



CHEQUERS ROAD (SITE B), LOUGHTON
Phase 2 Geo-Environmental Assessment – Volume 1 of 2

CHEQUERS ROAD (SITE B), LOUGHTON

Phase 2 Geo-Environmental Assessment

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1.0 INTRODUCTION

- 1.1 Create Consulting Engineers Ltd (CCE) was instructed by ECD Architects, on behalf of Epping Forest District Council, to undertake a Phase 2 Geo-Environmental Assessment of the parcel of land off Chequers Road (Site B) in Loughton, IG10 3QF (the 'Site').

Project Context

- 1.2 The Site is owned by Epping Forest District Council and was formerly occupied by a series of garages for local residents.
- 1.3 Planning approval was granted for the demolition of the existing garages and replacement with 5 No. two-storey affordable residential units with rear garden areas, car parking, vehicle access and landscaping on 9 February 2016 (Ref: EPF/2609/15).
- 1.4 The proposed layout of the development (ground floor) is provided in Figure 1.1, below:

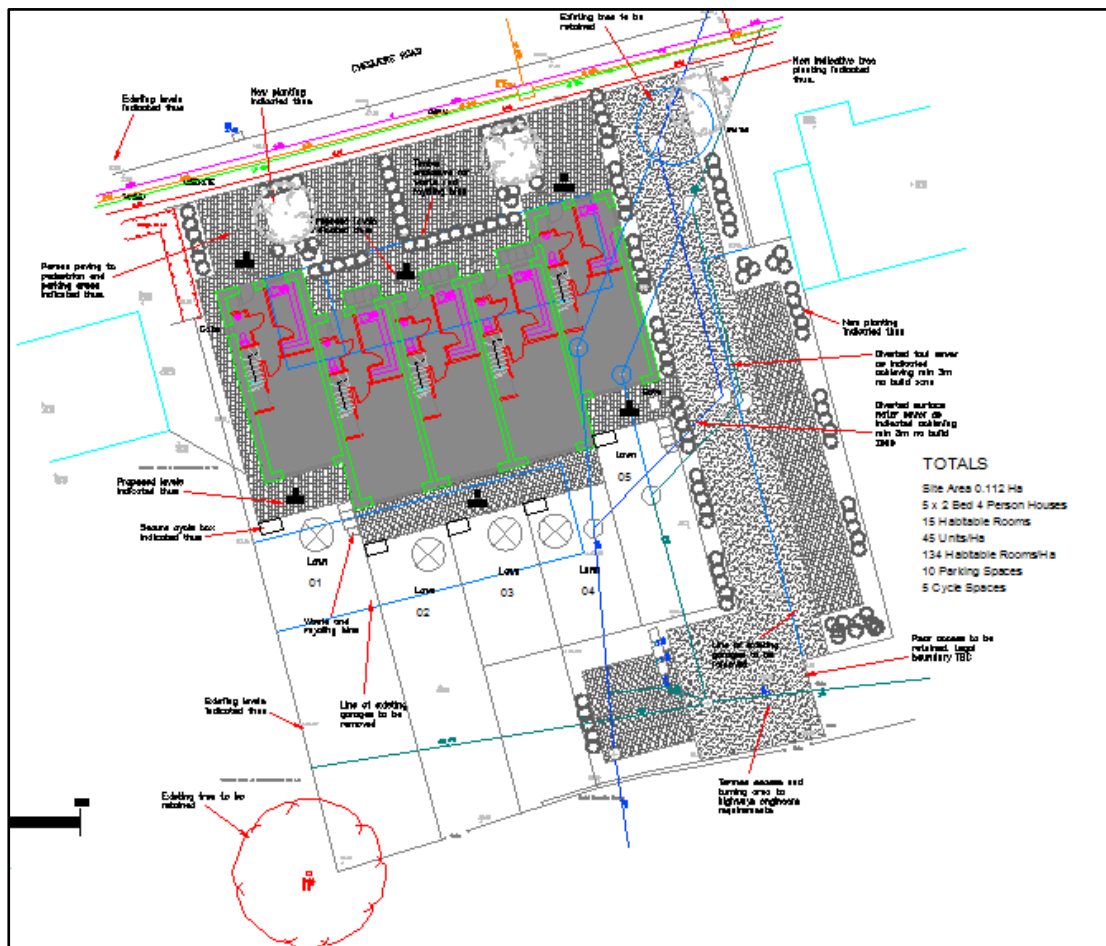


Figure 1.1: Proposed Development Plan

- 1.5 A Phase 1 Contamination Land Assessment was carried out by CCE in November 2018 (Ref: CB/JEB/P18-1639/01 – Rev A) which highlighted a number of issues to be addressed.

- 1.6 The development was granted subject to a number of pre-commencement conditions, including:

Condition 7: Should the Phase 1 Land Contamination preliminary risk assessment carried out under the above condition identify the presence of potentially unacceptable risks, no development shall take place until a Phase 2 site investigation has been carried out. A protocol for the investigation shall be submitted to and approved by the Local Planning Authority before commencement of the Phase 2 investigation. The completed Phase 2 investigation report, together with any necessary outline remediation options, shall be submitted to and approved by the Local Planning Authority prior to any redevelopment or remediation works being carried out. The report shall assess potential risks to present and proposed humans, property including buildings, crops, livestock, pets, woodland and service lines and pipes, adjoining land, groundwaters and surface waters, ecological systems, archaeological sites and ancient monuments and the investigation must be conducted in accordance with DEFRA and the Environment Agency's "Model Procedures for the Management of Land Contamination, CLR 11 ", or any subsequent version or additional regulatory guidance.

Objectives

- 1.7 The objectives of the site investigation were as follows:
- To discharge Condition 7 of the pre-commencement conditions relating to Contaminated Land as outlined in CCE Phase 1 Contaminated Land Assessment report; and
 - Provide geotechnical information for the proposed development of the Site.
- 1.8 The geo-environmental investigation works was carried out in accordance with best practice and planning guidance such as that set out in the National Planning Policy Framework, 2019 and the Environment Agency's Model Procedures for the Management of Land Contamination, CLR 11 2004.

Scope of Work

- 1.9 The scope of works proposed for this assessment was as follows:

Geo-Environmental Site Investigation

- Drilling of 4No. windowless sample boreholes to a maximum depth of 5.45m below ground level (or refusal) with hand-dug excavation pits to 1.0m for each borehole;
- During drilling of the boreholes, *in situ* (SPT) testing and disturbed / undisturbed sampling undertaken for laboratory analysis;
- Standpipes to be installed in each of the windowless sample boreholes to allow subsequent groundwater level and gas monitoring (if required);

- Excavation of 4No. trial pits in areas proposed for soft landscaping to a maximum depth of 1m below ground level or to prove natural soils for environmental laboratory testing;
- Soil samples collected and submitted to UKAS accredited testing laboratory for moisture content, plasticity, triaxial, CBR and aggressiveness to concrete tests;
- Soil samples collected and submitted to an M-CERTS accredited testing laboratory for chemical testing for total organic carbon (TOC) and a standard suite of organic and inorganic parameters;
- Ground Gas and groundwater level monitoring to be undertaken on completion of the site works should TOC levels present a viable gassing regime to the Site; and
- A summary interpretative report prepared on completion of the works and subsequent laboratory testing.

Constraints and Limitations

- 1.10 The copyright of this report is vested in Create Consulting Engineers Limited and the Client, Epping Forest District Council. The Client, or their appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Limited or the Client.
- 1.11 Create Consulting Engineers Limited accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.
- 1.12 Create Consulting Engineers Limited has endeavoured to assess all information provided to them during this appraisal. Should additional information become available which may affect the opinions expressed in this report, Create Consulting reserves the right to review this information and, if warranted, to modify the opinions presented in the report accordingly.
- 1.13 The report summarises information from a number of external sources and is unable to offer any guarantees or warranties for the completeness or accuracy of information relied upon. Information from third parties has not been verified by Create Consulting Engineers Limited unless otherwise stated in this report.
- 1.14 The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

2.0 SITE LOCATION AND DESCRIPTION

Site Location

- 2.1 The Site comprises a square parcel of land located to the south of Chequers Road, approximately 1.25kms to the east-southeast of Loughton centre. The Site is located at approximate National Grid Reference 543514E, 195810N and the nearest postcode is IG10 3QQ.
- 2.2 A Site location plan is provided as Figure 2.1, below:

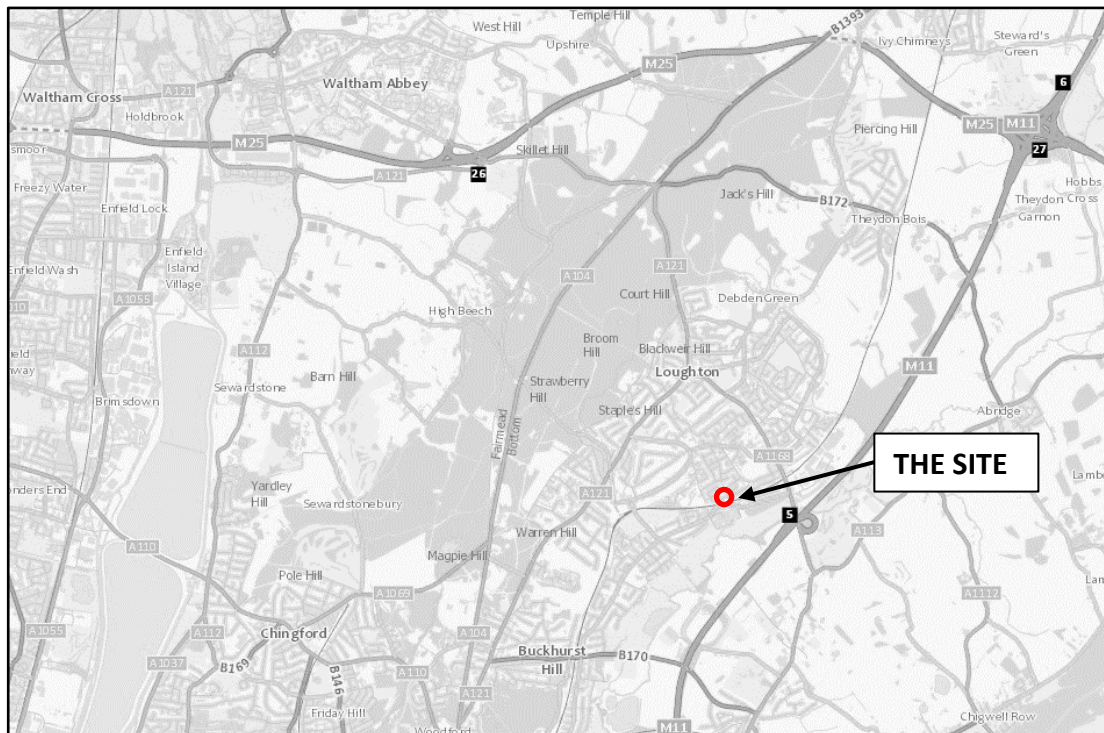


Figure 2.1: Site Location Plan

Site Description

- 2.3 The Site covers an area of approximately 0.11ha and is situated in a residential area.
- 2.4 A Site walkover assessment was undertaken on 31 October 2018 as part of the CCE Phase 1 Contamination Assessment.
- 2.5 The Site comprised an area of concrete hardstanding with access road from Chequers Road (to the north) and originally accommodated 28No. individual garages over four rows with hardstanding areas in front of each set of facing garages (removed). The end (west) structure on the most northerly row, adjacent to the site entrance is a building housing an Electricity Substation (still present).

2.6 The layout of the Site is illustrated in Figure 2.2, below:

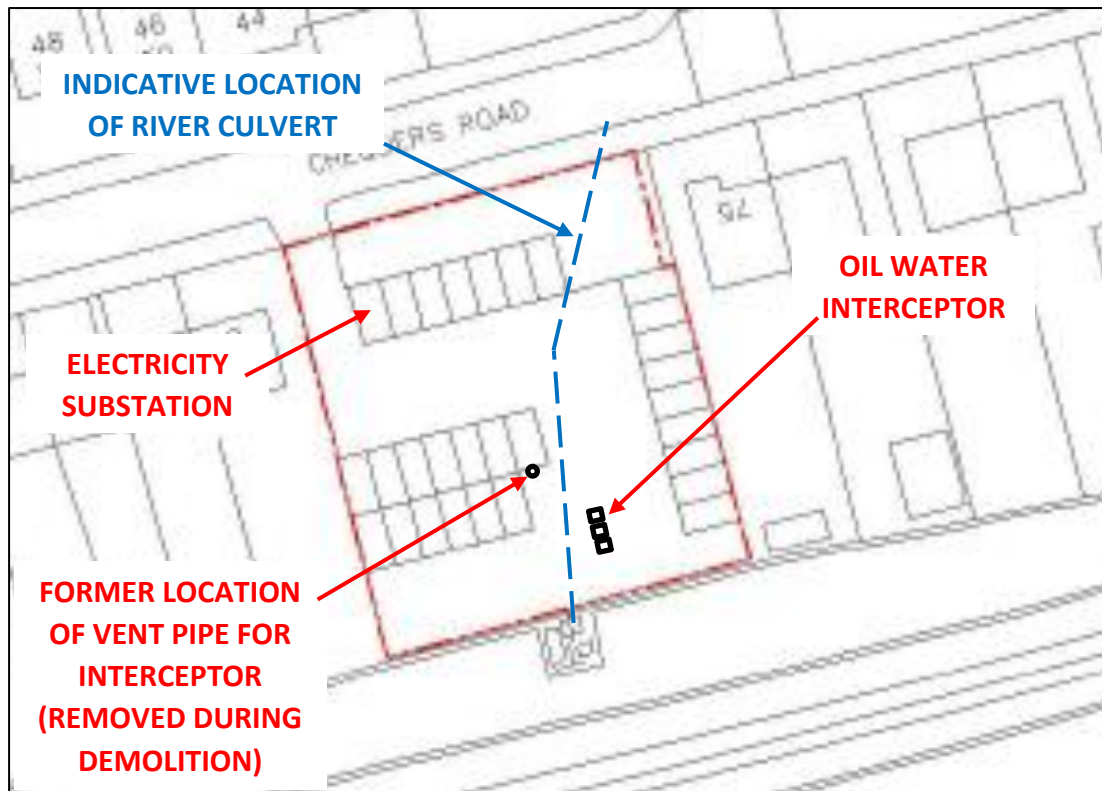


Figure 2.2: Site Layout (pre-demolition)

- 2.7 There is a grassed area in the northeast corner of the Site and along the northern boundary between the former garages and the site boundary
- 2.8 An underground oil water interceptor is located in the central southern area of the Site and the site survey drawing identified a former vent pipe located adjacent to the central garages, although this was removed during the demolition of the garages.
- 2.9 The concrete hardstanding was generally observed to be in good condition across the Site. The survey for the Site identifies a service running broadly north to south running through the Site, which is likely to be a culvert for the river formerly running through the Site / this area.

