

Thinking Buildings

Report
on
Ground Investigation

at

**Alexandra Park School
Bidwell Gardens
London
N11 2AZ**



September 2023

Report No. S.6125



**GROUND INVESTIGATION
SERVICES
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1.0 INTRODUCTION

1.1 Authority

Ground Investigation Services (Southern) Ltd (GIS) has been commissioned by Thinking Buildings (Architectural Consultants) to undertake a ground investigation at the following (hereinafter referred to as the) 'site':

Alexandra Park School, Bidwell Gardens, London N11 2AZ

1.2 Development Proposals

It is proposed extend the existing 6th Form block along the north east gable wall to accommodate a three-storey structure with some cantilever structures at 1st floor level. In addition, a new stairwell is proposed at the rear (southwest gable wall) of the 6th Form block.

The proposed development is presented in the Proposed Development Plan (Figure 2).

1.3 Purpose of Investigation

The purpose of the investigation was to establish the general ground conditions and groundwater regime in order assess the potential of the ground to accept surface drainage water via local soakaway drains and provide geotechnical parameters for design of foundations. In addition, a contamination survey will also be undertaken.

1.4 Scope of Investigation

The scope comprised the following:

- conduct in-situ permeability tests in two trial pits in accordance with BRE Digest DG365 - Soakaway Design
- Hand dig foundation inspection pits to establish existing foundations
- Conduct a ground gas assessment within installed borehole wells
- Sink a Cable percussion borehole with in-situ tests and sampling
- Sink a single windowless sampling borehole with in-situ tests and sampling
- Install ground gas and groundwater wells in both boreholes
- Undertake a single in-situ CBR test
- Undertake geotechnical and contamination laboratory soil analysis
- compile an interpretive report with recommendations in respect of the proposed development

1.5 Service Constraints

The report is subject to, and should be read in conjunction with, the Service Constraints presented as a foreword to the Appendices.

2.0 THE SITE

2.1 Site Setting

2.1.1 Site Location

The site is located in the district of Muswell Hill adjacent to Muswell Hill Golf Club at the following Ordnance Survey National Grid Reference 529148E,190957N. The Location Plan is illustrated in Appendix A, Figure 1.

2.1.2 Site Description

The immediate area under investigation comprises the rear (northeast corner) of the school campus which consists of a 6th form college block and grounds which are grassed. The land is uneven and slopes down via a gentle slope towards the north west boundary.

There are a number of trees on and immediately off site located mainly towards the eastern boundary with some hedging along the south facing boundary which classified as low to high water demand¹ for species identified. Other unidentified species are also classified similarly.

2.2 Published Geology

Reference to the British Geological Survey Solid and Drift Map for the area indicates the site is immediately underlain by bedrock represented by London Clay Formation characterised by clay sand and silt.

2.3 Hydrogeology/Hydrology

2.3.1 Groundwater Vulnerability and Soil Classification

The Environment Agency has classified the bedrock soil underlying the site as:

- **Unproductive Strata:** These are classified as soils with low permeability that have negligible significance for water supply or river base flow. These are aquifers formerly classified as non-aquifers.

2.4 Radon Gas

The property is not in a Radon Affected Area as less than 1% of properties are above the Action Level.

¹ NHBC Standards Chapter 4.2 Building near trees

3.0 GROUND INVESTIGATION

3.1 Introduction and General Standards

The intrusive geotechnical investigation has been conducted in general accordance with procedures outlined in the following:

3.1.1 General Standards

- BS 5930:2015+A1:2020 - *Code of Practice for Ground Investigations*
- Eurocode 7 BS EN 1997-2 (2007) *Geotechnical Design - Part 2 Ground Investigation and Testing*
- BS 1377:Part 9:1990 *Methods of test for Soils for civil engineering purposes In-situ tests*
- BS EN ISO 22476-3: 2005+A1:2011 *Geotechnical Investigation and Testing – Field Testing Standard Penetration Test*
- BS EN ISO 14688-1:2018 *Geotechnical Investigation and Testing – Identification and Classification of Soil Part 1: Identification and Description*
- BS EN ISO 14688-2:2018 *Geotechnical Investigation and Testing – Identification and Classification of Soil Part 1: Principles for a classification*
- BS EN ISO 14689:2018 *Geotechnical Investigation and Testing – Identification and Classification of Rock Part 1: Identification and Description*
- *BRE Digest DG365 Soakaway Design*
- BS EN ISO 17892: *Geotechnical Investigation and testing, Laboratory testing of soil: Part 1-12 (various clauses)*
- BS 10175: 2011+A2 2017 - *Investigation of potentially contaminated sites. Code of Practice*

3.2 Fieldwork

3.2.1 General

The field-work was undertaken between the 7 and 9 August 2023. The weather was generally warm, dry and sunny over this period.

3.2.2 Location of Intrusive Test Positions and Preliminary Works

All intrusive test holes were initially located in advance on plan by Thinking Buildings the locations of which were designed primarily to give representative information relevant to the proposed development. Both windowless sampling borehole positions were moved within the footprint of the new build while WS1 was substituted by a cable percussion borehole.

A Cable Avoidance Tool was utilised to provide information on existing buried services. No buried services utilities were recorded during remote sensing or during intrusive test work.

3.2.3 Light Cable Percussion Borehole

One light cable percussion borehole was sunk to 15.00m depths using shell and auger techniques and utilising 150mm diameter bores and steel casing.

In-situ Standard Penetration Tests (SPTs) were performed at regular 1.00m intervals thereafter or at a change in strata in order to provide an indication of the engineering behaviour of the soil. A SPT calibration report measuring the hammer energy is attached to the rear of this report.

Representative Class 3 small disturbed samples from the SPT sampling tool were recovered during the course of the boring for identification and laboratory testing and Class 5 small disturbed samples obtained at regular depth intervals.

In addition, undisturbed Class 2 U105mm diameter core samples were obtained within the cohesive soils.

The samples were immediately inspected, sampled and logged by the GIS engineer.

All data pertaining to the boreholes are presented in the Borehole Logs and with reference to the Notes and Abbreviations Sheet in Appendix A.

3.2.4 Windowless sampling Borehole

A single borehole was advanced to 8.00m depth using windowless sampling techniques and utilising bore diameters ranging from 86mm to 116mm. Representative Class 2 undisturbed continuous liner samples were obtained during the course of the boring for identification and laboratory testing.

In-situ Standard Penetration Tests (SPTs) were performed at 1.00m depth centres in order to provide an indication of the engineering grade of the soils. A SPT calibration report measuring the hammer energy is attached to the rear of this report.

The sample tubes were split and described by GIS representative on site.

All data pertaining to the boreholes are presented in the Borehole Logs and with reference to the Notes and Abbreviations Sheet in Appendix A.

3.2.5 Ground Gas and Groundwater Strategy

Each borehole was converted into semi-permanent ground gas monitoring wells for future monitoring purposes. The head-works comprised two gas taps, one of which was connected to a rubber bung to draw gas from a point approximately 0.20m below existing ground level and the other tap to an internal tube terminating approximately 0.50m above the groundwater level to allow for re-circulation of air. A flush steel cover protected the headworks.

Details of the installations are presented on respective borehole logs.

3.2.6 Trial Pits and Percolation Tests (BRE 365)

Two trial pits were mechanically excavated by an 3T mechanical excavator to depths of 0.60 and 1.20m. These were logged and sampled by the engineer and samples of various soil horizons were obtained and placed in airtight plastic bags for later geotechnical laboratory analysis.

SA1 and SA2 were subject to permeability testing in accordance with BRE DG365 provisions. These were filled with potable water, which was allowed to drain, while measurements of the falling head were recorded over three days. The results of this work are presented in Appendix A.

3.2.7 Foundation Inspection Pits

Two hand dug pits were excavated adjacent to the existing 6th Form block. These were inspected sampled and photographed by the engineer. All data pertaining to the trial pits are presented in the Inspection Pit Logs presented in Appendix A.

3.2.8 California Bearing Ratio (CBR) Test

A single in-situ California Bearing Ratio (CBR) test was performed at 0.50m depths using an ELE reaction frame and utilising the weight of the tracked excavator for stabilising kentledge.

The results of this work are presented in Appendix A.

3.2.9 Geotechnical and Contamination Investigation and Sampling

Geotechnical Soil samples for subsequent laboratory 'classification' testing were taken from the boreholes and trial pits. The samples were immediately placed in plastic bags and plastic tubs and subsequently sealed and labelled. Soil samples were obtained to meet Category A Class 1 & 2 as described in BS EN 22475-1 (Table 1) sufficient for laboratory testing being considered. Sample sizes were also appropriate for the laboratory test being considered (refer BS EN 1997-2:2007 annex L). Samples were submitted to the laboratory on the 28 September 2023.

Contamination samples were taken from various invasive test. Soil samples for contamination analysis were placed into laboratory supplied clean and airtight plastic tubs and 250ml amber jars and were submitted on 28 and 31 August 2023 to the UKAS and MCERTS accredited laboratory of Element Materials Technologies Ltd Laboratories under full Chain of Custody Documentation.

3.2.10 Test Locations/Layout

The locations of the various invasive test positions are illustrated in the Borehole/Trial Pit/CBR Location Plan in Appendix A, Figure 3

3.3 Laboratory Testing

3.3.1 Geotechnical Analysis

Representative samples were obtained of the various soil horizons and subjected to analysis, the results of which are discussed under Section 4. The following table illustrates the type of test, methodology and reasoning behind the various test procedures.

TABLE 1. INITIAL LABORATORY TEST SCHEDULE

Test/Type	Reason for Test
Sulphate (aqueous soluble content and acid soluble content and sulphur) and pH BS 15923-1	Assess acidity/alkalinity/sulphates of soil to allow design of buried concrete
Natural water content and Atterburg Limits (BS EN ISO 17892-12 : Clauses 5.3 and 5.5 : 2018)	Determine shrinkage potential/classification properties to assist in design of foundations and appropriate depths
Triaxial compression Test (Multistage) without measurement of pore water pressure (BS EN ISO 17892-8:2018)	Establish cohesion and angle of internal friction in order to assist in design of pile foundations
Bulk and dry density (Part 2 Method 7)	Used primarily to evaluate general soil properties

3.3.2 Contamination Analysis

The details of the laboratory testing are itemised under Section 4.

4.0 GROUND AND GROUNDWATER CONDITIONS

4.1 Strata Encountered

The strata encountered during the exploratory works generally confirm the preliminary assessment, expounded in Section 2.2 of bedrock underlying the site capped by a mantle of superficial deposits and made ground.

The following general interpretation of the descending sequence of strata is made.

4.1.1 Made Ground

Made ground was identified in each invasive test position from ground level to depths ranging from 1.20m (SA2) and 2.20m (BH1).

This comprises in general soft to firm brown sandy clay and loose clayey sand with some to much fine to coarse gravel sized stone and brick and rare glass, metal, plastic, brick china and clinker deposits. This superposes a layer of loose dark grey/black carbonised sand and gravel layer in BH1 which extends down to 1.80m depth over a 0.40m thick layer of brown intact gravelly clay.

The formation in both inspection pits was at variance with the general trend in other test positions in that it consists of very loose medium brown clayey sand with much gravel sized general stone & brick and some china.

4.1.2 Superficial Deposits

A single exposure of superficial Deposits were encountered in BH2 beneath the made ground at 1.20m depth extending down to 1.70m depth. It consists of soft black and grey silty organic clay with some decomposed roots and fine gravel. It was not encountered in BH1 as a result of replacement by made ground (inferred).

4.1.3 London Clay Formation

The London Clay Formation was identified in BH1/BH2 and proven to a maximum depth of 15.00m. The strata consists of a mantle layer of firm and firm to stiff light brown and orange brown mottled light grey intact clay with some fine medium coarse flint gravel and fine medium siltstone gravel.

This is underpinned by stiff light brown/brown weakly mottled grey intact and fissured clay. At 8.80m depth in BH1 the stratum is greyish brown to dark brown weakly fissured clay. This sequence continues to the base of the borehole.

4.2 Groundwater

Groundwater was encountered only in BH2 at 3.00m depth recorded as a 'trace'. Subsequent monitoring of the installed wells reveal groundwater has developed standing at depths of 2.22m/3.95m (29.08.23) and 1.71m/1.54m (26.09.23).

4.3 Site Test Results

4.3.1 Permeability Tests in Trial Pits (BRE 365)

Three repeat tests were completed. The results of the permeability tests undertaken within the made ground formation and based on the slowest of the three repeat tests indicate moderate drainage characteristics with calculated soil infiltration rate (f) of:

$8.66 \times 10^{-6} \text{m/sec (SA1)}$

$8.16 \times 10^{-5} \text{m/sec (SA2)}$

The test results are illustrated in Appendix A.

4.3.2 Foundation Inspection Pits

The foundation inspection pits reveal the following:

IP1 – Block wall superstructure surmounts a concrete foundation at 0.75m depth which protrudes 250mm from the wall face and extends down to 0.90m depth superposing loose brown clayey sand with some to much general stone gravel (Made ground)

IP2 – Block wall superstructure surmounts a very small concrete foundation at 0.95m depth which protrudes 40mm from the wall face and extends down to 1.05m depth superposing very loose (wet) greyish brown clayey sand with some to much general stone gravel (Made ground).

4.3.3 California Bearing Ratio (CBR) Test

A single in-situ CBR test was conducted within made ground formation at 0.50m depth, the results of which reveal bearing value of 3%, for a subgrade identified as firm clay with pockets of brown sand and stone gravel (Made ground).

4.3.4 Ground Gas Test Results

Data obtained from the three site visits on the 29 August, 13 and 26 September 2023, to monitor ground gases revealed an absence of methane and very low to negligible concentrations of carbon dioxide in BH2 but elevated Carbon dioxide in BH1 with peak concentrations of 8.2% v/v.

The test results are illustrated in Appendix A.

4.4 Laboratory Testing Schedule/Results - Geotechnical

The test schedule comprises the following:

TABLE 2: ITEMISED SCHEDULE OF GEOTECHNICAL TESTS

Test/Type	Soil Type	Number of Samples Tested	Sample Location	Sample Depths (m)
Water Content and Atterburg Limits	Made ground	4	BH1 BH2 IP2 CBR 1	2.00 1.00 1.20 0.50
	Superficial deposits	1	BH2	1.30
	London Clay Formation	3	BH1 BH2	3.50, 4.00 & 9.50 2.00
pH/SO ₄ /S	Made ground	1	BH2	0.50
	Superficial deposits	1	BH2	1.30
	London Clay Formation	6	BH1 BH2	3.00, 6.50, 9.50 & 15.00 4.00 & 7.00
Triaxial compression Tests and Bulk Density	London Clay Formation	4	BH1	3.00-3.45, 5.00-5.45, 8.00-8.45 & 11.00-11.45

The results of the geotechnical testing are tabulated in Appendix B and discussed in more detail below:

4.4.1 Atterberg Limits

- Made ground

The cohesive layers where encountered are classified as inorganic clay of medium and high plasticity and low and medium volume change potential. All the samples were normally hydrated with natural moisture contents in equilibrium condition.

- Superficial Deposits

A single sample is classified as organic clay of medium plasticity and non volume change potential. The sample was normally hydrated with natural moisture contents in equilibrium condition.

- London Clay Formation

The London Clay Formation is classified as inorganic clay of high and very high plasticity and low and medium and high volume change potential. All the samples were normally hydrated with natural moisture contents in equilibrium condition.

4.4.2 Chemical Tests (pH/SO₄/S) and Loss on Ignition

The results indicate neutral to alkaline pH conditions with pH ranging between 7.4pH and 8.8pH while water soluble sulphate concentrations were generally low, but elevated in a single sample of the London Clay Formation. Sulphur concentrations were universally low.

Loss on ignition test results for the superficial deposits indicate a value of 6.9%.

4.4.3 Strength Tests

Triaxial compression tests on undisturbed samples of the London Clay Formation recorded medium strength material at shallow depth increasing in strength with progressive depth with values of mean undrained shear strength ranging from 68kPa to 114 kPa. The prevailing trend indicates a general increase in strength with progressive depth.

