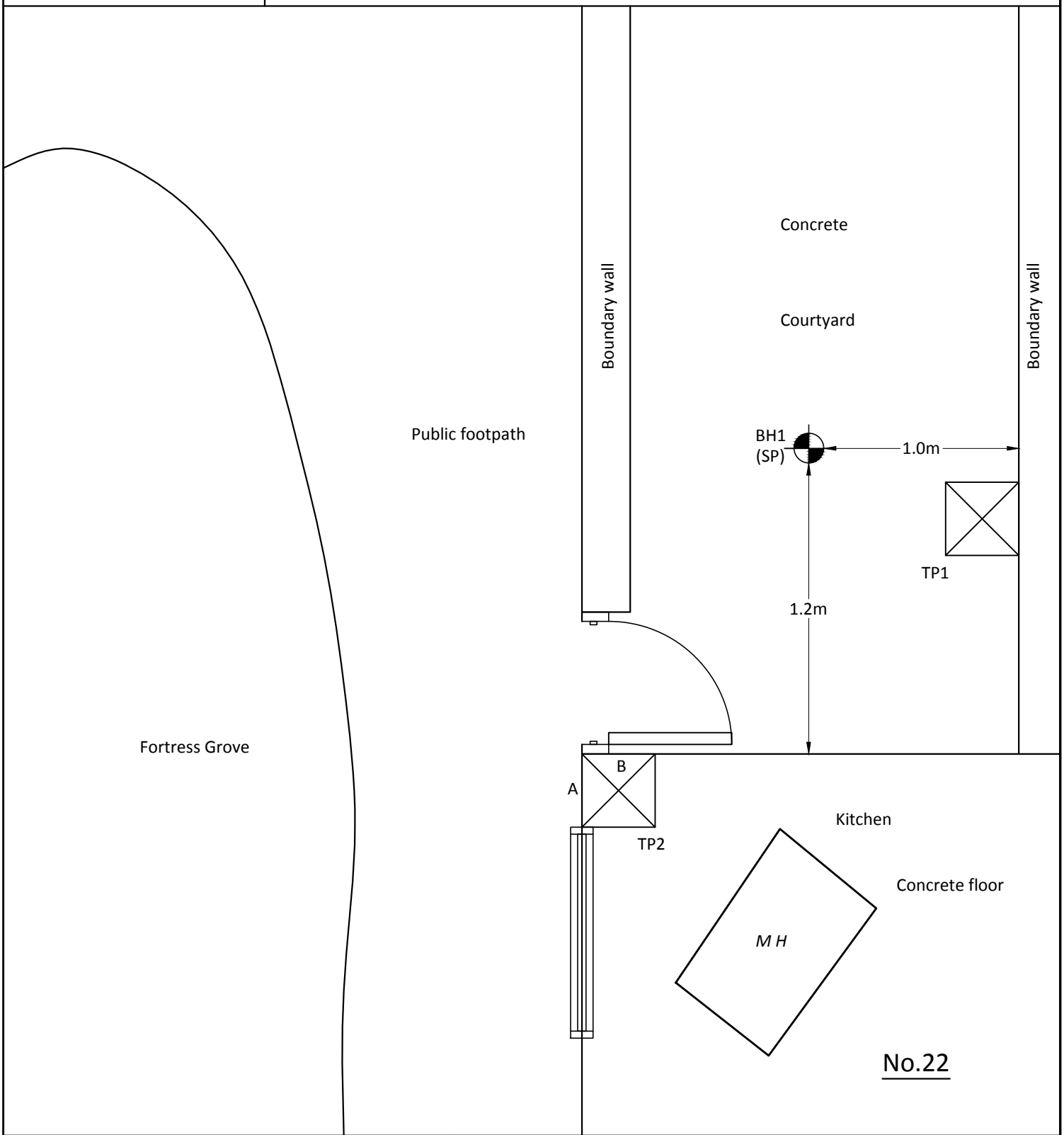
NR = Not recorded
Values in Bold exceed the CO_2 Building Regulations threshold (>1.5%)
Values in Red exceed the Buildings Regulations Action Level (CO_2 >5.0% and CH_4 >1.5%)

Chelmer Site Investigations
'Groundbreaking Services'