3.0 ENVIRONMENTAL SETTING

Geology

- 3.1 Reference has been made to the BGS 1:50,000 Solid and Drift map of the area (Sheet 257, Romford, dated 1996), which indicates that the Site is directly underlain by the London Clay Formation with no superficial deposits identified.
- 3.2 There are a number of BGS borehole records to the south/southeast of the Site which confirm this area is underlain the London Clay Formation.

Hydrogeology

- 3.3 The underlying London Clay Formation is classified as Unproductive, with low permeability that has negligible significance for water supply or river base flow.
- 3.4 According to the Environment Agency, the Site is not located within a designated groundwater source protection zone and no active groundwater abstraction licenses within 1km of the Site.

Hydrology

- 3.5 There is a culverted inland river passing through the Site, with the closest water feature (at surface) the continuation of this river adjacent to the south of the Site. This inland river, which pre-development flowed north to south through the Site, flows south (culverted) and is a tributary to the River Roding to the south.

Sensitivity

- 3.6 The sensitivity of each of the identified receptors is rated depending upon the environmental setting of the Site, the likelihood for pollutant linkages to be present and potential consequence of those potential pollutant linkages. The assessment approach adopted is based on guidance set out in the *Guidance for the Safe Development of Housing on Land Affected by Contamination R&D 66* document.
- 3.7 The Site sensitivity with regards to groundwater within the London Clay Formation directly underlying the Site is designated as **L2 (Very Low)**, described as a '*not a recognised aquifer*'.
- 3.8 The Site sensitivity with regards to surface water given the presence of an inland river running (culverted) through the Site is designated as **H1 (Very high)**, described as '*with a watercourse in close proximity to Site*'

4.0 REVIEW OF EXISTING INFORMATION

Phase 1 Contaminated Land Assessment, Create Consulting Engineers Ltd (Ref: CB/JEB/P18-1639/01 – Rev A) dated November 2018

- 4.1 CCE conducted a Phase 1 Contaminated Land Assessment to support a planning proposal for the redevelopment of the Site to residential end-use.
- 4.2 The environmental sensitivity of the site has been assessed as very low with respect to groundwater on the basis of the underlying unproductive aquifer and very high with respect to surface water given the culverted water course running through the Site.
- 4.3 A number of potential pollutant linkages were identified associated with the proposed site end-use of residential with private gardens. These key potential contamination sources identified were:
- Potential pollutants arising from stockpiling of materials or fly tipped material prior to site clearance / demolition;
 - Potential pollutants or ground gas present within poor quality made ground associated with site development in 1960s;
 - Potential pollutants from on-site electricity substation; and
 - Potential pollutants arising from the presence of an underground oil/water interceptor.
- 4.4 Any potential ACMs present within the garage structures were removed from the Site during demolition works.
- 4.5 In order to manage the uncertainty associated with these potential ground contamination sources, a site investigation was recommended to include any Made Ground and shallow soils and, depending on both the extent and the Total Organic Carbon percentage of Made Ground beneath the Site, ground gas monitoring.

5.0 GROUND INVESTIGATION

- 5.1 Ground investigation works were undertaken at the Site on 31 January 2020 in accordance with the Sampling and Analysis Plan (see Appendix A), which was reviewed and agreed with the Contaminated Land Officer (CLO) prior to commencement.

Description of Fieldwork

- 5.2 The scope of works undertaken was as follows:
- Excavation of 5No. hand dug pits to a maximum depth of 1.20m bgl to enable the collection of soil samples for chemical testing;
 - Drilling of 5No. windowless sample boreholes (WS01 to WS05) to a maximum depth of 5.45m bgl to determine ground and groundwater conditions, provide *in situ* soil strength information (SPTs and U-samples), enable the collection of soils samples for chemical and geotechnical testing and the installation of groundwater and ground gas monitoring standpipes (WS05 did not have a standpipe installed);
 - Detailed description of Made Ground material including fractions;
 - Chemical laboratory testing of Made Ground and natural soils beneath the Site;
 - Chemical laboratory testing of a water sample collected from the on-Site oil/water separator; and
 - Geotechnical laboratory testing of soil samples beneath the Site, and
 - Ground gas monitoring on 3No. occasions on a fortnightly basis (19 February to 16 March 2020), using an infrared gas analyser GA5000 to establish the initial site gassing regime.
- 5.3 An Exploratory Hole Location Plan is provided in Appendix B.
- 5.4 The soil arisings from each borehole and trial pit were logged by a suitably qualified Engineer, in line with the relevant British Standard (BS 5930 and Eurocode 7). The exploratory hole logs are included within Appendix C.
- 5.5 All works were undertaken in accordance with the CCE Health and Safety Policy and within the framework of a Health and Safety plan.

Geo-Environmental Laboratory Testing

- 5.6 Soil samples were collected from the Made Ground and underlying natural soils at various locations and depths across the site and submitted for chemical and aggressiveness to concrete testing (BRE SD1 Suite - Greenfield with pyrite) at a UKAS/MCERTS accredited laboratory.

-
- 5.7 Samples for contamination analysis were collected in suitable amber glass 250ml jars and 60ml vials as well as 1ltr plastic tubs, using clean nitrile gloves to avoid any cross-contamination between samples.
- 5.8 All samples were transported under chain of custody documentation and tested for a range of inorganic and organic compounds. Cool boxes were kept cool (<4°C) with ice packs during sample collection and subsequent transportation by courier to the testing laboratory.
- 5.9 The chemical testing comprised a range of organic and inorganic parameters including asbestos, metals, petroleum hydrocarbons (TPH CWG), speciated polycyclic aromatic hydrocarbons (PAHs) and phenolic compounds.
- 5.10 The laboratory test certificates are included as Appendix D.

Geotechnical Laboratory Testing

- 5.11 Selected soil samples were subjected to testing within a UKAS accredited geotechnical laboratory. The results of this testing, along with laboratory certificates are included as Appendix E. Testing included:
- Moisture content;
 - Plasticity index;
 - Triaxial testing of U70 samples (multi-stage); and
 - California Bearing Ratio (CBR).

Ground Gas Monitoring

- 5.12 An empirical semi-quantitative approach was used to assess ground gas risk on the Site in accordance with BS 8485:2015+A1:2019. Samples of Made Ground encountered were collected and submitted for Total Organic Carbon (TOC) analysis and subjected to a detailed examination to determine the fractions present. The ratio of fine to coarse Made Ground material was quantified by weight and used to assess the potential for ground gas generation. If the TOC analysis exceeded the specified trigger level, ground gas monitoring would be required.
- 5.13 The ground gas risk assessment is discussed in Section 7.

6.0 GROUND CONDITIONS

- 6.1 The encountered ground conditions are provided in detail within the exploratory hole logs (Appendix C), laboratory geotechnical test results (Appendix E) and geotechnical plots (Appendix F) and summarised below.

General

- 6.2 The ground investigation comprised a total of 10No. exploratory holes (TP01 to TP05 and WS01 to WS05), formed across the Site, to provide a general indication of ground conditions, collect samples for geotechnical and chemical testing and install monitoring standpipes to enable ground gas and groundwater monitoring.
- 6.3 The following provides a summary of ground conditions from the ground investigation undertaken at the Site.

Topsoil

- 6.4 None of the exploratory hole locations were undertaken within the grassed area at the north of the Site.

Hardstanding

- 6.5 Concrete hardstanding was encountered across the Site, to a maximum depth of 0.13 metres below ground level (m bgl). Reinforcement of the concrete was not recorded within any of the exploratory holes formed at the Site.

Made Ground

- 6.6 Variable Made Ground was recorded across the Site, generally comprising a band of granular material to depths of between 0.45m and 0.60m bgl, described as a '*slightly silty gravelly fine to coarse sand*', overlying cohesive Made Ground to depths of between 0.65m and 1.50m bgl, described as a '*slightly gravelly silty clay*'. Anthropogenic material within the Made Ground comprised fragments of brick, concrete and clinker.
- 6.7 Due to the limited nature of the strata, a single *in situ* SPT test was undertaken within the Made Ground, recording an SPT N-value of N = 11 recorded, corresponding to a borehole log strength description of 'firm'.

Superficial Deposits

- 6.8 No superficial deposits were encountered during the site investigation, in line with BGS mapping of the area.

Weathered London Clay

- 6.9 Weathered bedrock of the London Clay Formation was encountered across the Site to the maximum extent of the boreholes (5.45m), in line with BGS mapping of the area and was generally described as a '*Soft becoming firm silty CLAY*'. Features within the London Clay such as grey veining were noted with depth across the Site. Other characteristic features of the London Clay, such as selenite crystals and fissures, were not noted during the investigation.
- 6.10 Traces of fine to coarse flint gravel were noted within the weathered London Clay at one exploratory hole location, becoming fine siltstone at 2.30m, to a maximum depth of 3.40m bgl.
- 6.11 Two exploratory hole locations, WS03 and WS05, recorded a 0.30m to 0.35m band of '*brown silty very gravelly CLAY. Gravel is angular to subrounded fine to coarse flint*' at depths of 2.85m and 2.80m bgl respectively. Exploratory hole WS05 also recorded a 10cm band of gravelly clay between 2.50m and 2.60m bgl.
- 6.12 A total of 20 No. SPT tests were undertaken within the weathered London Clay, with corrected SPT N-values in the range of $N_{60} = 10$ to $N_{60} = 23$ and were generally seen to increase in strength with depth, as detailed in the SPT depth plot, Appendix F. The SPT N_{60} values corresponded to borehole log strength descriptions of 'firm' and 'firm to stiff'.
- 6.13 Laboratory geotechnical test results of Site won weathered London Clay are summarised in Table 6.1, below, with laboratory test certificates presented in Appendix E.

Laboratory test	No. of Tests	Result Range
Moisture Content	13	21% to 35%
Plasticity Index	9	22% to 57% (CI to CV)
Bulk density	3	1.83 to 1.89Mg/m ³
Undrained shear strength (τ)	3	70kPa to 122kPa
California Bearing Ratio (CBR)	1	18.6%

Table 6.1: Summary of weathered London Clay geotechnical test results

- 6.14 The laboratory geotechnical test results of the weathered London Clay indicate the material is of moderate to very high plasticity (see Plasticity Chart, Appendix F) and therefore of high volume change potential. The samples taken from depths <2.0m bgl were generally seen to be of lower plasticity (CI to CH). The 'Moisture Content Depth Plot' (Appendix F) indicates moisture content generally increases with depth.
- 6.15 The laboratory undrained shear strength (C_u) test results generally confirm the *in situ* SPT test results. Calculated C_u values of 44.6kPa to 52kPa were in line with the values derived from *in situ* SPT results over the same depth range (41kPa to 71kPa), as detailed in the shear strength plot (Appendix F). The calculated shear strength values from laboratory testing are detailed in Appendix D.

Groundwater

- 6.16 No groundwater strikes were encountered during the site investigation. Subsequent monitoring of installed standpipes recorded standing perched groundwater at levels of between 0.45m and 1.78m bgl.

Visual and Olfactory Observations of Contamination

- 6.17 No significant visual or olfactory evidence of contamination was identified during exploratory hole formation across the Site.

7.0 CONTAMINATION ASSESSMENT

Soil Contamination

- 7.1 The soil characteristics have been assessed with reference to Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) 'Suitable 4 Use Levels' (S4ULs) for human health risk assessment 2015). In the case of lead a DEFRA Category 4 Screening Level has been adopted.
- 7.2 A Tier 1 (semi-quantitative) risk assessment has been undertaken comparing soil chemical testing results against current and appropriate published guidelines for residential end-use with home grown produce and as a conservative measure, using the minimum soil organic matter (SOM) result (minimum recorded value from across the Site was 0.70%) for quantifying the assessment criteria for organic components. In the case of heavy metals, the 6.0% SOM criteria has been utilised. This assessment, along with the laboratory test certificates, are provided in Appendix D.