4.4.4 Bulk Density

Wet bulk density of the London Clay Formation is in the narrow range between 1.97mg/m³ and 2.20mg/m³ while dry bulk density ranges from 1.51mg/m³ to 1.85mg/m³.

5.0 CONTAMINATION ANALYSIS

5.1 Guidelines and Assessment Criteria

5.1.1 Appropriate Guidance (Soils)

The following guidance documents have been referred to:

- Environment Agency – Contaminated Land Exposure (CLEA) model (software v1.06) and handbook
- Environment Agency – Science Report SC050021/SR3: Updated Technical background to the CLEA Model and Science Report SC0021/SR2: Human Health toxicological assessment of contaminants in soil
- LQM/CIEH Suitable 4 Use Levels
- Various Soil Guidance Values (SGV) reports
- WS Atkins ATRISK^{soil} Soil Screening Values (SSVs)
- BS 3882:2015 Specification for Topsoil
- Part IIA Category 4 Screening Levels (C4SL)
- Asbestos in soil and made ground: a guide to understanding and managing risks Ciria report C733

5.1.2 Selection of Appropriate Tier 1 Screening Values

In the UK there are currently no statutory limits by which to measure soil contamination. In order to assess whether soil beneath a site is contaminated, the results of the chemical analysis have to be compared with suitable guidelines.

In March 2009 DEFRA (Department of Environment, Food and Rural Affairs) and the Environment Agency released the revised CLEA (Contaminated Land Exposure Assessment) model and the first tranche of revised Soil Guideline Values (SGV) covering 8 contaminants: Selenium, Benzene, Ethylbenzene, Toluene, Xylene, Mercury, Arsenic and Nickel. In October 2009 further SGVs for dioxins, furans, and dioxin-like PCBs were released.

Generally there will be SGVs for each contaminant, for several different uses of land. At the moment the land uses are limited to residential (with and without plant uptake), allotments and commercial.

In the absence of currently published SGV values for other common occurring contaminants and for other land uses not covered by the DEFRA, W S Atkins have derived ATRISK^{soil} Soil Screening Values (SSVs) based on the 2009 guidance (SC050021/SR3 (the CLEA report) and SC050021/SR2) (the Tox report) for commercial/industrial/residential/open spaces and parks land uses. CLEA guidance is predicated on Soil Organic Matter (SOM) content of 6%. The SSVs produced by WS Atkins are similarly based on 6% SOM but also have SSVs for 1% SOM for a range of land uses.

Where neither of the aforementioned publications publish data for the various contaminants reference is made to the *LQM/CIEH Suitable 4 Use levels* published by CIEH and LQM (2015).

The aim of this report was to derive Soil Assessment Criteria (SAC) for an extended range of 89 substances. For each substance S4ULs have been derived for a range of generic land uses and soil organic matter (% SOM) contents. The assessment Criteria have been updated in line with developments in UK human health risk assessments since 2009, in particular the additional land uses and exposure assumptions presented in DEFRA's recent C4SL guidance. However, the S4ULs are all based on health criteria that represent minimum or tolerable levels of risks to health as described in the EA SR2 guidance, ensuring that the resulting assessment criteria are 'Suitable for use' under local authority planning.

For each substance S4ULs have been derived for six generic land uses (including two public open space land uses defined in C4SL guidance and a range of Soil Organic Matter (SOM) content for organic substances.

In addition, reference has also been made to the recently introduced Part IIA Category 4 Screening Levels (C4SL) principally as an assessment tool for Lead in the soil as the SSV (WS Atkins) for lead has been withdrawn following recent appraisal of the toxicological parameters.

In the following sections, all Tier 1 assessment criteria have been collectively referred to as 'Site Acceptance Criteria' (SAC).

5.1.3 Contamination Assessment Rationale

It is understood that the site is proposed as a new school. Our assessment of the contamination test results has been undertaken based on *Public Open Space (POS) Park*.

5.1.4 Appropriate Guidance (Leachate)

The results of the leachate analysis have been compared to appropriate Environmental Quality Standards (EQS) relevant to the environmental setting. As the groundwater aquifer underlying the site is classified as a Unproductive Aquifer and not resourced for potable supplies in the locale, the results will be compared with the Environmental Quality Standard (EQS) for freshwater. Where such values are not available, *The Surface Water (Abstraction for drinking Water) 1996* has been used. An extract of the relevant tables pertaining to the above guidance is presented to the rear of this report.

5.1.5 Site-Specific Considerations

The following site-specific considerations have been considered with respect to the soils at the site (as appropriate).

- Soil pH
- Soil type
- Soil Organic Matter (SOM) content

The SOM content and soil type are used to provide an assessment of the applicability of the Tier 1 SAC adopted.

5.2 Statistical Considerations

5.2.1 Application of Limit of Detection

Analytical techniques operate within a limit of detection (LOD). The LOD equates to a concentration below which the technique cannot detect the presence of a chemical. Accepted UK best practice is that where a concentration of a chemical is below the LOD of the technique, the LOD is adopted as the chemical concentration. It is necessary to adopt this approach in order to undertake a robust statistical analysis of the entire data set. Please note that SACs have only been adopted for determinants, which are present at concentrations in excess of the LOD on at least one occasion, or where key indicator compound assessment is required.

5.2.2 Assessment of Averaging Areas following Site Investigation Works

For the purposes of investigation and assessment a site can be divided into zones based on the historical usages or proposed end use and these zones can be further divided into averaging areas. These averaging areas can be used to assess different soil types revealed or different potential exposure pathways etc for the purposes of accurately modelling site conditions. Each averaging area can be considered independently of each other for human health exposure assessment. Based on the proposed end use of the site and the findings of the site investigation it is proposed that a single zone split into one averaging areas is appropriate for the site and defined as the **General Site Area – Made ground**.

5.2.3 Methodology

The methodology to site sampling and assessment of the soil test results is and targeted approach assuming the whole site is contaminated given the presence of extensive made ground. A statistical approach is not considered appropriate as sampling will not be random but targeted to soil horizons that exhibit visual or olfactory evidence of pollution (materials of interest).

5.3 Sampling Strategy

5.3.1 Soils

The sampling strategy was essentially targeted and the sampling pattern relatively random. Samples were gathered at shallow depths of 0.10m and 1.00m and comprised made ground.

Soil samples were subject to chemical analysis for a suite of contaminants deemed appropriate on the Land Use Assessment as itemised in Table 3. The testing schedule is as follows:

TABLE 3 - ITEMISED SCHEDULE OF CONTAMINATION TESTS (solid form)

Test	Type/Medium Soil/water	Number of Samples Tested	Sample Identifier	Sample Depths (m)
Arsenic, Cadmium, Hexavalent Chromium, Trivalent (total) Chromium, Lead, Mercury, Nickel, Selenium, Beryllium, Copper, Vanadium, Boron, Zinc, pH, Organic Matter Content and speciated Polycyclic Aromatic Hydrocarbons (PAH)	Made Ground	8	BH1 BH2 IP1 IP2 SA1 SA2	0.10/0.20 & 1.00 0.10/0.20 & 0.50 0.20 0.20 0.10 0.10
Asbestos	Made ground	4	BH1 BH2 IP1 IP2	0.10/0.20 0.10/0.20 0.20 0.20
Waste Acceptance Criteria	Made ground	1	BH1	1.00

5.3.2 Leachate Analysis

The testing schedule in Table 4 was undertaken to reflect the risk that organics contamination and other associated metals/metalloids may have developed. Two soil samples were obtained from the Infiltration test SA1 and SA2 to establish a link (or otherwise) between potential sources of contamination and potential receptors (neighbouring site downstream of site)

TABLE 4: ITEMISED SCHEDULE OF CONTAMINATION TESTS (Leachate)

Test	Type/Medium Soil	Number of Samples Tested	Sample Identifier	Sample Depths (m)
Arsenic, Cadmium, Hexavalent Chromium, Trivalent Chromium, Lead, Mercury, Nickel, Selenium, Beryllium, Copper, Vanadium, Boron, Zinc, pH, dissolved Organic Carbon, speciated Polycyclic Aromatic Hydrocarbons, (PAH) and total TPH	Made ground	2	SA1 SA2	0.30 0.50

5.4 Site Specific Consideration

- Made ground

Table 5 summarises the site-specific considerations applicable to the made ground at the site:

Table 5 - SUMMARY OF MADE GROUND SITE SPECIFIC CONSIDERATIONS		
Parameter	Value	Comments
pH	8.3	Mean value
Soil Type	Silty loam	Visual observation
Soil Organic Matter	3.08%	Mean value

A soil organic matter of 2.5% has been used in the analysis and the Tier 1 SAC is based on the mean average of 3.08 % calculated from the eight soil samples.

5.5 Contamination Test Results

5.5.1 Significance Tests

The outcome of the significance tests is summarised in the following table together with respective critical concentrations, The full set of results are presented in Appendix B - Laboratory Test Results.

TABLE 6. SIGNIFICANCE TESTS: MADE GROUND

Determinant	No. of samples tested	Critical Concentration (Cc) SSVs/GACs	Published Reference	Measured Range	No. of samples exceeding Tier 1 SAC	Sample Mean, (x)	Upper Confidence Limit (of true mean concentration μ)	Evidence Level (%)	Outcome	Reject Null Hypothesis (Ho) YES/NO
Metals, Semi- Metals and Non-Metals										
Arsenic	8	170	S4ULs	4.3 – 15.2	2	13.57	N/A	N/A	N/A	N/A
Cadmium	8	532	S4ULs	<0.1 – 0.3	0	N/A	N/A	N/A	N/A	N/A
Chromium III (total)	8	33000	S4ULs	57 - 148	0	N/A	N/A	N/A	N/A	N/A
Chromium (VI)	8	220	S4ULs	<0.3	0	N/A	N/A	N/A	N/A	N/A
Copper	8	44000	S4ULs	27 - 48	0	N/A	N/A	N/A	N/A	N/A
Lead	8	1300	C4SLs	32 - 224	2	N/A	N/A	N/A	N/A	N/A
Elemental Mercury	8	30	S4ULs	<0.1 – 0.4	0	N/A	N/A	N/A	N/A	N/A
Nickel	8	3400	S4ULs	12.6 - 59	0	N/A	N/A	N/A	N/A	N/A
Zinc	8	170000	S4ULs	9 - 208	0	N/A	N/A	N/A	N/A	N/A
Boron (Water soluble)	8	4600	S4ULs	0.3 - 1	0	N/A	N/A	N/A	N/A	N/A
Selenium	8	1800	S4ULs	<1	0	N/A	N/A	N/A	N/A	N/A
Vanadium	8	5000	S4ULs	30 - 100	0	N/A	N/A	N/A	N/A	N/A
Beryllium	8	60.3	SSV's	<0.5 – 1.8	0	N/A	N/A	N/A	N/A	N/A
Asbestos	4	No asbestos detected								
Polycyclic Aromatic Hydrocarbons										
Naphthalene	8	1200	S4ULs	<0.04 – 0.14	0	N/A	N/A	N/A	N/A	N/A
Acenaphthylene	8	29000	S4ULs	<0.03 – 0.92	0	N/A	N/A	N/A	N/A	N/A
Acenaphthene	8	29000	S4ULs	<0.05 – 0.45	0	N/A	N/A	N/A	N/A	N/A
Fluorene	8	20000	S4ULs	<0.04 – 0.52	0	N/A	N/A	N/A	N/A	N/A
Phenanthrene	8	6200	S4ULs	<0.04 – 7.1	0	N/A	N/A	N/A	N/A	N/A
Anthracene	8	15000	S4ULs	<0.04 – 3.39	0	N/A	N/A	N/A	N/A	N/A
Fluoranthene	8	6300	S4ULs	0.18 – 19.06	0	N/A	N/A	N/A	N/A	N/A
Pyrene	8	15000	S4ULs	0.18 – 15.96	0	N/A	N/A	N/A	N/A	N/A
Benzo(ah)anthracene	8	62	S4ULs	0.17– 9.35	0	N/A	N/A	N/A	N/A	N/A
Chrysene	8	93	S4ULs	0.17 – 8.66	0	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	8	13	S4ULs	0.13 – 11.23	0	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	8	370	S4ULs	0.05 – 4.37	0	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	8	11	S4ULs	0.04 – 9.86	0	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	8	150	S4ULs	0.05 – 6.36	0	N/A	N/A	N/A	N/A	N/A
Dibenz(ah)anthracene	8	1.1	S4ULs	<0.04 – 1.27	1	N/A	N/A	N/A	N/A	N/A
Dibenzo(g,h,i)perylene	8	1400	S4ULs	0.05 – 6.53	0	N/A	N/A	N/A	N/A	N/A
Key All measurements in mg/kg unless otherwise stated Note: Null hypothesis (H ₀): the level of contamination is the same as, or higher than, the critical concentration SSVs – Soil Screening values for 2.5% SOM Public Open Space (POS) S4ULs – Soils screening values for 2.5% SOM C4SL Part IIA Category 4 Screening Levels (C4SL) LQM/CIEH S4ULs										

5.5.2 Summary of Test Results (Leachate)

The following table demonstrates the appropriate guideline values and recorded range in values of contaminants tested where these exceed the guideline values.

TABLE 7. SUMMARY OF LEACHATE TEST RESULTS

Tabulated Results For Leachate Samples				
Determinant	Units	EQS Source	EQS Level	Sample where EQS Level was exceeded
Metals and Metalloids				
Arsenic	ug/l	FW	50	None
Cadmium	ug/l	FW	5	None
Beryllium	Ug/l	FW	2000	None
Chromium	ug/l	DWS	50	None
Copper	ug/l	FW	28	None
Nickel	ug/l	FW	50	None
Lead	ug/l	DWS	25	None
Mercury	ug/l	DWS	1	None
Selenium	ug/l	DWS	10	None
Zinc	ug/l	DWS	5000	None
Boron	ug/l	DWS	2000	None
Vanadium	ug/l	FW	60#	None
Polycyclic Aromatic Hydrocarbons and TPH/BTEX				
Naphthalene	ug/l	DWS	10*	None
Benzo(a)pyrene	ug/l	DWS	0.01*	None
Total PAH	ug/l	SW*2	0.20-1.0	None
Total TPH	ug/l	DW	300	None
Notes DWS = UK Drinking Water Standards WSR = Water Supply Regulations (Water Quality) 1989 SW = Surface Waters (Abstraction for Drinking Water) 1996 FW = Freshwater standard WHO = World Health Organization Guidelines for drinking water USEPA = United States Environmental Protection Agency * EQS for Total PAH 0.1ug/l but no EQS for individual PAH isomers except Benzo(a)pyrene and Naphthalene # hardness of 80-365mg/l CaCO ₃ *2 Surface water Standards either DW1 – physical treatment to be transformed for drinking water or DW3 – Intensive physical and chemical to be transformed for drinking water				

5.6 Discussion of Test Results

5.6.1 Assessment of Test Results (Human Risk) Made ground and Topsoil

The above assessments of samples of made ground have revealed that all determinants assessed were found to be present at concentrations below the UCL Tier 1 SAC for *Public Open Space (POS) Parks* except for dibenzo(ah)anthracene recorded in a single sample from BH1 (1.00m depth) with a value of 1.27mg/kg which exceeded the relevant Tier 1 SAC of 1.1mg/kg.

5.6.2 Assessment of Test Results (Vegetation)

In order to assess the risk posed to vegetation on site from potentially phytotoxic contaminants, the concentrations of arsenic, chromium, copper, zinc, boron and nickel were compared against values given in BS 3882:2015 '*Specification for Topsoil*', the ICRL Guidance Note 70/90 and for values not stated in these publications reference has been made to ICRL 59/83 for boron and the Dutch ecotoxicological intervention value for total chromium (trivalent).

Based on the pH values the mean average of which is 8.4pH, the concentrations of copper, zinc, nickel, arsenic, boron and chromium were compared against the appropriate guidelines of 200mg/kg, 1000mg/kg, 110mg/kg, 250mg/kg, 7mg/kg, and 230mg/kg respectively.

None of the determinants recorded by the chemical analysis were found to exceed the adopted phytotoxic screening values. Therefore, the existing ground conditions does not pose a risk to potential phytotoxic receptors.