Client: Les Property Development		**Scale:** N.T.S.	**Sheet:** 1 of 2	**Date:** 22.07.15	
Location: 22 Fortess Grove, Kentish Town, NW5 2HD		**Job No:** 5575	**Weather:** Fine	**Drawn by: TP**	**Checked by: JH**

No.1

Back wall

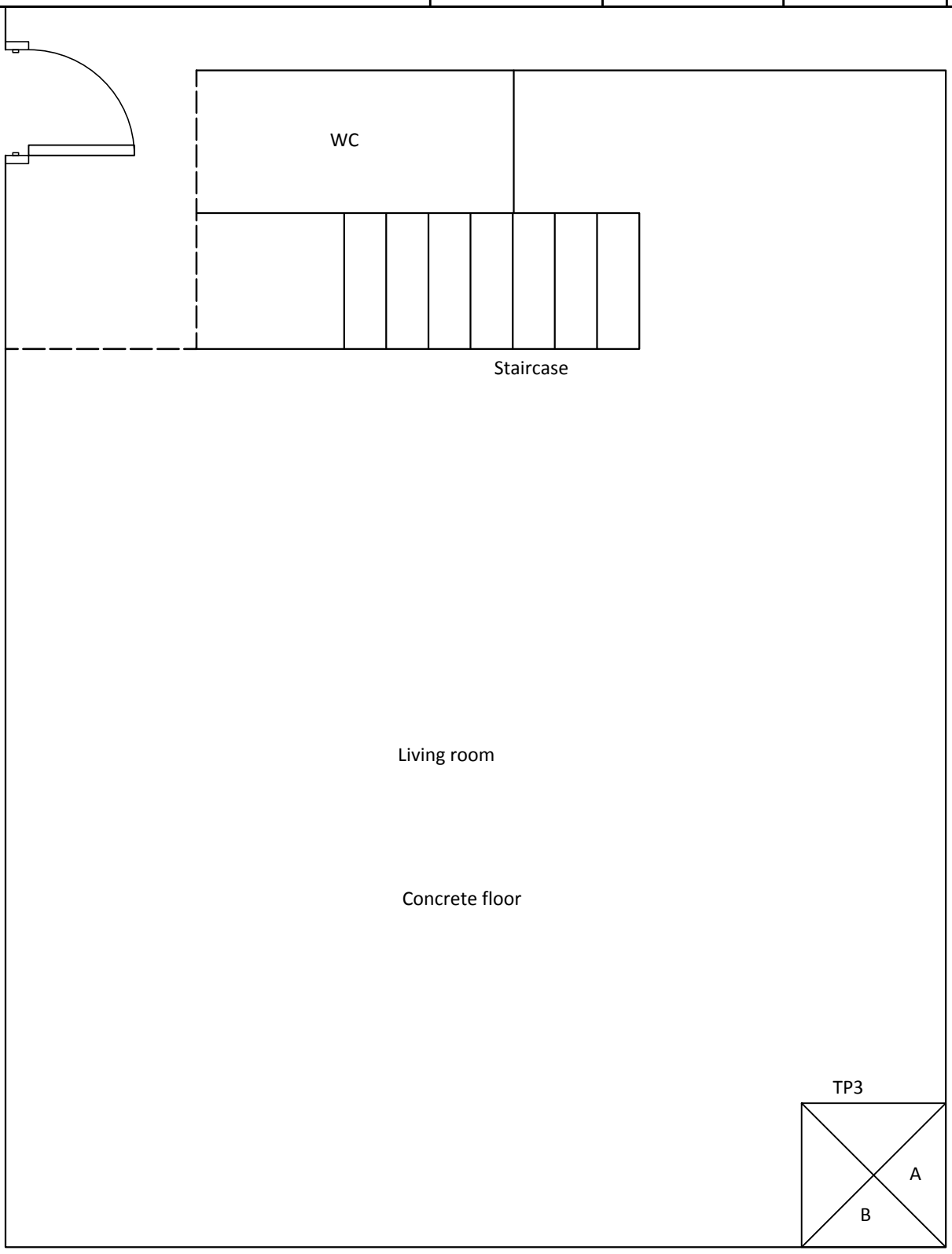


Notes: *On site tree identification for guidance only. Not authenticated.*

Key:

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

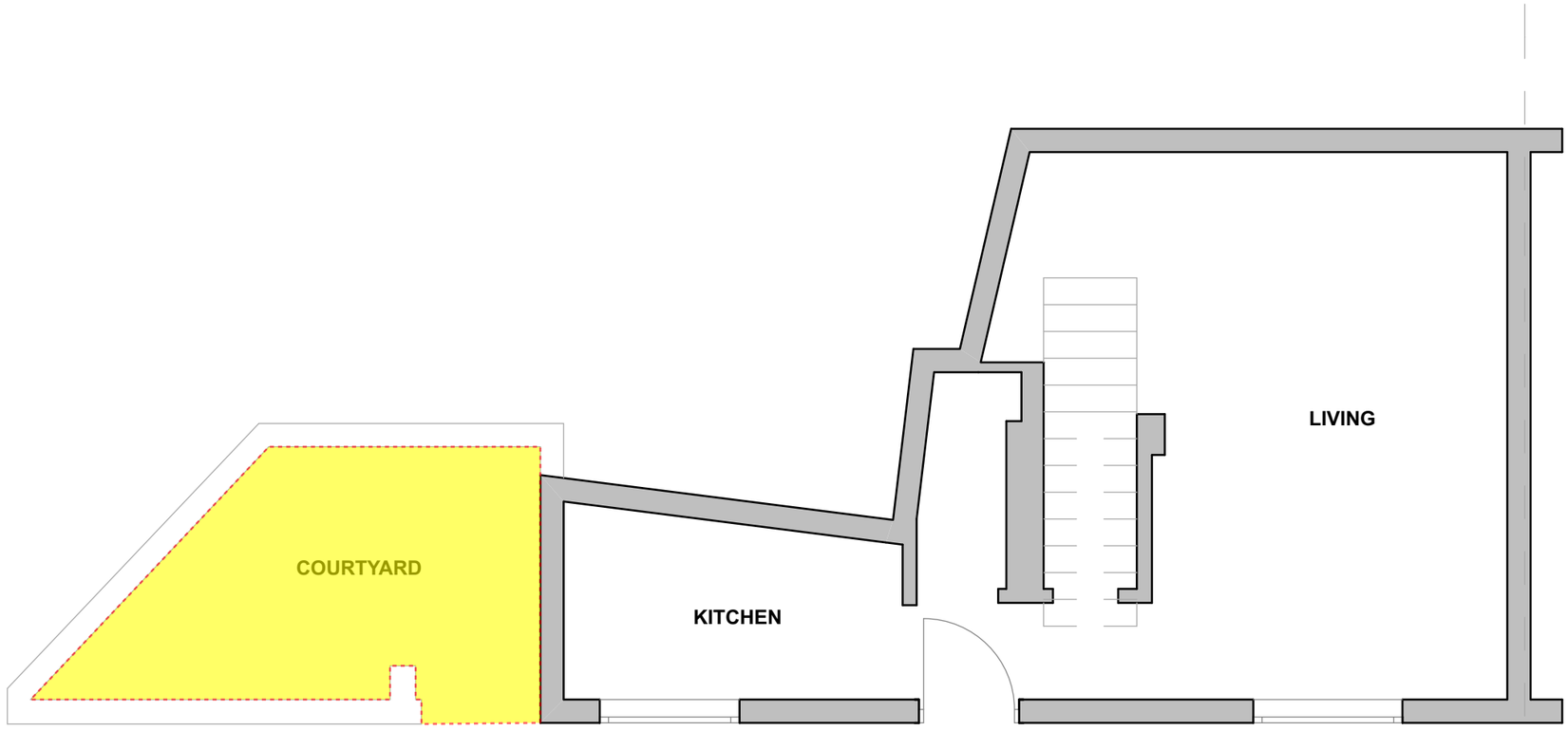
Client: Les Property Development		**Scale:** N.T.S.	**Sheet:** 2 of 2	**Date:** 22.07.15	
Location: 22 Fortess Grove, Kentish Town, NW5 2HD		**Job No:** 5575	**Weather:** Fine	**Drawn by: TP**	**Checked by: JH**