Tier 1 Assessment

- 7.3 The majority of the contaminants of concern underlying the Site were confirmed as being less than the assessment criteria (SSAC) in the samples of Made Ground collected and tested, with the exception of the following:
- Beryllium (1.7mg/kg) was exceeded in one sample: TP02 (2.0mg/kg at 0.60m); and
 - Lead (200mg/kg) was exceeded in three samples: WS01 (270mg/kg at 0.60m), TP01 (370mg/kg at 0.50m) and TP03 (220mg/kg at 0.50m).
- 7.4 Trace and low concentrations of petroleum hydrocarbons and polycyclic aromatic hydrocarbons were identified in the Made Ground, although not exceeding the Site Specific Assessment Criteria (SSAC) for a residential scenario with home grown produce.
- 7.5 Bundles of asbestos fibres (Amosite, Chrysotile and Crocidolite) were found within the Made Ground across the Site. Quantification analysis of these samples was carried out and confirmed the following:
- Amosite asbestos fibres were recorded at one location: WS02 (0.80m) at a concentration of <0.001%;
 - Crocidolite asbestos fibres were recorded at one location: TP02 (0.60m) at a concentration of <0.001%; and
 - Chrysotile asbestos fibres were recorded at four locations: WS04 (0.40m) at 0.001% and TP01 (0.50m), TP03 (0.50m) and TP04 (0.60m) at <0.001%.

- 7.6 The contaminants of concern underlying the Site were confirmed as being less than the assessment criteria (SSAC) in the samples of natural soils collected and tested, with the exception of the following:

- Lead (200mg/kg) was exceeded in one sample: WS04 (240mg/kg at 0.75m).

- 7.7 No elevated levels or petroleum hydrocarbons, PAHs or asbestos were recorded within the samples of natural soils collected and tested.

Asbestos in soils

- 7.8 Inhalation of asbestos fibres is linked to an increased risk of lung cancer and mesothelioma, although there is often a long latency period between exposure and the onset of symptoms.

- 7.9 There is presently no known safe threshold of exposure to airborne asbestos fibres but the risk to human health is proportional to the level of exposure. The quantitative risk assessment methodology, as set out in CIRIA C733, provides a cumulative exposure (fibres/ml.hours), expressed in terms of the concentration of asbestos in the air (fibres/ml) and the duration of exposure (hours).

- 7.10 This risk assessment methodology uses predicted cumulative exposures to airborne asbestos fibres together with risk assessment models to provide an estimate of the likelihood that such exposures would cause, or contribute to the cause of, asbestos related diseases. The risk is a function of the composition and quantity of fibres released from the soil, the exposure scenario and the critical receptor.

- 7.11 The fibre concentrations recorded can be used to assess the cumulative exposure and therefore the overall excess lifetime cancer risk when considering exposure concentration, frequency and duration. The annual exposure (E_i) from each event, i , can be expressed in fibre/ml.hours as:

$$E_i = C_i \times F_i \times T_i$$

Where:

C_i = the estimated concentration (f/ml) for the event

F_i = the frequency of the event per year

T_i = the period of time that the event lasts in hours

- 7.12 A conservative exposure scenario would be a 5-year old child (as inhalation of asbestos fibres during childhood are generally considered to be more serious) in a residential setting, exposed to airborne fibres in dust for 4 hours per day and 20 days per year, resulting in an exposure duration of 80 hours per year. An asbestos concentration of <0.001% represents a concentration in air of 0.01 fibre/ml per mg/m³ (Addison *et al*, 1988).

- 7.13 Ambient respirable dust levels generated through gardening and play are considered to be $0.1\text{mg}/\text{m}^3$ resulting in a concentration of fibres in the air (C_i) of $0.001\text{fibre}/\text{ml}$. Thus:

$$E_i = C_i \times F_i \times T_i$$

$$E_i = 0.001 \times 4 \times 20$$

$$E_i = 0.08 \text{ fibre}/\text{ml.hours}/\text{year}$$

- 7.14 Based on an exposure period of 20 years, cumulative exposure (CE_i) can be expressed as the annual exposure (E_i) multiplied by the number of years the exposure event occurred (Y_i):

$$CE_i = E_i \times Y_i$$

$$CE_i = 0.08 \times 20$$

$$CE_i = 1.6 \text{ fibre}/\text{ml.hours}$$

- 7.15 The models to quantify the exposure risk is based on the number of hours in an occupational working year (generally rounded to 2000 hours). Therefore:

$$CE_i = 1.6 / 2000 \text{ fibre}/\text{ml.years}$$

$$CE_i = 0.0008 \text{ fibre}/\text{ml.years}$$

- 7.16 The maximum concentrations of the three asbestos fibre types detected at the Site were:

$$\text{Crocidolite \& Amosite} = <0.001\%$$

$$\text{Chrysotile} = 0.001\%$$

- 7.17 Based on the above scenario, methodology, risk summary statements in CIRIA C773 (Tables 14.1 and 14.3), and using the age-adjustment factors (Table 14.2), although it is considered that the lifetime risk from potential exposure is negligible, given the relatively small size of the Site and the frequency of asbestos detection in the samples collected and tested, it is possible that there are areas of the Site that contain greater concentrations of asbestos fibres. As a result, it is recommended that remediation/removal of Site soils from proposed soft landscaped areas and gardens is undertaken.

Leachate Contamination Assessment

- 7.18 Given the very high vulnerability with respect to surface water due to the presence of a culverted watercourse running through the Site, two Made Ground samples were collected from exploratory holes along the alignment of the culverted river and tested for leachable contaminants.
- 7.19 A Tier 1 (semi-quantitative) risk assessment has been undertaken comparing leachate chemical testing results against current and appropriate published Controlled Water

(Ecological Status) – Rivers and Fresh Water guidelines This assessment along with the laboratory test certificates are provided in Appendix D.

7.20 The majority of contaminants of concern underlying the Site were confirmed as being less than the assessment criteria (SSAC) in the samples tested, with the exception of the following:

- Benzo(a)pyrene (0.075µg/l) was exceeded in the samples from WS01 (0.1µg/l at 0.60m).

7.21 Given this is a marginal exceedance and the Made Ground is directly underlain by impermeable Lndon Clay Formation, it is not considered that this poses a significant risk to the culverted tributary.

7.22 Recorded pH levels within the samples taken were 7.2 and 7.3.

Oil/Water Separator Assessment

7.23 A sample of sludge from one of the oil/water separator chambers was tested for levels of Total Petroleum Hydrocarbons (TPH) and Polyaromatic Hydrocarbons (PAHs).

7.24 The sample analysis showed no concentrations of aliphatic and aromatic hydrocarbons above the laboratory limit of detection and only trace amounts of PAHs present within the oil/water interceptor chamber sampled.

Risk Assessment for Ground Gases

7.25 During the site investigation, an empirical semi-quantitative approach was used to assess ground gas risk on the Site in accordance with BS 8485:2015+A1:2019. On the basis of the conceptual site model prepared in the Phase 1 Assessment, a low to moderate potential ground gas risk was identified related to Made Ground on the Site. Samples of the Made Ground encountered were collected and submitted for Total Organic Carbon (TOC) analysis and subjected to a detailed examination to determine the fractions present. The ratio of fine to coarse Made Ground material was quantified by weight and, in tandem with the subsequent sample analysis of the total organic carbon content, used to assess the potential for ground gas generation.

7.26 For Made Ground which is >20 years old, a TOC percentage of ≤6% is allowed before ground gas monitoring is considered necessary to determine the gassing regime potential on the Site. If this TOC percentage is not exceeded, the following assumed characteristic situations can be applied to the Site on the basis of TOC percentage:

- Characteristic Situation 1 (CS1) classification: $\leq 1\%$ TOC
- Characteristic Situation 3 (CS2) classification: $\leq 3\%$ TOC
- Characteristic Situation 3 (CS3) classification: $\leq 6\%$ TOC

7.27 The results of this analysis is presented in Table 7.1, below:

Sample ID	Depth (m)	Fines Fraction		TOC value of fines fraction (%)	Coarse Fraction		TOC value of coarse fraction (%)	Calculated TOC value (%)
		kg	%		kg	%		
WS01	0.60	0.50	14.3	2.6	3.00	85.7	0.0	0.37
WS02	0.80	2.10	76.4	8.4	0.65	23.6	0.0	6.42
WS03	0.50	3.30	79.5	2	0.85	20.5	0.0	1.59
WS04	0.40	2.30	46.9	4.2	2.60	53.1	0.0	1.97
TP01	0.50	1.20	30.8	1.2	2.70	69.2	0.0	0.37
TP02	0.60	3.45	67.6	2.0	1.65	32.4	0.0	1.35
TP03	0.50	2.45	47.1	1.8	2.75	52.9	0.0	0.85
TP04	0.60	3.75	75.0	4.1	1.25	25.0	0.0	3.08

Table 7.1: Summary of Made Ground total organic carbon quantification

7.28 The majority of the samples of Made Ground tested confirmed TOC percentages below 3%. As 1No. sample exceeded 6% TOC, ground gas monitoring was considered necessary.

Ground Gas Monitoring

7.29 Ground Gas Monitoring was undertaken across the Site to assess the potential impact of ground gas from the poor quality Made Ground underlying the Site. Current guidance for ground gas monitoring is to provide a minimum of 6No. measurements over a period of three months, with at least one the visits undertaken during low (<1005mb) or falling atmospheric conditions to establish ground gas regime.

7.30 Ground gas monitoring has been undertaken within the installed monitoring wells across the Site on 3No. occasions: 19 February, 3 March and 16 March 2020, to provide an initial assessment of the ground gas regime across the Site, with one of the monitoring visits was undertaken during low atmospheric pressure conditions, which are most conducive to ground gas generation. On completion of these initial monitoring visits, it was concluded that further gas monitoring was not required.

7.31 The ground gas monitoring recorded a maximum methane (CH₄) concentration of 0.2% by volume during the monitoring visits.

7.32 Carbon dioxide (CO₂) was recorded at concentrations between 0.1% and 1.2% by volume across the Site with the highest concentration in WS03, positioned in the south of the Site and adjacent to the oil/water separator.

- 7.33 Oxygen (O₂) concentrations were slightly depleted at position WS03, corresponding to a slightly elevated carbon dioxide concentration. Overall Site values recorded ranged from 15.3% to 21.9%.
- 7.34 Negligible ground gas flows were recorded across the Site with stable flows ranging from 0.0l/hr to 0.1l/hr across the Site. A higher flow of 7.9l/hr was recorded during the first monitoring visit at position WS04, although this reading can be discounted as the water level within the standpipe was above the level of the slotted pipe, providing an artificially high value due to the air within the blank section of pipe being compressed by the rising water level.
- 7.35 The results of the ground gas monitoring visits are provided in Appendix G.

Ground Gas Risk Assessment

- 7.36 The assessment of gas risk uses the gas concentrations present and the flow rate measured, which gives a gas screening value (GSV). Using this method and the worst-case measurements (Ref: BS 8485: 2015+A1:2019), the GSV for the areas identified across this Site have been established and a gas risk rating assigned in accordance with the 'traffic light' system outlined in the NHBC Guidance on Evaluation of Development Proposals on sites where Methane and Carbon Dioxide are present (March 2007).
- 7.37 The 'traffic light' system enables the assessment of derived GSVs against pre-determined gas screening values, as well as consideration to typical maximum concentrations, for methane and carbon dioxide. The screening values and typical maximum concentrations along with the gas protection measures required are outlined in Table G1 and G2 in Appendix G.
- 7.38 The worst case GSVs have been determined using the highest gas concentrations detected and the highest gas flow measured (0.1l/hr) on the site using the monitoring results and the worst case GSVs are:
- Methane (0.2%) x gas flow (0.1l/hr) gives a GSV of 0.0002; and
 - Carbon Dioxide (1.2%) x gas flow (0.1l/hr) gives a GSV of 0.0012.
- 7.39 These GSVs, which represent the worst-case ground gas risk on the Site, indicate an NHBC 'green' classification for both methane and carbon dioxide with the GSVs an order of magnitude lower than the trigger for ground gas protection measures (Amber 1), see Table G1 in Appendix G.
- 7.40 On the basis of the NHBC 'green' classification, it is considered that ground gas protection measures will not be required for this development. Whilst the minimum number / duration of ground gas monitoring typically to establish ground gas risk, it was concluded on the basis of the risk assessment following the initial set of monitoring that this was not necessary.