5.6.3 Assessment of Test Results (Groundwater – Aquifer Risk)

The results of the leachate analyses revealed that all determinants, fell below their respective Environmental Quality Standards EQS FW, SW, WSR or DWS values.

5.6.4 Asbestos

No individual fibres or ACMs recorded in four samples.

5.7 Waste Acceptance Criteria Testing

As it is anticipated that soil will be removed from the site, as a result of surplus material excavated from excavations and service trenches and any remedial activity, it will be necessary to subject the soil to leachate analysis in accordance with WAC guidelines for classification purposes prior to export to landfill.

To further classify the waste soil for landfill disposal, Waste Acceptance Criteria (WAC) testing should be undertaken on Non-hazardous classification soils in order to determine whether these soils can be classified as inert or non-hazardous.

This supplementary leachate analysis can be undertaken once the area of excavation and the maximum depth of dig has been concluded in order to determine the volumes of disposal for export.

Uncontaminated soil and stones, including naturally occurring sands and clays, may be accepted in an inert landfill without testing, provided that it is not topsoil or peat and excludes soil from contaminated sites. Inert waste should not undergo change, will not burn, react, biodegrade or adversely affect human health or the environment. It should not contain metals or plastics.

Analytical results relevant to the materials being disposed of should be provided to the landfill operators or waste management contractors to confirm whether it meets their license agreements and to confirm tipping costs.

The Landfill Regulations dictate that all waste must be treated before going to landfill. This treatment should fulfil all of the following three criteria:

- Physical, thermal, chemical or biological process including sorting.
- Change the characteristics of the waste.
- Reduce the volume, reduce the hazardous nature, facilitate its handling or enhance its recovery.

The most basic method of pre-treatment is sorting of the waste and recycling any possible materials, many waste disposals companies will have on-site recycling facilities that will be able to undertake this process at the landfill site. However, if treatment would not reduce its quantity or the hazards it poses to human health or the environment, then all three steps may not be necessary. The exception is inert waste for which treatment is not technically feasible.

The Environment Agency expect all landfill operators to obtain written evidence that the waste they accept has been pre-treated. We recommend that a signed certificate should be obtained describing the treatment to give to the receiving landfill. Further testing may be required after the treatment before the soil is accepted by the relevant landfill.

As a result of the general construction and remedial works it is likely to be necessary to remove surplus material from the site in association with excavations for foundations. Thus, an assessment of the waste categorisation has to be undertaken in accordance with the regulatory and guidance framework set out in Technical Reference Document 1².

When waste is intended for disposal at a suitably licensed landfill site it is necessary for the producer (i.e. the developer or consultant on their behalf) to identify, among other general information, the following:

- The List of Waste (LoW) code for the waste.
- The relevant hazardous property (HP1 to HP15).
- The landfill class where the waste may be accepted.
- Waste Acceptance Criteria (WAC) testing results.

Relevant information on the above can be found in WM3¹⁵ and is outlined in Technical Reference Document 1.

List of Waste (LoW) code

Based on the chemical analysis results for the soils on the site, including the 'solid' analysis and leachate (WAC) analysis for the made ground soils (BH1 1.00m depth) and the information presented in Technical Reference Document 1, it is anticipated that the most suitable LoW codes for the site will be:

- 17 05 03 (soils and stones containing hazardous substances).
- 17 05 04 (soils and stones other than those mentioned in 17 05 03).

Hazardous waste codes and soil waste classification

For the determination of whether the made ground soils revealed on the site are hazardous, the chemical analysis results obtained should be presented to the landfill operator of choice in order to demonstrate compliance with WAC guidelines.

A separate Basic Characterisation Report may be required once the final design depths have been confirmed for the new buildings and the likely volumes of all excavations have been established. It is likely that three basic categorisation schedules relating to the made ground, topsoil and natural strata will be required. A HazWaste assessment should be undertaken to determine the waste classification prior to off-site disposal.

² EA 'Guidance on the classification of and assessment of waste (1st Edition 2015) Technical Guidance WM3

6.0 CONTAMINATION RISK ASSESSMENT

6.1 Risk Assessment, Evaluation and Management

The following assessment is based on the development of the site for a new school. Should an assessment of the contamination risks to any other development of the site other than the foregoing then the results of this investigation would need to be re-evaluated.

In accordance with the current UK guidance, a source - pathway - target model has been developed based on the information available. This conceptual model has been used to determine the significance of potential pollutant linkages in line with CLR11.

6.1.1 Conceptual Model

The chemical test results have revealed the site (made ground) is contaminated with elevated Dibenzo(a,h)anthracene limited to the made ground at a single location (BH1 1.00m).

The conceptual site model (CSM) of the potential risks for the proposed type of development is summarised overleaf:

TABLE 8 - RISK ASSESSMENT FOR SITE

Sources	Receptor	Pathway	Consequences of Pollutant Linkage	Probability of Pollutant Linkage	Risk Assessment*	COMMENTS AND RECOMMENDATIONS
Present and Construction Phase and Proposed end-use						
Elevated dibenz(ah)pyrene in made ground	Construction and ground workers and maintenance workers	Dermal absorption through handling Ingestion of soil through handling Inhalation of airborne dust	Mild	High	MODERATE	Construction workers in contact with soil should use correct PPE including appropriate clothing. Site to be classified in accordance with CIRIA Report 132 <i>A guide for safe working on contaminated sites</i>. For construction works at the site, ground related risk would be evaluated by design and construction specific H & S risk assessments, which most likely lead to implementation of standard health and safety protection measures such as the use of standard PPE, maximising the use of mechanical excavation plant and minimising hand excavation, reduced time in excavations and best practice for soil handling and prevention of dust generation from excavations and excavated material from leaving site. Site works should be undertaken in accordance with the guidelines prepared by the Health and Safety Executive (<i>Protection of workers and the general public during the development of contaminated land</i>) - Guidance Note HS(G)66 1991 and the requirements of the Local Authority Environmental Health Officer
	Future site users (School pupils and staff)	Dermal absorption through handling Ingestion of soil through handling and Inhalation of airborne dust	Mild	Unlikely	VERY LOW	Single hotspot of dibenz(ah)anthracene limited to a zone of carbonised matter between 0.80m and 1.80m depth in BH1, capped by a layer of uncontaminated clay mantle effectively acting as a cover preventing contact between source and receptor. This layer was not identified in any other location so assume this is highly localised. No action required, other than a watching brief during any groundworks within areas of proposed soft landscaping

TABLE 8 – RISK ASSESSMENT FOR SITE

Sources	Receptor	Pathway	Consequences of Pollutant Linkage	Probability of Pollutant Linkage	Risk Assessment*	COMMENTS AND RECOMMENDATIONS
Present and Construction Phase and Proposed end-use						
Elevated dibenz(ah)pyrene in made ground	Adjacent Users (school and golf course)	Migration via surface runoff	Mild	Unlikely	VERY LOW	Migration via surface runoff into neighbouring land is very low risk as the land is well drained and runoff can be avoided. Leachate concentrations are very low so any migration of surface drainage water down gradient (east) to the golf course will not affect these receptors When excavation work commences there is a risk of air-born dust generation so measures such as rapid removal of contaminated ground or wetting of surface should be implemented. Any temporary storage of stockpiled contaminated ground should be covered by sheeting to prevent the generation and migration of air-born dust.
	Flora and Fauna	Plant uptake, direct contact	Mild	Unlikely	VERY LOW	Phytotoxic chemicals (copper, boron, arsenic, nickel, chromium and zinc) and other metals at low concentration levels. Existing growth medium is suitable for vegetation.
	PROPERTY: Buildings (End users) and buried concrete)	Direct contact, permeation of organic chemicals affecting buried concrete	Negligible	Unlikely	VERY LOW	Buried concrete to be designed in accordance with BRE Special Digest 1. The elevated levels of PAH and lead will not materially affect buried concrete and the sulphate, pH and sulphur test results should be used to determine the concrete classification.
	PROPERTY: Buildings buried services (e.g. potable water pipes)	Direct contact, permeation of organic chemicals affecting plastic pipes	Mild	Medium	MODERATE/ LOW	Water pipes installed in accordance with UKWIR 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. Very Low risk in natural soils but elevated within made ground soils due to elevated PAH concentrations. Further chemicals testing may be required once buried services routes are scheduled
* Risk Assessment Methodology presented in rear of report in Appendix B						

6.2 Conceptual Model/Risk Assessment Conclusions

Quantitative risk assessments using a standard methodology in relation to the proposed development, found the land to present a very low, moderate/Low, and moderate geoenvironmental risk to the identified receptors based on laboratory test data. The very low risks can be removed from further discussion while the remaining risks should be addressed as identified overleaf:

Moderate Risk Scenarios:

- Ground workers at risk from contact with dibenz(ah)pyrene contamination in the made ground

Moderate/Low Risk Scenarios:

- Buried potable water pipes at risk from permeation by elevated PAH contamination in the made ground

6.2.1 Conceptual Model/Risk Assessment Conclusions

- Human Receptors (future site users and site workers)

The risk assessment has shown that the concentration levels of speciated PAH poses a significant risk of causing harm to the receptors identified in the conceptual model.

The site investigation has revealed a potential risk to humans from contact with PAH contamination. This contamination will pose a risk to human health through exposure pathways including skin contact, ingestion (soil pica - children particularly) of soil particles and inhalation of dust particles.

Exposure to organic hydrocarbons contamination via dermal contact, ingestion or inhalation can lead to acute short term effects such as dermatitis and respiratory difficulties or chronic conditions such as neurological or carcinogen damage and may affect the development of vital tissues and organs in young children and the unborn child and may cause cancer.

- Construction Workers and future groundworkers

The development is to be carried out under the Construction (Design and Management) Regulations 2015 with the client appointing the successful contractor as the Principal Contractor and a CDM co-ordinator. As such the Principal Contractor is to produce, prior to the commencement of the works a Health and Safety Plan, which includes risk assessments, COSHH assessments and detailed method statements.

Site works should be undertaken in accordance with the guidelines prepared by CIRIA Report 132 *A safe guide for safe working on contaminated sites* and the requirements of the Local Authority Environmental Health Officer.

Assessment of risk should be undertaken for all employees working on site in accordance with *The management of Health and Safety at Work regulations (MHSW)* and *Control of Substances Hazardous to Health Regulations (COSHH)*.

Appointed contractors will need to undertake prior health and safety risk assessments and adopt a system of safe working to mitigate any potential risks in line with CDM Regulations and Occupational exposure limits as set by the Health and Safety Executive.

- Buried water pipes

Elevated organics within made ground is likely to degrade PVC/PE pipes. Water supplies may be tainted and power lines penetrated leading to a potential source of ignition. Drinking water pipes specifically will be required to be protected against permeation and corrosion by contaminants in accordance with UKWIR 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' Threshold Levels for Determining Pipe Material, unless it can be demonstrated all contaminated soils above threshold levels have been remediated. Water pipes installed within natural ground will not require special measures.

6.3 Conclusions

The ground investigation has revealed an isolated exposure of elevated dibenz(ah)pyrene at a depth of 0.80m within a zone of black carbonised sand recorded between 0.80m-1.80m depth. Although the concentration is greater than the accepted Soil Guidance Value for the adopted land use scenario GIS consider this to be encapsulated or 'capped' by uncontaminated 'clean' soil which effectively provides a barrier to contact with site users. Therefore, the source pathway receptor link is broken which means the site can be developed without interventionist remedial work.

7.0 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

7.1 Proposed Development

The proposed development comprises a new 6th Form classroom block extending out from the existing classroom block. It will comprise a three-storey structure of part masonry walls and possible localised column loads.

The bearing loads have not been made available but are anticipated to be 110kN/m for perimeter wall loads and up to 500Kn for column loads.

7.2 Building Regulations

Current Approved Document A of the building Regulations references Eurocodes and their UK National Annexes as practical guidance in meeting part A requirements. Approved document A advises there may be alternative ways of achieving compliance with requirements where it can be demonstrated that the use of withdrawn standards no longer maintained by the British Standards Institution continues to meet Part A requirements.

This chapter also provides building foundation design parameters ('Traditional Methods') which relate (in part) to withdrawn British Standards as we understand that the development will likely follow such "traditional" method of design and construction. It is for the foundation designer to select the design methodology and demonstrate compliance with part A requirements. Should it be required GIS can provide a foundation strategy for the proposed development and geotechnical design parameters to comply with Eurocode 7 (BS EN 1997-1:2004 '*Geotechnical Design – part 1 General Rules*') and the corresponding UK National Annex).

7.3 Geotechnical Assessment

The site comprises a variable thickness of made ground superposing some residual superficial deposits and bedrock clay.

Made ground was encountered over the whole site forming a raised platform above lower lying neighbouring land due east. It is thought the made ground was introduced prior to development of the existing school, replacing the mantle layer of superficial deposits, of which a remnant was identified in BH2. The existing school is constructed upon a layer of poor quality and variable made ground material which extends down and beyond 1.20m depth.

A pocket of superficial deposits recorded in BH2 extended down to the bedrock at 1.70m depth comprising soft black organic compressible clay.

The bedrock clay comprises generally firm becoming stiff brown and light grey clay with a little gravel in the upper mantle layer. It is classified as high/very plasticity and medium to high volume change potential.

Groundwater was not initially encountered during site work but has since developed as a standing level at depths of 1.54m/1.71m (26.09.23)

Infiltration test data demonstrate generally moderate drainage of the made ground soils.

Chemical test data indicates neutral/alkaline pH values and low sulphur and slightly elevated sulphate concentrations.

There are a number of trees located within and adjacent to the development footprint which are classified as low/high³ water demand species. The distance from the trees to prospective foundations will be critical to foundation design with respect to clay shrinkage/swelling.

7.4 Geotechnical Hazards

A summary of commonly occurring geotechnical hazards is given in Table 9 together with an assessment of whether the site may be affected by each of the stated hazards

TABLE 9. Summary of Potential Hazards that may affect site

Hazard Category	Hazard Status on Investigation Findings	Engineering Considerations/Comments
Shrinkable Clay Soils	Made ground soils are classified as low/Medium volume change potential while Bedrock soils are classified as High Volume change potential	Design to NHBC Standards Chapter 4 – Building near trees- use worst case scenario for design purposes
Tree Growth	Existing and new tree growth will require foundation design to offset potential risk from clay soil swell and shrinkage	Design to NHBC Standards Chapter 4 – Building near trees- use worst case scenario for design purposes
Made ground	Extensive and localised deep made ground on more elevated ground	Consider piles or ground improvement techniques for support
Groundwater table	Groundwater is recorded at a range of depths but generally shallow between 1.54m/1.71m	Will affect permanent works (Foundations and other buried substructures) and temporary works and any open excavations
Instability and collapse	Open excavations within made ground strata are likely to become highly unstable in the short term	Open excavations must be supported or cut back to a safe angle of repose not less than 1:4 to prevent collapse
Adjoining structures	New structure will abut existing structure which is supported on insignificant strip foundations upon loose unstable made ground soils	Consider deep piles for new structure at safe distance from existing to ensure continued stability of existing.

³ NHBC Standards – Chapter 4.2 Building near trees

7.5 Site Preparation and Excavation

It should be ensured that scheduled clearance of the existing infrastructure (buried drain runs) should be completed because if these were left in place they could provide hard spots for foundations.

7.6 Foundation Design

Assessment of the foundation options relevant to the proposed design build are predicated on the basis of ground conditions, anticipated bearing pressures, site history, design layout and the geotechnical hazards highlighted in Table 9.

As a result of a combination of factors, including deep made ground, high bearing loads exceeding the carrying capacity of the bedrock clay, proximity to the existing building and the proximity of high water demand trees, GIS consider the only safe sustainable foundation solution would be to opt for deep pile foundations.

Although a range of generic pile options are available, we have provided estimates for pile safe working loads for CFA piles.

The high engineering grade of the cohesive bedrock soils exposed across the site will provide a suitable stratum for skin friction and end-bearing parameters for cast-in-situ piles. The results of the SPT 'N' values and triaxial compression tests have been used in calculation of pile design.

Work undertaken by Stroud MA, *The Standard Penetration Test in Insensitive Clays and Soft Rocks* 1974, determined a relationship between SPT 'N' values and the undrained shear strengths of over-consolidated clay and subsequent work undertaken on glacial materials confirmed there to be a correlation between the 'N' value and undrained shear strength.