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



1: 100 @ A3

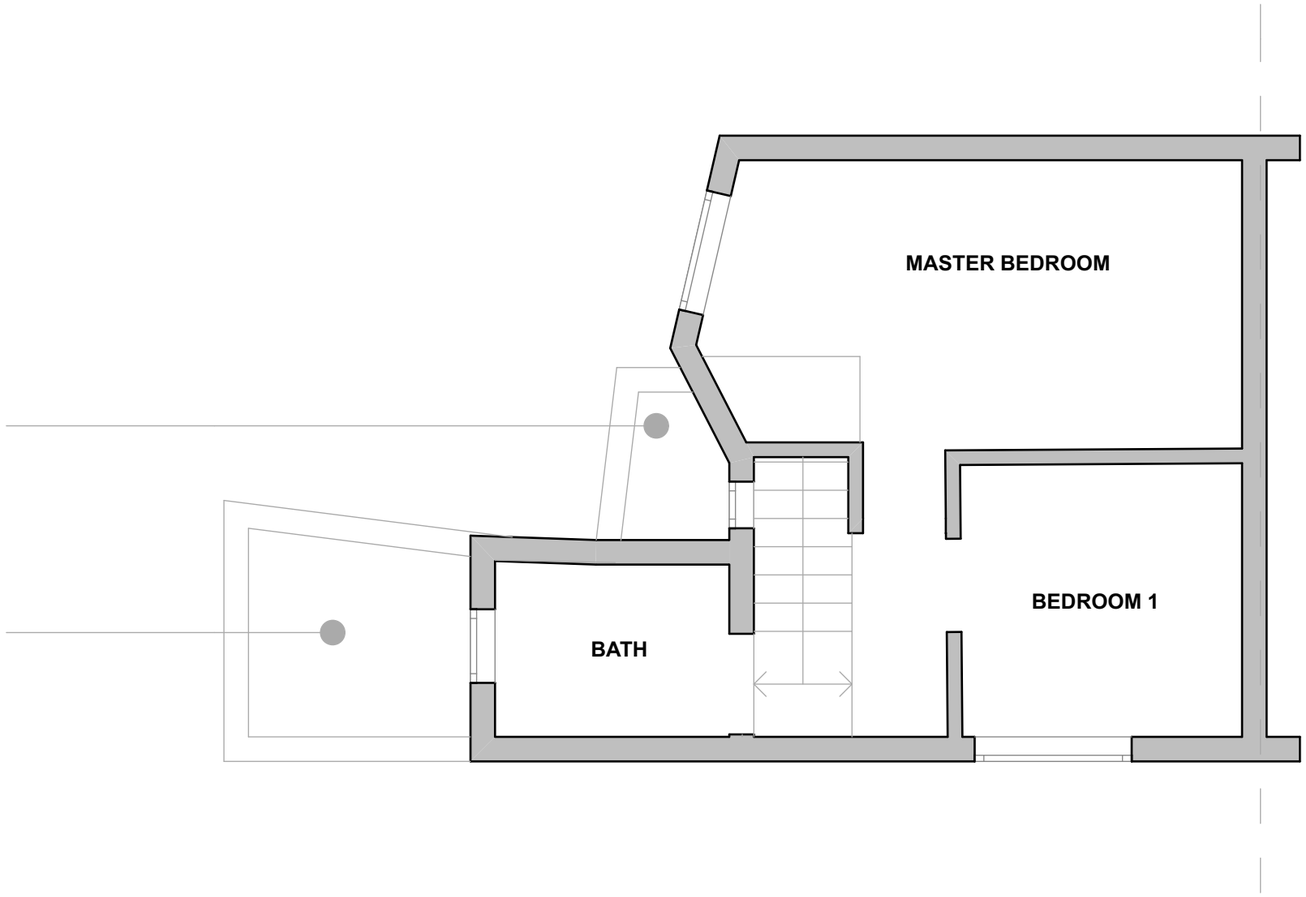
0m 10m

FORTESS GROVE KENTISH TOWN
EXISTING GROUND FLOOR PLANS

MEAD
Architecture & Construction

FLAT ROOF OVER GROUND FLOOR WC

FLAT ROOF OVER KITCHEN

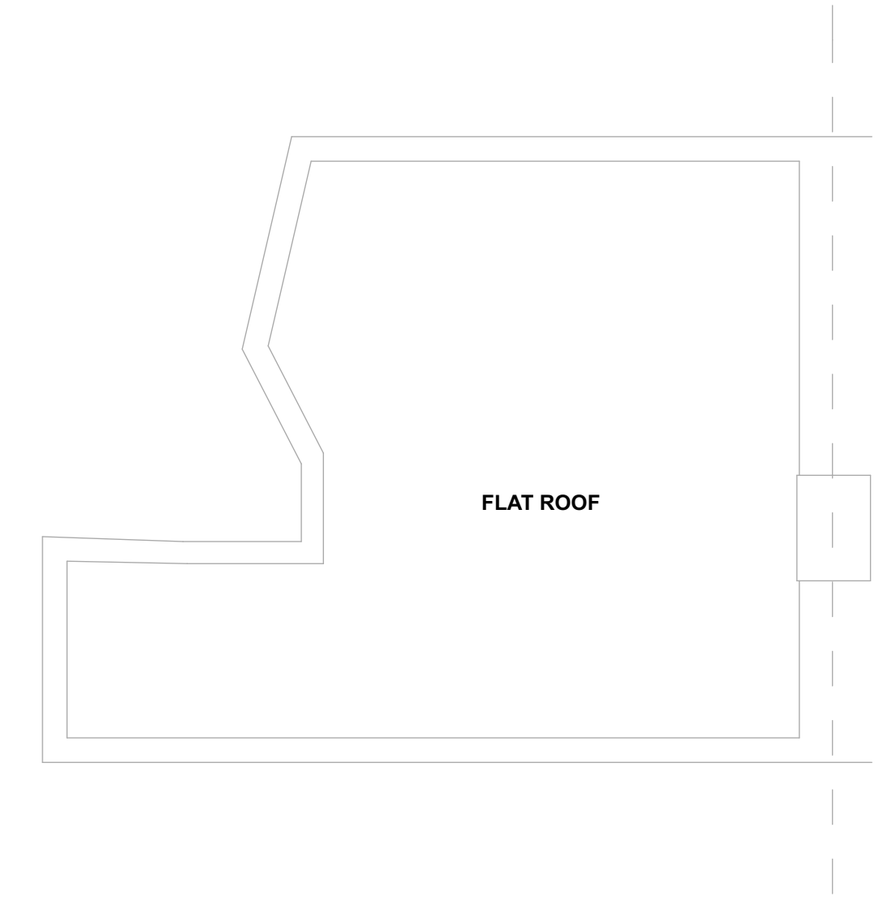


1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
EXISTING FIRST FLOOR PLANS