Updated Conceptual Site Model

- 7.41 Based on the intrusive investigation and subsequent contamination sampling and ground gas monitoring undertaken at the Site, the Conceptual Site Model from the Phase 1 Contaminated Land Assessment can be updated with proven pollutant linkages, as per Table 7.2, below:

Source	Pollutant	Pathway	Receptor	Likelihood of Occurrence	Consequence (severity)	Potential Risk	Possible Mitigation Measures	Further Action
Poor quality Made Ground soils underlying Site	Asbestos-containing soils (ACSS), lead and beryllium	Direct exposure, inhalation or ingestion of contaminated soils, dust or vapours during construction or in garden areas	Future Site Residents	Likely	Medium	Moderate	Potential exposure to contamination in garden areas. Site investigation confirms elevated concentrations of Lead, Beryllium and detections of asbestos fibres within Made Ground soils. Remediation / mitigation measures required to mitigate risk.	Yes
			Construction Workers	Low Likelihood	Medium	Moderate / Low	Potential short term exposure can be managed with Personal Protective Equipment and good hygiene practices.	No
	Leachable contaminants: Benzo(b)fluoranthene and Benzo(a)pyrene	Vertical migration via leaching / lateral migration down hydraulic gradient	Controlled waters (surface water and groundwater)	Low Likelihood	Mild	Low	Culverted river through Site. Limited potential for infiltration migration as culvert encased by concrete and impermeable London Clay present below contaminated Made Ground, acting as a further barrier to leachable contaminants. No further action required	-
		Permeation of water supply pipes by organic contaminants present in underlying ground.	Water supply pipes (future residents)	Low Likelihood	Mild	Low	Barrier pipe should be utilised as a precautionary measure.	Yes
	Ground gases (methane and carbon dioxide)	Inhalation of harmful (asphyxiant) ground gases or accumulation of explosive gases	Future Site Residents	Unlikely	Medium	Low	Site investigation including Total Organic Carbon testing and ground gas monitoring. Monitoring resulting in NHBC Green classification for both Methane and Carbon Dioxide. Ground gas protection measures not required to mitigate risk based on monitoring undertaken.	No
Electricity Substation on Site, enclosed in concrete building	Hydrocarbons and Polychlorinated Biphenyls (PCBs)	Direct exposure, inhalation or ingestion of contaminated soils, dust or vapours during construction or in garden areas	Future Site Residents	Assessment to be undertaken when substation is removed/demolished				Yes
			Construction Workers					
Oil water interceptor	Hydrocarbons	Direct exposure, inhalation or ingestion of contaminated material	Construction Workers	Unlikely	Mild	Very Low	Potential short term exposure can be managed with Personal Protective Equipment and good hygiene practices.	-

Table 7.2: Updated Conceptual Site Model

8.0 GEOTECHNICAL APPRAISAL

General

- 8.1 This section of the report should be read in conjunction with Section 6.0 (Ground Conditions), which indicates the Site is directly underlain by solid geology of the London Clay Formation.
- 8.2 Hardstanding was encountered across the Site, to a maximum depth of 0.13m bgl. Made Ground soils were encountered to depths of between 0.65m and 1.50m bgl, though generally to depths of <1.00m, underlain by solid strata of the London Clay Formation to the extents of the exploratory holes (5.45m bgl). The gravelly clay bands recorded in two of the exploratory hole locations are not considered to be significant with relation to foundation design and no perched water was noted within these bands. The London Clay was found to be soft to firm and generally increasing in strength with depth. No groundwater was encountered during the site investigation.
- 8.3 It is understood the Site is to be developed with low-rise residential properties.

Ground Model

- 8.4 Based on the material descriptions, *in situ* strength test results and geotechnical laboratory test results the design parameters outlined in Table 8.1 were used for geotechnical design.

Material	Depth to base (m bgl)	γ (kN/m ³)	Design N-value	Φ (°)	I _p (%)	C' (kN/m ²)
Made Ground	0.90	16	-	1	-	1
London Clay	>5.45	18.3*	N=10 to N=23	12 – 14 [†]	46*	30
Groundwater	>5.45m bgl					

Table 8.1 Geotechnical design parameters

* - Derived from geotechnical laboratory test results

† - Interpretation of geotechnical laboratory test results

Shallow Strip Foundations

- 8.5 Cohesive near surface soils (<1.5m bgl) were found to be of moderate strength, with a design corrected SPT N₆₀ value of N₆₀ = 11. The allowable bearing capacity of such material is calculated as:

$$q_a = \frac{1}{F} \left(c \cdot N_c \cdot s_c + \sigma_0 \cdot N_q \cdot s_q + \frac{1}{2} \cdot B \cdot \gamma \cdot N_\gamma \cdot s_\gamma \right)$$

Where:

N_c, N_q and N_γ are bearing capacity factors

s_c, s_q and s_γ are shape factors

c' is the cohesive strength of the soil (kN/m^2)

B is the width of the foundation (m)

γ is the unit weight of the soil (kN/m^3)

σ_0 is the overburden pressure

F is a factor of safety against bearing capacity failure

- 8.6 Based on the average extent of the Made Ground (0.90m), the minimum foundation base depth recommended is 1.00m. Therefore, the allowable bearing capacity (q_a) for strip foundations with a factor of safety of 3 is thus:

Foundation Depth (m)	Foundation Width (m)	Allowable Bearing Capacity (kN/m^2)
1.00	0.45	110
1.00	0.60	110
1.20	0.45	121
1.20	0.60	121
1.50	0.45	136
1.50	0.60	136

Table 8.2: Summary of shallow foundation design options

- 8.7 Notwithstanding, formation level should be proof-rolled and any identified areas of Made Ground extending greater than 1.00m bgl should be excavated out and backfilled to a suitable earthworks specification.
- 8.8 Foundations constructed on this basis would limit settlements to approximately 25mm.

Floor Slabs

- 8.9 Based on the ground conditions recorded, slabs should be suspended

Pavements

- 8.10 Based on the guidance of Interim Advice Note 73-06 Revision 1, Design Guidance for Road Pavement Foundations (Chapter 3), the following sub-base values have been derived.
- 8.11 Laboratory testing of site soils gave an average CBR value of 2.0%.
- 8.12 Due to the low strength soils recorded at shallow depth, some form of ground improvement would be required prior to pavement construction.
- 8.13 A geogrid could be utilised to improve the ground stability for pavement design.

- 8.14 Following improvement in line with guidance of Interim Advice Note 73-06 Revision 1, Design Guidance for Road Pavement Foundations (Chapter 5.16), the new design CBR should be assumed to be equivalent to 2.5% in order to allow for effects of any softer underlying material and the potential reduction in the strength of the replacement material to its long-term CBR value. A 2.5% CBR for a Class 2 single foundation layer option (as per Figure 4.3, Interim Advice Note 73-06) of stiffness 150MPa would require a thickness of 350mm.
- 8.15 Notwithstanding, formation levels should be inspected by a suitably qualified engineer and proof-rolled prior to sub-base placement. Any identified soft-spots are to be excavated out and backfilled with suitable engineered fill to an appropriate specification.

Excavations and Earthworks

- 8.16 In general, shallow cohesive soils should remain freestanding over the short to medium term. Granular soils are not expected however, if encountered, shoring should be used.
- 8.17 Earthworks are not anticipated at the Site. However, were earthworks required, targeted laboratory geotechnical testing is recommended and a detailed earthworks specification should be prepared. The earthworks specification should including assessment of the typical parameters for the soil types anticipated and a programme of quality control.
- 8.18 There is the potential for foundation structures to also be present below former and existing structures, which will need to be grubbed out prior to development.

Buried Concrete

- 8.19 Design/mix of buried concrete should be undertaken in accordance with the appropriate ACEC classification, of BRE Special Digest 1: 2005 (Concrete in Aggressive Ground). On this basis the Site is deemed to classify as "greenfield". On the basis of the Site history, the geological setting, and observations during the formation of exploratory holes, the Site is considered to be one that may contain pyrite (i.e. sulphide).
- 8.20 A total of 15No. samples from the Made Ground and cohesive bedrock deposits were subject to pH and SO_4 analysis. Results indicate soluble sulphate concentrations in soil samples of 10mg/l to 340mg/l, with the mean of the highest 20% calculated as 206mg/l. On the basis of these chemical test results, the Design Sulphate Class for the Site is considered to be "DS-1".
- 8.21 Pyrite is suspected within Site soils; therefore, for each individual sample, the amount of oxidised sulphides was determined ($\text{OS}\%\text{SO}_4 = \text{TPS}\%\text{SO}_4 - \text{AS}\%\text{SO}_4$). Calculated values were in the range of 0.0001% to 0.059%. Therefore, as none of the samples had a calculated oxidised sulphide value $>0.3\%$, pyrite is not considered to be present within Site soils.

-
- 8.22 Based on the Site geology, the groundwater conditions can be described as 'static'. Recorded soil pH values were in the range of 6.9 to 11.5. On this basis, the "Aggressive Chemical Environment for Concrete (ACEC)" class for concrete in the ground is indicated to be AC-1s. Design/mix of buried concrete should be undertaken in accordance with these classifications.

9.0 CONCLUSIONS & RECOMMENDATIONS

Conclusions

- 9.1 A Phase 2 Geo-Environmental Assessment of a Site at Chequers Road (Site B), Loughton was undertaken for proposed residential end-use.
- 9.2 The site investigation comprised 10No. exploratory holes comprising 5No. windowless sampler boreholes and 5No. hand dug trial pits to establish the ground conditions and determine the potential for ground, groundwater and ground gas contamination across the Site.
- 9.3 The ground conditions across the Site generally comprise Made Ground to a maximum depth of 1.50m and an average of 0.90m across the Site. The underlying soils comprise cohesive deposits (clay) of the London Clay Formation, with a minor gravelly clay band recorded at two exploratory hole locations.
- 9.4 Chemical testing identified slightly elevated concentrations of Beryllium and Lead within the Made Ground (and Lead in the natural soils) that exceeded the SSAC for a residential scenario with home grown produce. No elevated levels of petroleum or polyaromatic hydrocarbons were recorded.
- 9.5 Asbestos was detected within 6 of the samples of Made Ground collected and tested. Comprehensive quantification analysis was subsequently carried out, confirming maximum concentrations of 0.001% Chrysotile and <0.001% Amosite and Crocidolite fibres. Although the risk to end-users is considered negligible (in line with CIRIA C733), it is recommended that remedial measures are undertaken as a precautionary measure.
- 9.6 The underlying natural soils did not show any evidence of elevated levels of heavy metals, petroleum hydrocarbons or PAHs with the exception of lead, indicating limited leaching of contaminants from the overlying Made Ground. No asbestos was detected in the natural soils.
- 9.7 The leachate testing identified a marginal exceedance of benzo(a)pyrene in one of the samples although given the tributary passing through the Site is protected by a culvert and the soils beneath the Made Ground comprise impermeable London Clay it is not considered that this poses a significant risk to the river.
- 9.8 The Made Ground on the Site was subjected to a detailed description and total organic carbon analysis to provide an empirical assessment of ground gas risk, in accordance with BS8485:2015+A1:2019. Given the made ground was >20 years old and the adjusted TOC concentrations were above a 6% trigger in one sample, ground gas monitoring was required.

- 9.9 Gas monitoring undertaken confirmed a maximum stable flow of ground gas of 0.1l/hr, with peak methane and carbon dioxide values of 0.2% and 1.2% respectively with slightly depleted oxygen levels recorded in one of the boreholes during monitoring. The GSV values calculated result in an NHBC 'green' classification for both methane and carbon dioxide and no protection measures are considered necessary.
- 9.10 For proposed new structures, an allowable bearing capacity of 110kN/m² was given for a 450mm wide strip foundation at a depth of 1.0m bgl. Notwithstanding, formation level should be proof-rolled and any identified soft spots excavated out and backfilled to a suitable earthworks specification.
- 9.11 Based on the ground conditions recorded, slabs should be suspended.
- 9.12 Due to the low strength soils recorded at shallow depth ground improvement would be required prior to pavement construction, possibly in conjunction with the use of a geogrid. Following improvement, a 2.5% CBR for a Class 2 single foundation layer option of stiffness 150MPa would require a thickness of 350mm.
- 9.13 Buried concrete should be classified as DS-1, with an ACEC classification of AC-1s.
- 9.14 Shallow excavations within cohesive soils may offer short to medium-term stability.

Recommendations

- 9.15 Based on the findings of the site investigation works undertaken we would recommend the following:
- Given the presence of Beryllium and Lead concentrations within the Made Ground and natural soils exceeding the SSAC scenario for residential with home grown produce, remediation works will be required in private gardens and soft landscaped areas to render the Site suitable for the proposed end-use. In addition, the presence of asbestos fibres warrants remediation works to be undertaken. A Remediation Method Statement will need to be prepared to detail the proposed remediation works and outline the validation process to render the Site suitable for residential end-use.
 - On removal of the oil/water interceptor chambers, any fluids / sediment within the chambers should be disposed of appropriately and the surrounding soils inspected on removal to assess for any further contamination.
 - On the basis of the ground gas monitoring undertaken to date, no ground gas protection measures are considered necessary at the Site.
 - Any earthworks should be undertaken in accordance with a detailed earthworks specification, which will require targeted laboratory geotechnical testing.