The relationship was of the form:

$$C_u = F_1 \times N$$

Where C_u Undrained shear strength
 F_1 Factor

It was determined by Stroud that F_1 varied between 4kN/m² for material of high plasticity and 6kN/m² for material of low plasticity.

It is considered that for this site a value of $F_1 = 4\text{kN/m}^2$ (where N value is >25 and 4.5kN/m² (where N value is <25) would be appropriate.

Estimates of pile working loads for a range of pile diameters 300mm/450mm bored cast in-situ pile, end bearing within the bedrock clay are presented overleaf.

These are for guidance purposes only and actual working loads should be obtained from specialist piling contractors based on their own particular method of pile installation and experience in similar ground conditions.

These should be designed as tension piles, reinforced to resist uplift from rehydration and swelling brought about changes in environmental conditions.

The following table gives a safe working load with a Factor of Safety of 3.0.

TABLE 10 – PILE DESIGN

Borehole No.	Pile Depth m	Estimate of Working Load (kN)	
		Pile diameter (mm)	
		300	450
One	12.00	152	230

First 2.50m of pile length (GL-2.50m depth) have not been used in design due to made ground and tree root growth

The values presented above ignore the first 2.50m of ground due to loose state of the made ground and the possibility of clay soil desiccation and heave potential which should be resisted by installation of a suitable reinforcement cage with sufficient length to resist uplift from heave.

A suitable working platform will be required to support the piling equipment and guidance in this regard should be obtained from BRE 470 2004 Working Platforms for Tracked Plant: Good Practice guide to the design, installation, maintenance and repair of ground-supported working platforms.

7.7 Ground Floor Slab

The subgrade soil conditions beneath the footprint of the ground floor is loose made ground, therefore GIS recommend the floor slab is suspended to offset the possibility of future consolidation.

Reference to NHBC Standards, Chapter 5.2 - *Suspended Ground Floors* is recommended.

7.8 Excavations and Ground Stability

Excavations for service trenches will remain stable in the short term but will require temporary shoring if left open for a prolonged period of time. It is recommended all excavations in excess of 1.20m depth should be supported at all times or cut back to a safe angle of repose (approximately 33°) although steeper angles (50°) may be permitted for short term duration.

Excavations should be regularly inspected by a competent person to ensure continued safety. Further advice on the safety of excavations can be obtained from the Construction Design and Management Regulations (2015).

Currently (September 2023), groundwater levels are rising and are expected to rise continually throughout the winter period.

If excavations progress during the early spring at the peak of high groundwater table then dewatering techniques may be required to facilitate deep (>1.00m excavations). If, however site work progresses during the summer months then water levels will fall back and excavations may remain dry.

7.9 Sub-Surface Concrete

The characteristic value for the water-soluble sulphate results for the soils tested falls into Design Sulphate Class of DS-1 for made ground and superficial Deposits and DS1/DS3 for the bedrock soil profiles in Table C2 of the BRE Special Digest 1.

As the site is potentially pyritic and assuming the concrete may be exposed to disturbed ground in which pyrite may oxidize to sulphate, the oxidisable sulphide content of the soils must be calculated using the total sulphur and acid soluble sulphate results.

The results indicate a none of the tested samples has an oxidisable sulphide content which exceeds the 0.3% level given in the Digest and indicates that pyrite is probably not present.

The site is classified as not brown-field with mobile groundwater conditions. Therefore based on the characteristic pH value of 8.1pH, according to Table C2, the Aggressive Chemical Environment for Concrete (ACEC) Class is AC-3. Therefore, it is recommended that a Design Sulphate Class of DS-3 and ACEC Class of AC-3 would be appropriate for concrete in contact with the London Clay Formation.

For all substructures, precast or cast insitu concrete within made ground and superficial deposits profile, DS-1 and AC-1 classification would be appropriate.

7.10 Soakaway Assessment

In consideration of the drainage area and the permeability test results, the following table provides indicative infiltration drainage design.

TABLE 11 – INDICATIVE INFILTRATION DRAINAGE DESIGN

Infiltration Test Location and depth	Slowest Infiltration Rate	Soakaway for Impermeable Area for 1 in 100 year up to 24 hour event (Note 1)	Comments
SA1 – 0.60m	8.66×10^{-6} m/sec	Shallow Trench Soakaway: (50m² drainage area) 5.20m x 5.20m (L x W) x 0.45m effective depth with 0.15m invert level Half empty time – 12.5 hours (0.52 utilisation factor – OK) Required storage 3.43m ³ Provided Storage 3.65m ³ (0.94 utilisation factor OK)	Conventional cubiform chamber design will be suitable for discharge
SA2 – 1.20m	8.16×10^{-5} m/sec	Shallow Trench Soakaway: (50m² drainage area) 2.40m x 2.40m (L x W) x 0.95m effective depth with 0.25m invert level Half empty time – 0.61 hours (0.03 utilisation factor – OK) Required storage 1.60m ³ Provided Storage 1.64m ³ (0.97 utilisation factor OK)	Conventional cubiform chamber design will be suitable for discharge
Notes: 1. BRE 365 Soakaway Design methodology, based on drainage through soakaway sides only (effective depth) with a factor of safety of 1 is applied as it assumes the base may silt up with time, granular backfill porosity with 30% free volume design aims for a soakaway to be less than half full in 24 hours following a storm event based on M5-D 60 minutes and up to 24 hours rainfall event 2. An allowance has been made for possible climate change effects of 40% to the peak rainfall intensity for design storm events.			

The indicative infiltration drainage design is for illustrative purposes only, a more specific design based on the actual land area available and various storm duration permutations should be considered. It should be noted these calculated values have been based on a software programme produced from the official BRE Digest 365 Soakaway Design.

The test data has revealed that local soakaway drains are practicable over the site for aggregate filled chambers (30% free volume).

Chamber depths should be limited to a depth equivalent to 0.50m above standing groundwater level, which at this site at its shallowest point, is 1.54mm (26.09.23) which is expected to rise during autumn and spring months.

Final chamber depth values can only be determined pending the results of the groundwater monitoring programme which should be designed for 'worst case' scenarios.

Local soakaways should be sited at least 5.00m distance from foundations in order to mitigate risk of erosion of soils from beneath and around existing and proposed shallow foundations.

Shallow permeable paving will be effective for proposed hardstanding pavements for Type A Full infiltration or Type B Partial infiltration in accordance with CIRIA 753 *The SuDS Manual*.

Leachate concentrations within the made ground are very low and direct discharge of surface water drainage waters into this stratum will be permissible without creating new migration pathways to the groundwater aquifer.

7.11 Road and Hardstanding Pavement Design

Results of the in-situ CBR tests within made ground formation reveal bearing value of 3% for subgrade described as brown/light brown rarely clayey gravelly sand.

On the basis that the in-situ test was undertaken within naturally hydrated soil we advise a CBR Design value of 3% should be adopted for hardstanding pavements within made ground subgrade.

We note the eastern side of the site is populated by trees, which may affect the long term serviceability of road pavements as proposed, particularly in respect of possible subgrade shrinkage. Therefore measures to ameliorate these effects should be considered including an allowance for increasing the depth of pavement and/or provision of a root barrier.

7.12 Ground Gas Assessment

Initial Ground test results from three site visits have revealed absence of methane while carbon dioxide concentrations were very low in BH2 and elevated in BH1.

Therefore, based on the existing data the site has been classified as LOW hazard potential and classified as **Characteristic Gas Situation 2 (CS2)**. The full report will be submitted on the 10th November 2023.

8.0 REFERENCES

1. British Standards Institute, Code of Practice for Ground Investigations BS 5930:2015+A1:2020
2. Eurocode 7 BS EN 1997-2 (2007) Geotechnical Design - Part 2 *Ground Investigation and Testing*
3. BS EN ISO 14688-1: (2018) *Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description*
4. BS EN ISO 14688-2: (2018) *Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Principles for a classification*
5. BS EN ISO 22476-3: (2005) *Geotechnical Investigation and Testing - Field Testing Part 3 Standard Penetration Test*
6. British Standards Institute, Methods of Test for Soils for Civil Engineering Purposes, BS 1377 : 1990
7. Construction Design and Management Regulations (2015).
8. BRE Digest 1 (2005) - Concrete in Aggressive Ground
9. BS EN ISO 17892: 2018 Geotechnical Investigation and Testing Laboratory testing of soil' various clauses
10. DG BRE Digest DG365 - Soakaway Design
12. NHBC Standards, Chapter 5.2 - *Suspended Ground Floors*
13. Department of the Environment, Food and Rural Affairs and The Environment Agency - The Contaminated Land Exposure Assessment (CLEA) Model 2009
14. WS Atkins ATRISK^{soil} Soil Screening Values (SSVs)
15. BS 10175: 2011+A2:2017 - *Investigation of potentially contaminated sites. Code of Practice*
16. The LQM/CIEH S4ULs for Human Health Risk Assessment
17. Part IIA Category 4 Screening Levels (C4SL)

SERVICE CONSTRAINTS

1. This report and the site investigation (the “Services”) were compiled and carried out by Ground Investigation Services (Southern) Ltd (GIS) in accordance with the terms of a contract between GIS and the “client”. The Services were performed by GIS with skill and care taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between GIS and the client.
2. Unless otherwise agreed the Services were performed by GIS exclusively for the purposes of the client. Unless expressly provided in writing, GIS does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, be made known to any third party, such party using any information within the report do so at their own risk.
3. It is GIS’s understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without GIS’s review and advice shall be at the client’s sole and own risk.
4. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of GIS. In the absence of such written advice of GIS, reliance on the report in the future shall be at the client’s own and sole risk.
5. The Services are based upon GIS’s observations of existing physical conditions at the site together with GIS’s interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which GIS was reasonably entitled to rely.
6. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site.
7. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.

CLIENT: Thinking Buildings

LOCATION: Alexandra Park School, Bidwell Gardens, London
N11 2AZ

REPORT NO.: S.6125

DATE: September 2023

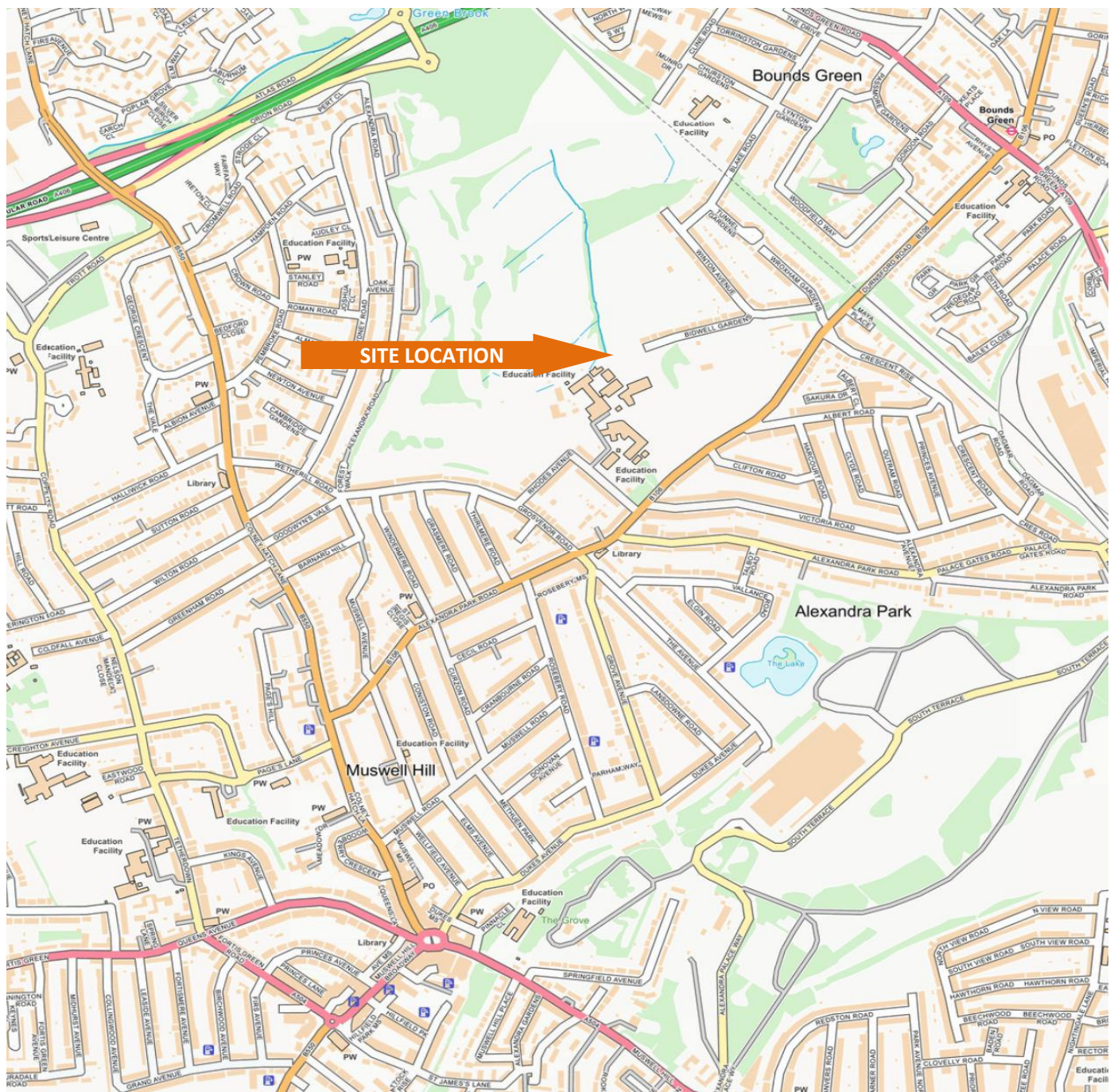
APPENDICES

APPENDIX A	SITE DATA
APPENDIX B	LABORATORY TEST RESULTS

APPENDIX A

SITE DATA

Figure 1	Site Location Plan
Figure 2	Proposed Development Plan
Figures 3	Borehole/Trial Pit/CBR Location Plan
Key 1	Notes and Abbreviations Sheet
Figure 4 - 6	Borehole Logs
Figures 7 & 8	Trial Pits (infiltration)
Figures 9 & 10	Infiltration Test Data
Figures 11 - 12	Inspection Pit Logs
Figure 13	California Bearing Ratio Test



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 GROUND INVESTIGATION SERVICES (Southern) Ltd

CLIENT: Thinking Buildings

SITE: Alexandra Park School, Bidwell Gardens, London N11 2AZ

Date: September 2023

**Ground Investigation Services
(Southern) Ltd**

40 Home Close, Wootton
 Abingdon OX13 6DD
 Tel 01865 326011

GIS (Southern) Ltd

SITE LOCATION PLAN

Report No.
 S.6125

Fig
 1



Client: Thinking Buildings

Site: Alexandra Park School, Bidwell Gardens, London N11 2AZ

Date: September 2023

Ground Investigation
Services (Southern) Ltd
40 Home Close, Wootton OX11 6DD
Tel 01865 326011