MEAD
Architecture & Construction



1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
EXISTING ROOF FLOOR PLANS

MEAD
Architecture & Construction

22 FORTESS GROVE EXISTING
FRONT ELEVATION

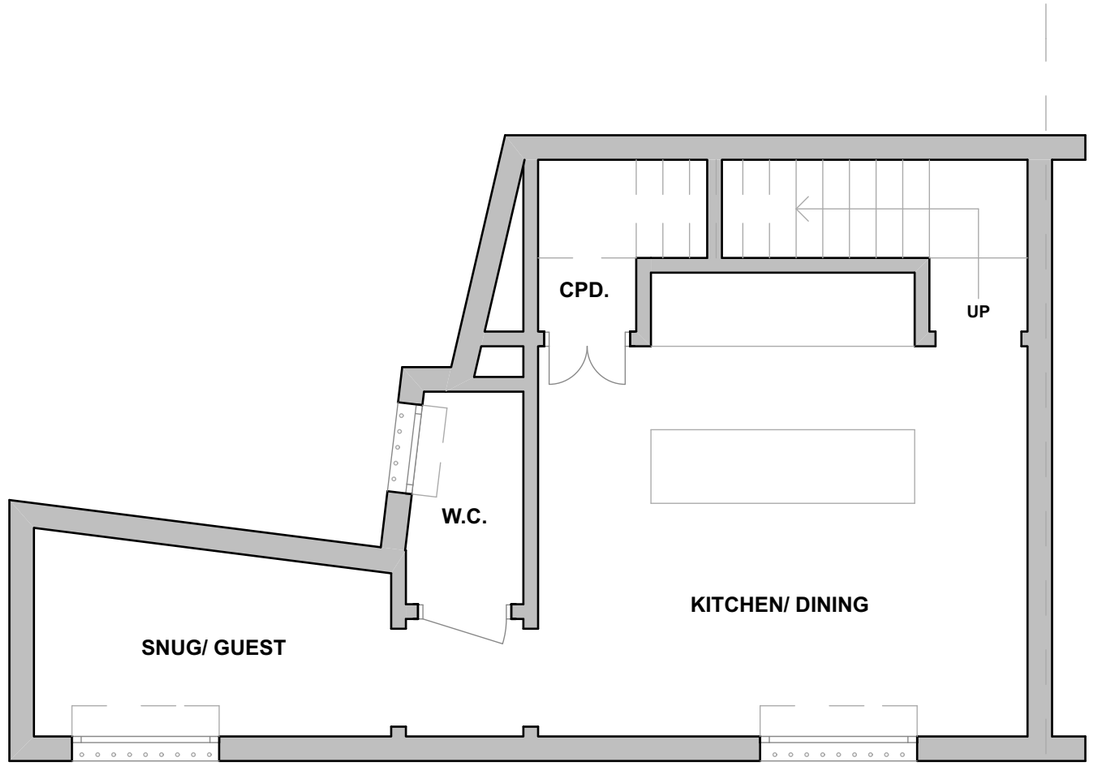
21 FORTESS GROVE EXISTING
FRONT ELEVATION