10.0 REFERENCES

- I. Addison, J, Davies, L, Robertson A and Willey, R. 1988. The release of dispersed asbestos fibres from soils. Research Report TM/88/14. Institute of Occupational Medicine, Edinburgh.
- II. British Standards Institute (BSI). BS 5930:2015 Code of practice for ground investigations. 2015.
- III. British Standards Institute (BSI). BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases in new buildings. 2019.
- IV. CIRIA. 2014. Asbestos in Soil and Made Ground: A Guide to Understanding and Managing the Risks. CIRIS C733. CIRIA, London.
- V. Contaminated Land: Applications in Real Environments (CL:AIRE). 2014. SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.
- VI. Create Consulting Engineers Ltd Phase 1 Contaminated Land Assessment. Ref: CB/JEB/P18-1639/01 dated November 2018.
- VII. DEFRA / Environment Agency, Model Procedures for the Management of Land Contamination, CLR11, September 2004.
- VIII. DEFRA, Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance, April 2012
- IX. Department for Communities and Local Government. National Planning Policy Framework. February 2019.
- X. Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.
- XI. ENVIRONMENT AGENCY. Guidance for the Safe Development of Housing on Land Affected by Contamination R&D Publication 66, 2008.
- XII. NHBC and Environment Agency. Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 Volume 1.
- XIII. NHBC guidance on evaluation of development proposals on sites where methane and carbon dioxide are present, Report Edition No. 04, March 2007.
- XIV. HIGHWAYS AGENCY. Interim Advice Note 73/06 Revision 1. Design Guidance For Road Pavement Foundations (Draft HD25), 2009

APPENDICES

APPENDIX A

SAMPLING AND ANALYSIS PLAN

CHEQUERS ROAD (SITE B), LOUGHTON, IG10 3QF
PHASE 2 SITE INVESTIGATION:
SAMPLING AND ANALYSIS PLAN (Rev B)

The Site is owned by Epping Forest District Council and occupied by a series of garages for local residents. Planning approval was granted for the demolition of the existing garages and replacement with 5No. two-storey affordable residential units with rear garden areas, car parking, vehicle access and landscaping on 2 February 2016 (Ref: EPF/2609/15).

A Phase 1 Contaminated Land Assessment (Ref: CB/JEB/P18-1639/01) was completed in November 2018 to discharge Planning Condition No. 6. The contaminated land assessment identified potential pollutant linkages associated with poor quality made ground associated with site development in 1960s, on-site electricity substation and the presence of an underground oil/water interceptor. A preliminary assessment of the potential presence of Unexploded Ordnance was assessed (Report Ref: EP7780-00) and a detailed assessment was recommended. UXO risk mitigation measures may be necessary during any intrusive works on the Site.

In order to further assess the potential exposure risk posed by on-site contamination sources identified to Construction Workers and future Site Residents, a site investigation was recommended to confirm the quality of the underlying made ground in particular in the rear garden and soft landscaped areas, as well as the soils around the oil/water interceptor.

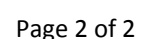
In order to achieve these objectives as required by Condition No. 7 and incorporating comments received by EFDC, the scope of works outlined in the Table 1 (below) is proposed and the borehole locations are illustrated in Figure 1 (overleaf).

Table 1: Sampling and Analysis Plan (SAP)

Target / Scope	Suite of Testing / Monitoring
<u>Private Garden Areas / Soft Landscaped Areas</u> <ul style="list-style-type: none">• 4No. boreholes to 5m depth (or refusal) across Site targeting private gardens and soft landscaped areas (BH01-BH04).• 4No. Hand Pits in rear gardens and soft landscaped areas (HP01 - HP04) to the base of the made ground.• Collection of shallow made ground (8No.) and underlying natural soils (4No.) samples from the borehole and hand pit locations.• Submission to M-CERTS accredited laboratory for standard suite of total and leachability tests.	<ul style="list-style-type: none">• Total and leachability testing (8No. made ground & 4No. natural soil samples) for standard suite of organic and inorganic parameters: asbestos, metals, inorganics, Total Petroleum Hydrocarbons (Criteria Working Group), Polyaromatic Hydrocarbons and phenols.
<u>Electricity Substation</u> <ul style="list-style-type: none">• Not accessible until substation removed; concrete slab below substation building and underlying soils should be inspected and tested (HP03) to assess any impact and removed / replaced with cover system if impacted.• Collection of shallow made ground (1No.) from the hand pit location.• Submission to M-CERTS accredited laboratory for standard soil suite and Polychlorinated Biphenyls.	<ul style="list-style-type: none">• 1No. made ground sample for standard suite of organic and inorganic parameters: asbestos, metals, inorganics, Total Petroleum Hydrocarbons (Criteria Working Group), Polyaromatic Hydrocarbons and phenols and Polychlorinated Biphenyls (PCBs).

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Figure 1: Indicative Borehole Location Plan



APPENDIX B


EXPLORATORY HOLE LOCATION PLAN



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[illegible]

PROJECT CHEQUERS ROAD (SITE B), LOUGHTON		DATE 04.02.20	DRAWING STATUS INFORMATION		 create CONSULTING ENGINEERS LTD
DRAWING TITLE EXPLORATORY HOLE LOCATION PLAN		SCALE(S) 1:100	DESIGNED IT	DRAWN IT	
		JOB No	CHECKED TB	APPROVED AW	
			1639		
CLIENT EPPING FOREST DISTRICT COUNCIL		DRAWING No 10/001	REVISION -		

DO NOT SCALE ORIGINAL SHEET SIZE - A1 Landscape

APPENDIX C

EXPLORATORY HOLE LOGS

Borehole Log

Borehole No.

WS01

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543516.20 - 195822.20

Hole Type
WS

Location: Loughton

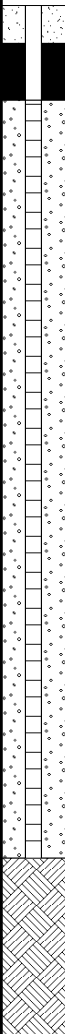

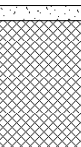
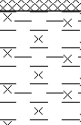
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Scale
1:40

Client: Epping Forest District Council

Dates: 31/01/2020 -

Logged By
TB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.08			0.08	27.19		CONCRETE	
		0.60	ES					Grey brown to light brown slightly silty sandy subangular to subrounded fine to medium flint and quartzite gravel. With frequent fragments of brick and occasional clinker. MADE GROUND.	
		0.70 - 1.00	B					..becoming dark grey to black slightly gravelly clay. With fragments of brick	
		1.00 - 1.45	U	Ublow=14	0.80	26.47		Soft to firm grey brown mottled brown grey silty CLAY. WEATHERED LONDON CLAY.	1
		1.30	D						
		2.00							
		2.00 - 2.45	D	N=14 (2,3/3,3,4,4)					2
		3.00						..becoming firm and orange brown mottled grey. With grey veining	
		3.00 - 3.45	D	N=14 (2,2/3,3,4,4)				..becoming brown	3
		3.80	D						
		4.00						..with occasional silty laminations	4
		4.00 - 4.45	D	N=14 (2,2/3,4,3,4)					
		5.00							
		5.00 - 5.45	D	N=15 (2,3/4,3,4,4)					5
					5.45	21.82		End of borehole at 5.45 m	6
									7
									8

Remarks

- WS01 halted at 5.45m, target depth reached
- No groundwater encountered
- Monitoring standpipe installed to 4.5m

Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543514.10 - 195806.30

Hole Type
WS

Location: Loughton

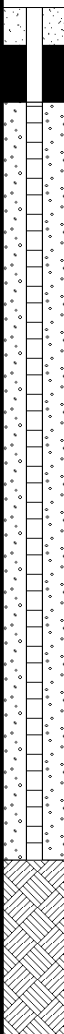
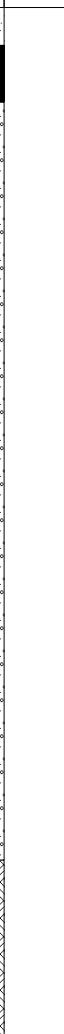
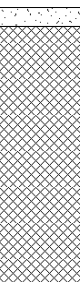
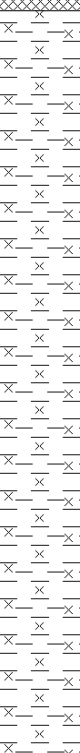
Level: 27.21

Scale
1:40

Client: Epping Forest District Council

Dates: 31/01/2020 -

Logged By
TB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.10	27.11		CONCRETE		
								Grey brown to dark grey slightly silty slightly gravelly fine to coarse sand. Gravel is angular to subrounded fine to medium flint with frequent fragments of brick and clinker. MADE GROUND.		
								..becoming brown. With half bricks		
								..becoming grey to dark grey slightly gravelly clay. With fragments of brick		
								..becoming black slightly silty gravelly fine to coarse sand. Gravel is angular fine to medium flint with fragments of brick	1	
									..becoming grey silty clay. With rare fragments of brick	
		0.80	ES							
		1.00		N=10 (3,3/2,3,2,3)						
		1.60	ES		1.50	25.71		Firm grey brown mottled brown silty CLAY. With rare subangular fine to coarse flint gravel. WEATHERED LONDON CLAY.		
		1.90	D	N=11 (2,2/3,2,3,3)						2
		2.00	D							
		2.00 - 2.45	D						..becoming brown. With grey veining. Gravel is subangular fine siltstone	
		3.00 - 3.45	U	Ublow=37						3
3.70 - 3.90	D					..with rare silty laminations. Gravel absent				
4.00	D	N=14 (2,2/3,3,4,4)						4		
4.00 - 4.45	D									
5.00	D	N=19 (2,3/4,5,5,5)				..becoming firm to stiff	5			
5.00 - 5.45	D									
				5.45	21.76	End of borehole at 5.45 m			6	
									7	
									8	

Remarks

- WS02 halted at 5.45m, target depth reached
- No groundwater encountered
- Monitoring standpipe installed to 4.5m

Borehole Log

Borehole No.

WS03

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543519.90 - 195800.50

Hole Type
WS

Location: Loughton

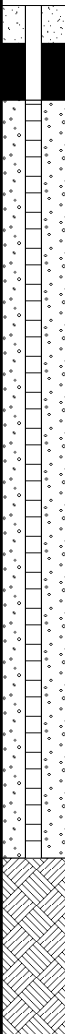

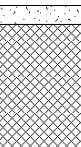
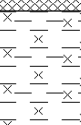
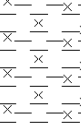
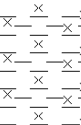
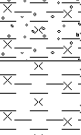
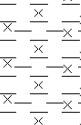
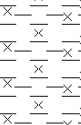
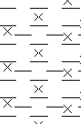



Level: 26.64

Scale
1:40

Client: Epping Forest District Council

Dates: 31/01/2020 -

Logged By
TB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	26.54		CONCRETE	
		0.50	ES					Grey brown to dark grey slightly silty slightly gravelly fine to coarse sand. Gravel is angular to subrounded fine to medium flint with frequent fragments of brick and clinker. MADE GROUND.	
		0.85	ES		0.80	25.84		..becoming dark grey mottled black slightly sandy slightly gravelly clay. Gravel is subangular fine to medium flint with fragments of brick and clinker	
		1.00		N=10 (1,1/2,3,3,2)				Soft to firm grey brown mottled brown grey silty CLAY. WEATHERED LONDON CLAY.	1
		1.50	D					..becoming brown mottled orange brown	
		2.00 - 2.45	U	Ublow=19				..becoming firm and brown to orange brown	2
		3.00		N=16 (2,3/4,4,4,4)	2.85	23.79		Brown silty very gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. WEATHERED LONDON CLAY.	3
		3.00 - 3.45	D		3.20	23.44		Firm brown silty CLAY. WEATHERED LONDON CLAY.	
		4.00		N=14 (2,3/3,3,4,4)				..becoming firm to stiff	4
		4.00 - 4.45	D						
		5.00		N=18 (1,3/4,5,5,4)					5
		5.00 - 5.45	D						6
					5.45	21.19		End of borehole at 5.45 m	7
									8

Remarks

- WS03 halted at 5.45m, target depth reached
- No groundwater encountered
- Monitoring standpipe installed to 4.5m

Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543501.90 - 195805.80

Hole Type
WS

Location: Loughton

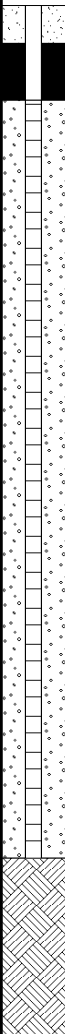

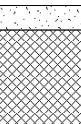
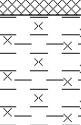
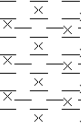
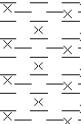
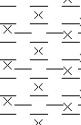
Level: 27.35

Scale
1:40

Client: Epping Forest District Council

Dates: 31/01/2020 -

Logged By
TB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.13			0.13	27.22		CONCRETE	
		0.40	ES					Dark grey to black slightly silty gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse flint with frequent fragments of brick and clinker. With whole bricks and cobble sized fragments of concrete. MADE GROUND.	
		0.75	ES		0.70	26.65		Soft grey brown silty CLAY. WEATHERED LONDON CLAY.	
		1.00		N=13 (3,2/3,3,3,4)					1
		1.00 - 1.45	D					..becoming firm	
		2.00		N=11 (1,3/2,3,3,3)				..becoming brown mottled orange brown. With grey veining	2
		2.00 - 2.45	D						
		3.00		N=13 (1,2/3,3,3,4)				..becoming brown	3
		3.00 - 3.45	D						
		4.00		N=13 (1,3/3,3,4,3)				..becoming firm to stiff	4
		4.00 - 4.45	D						
		5.00		N=18 (3,3/4,4,5,5)					5
		5.00 - 5.45	D						
					5.45	21.90		End of borehole at 5.45 m	6
									7
									8

Remarks

- WS04 halted at 5.45m, target depth reached
- No groundwater encountered
- Monitoring standpipe installed to 4.5m

Borehole Log

Borehole No.