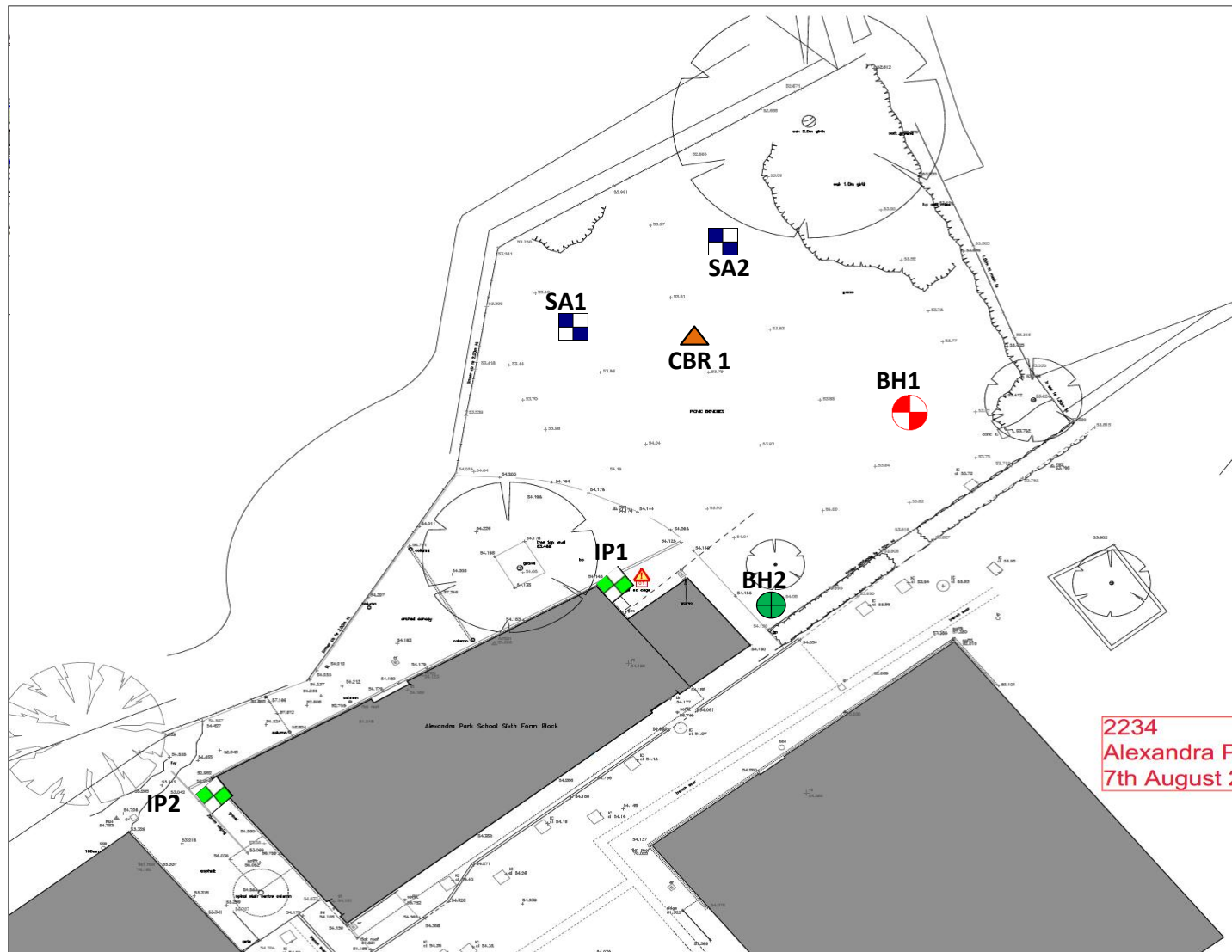
PROPOSED DEVELOPMENT PLAN

Report No.

S.6125

Fig

2



Client: Thinking Buildings

**Site: Alexandra Park School, Bidwell Gardens,
London N11 2AZ**

Date: September 2023



Light Cable Percussion Borehole



Windowless Sampling Borehole



In-situ CBR test



Foundation Inspection Pit



Trial Pit and Infiltration Test

Ground Investigation
Services (Southern) Ltd
40 Home Close, Wootton OX13 6DD
Tel 01865 326011

BOREHOLE/TRIAL PIT/CBR LOCATION PLAN

Report No.

S.6125

Fig

3

NOTES ON EXPLORATORY HOLE RECORDS

GENERAL NOTES

1 OPERATING PROCEDURES

The procedure used for cable percussion boring, rotary drilling, trial pitting, sampling, in situ and laboratory testing and sample descriptions are generally in accordance with BS5930:2015+A1:2020 'Code of practice for ground investigations', BS EN ISO 14688-1:2018 'Geotechnical investigation and testing – Identification and classification of soil – Part 1 Identification and description', BS EN ISO 14689-1:2018 'Geotechnical investigation and testing – Identification and classification of rock – Part 1 Identification and description' as appropriate, and BS1377:1990 'Methods of test for soils for civil engineering purposes', unless stated otherwise.

2 GROUNDWATER

Exploratory hole water levels are recorded together with the depths at which seepages or inflows of water are detected. These observations are noted on the Records, but may be misleading for the following reasons:

- a) The exploratory hole is rarely left open at the relevant depth for a sufficient time for the water level to reach equilibrium.
- b) A permeable stratum may have been sealed off by the borehole casing.
- c) Water may have been added to the borehole to facilitate progress.
- d) The permeability may have been altered by the excavation/boring/drilling process.

Standpipes or piezometers should be installed when an accurate record of groundwater level is required, however, it should be noted that groundwater levels may vary significantly due to seasonal, climatic or man made effects. Water levels recorded during the investigation and any advice or comment made accordingly may, therefore, not be appropriate to particular foundation, geotechnical design, or temporary works solutions. Long term monitoring of standpipes or piezometers is always recommended when water levels are likely to have a significant effect on design.

3 CHISELLING

The remarks in the Borehole Records contain information on the time spent advancing the borehole by 'Chiselling Techniques', and the depth of borehole over which it was required. Such information may be affected by a wide range of variable factors, unrelated to the geotechnical properties of the strata. Such factors include, but are not restricted to: plant, equipment and operator. The data should, therefore, only be used subjectively and with extreme caution.

4 IDENTIFICATION AND DESCRIPTION OF SOILS - SEE SEPARATE SHEET

The identification system follows the Company's Engineering: Geotechnical Procedures Manual which is based on BS EN ISO 14688-1:2018 and appropriate clarifications in the National Foreword, BS 5930:2015 and BS EN ISO 14689-1:2018

Relative density terms are given where supported by SPT N values, with the exception of Made Ground. The field assessment of compactness or relative density for coarse grained soils is only given on trial pit records where appropriate assessment of the soils has been undertaken.

Where the terms 'soft to firm', 'firm to stiff' etc. are used they indicate a strength which is close to the borderline between the two terms and cannot be precisely defined by inspection only, and/or which is indicated as borderline or ranging between the two terms after consideration also of in situ and laboratory test results. Consistencies may have been amended in the light of test results

Where 'to' links two terms, as in 'slightly sandy to sandy' this again represents a borderline case or a range, where the precise proportions cannot be determined as outlined previously.

The name of the geological formation is only given where this has been requested and can be determined with confidence (see Clause 41.5 of BS 5930:1999).

5 INTERPRETATION OF THE RESULTS OF THE INVESTIGATION

The description of ground conditions encountered and any engineering interpretation included in the report are based on the results of the boreholes and trial pits and the field and laboratory testing carried out. There may be ground conditions at the site which have not been revealed by the investigation and consequently have not been taken into account.

Any interpolation or extrapolation of strata between exploratory holes shown on any cross sections or site plans is an estimate only of the likely stratification based on general experience of the ground conditions and is subject to the interpretation of the reader.

The term "TOPSOIL" is used in this report to describe the surface, usually organic rich, layer including turf, subsoil and weathered material with roots. The use of this term may not imply that the soil satisfies the requirements of Clause 3 of BS 3882:2007, 'Specification for topsoil', or is suitable for general horticultural and agricultural purposes.

Laboratory test results in this report give the soil properties of individual specimens tested under specified conditions. Individual results or groups of results may not be appropriate for use as design parameters for some geotechnical analyses. The samples may be non-representative, disturbed internally, or prepared and tested under conditions suited for different geotechnical applications. Unless the selection of design parameters is discussed in this report, it is recommended that the advice of a Geotechnical Specialist is sought.

NOTES ON EXPLORATORY HOLE RECORDS

IN SITU TESTING AND SAMPLING

STANDARD PENETRATION TESTS

- S() Standard Penetration Test (SPT). A 50mm diameter split barrel sampler is driven 450mm into the soil using a 63.6kg hammer with a 760mm drop. The penetration resistance (also known as the 'N' value) is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm which is taken through any ground which may be disturbed at the base of the borehole. The test is usually completed when the number of blows recorded during the test drive only reaches 50 in soils or 100 in weak rock. If a sample is not recovered in the sampler, a disturbed sample is taken on completion of the test and given the same depth as the top of the Standard Penetration Test drive.
- C() Standard Penetration Test carried out with a 60 degree cone. The test is usually conducted in coarse granular soils or weak rock using the same procedure as for the SPT, but with a 50mm diameter, 60 degree apex, solid cone fitted to the split barrel. A bulk disturbed sample is taken and given the same depth as the top of the test drive.
- The depth on the borehole record at the left hand side of the 'depth' column is that at the start of the normal 450mm penetration. Where the full penetration of 300mm for the test drive is obtained, the penetration resistance ('N' value) is reported in the 'SPT Blows/N' column. If the full penetration of 300mm in the test drive is not obtained, then the length of drive (test length in mm) and the penetration resistance (number of blows) are both reported. Blows through the initial seating drive (normally 150mm) are not reported. Both tests are based on BS EN ISO 22476-3 (2005) Geotechnical Investigation and Testing – Field Testing Part 3 Standard Penetration Test and BS5930:2015+A1:2020 'Code of practice for ground investigations'
- * in the 'Test Length' column denotes that the blows and penetration were all in the initial Seating Drive section.

OTHER IN SITU TESTS

The following in situ tests are reported on the **Exploratory Hole Records**, in the 'Test' or 'Type' and 'Results' columns where appropriate.

- k In situ Permeability Test - refer to detailed test results for permeability values
- PMT Pressuremeter Test - refer to detailed test results for modulus values, etc.
- VN/R() Borehole Shear Vane Test (undrained shear strength - c_u - in kPa) - refer also to detailed test results, N - 'Natural' or peak shear strength, R - Remoulded shear strength
- V() Hand Shear Vane Test (Direct reading of undrained shear strength in kPa). 'N' and 'R' as above. The values are indicative and should not be taken as being equivalent to laboratory test results. The Pilcon vane results have a factor varying from about a sixth for the 33mm vane to a third for the 19mm vane which reduces the BS1377 shear vane value. The values presented are therefore approximate and should be treated with great caution if used for design purposes
- PP() Pocket Penetrometer. Unconfined Strength (UCS) reported in kg/cm^2 to the nearest 0.25 kg/cm^2 or kPa with the same accuracy. Equivalent c_u in kPa is very approximately $\text{UCS} \times 50$. Pocket Penetrometers are an aid to logging of cohesive soils, the results are indicative and should not be relied upon. The equipment used is not calibrated
- CBR() California Bearing Ratio Test (CBR%) - refer also to detailed test results
- PID() Photo-Ionisation Detector Readings in headspace of small disturbed chemical samples. Result given in ppm by volume

SAMPLES

- U General purpose open tube sample. Sample normally taken with open tube sampler approximately 0.1m diameter and 0.45m long and driven with 80kg sinker bar and 56kg sliding hammer, unless noted otherwise. "XX" in U100 blows column denotes the number of hammer blows. The height of hammer drop can be variable depending on operator technique. Depths are given to the top of the sample if full penetration and recovery are achieved, otherwise actual lengths of penetration and recovery are given in the appropriate columns.
- U(X) General purpose open tube sample (X) mm diameter
- TW(X) Thin wall (push) sample (X) mm diameter
- P(X) Piston sample (X) mm diameter
- CBR Sample taken in CBR Mould
- D Small disturbed sample (plastic tub or jar with air tight lid)
- B Bulk disturbed sample (polythene bag, tied at neck - size dependent on purpose)
- W Water sample
- # Sample not recovered
- C Core sample (CS – short core, generally about 100mm; CL – long core, generally 200mm to 300mm)
- CD Sample for chemical analysis in a plastic tub K Sample for chemical analysis in an amber glass jar
- V Sample for chemical analysis in a glass vial CDKV Set of samples for chemical analysis as above
- WAC Sample for Waste Acceptance Criteria
- ES Environmental Sample EW Environmental Water Sample
-

Recommended symbols for soils and rocks – BS 5930:2015+A1:2020

	Made ground		Chalk
	Topsoil		Limestone
	Boulders and Cobbles		Conglomerate
	Gravel		Brecia
	Sand		Coal
	Silt		Shale
	Clay		Siltstone
	Peat		Sandstone
Composite soil types may signified By combined symbols, e.g.			Mudstone/Claystone
	Sandy CLAY with a trace of fine medium gravel		
	Silty slightly clayey SAND		

IDENTIFICATION AND DESCRIPTION OF SOILS

NOTES Identification and descriptive method and descriptions, generally in accordance with BS5930:2015 Section 6 clauses 41 and 43 and BS EN ISO 14688-1:2002. Additional notes relating to BS EN ISO 14688-2:2004 – modified terms for content of secondary fraction given in Annex B Table B1 are not comparable to 5930 and are not be used.

Organic Content :: Low – 2 to 6%; Medium - 6 to 20%; High - >20%. Terms not used on borehole records

Carbonate content - Only noted if field test with dilute HCl undertaken – Carbonate free if no effervescence; Calcareous if slight effervescence; Highly calcareous if strong reaction

Undrained shear strength - terms from laboratory or in situ tests not given on borehole records.

Very Coarse Soils – described by initially removing very coarse materials and describing residue before adding back the very coarse soils. If residue is cohesive then described as ' (COBBLES / BOULDERS) with low (cobble / boulder) content with (some / much etc) matrix of ' If residue is granular then described as ' with matrix of ' or as a coarse soil. **Cobbles** :- <10% - low cobble content; 10 to 20% - medium content; >20% - high content; **Boulders** <5% - low boulder content; 5 to 20% - medium content; >20% - high content

 GROUND INVESTIGATION SERVICES (SOUTHERN) LTD		Date September 2023	Borehole No. One
CLIENT Thinking Buildings		Ground Level (mTBM) 53.80	Co-ordinates Sheet 1 of 2
SITE LOCATION Alexandra Park School, Bidwell Gardens, London N11 2AZ		Boring Method: Light cable percussion	Diameter of casings and bore: 150mm Report No. S.6125

SAMPLES AND TESTS										Water	Reduced	Depth	Legend	Strata Description	Backfill/ Installation	Depth	
Depth metres	Type & No.	SPT records ratio = 71.2%					PID	Hand pen'	HSV	depth	Level	(thickness)					
		150mm	75mm	75mm	75mm	75mm											'N' Value
0.50	D1												0.40	Grass over dark brown clayey humic silty SAND with a little fine medium general stone gravel			
1.00-1.45	D2/S	7	3	2	1	1	7						(0.40) 0.80	Soft to firm brown and light brown friable sandy CLAY with some fine medium rare coarse gravel sized flints and rare glass and brick		1	
2.00-2.45	D3/S	2	2	2	2	3	9						(1.00) 1.80	Loose dark grey/black carbonised SAND with some fine medium coarse gravel sized general stone and burnt coal material and fine brick		2	
													(0.40) 2.20	Soft light brown intact CLAY with a little gravel sized flint and brick			
														MADE GROUND			
														Firm light brown weakly mottled light grey slightly gravelly CLAY. Gravel is fine medium coarse subrounded flint			
3.00-3.45	U4	29 blows for 100% full											(1.70)	3.00m - stiff		3	
3.50	D5																
4.00-4.45	D6/S	5	3	4	4	5	16						3.90	Stiff light brown intact CLAY		4	
5.00-5.45	U7	41 blows for 100% full															5
5.50	U8													5.50m - weakly fissured		6	
6.50-6.95	D9/S	4	3	4	5	6	18						(4.90)	6.50m - some grey mottling		7	
8.00-8.45	U10	58 blows for 100% full															8
8.50	D11												8.80	Stiff greyish brown to dark brown weakly fissured CLAY		9	
9.50-9.95	D12/S	7	4	5	6	7	22						(1.20)				
													10.00	LONDON CLAY FORMATION		10	