1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
EXISTING FRONT ELEVATION

MEAD
Architecture & Construction

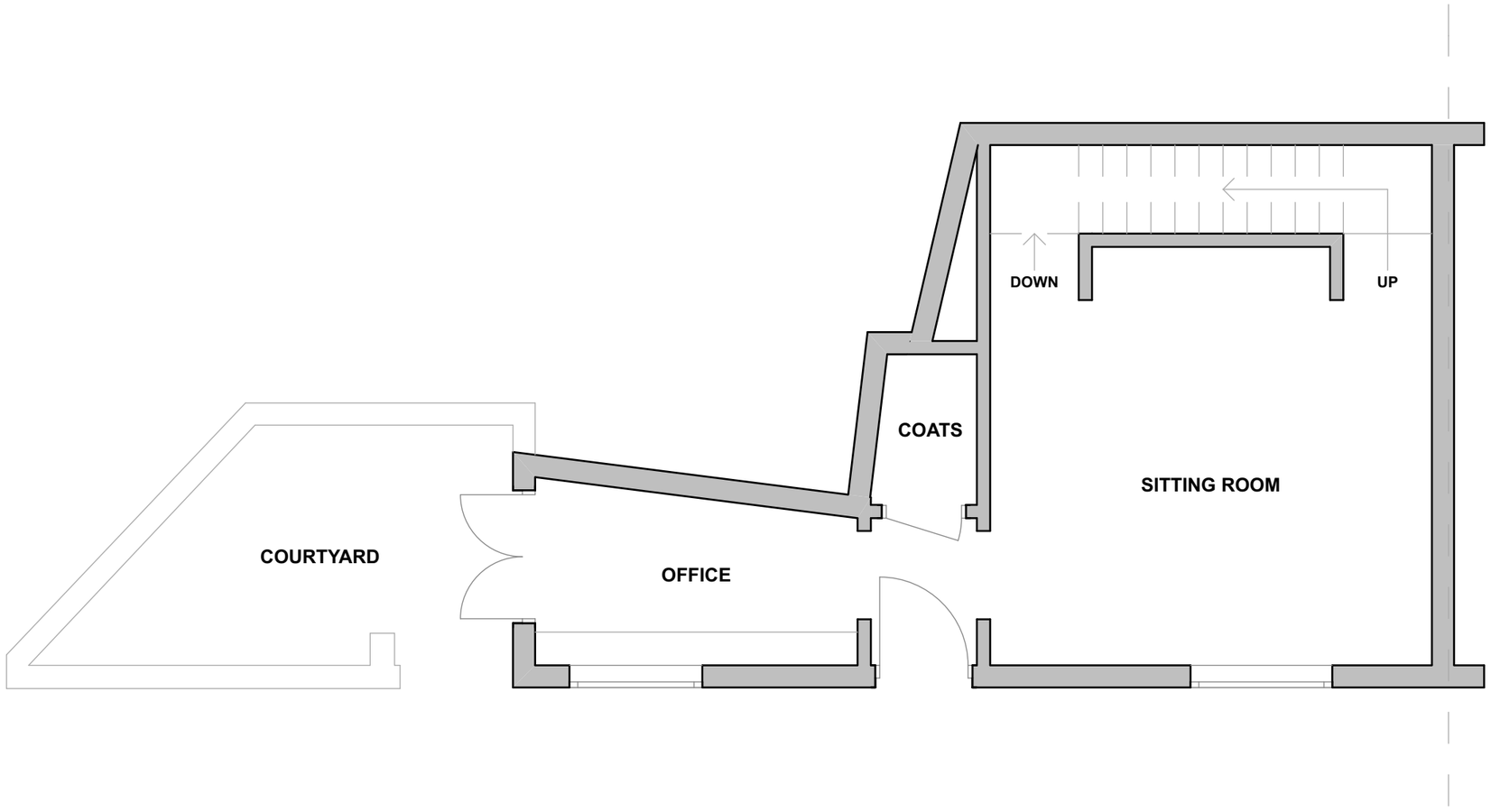


1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
PROPOSED BASEMENT FLOOR PLANS