WS05

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543508.60 - 195812.20

Hole Type
WS

Location: Loughton


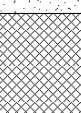
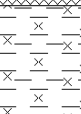
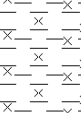
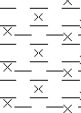
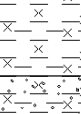
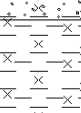
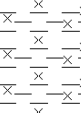
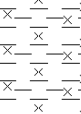
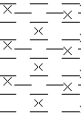



Level: 27.42

Scale
1:40

Client: Epping Forest District Council

Dates: 31/01/2020 -

Logged By
TB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	27.32		CONCRETE	
		0.65			0.65	26.77		Grey brown to light brown slightly silty sandy subangular to subrounded fine to medium flint and quartzite gravel. With frequent fragments of brick and occasional clinker. MADE GROUND.	
		0.80	D					..becoming clayey	
		1.00 - 1.45	U	Ublow=19				Soft to firm grey brown to dark grey brown silty CLAY. WEATHERED LONDON CLAY.	1
		2.00							
		2.00 - 2.45	D	N=13 (2,2/3,3,3,4)					2
		3.00			2.80	24.62		..with 10cm gravelly band. Gravel is angular fine to medium flint	
		3.20 - 3.40	D	N=12 (1,1/3,2,3,4)	3.10	24.32		Firm brown silty very gravelly CLAY. Gravel is angular to subrounded fine to coarse flint. WEATHERED LONDON CLAY.	3
		4.00						Firm brown silty CLAY. With grey veining. WEATHERED LONDON CLAY.	
		4.00 - 4.45	D	N=12 (2,2/3,3,3,3)					4
		5.00						..becoming firm to stiff	5
		5.00 - 5.45	D	N=18 (3,4/4,4,5,5)	5.45	21.97		End of borehole at 5.45 m	6
									7
									8

Remarks

- WS05 halted at 5.45m, target depth reached
- No groundwater encountered
- Borehole backfilled with arisings

Trial Pit Log

Trialpit No

TP01

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543508.20 - 195799.60

Level: 26.93

Date

31/01/2020

Location: Loughton

Dimensions (m):

0.3

Depth
0.90

0.3

Scale

1:20

Logged
TB

Client: Epping Forest District Council

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10			0.10	26.83		CONCRETE	
							Brown gravelly sand. Gravel is angular to subrounded fine to coarse flint with frequent fragments of brick and whole bricks. MADE GROUND.	
	0.50	ES					...becoming slightly clayey	
				0.70	26.23		Soft grey brown mottled brown silty CLAY. With rare subangular fine to coarse flint gravel. WEATHERED LONDON CLAY.	
				0.90	26.03		End of pit at 0.90 m	

Remarks:

1. TP01 halted at 0.9m, target depth reached
2. No groundwater encountered
3. Trial pit backfilled with arisings

Stability: Stable



Trial Pit Log

Trialpit No

TP02

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543513.90 - 195792.80
Level: 26.73

Date
31/01/2020

Location: Loughton

Dimensions (m): 0.3







Client: Epping Forest District Council

Depth
0.90

0.3

Scale
1:20

Logged
TB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.60	ES		0.07	26.66		CONCRETE	
							Brown gravelly sand. Gravel is angular to subrounded fine to coarse flint with frequent fragments of brick and whole bricks. MADE GROUND.	
							..becoming soft to firm brown gravelly clay. Gravel is subangular fine to coarse flint with fragments of brick	
							..becoming dark grey to black silty fine to coarse sand. With fragments of brick and half bricks	
				0.70	26.03		Soft grey brown mottled brown silty CLAY. With rare subangular fine to coarse flint gravel. WEATHERED LONDON CLAY.	
				0.90	25.83			
							End of pit at 0.90 m	

Remarks: 1. TP02 halted at 0.9m, target depth reached
2. No groundwater encountered
3. Trial pit backfilled with arisings

Stability: Stable



Trial Pit Log

Trialpit No

TP03

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 503504.10 - 195796.10
Level: 26.92

Date
31/01/2020

Location: Loughton

Dimensions (m): 0.3


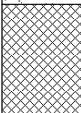
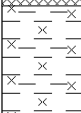

Client: Epping Forest District Council

Depth
0.90

0.3

Scale
1:20

Logged
TB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.15	26.77		CONCRETE	
	0.50	ES					Grey brown mottled grey gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse flint with occasional fragments of brick. With concrete obstructions between 0.20m and 0.40m. MADE GROUND.	
	0.80	ES		0.60	26.32		Soft becoming firm green grey to dark grey silty CLAY. With rare angular to subangular fine to coarse flint. WEATHERED LONDON CLAY.	
				0.90	26.02		End of pit at 0.90 m	

1

2

3

4

Remarks: 1. TP03 halted at 0.9m, target depth reached
2. No groundwater encountered
3. Trial pit backfilled with arisings

Stability: Stable



Trial Pit Log

Trialpit No

TP04

Sheet 1 of 1

Project Name: Chequers Road (Site B)

Project No.
P18-1639

Co-ords: 543523.10 - 195805.00

Level: 26.71

Date

31/01/2020

Location: Loughton

Dimensions
(m):

0.3

Depth
1.00

0.3

Scale

1:20

Logged
TB

Client: Epping Forest District Council

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10			0.10	26.61		CONCRETE	
							Brown mottled black gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse flint with fragments of brick. MADE GROUND.	
	0.60	ES					..becoming grey brown mottled dark grey slightly clayey gravelly fine to coarse sand. Gravel is angular to subangular fine to medium flint with fragments of brick	
				0.80	25.91		Soft to firm grey brown mottled brown grey silty CLAY. With rare subangular fine to coarse flint gravel. WEATHERED LONDON CLAY.	
				1.00	25.71		End of pit at 1.00 m	1
								2
								3
								4

Remarks: 1. TP04 halted at 1.0m, target depth reached
2. No groundwater encountered
3. Trial pit backfilled with arisings

Stability: Stable



APPENDIX D

CHEMICAL LABORATORY TEST CERTIFICATES COMPARISON OF RESULTS AGAINST SSAC



Certificate of Analysis

Certificate Number 20-02282

27-Feb-20

Client Create Consulting Engineers LTD
15 Princess Street
Norwich
NR3 1AF

Our Reference 20-02282

Client Reference P18-1639

Order No PO3572

Contract Title P18-1639 Chequers Road Site B

Description 16 Soil samples, 2 Leachate samples.

Date Received 04-Feb-20

Date Started 04-Feb-20

Date Completed 27-Feb-20

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Test	Method	LOD	Units	Lab No					
				Sample ID	Depth	Other ID	Sample Type	Sampling Date	Sampling Time
Asbestos Quantification	DETSC 1102	0.001	%	1633317	1633318	1633319	1633320	1633321	1633322
				WS01	WS01	WS02	WS03	WS03	WS04
				0.60	0.90	0.80	0.50	0.85	0.40
				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020
				n/s	n/s	n/s	n/s	n/s	n/s
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	19	14	16	9.8	11	11
Barium	DETSC 2301#	1.5	mg/kg	91	52	130	53	39	100
Beryllium	DETSC 2301#	0.2	mg/kg	0.7	0.9	1.5	0.6	0.7	0.8
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	2.1	0.9	1.2	2.0	1.0	0.4
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1	0.9
Chromium	DETSC 2301#	0.15	mg/kg	18	38	21	24	29	16
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	34	21	39	23	15	30
Lead	DETSC 2301#	0.3	mg/kg	270	21	130	50	22	150
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.34	< 0.05	0.18	0.08	< 0.05	0.05
Nickel	DETSC 2301#	1	mg/kg	18	21	27	16	14	19
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	39	63	53	45	54	32
Zinc	DETSC 2301#	1	mg/kg	87	53	78	62	39	100
Inorganics									
pH	DETSC 2008#		pH	8.3	7.8	10.0	7.8	8.1	11.4
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.3	0.1	0.2	0.2	0.2	0.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2084#	0.5	%	2.6	0.6	8.4	2.0	1.0	4.2
Organic matter	DETSC 2002#	0.1	%	2.5	3.0	0.7	3.1	0.9	1.3
Ammonia Aqueous Extract as N	DETSC 2119	10	mg/l						
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	90	10	190	20	29	22
Sulphide	DETSC 2024*	10	mg/kg	110	< 10	140	52	< 10	40
Sulphur as S, Total	DETSC 2320	0.01	%						
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.02	1.7	0.05	0.03	0.16
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	0.09	0.11	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	1.1	3.5	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633317	1633318	1633319	1633320	1633321	1633322
Sample ID	WS01	WS01	WS02	WS03	WS03	WS04
Depth	0.60	0.90	0.80	0.50	0.85	0.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	5.2	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	12	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	18	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	18	< 10	< 10	< 10	< 10	< 10
EPH (C10-C35)	DETSC 3311	10	mg/kg	960	< 10	< 10	< 10	< 10	< 10

PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.10	< 0.03	0.05	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.16	< 0.03	0.11	0.05	< 0.03	0.05
Pyrene	DETSC 3303#	0.03	mg/kg	0.13	< 0.03	0.10	0.04	< 0.03	0.05
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.07	< 0.03	0.06	0.03	< 0.03	0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.05	< 0.03	0.05	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	0.06	< 0.03	< 0.03	0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	DETSC 3301	0.1	mg/kg						
Acenaphthylene	DETSC 3301	0.1	mg/kg						
Acenaphthene	DETSC 3301	0.1	mg/kg						
Fluorene	DETSC 3301	0.1	mg/kg						
Phenanthrene	DETSC 3301	0.1	mg/kg						
Anthracene	DETSC 3301	0.1	mg/kg						
Fluoranthene	DETSC 3301	0.1	mg/kg						
Pyrene	DETSC 3301	0.1	mg/kg						
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg						
Chrysene	DETSC 3301	0.1	mg/kg						
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg						
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg						
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg						
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg						
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg						
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg						
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.62	< 0.10	0.45	< 0.10	< 0.10	0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633317	1633318	1633319	1633320	1633321	1633322
Sample ID	WS01	WS01	WS02	WS03	WS03	WS04
Depth	0.60	0.90	0.80	0.50	0.85	0.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAH Total	DETSC 3301	1.6	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

				Lab No	1633323	1633324	1633325	1633326	1633327	1633328
				Sample ID	WS04	TP01	TP02	TP03	TP03	TP04
				Depth	0.75	0.50	0.60	0.50	0.80	0.60
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	Method	LOD	Units							
Asbestos Quantification	DETS 1102	0.001	%		< 0.001	< 0.001	< 0.001			< 0.001
Metals										
Arsenic	DETS 2301#	0.2	mg/kg	14	13	15	7.0	11	13	
Barium	DETS 2301#	1.5	mg/kg	61	210	130	130	57	120	
Beryllium	DETS 2301#	0.2	mg/kg	0.8	0.5	2.0	0.4	0.8	1.1	
Boron, Water Soluble	DETS 2311#	0.2	mg/kg	1.8	0.5	0.4	0.3	0.9	0.4	
Cadmium	DETS 2301#	0.1	mg/kg	0.1	0.1	< 0.1	7.1	< 0.1	0.2	
Chromium	DETS 2301#	0.15	mg/kg	28	18	21	8.9	29	15	
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Copper	DETS 2301#	0.2	mg/kg	27	26	47	22	22	39	
Lead	DETS 2301#	0.3	mg/kg	240	370	110	220	29	91	
Magnesium Aqueous Extract	DETS 2076*	10	mg/l							
Mercury	DETS 2325#	0.05	mg/kg	0.11	0.39	0.12	0.14	0.05	0.07	
Nickel	DETS 2301#	1	mg/kg	21	14	40	16	21	30	
Selenium	DETS 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Vanadium	DETS 2301#	0.8	mg/kg	54	34	80	23	49	51	
Zinc	DETS 2301#	1	mg/kg	69	170	53	82	49	57	
Inorganics										
pH	DETS 2008#		pH	7.4	11.0	10.7	11.5	7.9	11.2	
Cyanide, Total	DETS 2130#	0.1	mg/kg	0.3	0.1	< 0.1	0.2	0.1	< 0.1	
Cyanide, Free	DETS 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Total Organic Carbon	DETS 2084#	0.5	%	2.5	1.2	2.0	1.8	1.1	4.1	
Organic matter	DETS 2002#	0.1	%	3.8	1.3	1.3	1.3	1.3	1.0	
Ammonia Aqueous Extract as N	DETS 2119	10	mg/l							
Chloride Aqueous Extract	DETS 2055	1	mg/l							
Nitrate Aqueous Extract as NO3	DETS 2055	1	mg/l							
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l	19	340	52	28	11	38	
Sulphide	DETS 2024*	10	mg/kg	52	< 10	88	40	60	72	
Sulphur as S, Total	DETS 2320	0.01	%							
Sulphate as SO4, Total	DETS 2321#	0.01	%	0.06	0.45	0.08	0.26	0.03	0.17	
Petroleum Hydrocarbons										
Aliphatic C5-C6	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic C6-C8	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic C8-C10	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic C10-C12	DETS 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	
Aliphatic C12-C16	DETS 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	
Aliphatic C16-C21	DETS 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	
Aliphatic C21-C35	DETS 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	
Aliphatic C5-C35	DETS 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	
Aromatic C5-C7	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic C7-C8	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic C8-C10	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633323	1633324	1633325	1633326	1633327	1633328
Sample ID	WS04	TP01	TP02	TP03	TP03	TP04
Depth	0.75	0.50	0.60	0.50	0.80	0.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C10-C35)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.03	0.03	< 0.03	0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.07	0.07	< 0.03	0.07	< 0.03	0.04
Pyrene	DETSC 3303#	0.03	mg/kg	0.06	0.06	< 0.03	0.06	< 0.03	0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.03	0.04	< 0.03	0.04	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.03	< 0.03	0.04	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	0.04	< 0.03	0.05	< 0.03	0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Naphthalene	DETSC 3301	0.1	mg/kg						
Acenaphthylene	DETSC 3301	0.1	mg/kg						
Acenaphthene	DETSC 3301	0.1	mg/kg						
Fluorene	DETSC 3301	0.1	mg/kg						
Phenanthrene	DETSC 3301	0.1	mg/kg						
Anthracene	DETSC 3301	0.1	mg/kg						
Fluoranthene	DETSC 3301	0.1	mg/kg						
Pyrene	DETSC 3301	0.1	mg/kg						
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg						
Chrysene	DETSC 3301	0.1	mg/kg						
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg						
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg						
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg						
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg						
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg						
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg						
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.13	0.17	< 0.10	0.25	< 0.10	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633323	1633324	1633325	1633326	1633327	1633328
Sample ID	WS04	TP01	TP02	TP03	TP03	TP04
Depth	0.75	0.50	0.60	0.50	0.80	0.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAH Total	DETSC 3301	1.6	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633329	1633330	1633331	1633332
Sample ID	Tank	WS01	WS03	WS05
Depth		1.30	1.50	0.80
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Asbestos Quantification	DETSC 1102	0.001	%				
Metals							
Arsenic	DETSC 2301#	0.2	mg/kg				
Barium	DETSC 2301#	1.5	mg/kg				
Beryllium	DETSC 2301#	0.2	mg/kg				
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg				
Cadmium	DETSC 2301#	0.1	mg/kg				
Chromium	DETSC 2301#	0.15	mg/kg				
Chromium, Hexavalent	DETSC 2204*	1	mg/kg				
Copper	DETSC 2301#	0.2	mg/kg				
Lead	DETSC 2301#	0.3	mg/kg				
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		< 10	< 10	< 10
Mercury	DETSC 2325#	0.05	mg/kg				
Nickel	DETSC 2301#	1	mg/kg				
Selenium	DETSC 2301#	0.5	mg/kg				
Vanadium	DETSC 2301#	0.8	mg/kg				
Zinc	DETSC 2301#	1	mg/kg				
Inorganics							
pH	DETSC 2008#		pH		6.9	7.5	7.0
Cyanide, Total	DETSC 2130#	0.1	mg/kg				
Cyanide, Free	DETSC 2130#	0.1	mg/kg				
Total Organic Carbon	DETSC 2084#	0.5	%				
Organic matter	DETSC 2002#	0.1	%				
Ammonia Aqueous Extract as N	DETSC 2119	10	mg/l		< 10	< 10	< 10
Chloride Aqueous Extract	DETSC 2055	1	mg/l		2.8	3.0	3.2
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		< 1.0	< 1.0	< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l		< 10	16	< 10
Sulphide	DETSC 2024*	10	mg/kg				
Sulphur as S, Total	DETSC 2320	0.01	%		0.02	0.01	0.01
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.02	0.03	0.03
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01			
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01			
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01			
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5			
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2			
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5			
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4			
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10			
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01			
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01			
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01			