Casing Record			Chiselling record			Water level Observations (depths in metres below GL)							
Date	Diam' (mm)	Depth	Time	From (m)	To (m)	Date	Time	strike	Water level (after 20min)	Flow	Standing level	Casing depth	Remarks
22.08.23	150	4.00				22.08.23		dry					
						23.08.23	08.00				3.90*	nil	* recorded in well
Key			SPT/S	Split Spoon		REMARKS						Start date:	22.08.23
U	Undisturbed Sample		SPT/C	Solid Cone		Ground gas and groundwater well installed to 4.00m depth comprising 50mm diameter HDPE plastic slooted pipe from 1.00-4.00m with sand filter and plain pipe from GL-1.00m with bentonite seal and seal from 4.00-4.50m. Arisings from 4.50m-15.00m depths						End date:	22.08.23
B	Bulk sample		HSV	Hand Shear Vane								Logged by:	MPB
D	Disturbed Sample		Hand pen'	Hand penetrometer								Date	23.08.2023
W	Water Sample			Groundwater strike	(20							Approved by:	JH
E	Environmental Glass Jar/Plastic tub			Groundwater standing minutes duration)		Date	30.09.2023						
PID	Photo-ionisation Detector			Groundwater standing		Weather: Warm and dry						Checked by:	JMH
For explanation of symbols and abbreviations see preface to Borehole records. All depths in metres. Logged in accordance with BS5930:2015+A1:2020											Scale: 1:60	Date	03.10.23
Ground Investigation Services (Southern) Ltd 40 Home Close, Wootton OX13 6DD Tel 01865 326011			BOREHOLE LOG								Report No. S.6125		Figure 4



Date
September 2023

Borehole No.
One

CLIENT
Thinking Buildings

Ground Level (mTBM)

53.80

Co-ordinates

Sheet 2 of 2

SITE LOCATION

Alexandra Park School, Bidwell Gardens, London N11 2AZ

Boring Method:

Light cable percussion

Diameter of casings and bore:
150mm

Report No.
S.6125

[illegible]

Casing Record			Chiselling record			Water level Observations (depths in metres below GL)									
Date	Diam' (mm)	Depth	Time	From (m)	To (m)	Date	Time	strike	Water level (after 20min)	Flow	Standing level	Casing depth	Remarks		
22.08.23	150	4.00				22.08.23		dry							
						23.08.23	08.00				3.90*	nil	* recorded in well		
Key						REMARKS Ground gas and groundwater well installed to 4.00m depth comprising 50mm diameter HDPE plastic slooted pipe from 1.00-4.00m with sand filter and plain pipe from GL-1.00m with bentonite seal and seal from 4.00-4.50m. Arisings from 4.50m-15.00m depths Weather: Warm and dry						Start date: 22.08.23			
U	Undisturbed Sample (100mm diameter)			SPT/S	Split Spoon							End date: 22.08.23			
B	Bulk sample			SPT/C	Solid Cone							Logged by: MPB			
D	Disturbed Sample			HSV	Hand Shear Vane							Date 23.08.2023			
W	Water Sample			Hand pen'	Hand penetrometer							Approved by: JH			
E	Environmental Glass Jar/Plastic tub				Groundwater strike							Date 30.09.2023			
PID	Photo-ionisation Detector				Groundwater standing (20 minutes duration)	For explanation of symbols and abbreviations see preface to Borehole records. All depths in metres. Logged in accordance with BS5930:2015+A1:2020						Checked by: JMH			
												Date 03.10.23			
Ground Investigation Services (Southern) Ltd 40 Home Close, Wootton OX13 6DD Tel 01865 326011			BOREHOLE LOG									Report No. S.6125		Figure 5	

 GROUND INVESTIGATION SERVICES (SOUTHERN) LTD		Date July 2023	Borehole No. TWO
CLIENT Thinking Buildings		Ground Level (m OD) 54.10	Co-ordinates Sheet 1 of 1
SITE LOCATION Alexandra Park School, Bidwell Gardens, London N11 2AZ		Boring Method: Windowless Sampling	Diameter of (casings) and bore: 86, 96, 101 & 116 Report No. S.6125

SAMPLES AND TESTS										Water depth m	Reduced Level m (AOD)	Depth (thickness) metres	Legend	Strata Description	Backfill/ Installation	Depth
Depth metres	Type & No.	SPT records ratio = 79.9%				energy J/m	N Value	PID ppm	HSV kPa							
GL-1.00	1/U116									GL-1.00 80%				Grass over brown silty SAND with a little fine medium rounded flint and brick gravel		
1.00-1.45	2/DS	1	1	1	1	2	5			1.00-2.00 100%				Loose brown silty SAND with some fine medium gravel sized general stone, glass and brick		
1.00-2.00	3/U116													Soft light greyish brown mottled grey intact CLAY with some gravel sized brick and general stone		1
2.00-2.45	4/DS	0	2	1	2	3	8			2.00-3.00 100%				MADE GROUND		
2.00-3.00	5/U101													Soft black/dark grey and brown compressible silty organic CLAY with some decomposed roots and fine medium rounded flint gravel		2
3.00-3.45	6/DS	3	2	3	4	4	13			3.00-4.00 100%				SUPERFICIAL DEPOSITS		
3.00-4.00	7/U101													Firm olive brown and light grey intact CLAY with some fine roots		3
4.00-4.45	8/DS	3	3	3	4	4	14			4.00-5.00 100%				Firm to stiff orange brown intact CLAY with some cream silt partings and a little fine medium siltstone gravel		4
5.00-5.45	10/DS	1	2	3	3	3	11			5.00-6.00 100%						5
5.00-6.00	11/U101															
6.00-6.45	12/DS	3	3	4	4	5	16			6.00-7.00 100%						6
6.00-7.00	13/U96															
7.00-7.45	14/DS	3	3	4	5	6	18			7.00-8.00 100%						7
7.00-8.00	15/U86															
8.00-8.45	16/DS	3	4	5	6	7	22					8.00		LONDON CLAY FORMATION		8
																9
																10

Casing Record			Chiselling record			Water level Observations (depths in metres below GL)								
Date	Diam' (mm)	Depth	Time	From (m)	To (m)	Date	Time	strike	Water level (after 20min)	Flow	Casing level	Standing	Remarks	
						23.08.23		3.00		trace	nil			
						23.08.23	16.00				nil	dry		
Key						REMARKS						Start date: 23.08.23		
U	Undisturbed Sample		SPT/S	Split Spoon		Ground gas and groundwater well installed to 4.00m depth comprising 50mm diameter HDPE plastic slooted pipe from 1.00-4.00m with sand filter and plain pipe from GL-1.00m with bentonite seal and seal from 4.00-4.50m. Arisings from 4.50m-8.00m depths						End date: 23.08.23		
B	Bulk sample		SPT/C	Solid Cone								Logged by: MPB		
D	Disturbed Sample		HSV	Hand Shear Vane								Date 23.08.23		
W	Water Sample		Hand pen'	Hand penetrometer								Approved by: JH		
E	Environmental Glass Jar/Plastic tub			Groundwater strike		Weather: Warm, dry and sunny						Date 30.09.23		
PID	Photo-ionisation Detector			Groundwater standing								Checked by: JMH		
For explanation of symbols and abbreviations see preface to Borehole records. All depths in metres. Logged in accordance with BS5930:2015/A1:2020										Scale : 1:60		Date 03.10.23		
Ground Investigation Services (Southern) Ltd 40 Home Close, Wootton OX13 6DD Tel 01865 326011			BOREHOLE LOG								Report No. S.6125		Figure 6	



GROUND INVESTIGATION SERVICES (Southern) Ltd

40 Home Close, Wootton, Abingdon, Oxon OX13 6DD Tel 01865 326011

CLIENT

Thinking Buildings

SITE LOCATION

Alexandra Park School, Bidwell Gardens, London N11 2AZ

Date: September 2023

Ground Level (m) : 53.50

Orientation: East-west

Co-Ordinates (NGR):

TRIAL PIT

SA1

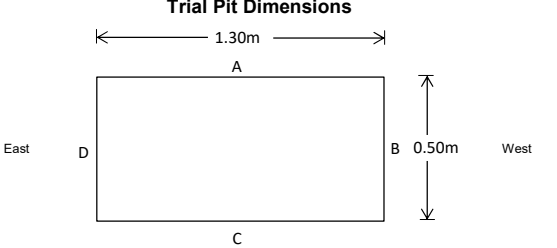
Sheet 1 of 1

Report No.

S.6125

SAMPLES AND TESTS						water	Reduced	Depth	Legend	STRATA AND DESCRIPTION
Depth	No.	Type	PID	Hand	HSV	depth	Level	(thickness)		
metres			% v/v	pen' kN/m2	kN/m2	m	m (AOD)	metres		
0.10		D/ES						0.15		Grass over brown and light brown indurated CLAY with a little gravel sized general stone
0.30		D/ES						(0.45)		Firm orange brown mottled grey friable CLAY with a little gravel sized fine medium general stone
0.50		D						0.60		Concrete hardcore
										MADE GROUND



Trial Pit Dimensions 		Date of logging: 21 August 2023 Excavation plant: 3T excavator Pit stability: Stable Weather: Warm, dry and sunny Groundwater (strike): ▽ dry Groundwater (standing): ▼ dry Logged by: SD Checked by: MPB
		General Remarks: Infiltration testing conducted in accordance with BRE Digest DG365 Soakaway Design

Scale 1:15

For explanation of symbols and abbreviations see preface to Borehole records. All depths in metres. Logged in accordance with BS5930:2015+A1:2021

Ground Investigation
Services (Southern) Ltd

40 Home Close, Wootton OX13 6DD
Tel 01865 326011

TRIAL PIT LOG

Report No.

S.6125

Figure

7



GROUND INVESTIGATION SERVICES (Southern) Ltd

40 Home Close, Wootton, Abingdon, Oxon OX13 6DD Tel 01865 326011

CLIENT

Thinking Buildings

SITE LOCATION

Alexandra Park School, Bidwell Gardens, London N11 2AZ

Date: September 2023

Ground Level (m) : 53.40

Orientation: East-west

Co-Ordinates (NGR):

TRIAL PIT

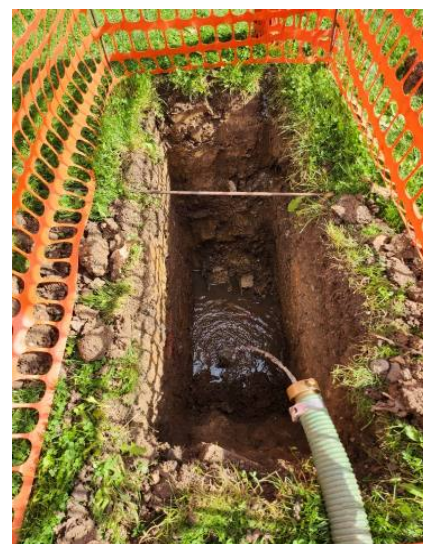
SA2

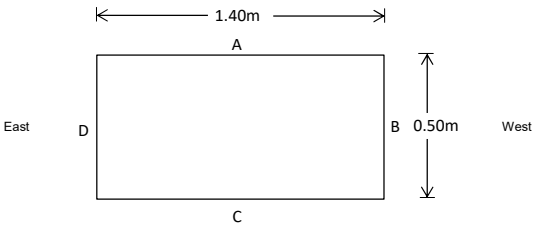
Sheet 1 of 1

Report No.

S.6125

SAMPLES AND TESTS						water	Reduced	Depth	Legend	STRATA AND DESCRIPTION
Depth	No.	Type	PID	Hand	HSV	depth	Level	(thickness)		
metres			% v/v	pen' kN/m2	kN/m2	m	m (AOD)	metres		
0.10		D/ES						0.10		Grass over dark brown CLAY with some brick gravel
								(0.30)		Firm indurated brown and light grey CLAY with a little fine medium rounded flint and red brick and a little plastic and metal
0.50		D/ES						0.40		Soft to firm brown CLAY with pockets of dark brown sand and fine medium rounded gravel
								(0.70)		
1.00		D						1.10		MADE GROUND
								(0.10)		Soft to firm light brown intact CLAY with a trace of fine medium rounded flint gravel
1.20		D						1.20		LONDON CLAY FORMATION



Trial Pit Dimensions 		Date of logging: 21 August 2023 Excavation plant: 3T excavator Pit stability: Stable Weather: Warm, dry and sunny Groundwater (strike): ∇ dry Groundwater (standing): $\blacktriangledown$ dry Logged by: SD Checked by: MPB
		General Remarks: Infiltration testing conducted in accordance with BRE Digest DG365 Soakaway Design

Scale 1:15

For explanation of symbols and abbreviations see preface to Borehole records. All depths in metres. Logged in accordance with BS5930:2015+A1:2021

Ground Investigation
Services (Southern) Ltd

40 Home Close, Wootton OX13 6DD
Tel 01865 326011

TRIAL PIT LOG

Report No.

S.6125

Figure

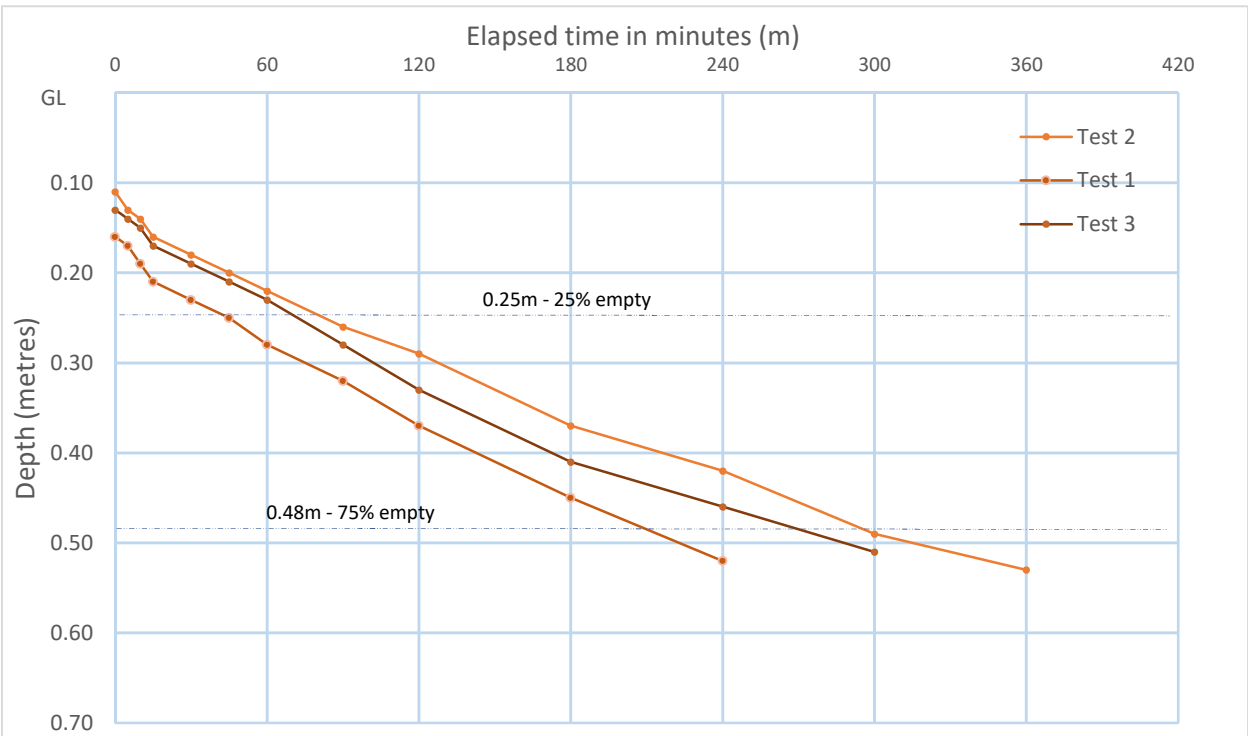
8

CALCULATION OF SOIL INFILTRATION RATE

[illegible]

TRIAL PIT	SA1	Logged by:	M Boughton
Test No.	3	Checked by:	J Hinxman
Groundwater		Date of test	21-23 August 2023
Strike:	dry		
Standing:	dry		
Weather	Warm dry and sunny		

Soakage Trial Pit Width W_t (m) =	0.50
Soakage Trial Pit Length L_t (m) =	1.30
Total Depth from ground level D_{tb} (m) =	0.60
Internal Surface Area of trial pit a_{p50} (m) =	1.50
Storage Volume between 75-25% V_p (m) =	0.15
Time for water to fall from 75-25% t_p (minutes) =	196.5
Allowance for infiltration through soakaway base	NO/YES
Free volume in aggregate (%) =	100
SOIL INFILTRATION RATE* (f) = 8.66×10^{-6} m/sec	



COMMENTS:

CLIENT: Thinking Buildings

**SITE : Alexandra Park School, Bidwell Gardens,
London N11 2AZ**

Date: September 2023

BRE DIGEST DG365: 2016

SOAKAWAY DESIGN

**Ground Investigation
Services (Southern) Ltd**
40 Home Close, Wootton, Abingdon OX13 6DD
Tel 01865 326011

INFILTRATION TEST DATA

Report No.
S.6125

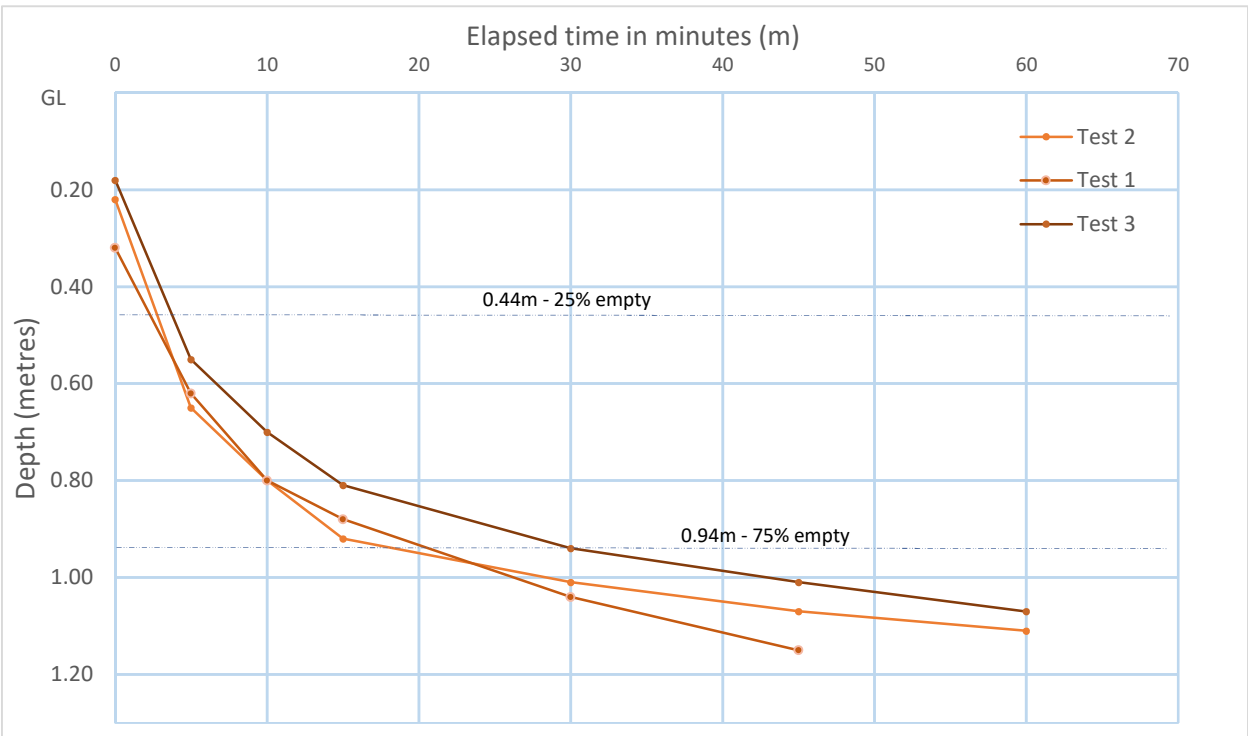
Fig.
9

CALCULATION OF SOIL INFILTRATION RATE

[illegible]

TRIAL PIT Test No. Groundwater Strike: Standing:	SA2	Logged by:	M Boughton
	3	Checked by:	J Hinxman
	dry	Date of test	21 August 2023
	dry		
Weather	Warm dry and sunny		

Soakage Trial Pit Width W_t (m) =	0.50
Soakage Trial Pit Length L_t (m) =	1.40
Total Depth from ground level D_{tb} (m) =	1.20
Internal Surface Area of trial pit a_{p50} (m) =	2.64
Storage Volume between 75-25% V_p (m) =	0.36
Time for water to fall from 75-25% t_p (minutes) =	27.6
Allowance for infiltration through soakaway base	NO/YES
Free volume in aggregate (%) =	100
SOIL INFILTRATION RATE* (f) = 8.16×10^{-5} m/sec	



COMMENTS:

CLIENT: Thinking Buildings

**SITE : Alexandra Park School, Bidwell Gardens,
London N11 2AZ**

Date: September 2023

BRE DIGEST DG365: 2016

SOAKAWAY DESIGN

**Ground Investigation
Services (Southern) Ltd**
40 Home Close, Wootton, Abingdon OX13 6DD
Tel 01865 326011

INFILTRATION TEST DATA

Report No.
S.6125

Fig.
10

IP1

Coordinates:

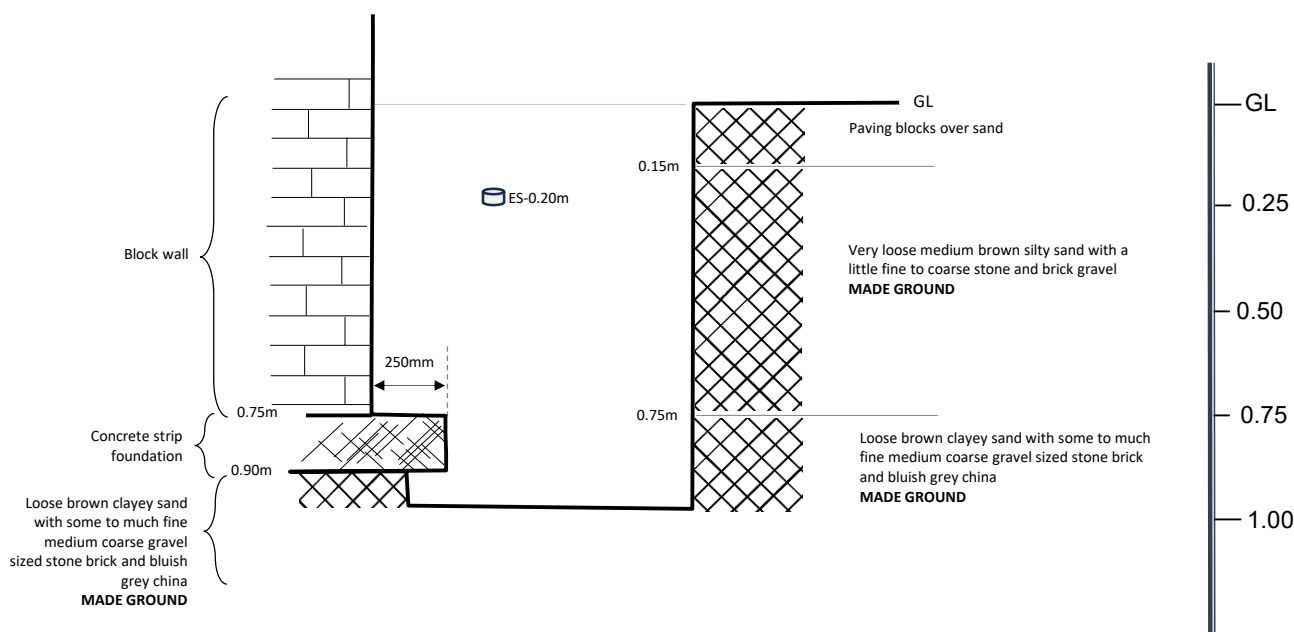
Ground level: 54.15m

Profile A - East Face

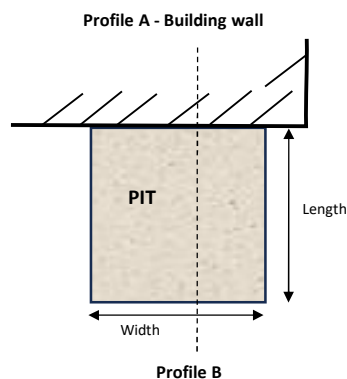
PROFILE VIEW

Profile B

Depth - metres



PLAN VIEW



Date of Logging: 21 August 2023

Excavation Plant: Hand excavated

Groundwater: dry

Pit Dimensions: 0.40m x 0.50m x 1.00m (Width x length x depth-metres)

Pit Orientation:

Pit Stability: Stable

Weather: Warm, dry and sunny

Remarks:

KEY

U	Undisturbed sample
D	Disturbed sample
B	Bulk sample
W	Water sample
J	Jar sample
ES	Contamination sample
Cm	CBR mould sample
V	Hand shear vane test (values in kpa)
PID	Photo-Ionisation Device (Readings given in PPM by volume)

Logged by: MPB

Checked by: JMH

CLIENT: Thinking Buildings

SITE: Alexandra Park School, Bidwell Gardens, London N11 2AZ

Ground Investigation
Services (Southern) Ltd
40 Home Close, Wootton, Abingdon OX13 6DD
Tel 01865 326011

INSPECTION PIT LOG

Report No.

S.6125

Fig

11

IP2

Coordinates:

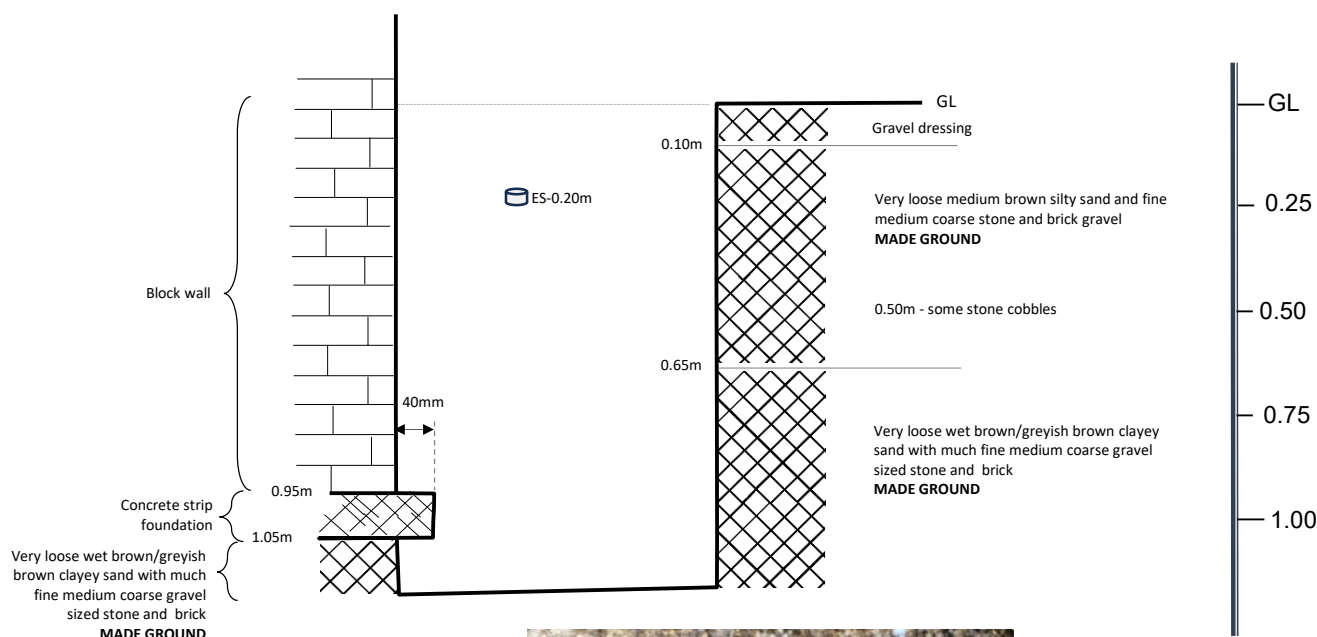
Ground level: 53.90m

Profile A - East Face

PROFILE VIEW

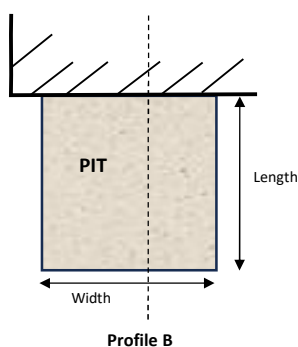
Profile B

Depth - metres



PLAN VIEW

Profile A - Building wall



Date of Logging: 21 August 2023

Excavation Plant: Hand excavated

Groundwater: dry

Pit Dimensions: 0.40m x 0.50m x 1.20m (Width x length x depth-metres)

Pit Orientation:

Pit Stability: Stable

Weather: Warm, dry and sunny

Remarks:

KEY

U	Undisturbed sample
D	Disturbed sample
B	Bulk sample
W	Water sample
J	Jar sample
ES	Contamination sample
Cm	CBR mould sample
V	Hand shear vane test (values in kpa)
PID	Photo-Ionisation Device (Readings given in PPM by volume)

Logged by: MPB

Checked by: JMH

CLIENT: Thinking Buildings

SITE: Alexandra Park School, Bidwell Gardens, London N11 2AZ

Ground Investigation
Services (Southern) Ltd40 Home Close, Wootton, Abingdon OX13 6DD
Tel 01865 326011

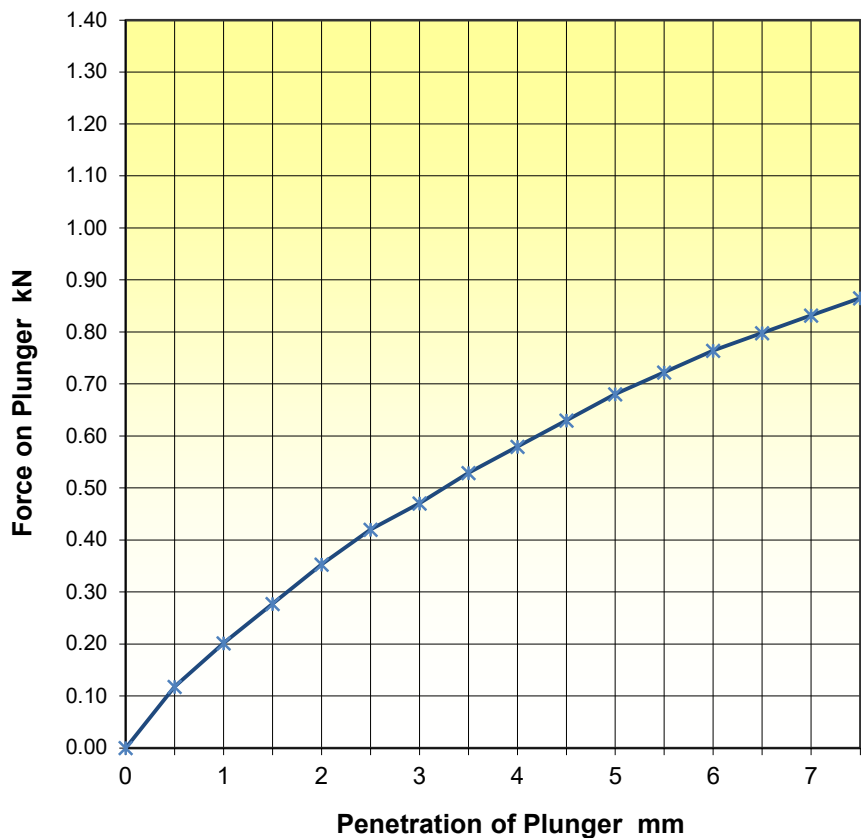
INSPECTION PIT LOG

Report No.