MEAD
Architecture & Construction

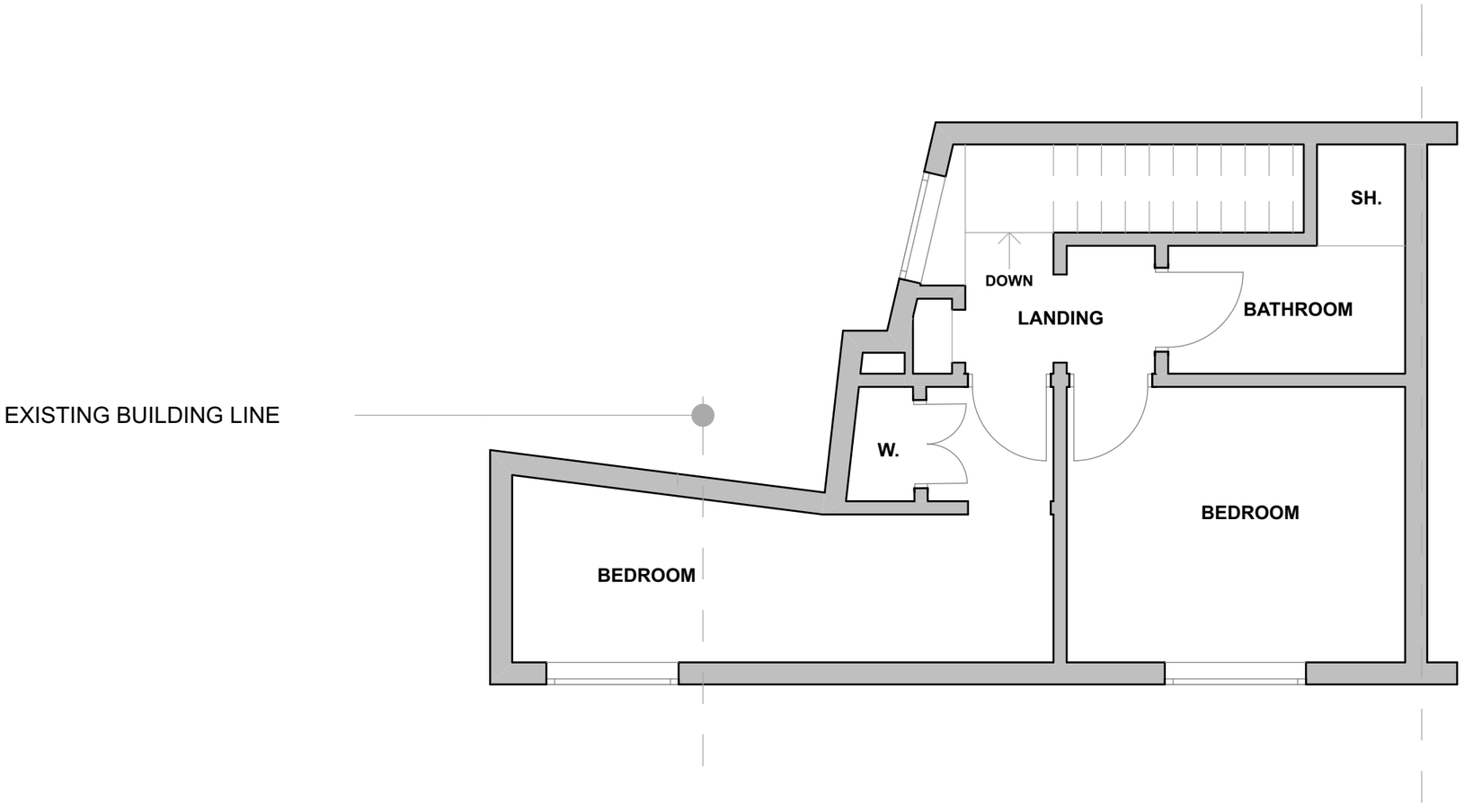


1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
PROPOSED GROUND FLOOR PLANS

MEAD
Architecture & Construction



1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN

PROPOSED FIRST FLOOR PLANS

MEAD

Architecture & Construction

22 FORTESS GROVE PROPOSED FRONT ELEVATION