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633329	1633330	1633331	1633332
Sample ID	Tank	WS01	WS03	WS05
Depth		1.30	1.50	0.80
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9			
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5			
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6			
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4			
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10			
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10			
EPH (C10-C35)	DETSC 3311	10	mg/kg				
PAHs							
Naphthalene	DETSC 3303#	0.03	mg/kg				
Acenaphthylene	DETSC 3303#	0.03	mg/kg				
Acenaphthene	DETSC 3303#	0.03	mg/kg				
Fluorene	DETSC 3303	0.03	mg/kg				
Phenanthrene	DETSC 3303#	0.03	mg/kg				
Anthracene	DETSC 3303	0.03	mg/kg				
Fluoranthene	DETSC 3303#	0.03	mg/kg				
Pyrene	DETSC 3303#	0.03	mg/kg				
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg				
Chrysene	DETSC 3303	0.03	mg/kg				
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg				
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg				
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg				
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg				
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg				
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg				
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1			
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1			
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1			
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1			
Phenanthrene	DETSC 3301	0.1	mg/kg	0.1			
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1			
Fluoranthene	DETSC 3301	0.1	mg/kg	0.2			
Pyrene	DETSC 3301	0.1	mg/kg	0.3			
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1			
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1			
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1			
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1			
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1			
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1			
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1			
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1			
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg				

Summary of Chemical Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633329	1633330	1633331	1633332
Sample ID	Tank	WS01	WS03	WS05
Depth		1.30	1.50	0.80
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units			
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6		
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg			

Summary of Chemical Analysis

Leachate Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633333	1633334
Sample ID	WS01	WS02
Depth	0.60	0.80
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	31/01/2020	31/01/2020
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Preparation					
BS EN 12457 10:1	DETSC 1009*			Y	Y
Metals					
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	2.1	4.1
Barium, Dissolved	DETSC 2306	0.26	ug/l	20	7.7
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	41	42
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.27	< 0.25
Chromium, Hexavalent	DETSC 2203	0.007	mg/l	< 0.007	< 0.007
Copper, Dissolved	DETSC 2306	0.4	ug/l	3.9	3.5
Lead, Dissolved	DETSC 2306	0.09	ug/l	9.5	2.4
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	0.7
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	1.3	2.9
Zinc, Dissolved	DETSC 2306	1.3	ug/l	8.9	1.8
Inorganics					
pH	DETSC 2008		pH	7.3	7.2
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20
Cyanide, Complex	DETSC 2130*	40	ug/l	< 40	< 40
Sulphate as SO4	DETSC 2055	0.1	mg/l	9.9	5.6
Sulphide	DETSC 2208	10	ug/l	< 10	< 10
Total Organic Carbon	DETSC 2085	1	mg/l	3.6	5.7
Petroleum Hydrocarbons					
EPH (C10-C35)	DETSC 3311	10	ug/l	< 10	55
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	0.97	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	0.05	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	0.15	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	0.11	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.17	0.04
Anthracene	DETSC 3304	0.01	ug/l	0.07	0.02
Fluoranthene	DETSC 3304	0.01	ug/l	0.19	0.08
Pyrene	DETSC 3304	0.01	ug/l	0.16	0.07
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.07	0.03
Chrysene	DETSC 3304	0.01	ug/l	0.10	0.05
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.13	0.07
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.06	0.03
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.10	0.05
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	0.08	0.06

Summary of Chemical Analysis

Leachate Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633333	1633334
Sample ID	WS01	WS02
Depth	0.60	0.80
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	31/01/2020	31/01/2020
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	0.02	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.09	0.06
PAH Total	DETSC 3304	0.2	ug/l	2.5	0.60
Phenols					
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100

Summary of Asbestos Analysis Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1633317	WS01 0.60	SOIL	NAD	none	D Wilkinson
1633318	WS01 0.90	SOIL	NAD	none	D Wilkinson
1633319	WS02 0.80	SOIL	Amosite	Amosite present as fibre bundles	D Wilkinson
1633320	WS03 0.50	SOIL	NAD	none	D Wilkinson
1633321	WS03 0.85	SOIL	NAD	none	D Wilkinson
1633322	WS04 0.40	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1633323	WS04 0.75	SOIL	NAD	none	D Wilkinson
1633324	TP01 0.50	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1633325	TP02 0.60	SOIL	Crocidolite	Crocidolite present as fibre bundles	D Wilkinson
1633326	TP03 0.50	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1633327	TP03 0.80	SOIL	NAD	none	D Wilkinson
1633328	TP04 0.60	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Asbestos Quantification Analysis

Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

			Lab No	1633319	1633322	1633324	1633325
			Sample ID	WS02	WS04	TP01	TP02
			Depth	0.80	0.40	0.50	0.60
			Other ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sampling Date	31/01/2020	31/01/2020	31/01/2020	31/01/2020
			Sampling Time				
Test	Method	Units					
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	< 0.001	0.001	< 0.001	< 0.001	
Gravimetric Quantification (a)	DETSC 1102	Mass %	na	na	na	na	
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	<0.001	0.001	<0.001	<0.001	
Quantification by PCOM (c)	DETSC 1102	Mass %	na	na	na	na	
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na	na	na	na	
Breakdown of Gravimetric Analysis (a)							
Mass of Sample		g	485.61	630.77	522.40	781.11	
ACMs present*		type					
Mass of ACM in sample		g					
% ACM by mass		%					
% asbestos in ACM		%					
% asbestos in sample		%					
Breakdown of Detailed Gravimetric Analysis (b)							
% Amphibole bundles in sample		Mass %	<0.001	na	na	<0.001	
% Chrysotile bundles in sample		Mass %	na	0.001	<0.001	na	
Breakdown of PCOM Analysis (c)							
% Amphibole fibres in sample		Mass %	na	na	na	na	
% Chrysotile fibres in sample		Mass %	na	na	na	na	
Breakdown of Potentially Respirable Fibre Analysis (d)							
Amphibole fibres		Fibres/g	na	na	na	na	
Chrysotile fibres		Fibres/g	na	na	na	na	

* Denotes test or material description outside of UKAS accreditation.
 % asbestos in Asbestos Containing Materials (ACMs) is determined by
 by reference to HSG 264.
 Recommended sample size for quantification is approximately 1kg
 # denotes deviating sample

Summary of Asbestos Quantification Analysis Soil Samples

Our Ref 20-02282

Client Ref P18-1639

Contract Title P18-1639 Chequers Road Site B

Lab No	1633326	1633328
Sample ID	TP03	TP04
Depth	0.50	0.60
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	31/01/2020	31/01/2020
Sampling Time		

Test	Method	Units		
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	< 0.001	< 0.001
Gravimetric Quantification (a)	DETSC 1102	Mass %	na	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	<0.001	<0.001
Quantification by PCOM (c)	DETSC 1102	Mass %	na	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na	na
Breakdown of Gravimetric Analysis (a)				
Mass of Sample		g	600.38	637.01
ACMs present*		type		
Mass of ACM in sample		g		
% ACM by mass		%		
% asbestos in ACM		%		
% asbestos in sample		%		
Breakdown of Detailed Gravimetric Analysis (b)				
% Amphibole bundles in sample		Mass %	na	na
% Chrysotile bundles in sample		Mass %	<0.001	<0.001
Breakdown of PCOM Analysis (c)				
% Amphibole fibres in sample		Mass %	na	na
% Chrysotile fibres in sample		Mass %	na	na
Breakdown of Potentially Respirable Fibre Analysis (d)				
Amphibole fibres		Fibres/g	na	na
Chrysotile fibres		Fibres/g	na	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
denotes deviating sample

Information in Support of the Analytical Results

Our Ref 20-02282
 Client Ref P18-1639
 Contract P18-1639 Chequers Road Site B

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1633317	WS01 0.60 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633318	WS01 0.90 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633319	WS02 0.80 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633320	WS03 0.50 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633321	WS03 0.85 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633322	WS04 0.40 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633323	WS04 0.75 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633324	TP01 0.50 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633325	TP02 0.60 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633326	TP03 0.50 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633327	TP03 0.80 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633328	TP04 0.60 SOIL	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633329	Tank SOIL	31/01/20	GJ 250ml x2		
1633330	WS01 1.30 SOIL	31/01/20	PG		
1633331	WS03 1.50 SOIL	31/01/20	PG		
1633332	WS05 0.80 SOIL	31/01/20	PG		
1633333	WS01 0.60 LEACHATE	31/01/20	GJ 250ml, GJ 60ml, PT 1L		
1633334	WS02 0.80 LEACHATE	31/01/20	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

CHEQUERS ROAD (SITE B), LOUGHTON

Comparison of Samples vs Site Specific Assessment Criteria

Scenario: Residential with plant uptake (1% SOM)

			Sample ID	WS01	WS01	WS02	WS03	WS03	WS04	WS04	TANK
LoD	Metals (Based on 6% SOM)	SSAC	Depth	0.60	0.90	0.80	0.50	0.85	0.40	0.75	-
0.2mg/kg	Arsenic	37		19	14	16	9.8	11	11	14	-
1.5mg/kg	Barium	-		91	52	130	53	39	100	61	-
0.2mg/kg	Beryllium	1.7		0.70	0.90	1.5	0.60	0.70	0.80	0.80	-
0.2mg/kg	Boron, Water Soluble	290		2.1	0.90	1.2	2.0	1.0	0.40	1.8	-
0.1mg/kg	Cadmium	11		< 0.1	< 0.1	< 0.1	0.10	< 0.1	0.90	0.10	-
0.15mg/kg	Chromium	910		18	38	21	24	29	16	28	-
1mg/kg	Chromium, Hexavalent	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-
0.2mg/kg	Copper	2400		34	21	39	23	15	30	27	-
0.3mg/kg	Lead	200		270	21	130	50	22	150	240	-
0.05mg/kg	Mercury	40		0.34	< 0.05	0.18	0.08	< 0.05	0.05	0.11	-
1mg/kg	Nickel	130		18	21	27	16	14	19	21	-
0.5mg/kg	Selenium	250		< 0.5	0.60	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-
0.8mg/kg	Vanadium	410		39	63	53	45	54	32	54	-
1mg/kg	Zinc	3700		87	53	78	62	39	100	69	-
Inorganics											
	pH	-		8.3	7.8	10	7.8	8.1	11	7.4	-
0.1mg/kg	Cyanide, Total	-		0.30	0.10	0.20	0.20	0.20	0.20	0.30	-
0.1mg/kg	Cyanide, Free*	34		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-
0.50%	Total Organic Carbon	-		2.6	0.60	8.4	2.0	1.0	4.2	2.5	-
0.10%	Organic matter	-		2.5	3.0	0.70	3.1	0.90	1.3	3.8	-
10mg/l	Sulphate Aqueous Extract as SO4	-		90	10	190	20	29	22	19	-
10mg/kg	Sulphide	-		110	< 10	140	52	< 10	40	52	-
0.01%	Sulphate as SO4, Total	-		0.07	0.02	1.7	0.05	0.03	0.16	0.06	-
Petroleum Hydrocarbons											
0.01mg/kg	Aliphatic C5-C6	42		< 0.01	< 0.01	< 0.01	0.09	0.11	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aliphatic C6-C8	100		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aliphatic C8-C10	27		< 0.01	< 0.01	< 0.01	1.1	3.5	< 0.01	< 0.01	< 0.01
1.5mg/kg	Aliphatic C10-C12	130		< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
1.2mg/kg	Aliphatic C12-C16	1100		< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
1.5mg/kg	Aliphatic C16-C21	65000		< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
3.4mg/kg	Aliphatic C21-C35	65000		< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
10mg/kg	Aliphatic C5-C35	-		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
0.01mg/kg	Aromatic C5-C7	70		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aromatic C7-C8	130		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aromatic C8-C10	34		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.9mg/kg	Aromatic C10-C12	74		< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
0.5mg/kg	Aromatic C12-C16	140		0.60	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
0.6mg/kg	Aromatic C16-C21	260		5.2	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
1.4mg/kg	Aromatic C21-C35	1100		12	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
10mg/kg	Aromatic C5-C35	-		18	< 10	< 10	< 10	< 10	< 10	< 10	< 10
10mg/kg	TPH Ali/Aro Total	-		18	< 10	< 10	< 10	< 10	< 10	< 10	< 10
10mg/kg	EPH (C10-C35)	-		960	< 10	< 10	< 10	< 10	< 10	< 10	-
10mg/kg	TPH (C10-C40)	-		-	-	-	-	-	-	-	-
PAHs											
0.03mg/kg	Naphthalene	2.3		0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Acenaphthylene	170		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Acenaphthene	210		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Fluorene	170		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Phenanthrene	95		0.10	< 0.03	0.05	< 0.03	< 0.03	< 0.03	0.03	0.10
0.03mg/kg	Anthracene	2400		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Fluoranthene	280		0.16	< 0.03	0.11	0.05	< 0.03	0.05	0.07	0.20
0.03mg/kg	Pyrene	620		0.13	< 0.03	0.10	0.04	< 0.03	0.05	0.06	0.30
0.03mg/kg	Benzo(a)anthracene	7.2		0.07	< 0.03	0.06	0.03	< 0.03	0.03	0.03	< 0.1
0.03mg/kg	Chrysene	15		0.05	< 0.03	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Benzo(b)fluoranthene	2.6		0.05	< 0.03	0.06	< 0.03	< 0.03	0.03	0.03	< 0.1
0.03mg/kg	Benzo(k)fluoranthene	77		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03	0.03	< 0.1
0.03mg/kg	Benzo(a)pyrene	2.2		< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Indeno(1,2,3-c,d)pyrene	27		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Dibenzo(a,h)anthracene	0.24		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.03mg/kg	Benzo(g,h,i)perylene	320		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.1
0.10mg/kg	PAH - USEPA 16, Total	4399		0.62	< 0.10	0.45	< 0.10	< 0.10	0.10	0.13	< 1.6
Phenols											
0.3mg/kg	Phenol - Monohydric	184		< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	-

Key

xx	At or exceeding the SSAC (Site Specific Assessment Criteria)
xx	Within 90th percentile of SSAC contaminant value
LoD	Laboratory 'Limit of Detection'
*	Based on ATKINS AtRisk Value, 2017

CHEQUERS ROAD (SITE B), LOUGHTON

Comparison of Samples vs Site Specific Assessment Criteria

Scenario: Residential with plant uptake (1% SOM)

LoD	Metals (Based on 6% SOM)	SSAC	Sample ID	TP01	TP02	TP03	TP03	TP04
			Depth	0.50	0.60	0.50	0.80	0.60
0.2mg/kg	Arsenic	37		13	15	7.0	11	13
1.5mg/kg	Barium	-		210	130	130	57	120
0.2mg/kg	Beryllium	1.7		0.50	2.0	0.40	0.80	1.1
0.2mg/kg	Boron, Water Soluble	290		0.50	0.40	0.30	0.90	0.40
0.1mg/kg	Cadmium	11		0.10	< 0.1	7.1	< 0.1	0.20
0.15mg/kg	Chromium	910		18	21	8.9	29	15
1mg/kg	Chromium, Hexavalent	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
0.2mg/kg	Copper	2400		26	47	22	22	39
0.3mg/kg	Lead	200		370	110	220	29	91
0.05mg/kg	Mercury	40		0.39	0.12	0.14	0.05	0.07
1mg/kg	Nickel	130		14	40	16	21	30
0.5mg/kg	Selenium	250		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
0.8mg/kg	Vanadium	410		34	80	23	49	51
1mg/kg	Zinc	3700		170	53	82	49	57
	Inorganics							
	pH	-		11	11	12	7.9	11
0.1mg/kg	Cyanide, Total	-		0.10	< 0.1	0.20	0.10	< 0.1
0.1mg/kg	Cyanide, Free*	34		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
0.50%	Total Organic Carbon	-		1.2	2.0	1.8	1.1	4.1
0.10%	Organic matter	-		1.3	1.3	1.3	1.3	1.0
10mg/l	Sulphate Aqueous Extract as SO4	-		340	52	28	11	38
10mg/kg	Sulphide	-		< 10	88	40	60	72
0.01%	Sulphate as SO4, Total	-		0.45	0.08	0.26	0.03	0.17
	Petroleum Hydrocarbons							
0.01mg/kg	Aliphatic C5-C6	42		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aliphatic C6-C8	100		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aliphatic C8-C10	27		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1.5mg/kg	Aliphatic C10-C12	130		< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
1.2mg/kg	Aliphatic C12-C16	1100		< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
1.5mg/kg	Aliphatic C16-C21	65000		< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
3.4mg/kg	Aliphatic C21-C35	65000		< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
10mg/kg	Aliphatic C5-C35	-		< 10	< 10	< 10	< 10	< 10
0.01mg/kg	Aromatic C5-C7	70		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aromatic C7-C8	130		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.01mg/kg	Aromatic C8-C10	34		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
0.9mg/kg	Aromatic C10-C12	74		< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
0.5mg/kg	Aromatic C12-C16	140		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
0.6mg/kg	Aromatic C16-C21	260		< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
1.4mg/kg	Aromatic C21-C35	1100		< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
10mg/kg	Aromatic C5-C35	-		< 10	< 10	< 10	< 10	< 10
10mg/kg	TPH Ali/Aro Total	-		< 10	< 10	< 10	< 10	< 10
10mg/kg	EPH (C10-C35)	-		< 10	< 10	< 10	< 10	< 10
10mg/kg	TPH (C10-C40)	-						
	PAHs							
0.03mg/kg	Naphthalene	2.3		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Acenaphthylene	170		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Acenaphthene	210		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Fluorene	170		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Phenanthrene	95		0.03	< 0.03	0.03	< 0.03	< 0.03
0.03mg/kg	Anthracene	2400		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Fluoranthene	280		0.07	< 0.03	0.07	< 0.03	0.04
0.03mg/kg	Pyrene	620		0.06	< 0.03	0.06	< 0.03	0.03
0.03mg/kg	Benzo(a)anthracene	7.2		0.04	< 0.03	0.04	< 0.03	< 0.03
0.03mg/kg	Chrysene	15		0.03	< 0.03	0.04	< 0.03	< 0.03
0.03mg/kg	Benzo(b)fluoranthene	2.6		0.04	< 0.03	0.05	< 0.03	0.03
0.03mg/kg	Benzo(k)fluoranthene	77		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Benzo(a)pyrene	2.2		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Indeno(1,2,3-c,d)pyrene	27		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Dibenzo(a,h)anthracene	0.24		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.03mg/kg	Benzo(g,h,i)perylene	320		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
0.10mg/kg	PAH - USEPA 16, Total	4399		0.17	< 0.10	0.25	< 0.10	< 0.10
	Phenols							
0.3mg/kg	Phenol - Monohydric	184		< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Key

xx	At or exceeding the SSAC (Site Specific Assessment Criteria)
xx	Within 90th percentile of SSAC contaminant value
LoD	Laboratory 'Limit of Detection'
*	Based on ATKINS AtRisk Value, 2017

Comparison of Samples vs Site Specific Assessment Criteria

Criteria: Controlled Waters (Ecological Status) - Rivers & Fresh Water

LoD	Metals	SSAC	Sample ID	WS01	WS02
			Depth	0.60	0.80
0.16ug/l	Arsenic, Dissolved	50		2.1	4.1
0.26ug/l	Barium, Dissolved	-		20	7.7
0.1ug/l	Beryllium, Dissolved	-		< 0.1	< 0.1
100ug/l	Boron	-		41	42
0.03ug/l	Cadmium, Dissolved	-		< 0.03	< 0.03
0.25ug/l	Chromium, Dissolved	4.7		0.27	< 0.25
0.007ug/l	Chromium, Hexavalent	3.4		< 0.007	< 0.007
0.4ug/l	Copper, Dissolved	28		3.9	3.5
0.09ug/l	Lead, Dissolved	-		9.5	2.4
0.01ug/l	Mercury, Dissolved	-		< 0.01	< 0.01
0.5ug/l	Nickel, Dissolved	-		< 0.5	0.70
0.25ug/l	Selenium, Dissolved	-		< 0.25	< 0.25
0.6ug/l	Vanadium, Dissolved	-		1.3	2.9
1.3ug/l	Zinc, Dissolved	125		8.9	1.8
Inorganics					
	pH	-		7.3	7.2
40ug/l	Cyanide, Total	-		< 40	< 40
20ug/l	Cyanide, Free	-		< 20	< 20
40ug/l	Cyanide, Complex	-		< 40	< 40
0.1mg/l	Sulphate as SO4	188000		9.9	5.6
10ug/l	Sulphide	-		< 10	< 10
1mg/l	Total Organic Carbon	-		3.6	5.7
Petroleum Hydrocarbons					
0.1ug/l	Aliphatic C5-C6	-		-	-
0.1ug/l	Aliphatic C6-C8	-		-	-
0.1ug/l	Aliphatic C8-C10	-		-	-
1ug/l	Aliphatic C10-C12	-		-	-
1ug/l	Aliphatic C12-C16	-		-	-
1ug/l	Aliphatic C16-C21	-		-	-
1ug/l	Aliphatic C21-C35	-		-	-
10ug/l	Aliphatic C5-C35	-		-	-
0.1ug/l	Aromatic C5-C7	-		-	-
0.1ug/l	Aromatic C7-C8	-		-	-
0.1ug/l	Aromatic C8-C10	-		-	-
1ug/l	Aromatic C10-C12	-		-	-
1ug/l	Aromatic C12-C16	-		-	-
1ug/l	Aromatic C16-C21	-		-	-
1ug/l	Aromatic C21-C35	-		-	-
10ug/l	Aromatic C5-C35	-		-	-
10ug/l	TPH Ali/Aro Total	-		-	-
10ug/l	EPH (C10-C35)	-		< 10	55
1ug/l	Benzene	0.75		-	-
1ug/l	Toluene	276		-	-
1ug/l	Ethylbenzene	-		-	-
1ug/l	Xylene	30.3		-	-
PAHs					
0.05ug/l	Naphthalene	13.2		0.97	< 0.05
0.01ug/l	Acenaphthylene	-		0.05	< 0.01
0.01ug/l	Acenaphthene	-		0.15	< 0.01
0.01ug/l	Fluorene	-		0.11	< 0.01
0.01ug/l	Phenanthrene	-		0.17	0.04
0.01ug/l	Anthracene	0.55		0.07	0.02
0.01ug/l	Fluoranthene	-		0.19	0.08
0.01ug/l	Pyrene	-		0.16	0.07
0.01ug/l	Benzo(a)anthracene	-		0.07	0.03
0.01ug/l	Chrysene	-		0.10	0.05
0.01ug/l	Benzo(b)fluoranthene	-		0.13	0.07
0.01ug/l	Benzo(k)fluoranthene	-		0.06	0.03
0.01ug/l	Benzo(a)pyrene	0.075		0.10	0.05
0.01ug/l	Indeno(1,2,3-c,d)pyrene	-		0.08	0.06
0.01ug/l	Dibenzo(a,h)anthracene	-		0.02	< 0.01
0.01ug/l	Benzo(g,h,i)perylene	-		0.09	0.06
0.2ug/l	PAH, Total	-		2.5	0.60
Phenols					
100ug/l	Phenol - Monohydric	82.8		< 100	< 100

Key

xx	At or exceeding the SSAC (Site Specific Assessment Criteria)
xx	Within 90th percentile of SSAC contaminant value
LoD	Laboratory 'Limit of Detection'
WSR	Water Supply (Water Quality) Regulations
PoCW	Protection of Controlled Waters