21 FORTESS GROVE EXISTING FRONT ELEVATION

1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
PROPOSED FRONT ELEVATION

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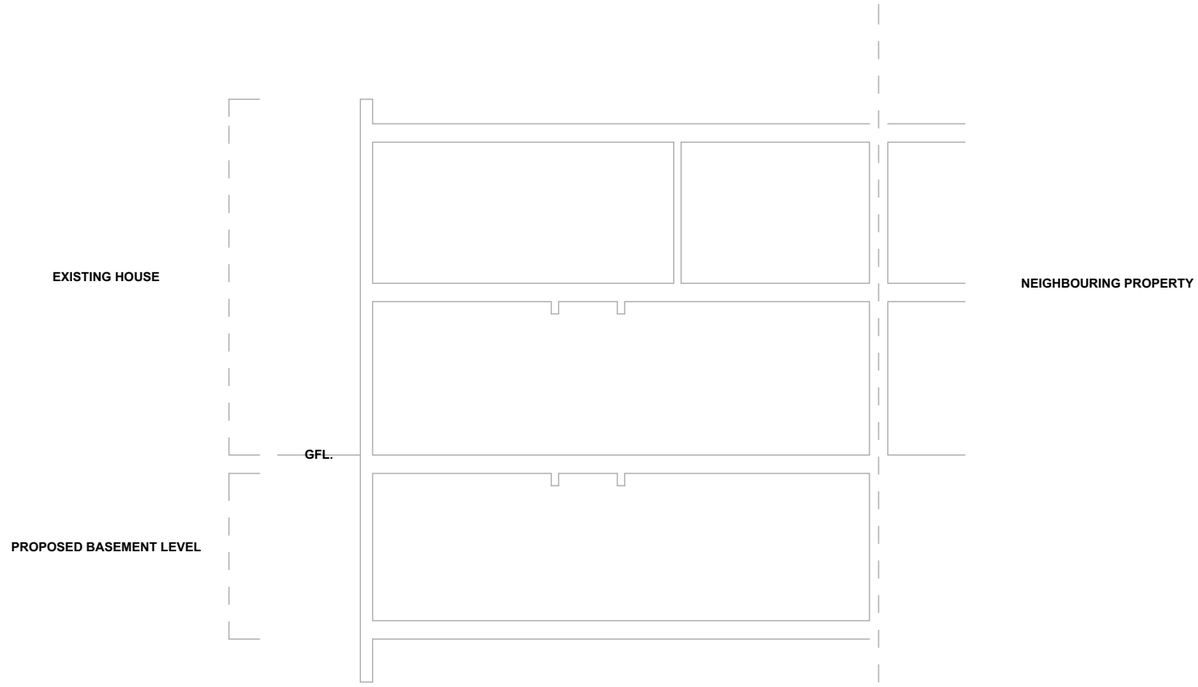

1: 100 @ A3

0m 10m

FORTESS GROVE KENTISH TOWN
PROPOSED SECTION

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