S.6125

Fig

12



Pen' of plunger mm	Force on plunger	
	Load gauge	kN
0	0	0
0.5	14	0.118
1	24	0.202
1.5	33	0.277
2	42	0.277
2.5	50	0.420
3	56	0.470
3.5	63	0.529
4	69	0.580
4.5	75	0.630
5	81	0.680
5.5	86	0.722
6	91	0.764
6.5	95	0.798
7	99	0.832
7.5	103	0.865

TEST SAMPLE DESCRIPTION (depth in m)

0.50 Firm light brown mottled brown friable CLAY with some pockets of brown sand and fine medium gravel sized stone and china
MADE GROUND

Area of annulus of disc used	16216	mm ²	CBR TEST RESULTS			
Mass of surcharge	4	kg	Penetration mm	Force kN	Standard Force kN	CBR %
Proving ring size	10kN					
Calibration of ring	8.4*		2.5	0.42	13.2	3.2
* Proving ring calibration certificate KL01213 (0.0084kN/Div)						
Water content	20	%	5.0	0.68	20.0	3.4
Plasticity Index	18 (16)	%	ACCEPTED CBR ..3 %			
Weather	Warm, dry and sunny					

Remarks:

Test No. CBR 01

Depth below existing GL: 0.50m

CLIENT: Thinking Buildings

LOCATION: Alexandra Park School, Bidwell Gardens,
London N11 2AZ

DATE OF TEST: 21 August 2023

Test Method BS 1377
Part 9 1990 - Method 4.3
Determination of the in-situ
California Bearing Ratio (CBR)

* proving ring calibration

APPENDIX B

LABORATORY TEST RESULTS

Table 2	Index Properties
Pages 1-6	Geolabs Report No. GEO/38728
Pages 1 - 14	Element Materials Technology Soils report 23/14405
Pages 1 - 13	Element Materials Technology Soils report 23/14318
Pages 1 – 8	GIS Selection of Human Health Generic Assessment Criteria (GAC)
Pages 1-5	Water Quality Standards

Ref No.	Sample		Water content W %	Liquid Limit W _l %	Plastic Limit W _p %	Plasticity Index I _p %	Plasticity Index (Adjusted) %	Mass Passing 425µm %	Shrinkage potential NHBC Guidelines	Classification BS 1377-Part 2: 1990	Sample Description	
	No.	Depth										
		m										
BH1	3	2.00	25	49	19	30	28	94	M	CI	gravelly clay (made ground)	
BH1	5	3.50	20	53	18	35	28	80	M	CH	Gravelly clay	
BH1	6	4.00	27	67	26	41	41	100	H	CH	Clay	
BH1	12	9.50	28	73	27	46	46	100	H	CV	Clay	
BH2	1	1.00	32	59	19	40	36	90	M	CH	Gravelly clay (made ground)	
BH2	3	1.30	36	46	37	11	9	85	N	CI(O)	Organic silty clay (superficial deposits)	
BH2	3	2.00	27	50	17	33	33	100	M	CH	Clay	
IP2		1.20	24	40	20	20	15	75	L	CI	Gravelly sandy clay (made ground)	
CBR 1		0.50	20	36	18	18	16	87	L	CI	Sandy gravelly clay (made ground)	
REMARKS:					CL	Inorganic CLAY low plasticity				ML	Inorganic SILT low compressibility	
					CI	Inorganic CLAY medium plasticity				MI	Inorganic SILT medium compressibility	
					CH	Inorganic CLAY high plasticity				MH	Inorganic SILT high compressibility	
					CV	Inorganic CLAY very high plasticity				MV	Inorganic SILT very high compressibility	
					CE	Inorganic CLAY extremely high plasticity				ME	Inorganic SILT extremely high compressibility	
					N	Non shrinkage Potential				(O)	Organic matter	
					L	Low shrinkage Potential						
					M	Medium shrinkage Potential						
					H	High shrinkage Potential						
CLIENT: Thinking Buildings							(BS EN ISO 17892-12 : Clauses 5.3 and 5.5 : 2018)			Checked by		
SITE: Alexandra Park School, Bidwell Gardens, London N11 2AZ							Natural water content					
DATE: September 2023							Liquid limit - cone penetrometer method (definitive method)			Approved by		
							Plastic limit and plasticity index					
Ground Investigation Services (Southern) Ltd 40 Home Close, Wootton OX13 6DD Tel 01865 326011				INDEX PROPERTIES						Report No.	Table	
										S.6125	1	

GEOLABS Limited
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Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Ground Investigation Services (Southern) Ltd
40 Home Close
Wooton
Abingdon
OX13 6DD

07 September 2023

Report No : GEO/38728/01

Page 1 of 1

For the attention of Mr M Boughton

Our ref **GEO / 38728**
Your Ref **S.6125**

Date samples received 23/08/2023
Date written instructions received 23/08/2023
Date testing commenced 24/08/2023
Date of sample disposal 05/10/2023

Project **ALEXANDRA PARK SCHOOL, MUSWELL HILL**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	4	Unconsolidated Undrained Multistage Triaxial Compression

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**



S Burke
Senior Technician

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression				Chemical Tests			Other tests and comments
Location	Depth (m)	Sample Ref	Type	Description	WC	LL	PL	PI	<425 µm	Bulk	Dry	Condition	Cell Pressure	Deviator Stress	Mean Shear Stress	pH	2:1 W/S SO4	W/S Mg	
					%	%	%	%	%	Mg/m³	Mg/m³		kPa	kPa	kPa		g/L	mg/L	
BH1	3.00-3.45		U	Stiff brown gravelly slightly sandy silty CLAY.	19.3					2.20	1.85	Undisturbed	30 60 120	68 130 209	68				
BH1	5.00-5.45		U	Very stiff fissured brown CLAY.	30.1					1.97	1.51	Undisturbed	50 100 200	110 166 174	75				
BH1	8.00-8.45		U	Very stiff brown fissure CLAY with rare gypsum.	28.8					1.98	1.54	Undisturbed	80 160 320	153 179 203	89				
BH1	11.00-11.45		U	Very stiff grey CLAY.	25.8					2.06	1.63	Undisturbed	100 200 400	194 242 249	114				

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by



S Burke - Senior Technician
07/09/2023

Project Number:

GEO / 38728

Project Name:

ALEXANDRA PARK SCHOOL, MUSWELL HILL
S.6125



UNCONSOLIDATED UNDRAINED MULTISTAGE TRIAXIAL COMPRESSION

Location BH1
Depth (m) 3.00-3.45
Sample Type U

Description:

Stiff brown gravelly slightly sandy silty CLAY.

Specimen Details

Specimen conditions	Undisturbed		
Length (mm)	163.0		
Diameter (mm)	102.7		
Water content (%)	19.3		
Bulk density (Mg/m ³)	2.20		
Dry density (Mg/m ³)	1.85		
Test Details	1	2	3
Latex membrane thickness (mm)	0.3	0.3	0.3
Specimen height prior to shearing (mm)	163.0	-	-
Membrane correction (kPa)	0.3	0.7	1.2
Mean rate of shear (%/min)	2.5	2.5	2.5
Cell pressure (kPa)	30	60	120
Strain at failure (%)	3.7	9.8	23.9
Maximum deviator stress (kPa)	68	130	209
Shear Stress Cu (kPa)	34	65	105

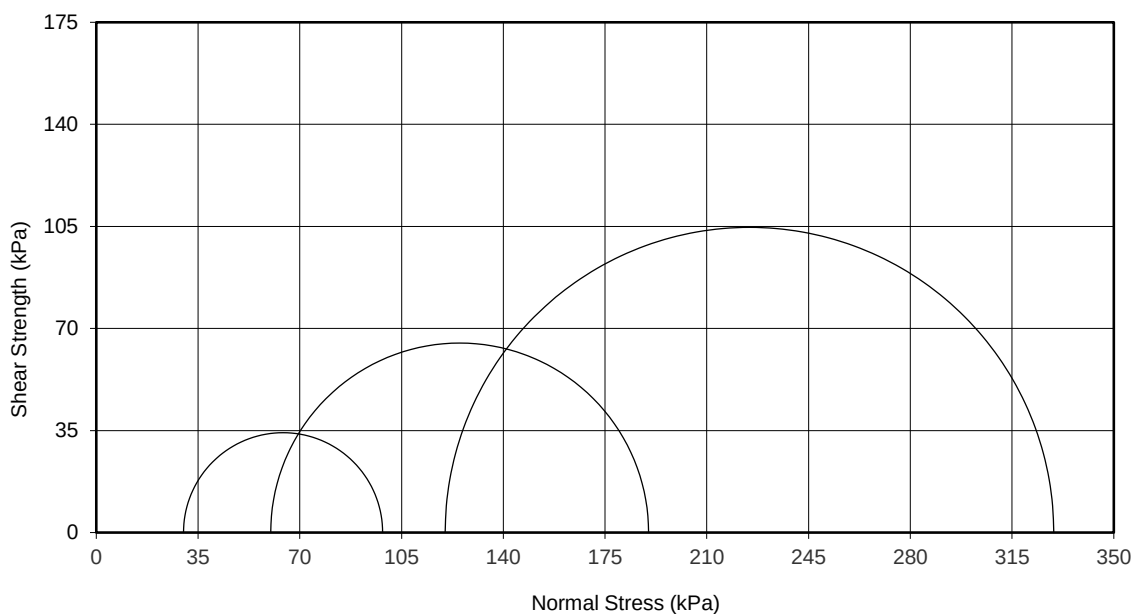
Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

30



Tested by AJ
Checked and Approved by

S Burke

S Burke - Senior Technician
07/09/2023

Project Number:

GEO / 38728

Project Name:

ALEXANDRA PARK SCHOOL, MUSWELL HILL
S.6125

GEOLABS

UNCONSOLIDATED UNDRAINED MULTISTAGE TRIAXIAL COMPRESSION

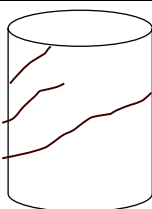
Location BH1
Depth (m) 5.00-5.45
Sample Type U

Description:

Very stiff fissured brown CLAY.

Specimen Details

Specimen conditions	Undisturbed		
Length (mm)	201.7		
Diameter (mm)	103.6		
Water content (%)	30.1		
Bulk density (Mg/m ³)	1.97		
Dry density (Mg/m ³)	1.51		
Test Details	1	2	3
Latex membrane thickness (mm)	0.3	0.3	0.3
Specimen height prior to shearing (mm)	201.7	-	-
Membrane correction (kPa)	0.2	0.5	0.7
Mean rate of shear (%/min)	2.0	2.0	2.0
Cell pressure (kPa)	50	100	200
Strain at failure (%)	2.7	7.4	9.9
Maximum deviator stress (kPa)	110	166	174
Shear Stress Cu (kPa)	55	83	87

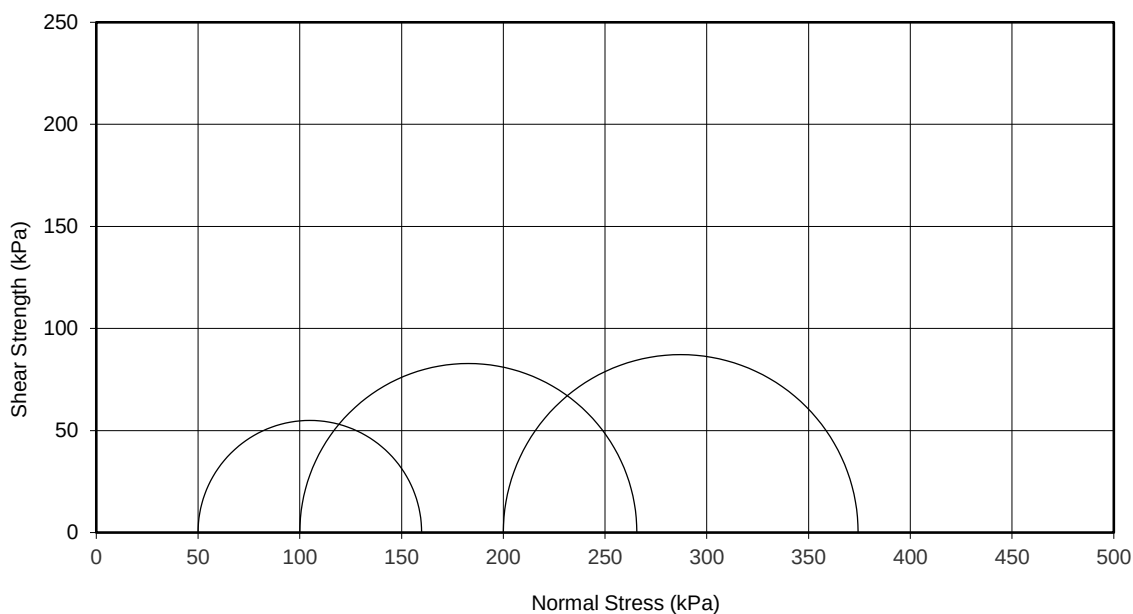
Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

20



Tested by AJ

Checked and Approved by

S Burke - Senior Technician
07/09/2023

Project Number:

GEO / 38728

Project Name:

ALEXANDRA PARK SCHOOL, MUSWELL HILL
S.6125

GEOLABS

UNCONSOLIDATED UNDRAINED MULTISTAGE TRIAXIAL COMPRESSION

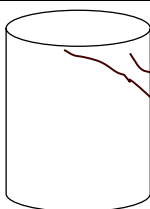
Location BH1
Depth (m) 8.00-8.45
Sample Type U

Description:

Very stiff fissured brown CLAY with rare gypsum.

Specimen Details

Specimen conditions	Undisturbed		
Length (mm)	201.3		
Diameter (mm)	102.5		
Water content (%)	28.8		
Bulk density (Mg/m ³)	1.98		
Dry density (Mg/m ³)	1.54		
Test Details	1	2	3
Latex membrane thickness (mm)	0.3	0.3	0.3
Specimen height prior to shearing (mm)	201.3	-	-
Membrane correction (kPa)	0.2	0.3	0.6
Mean rate of shear (%/min)	2.0	2.0	2.0
Cell pressure (kPa)	80	160	320
Strain at failure (%)	3.0	4.5	8.9
Maximum deviator stress (kPa)	153	179	203
Shear Stress Cu (kPa)	76	90	101

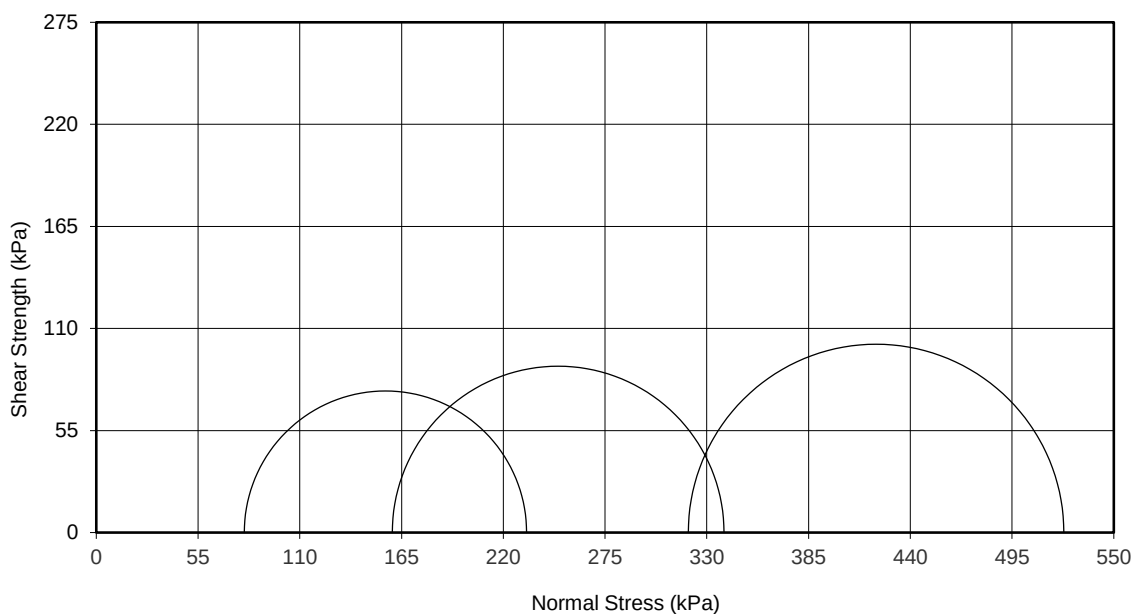
Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

40



Tested by AJ
Checked and Approved by

S Burke

S Burke - Senior Technician
07/09/2023

Project Number:

GEO / 38728

Project Name:

ALEXANDRA PARK SCHOOL, MUSWELL HILL
S.6125

GEOLABS

UNCONSOLIDATED UNDRAINED MULTISTAGE TRIAXIAL COMPRESSION

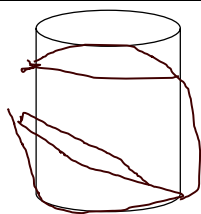
Location BH1
Depth (m) 11.00-11.45
Sample Type U

Description:

Very stiff fissured grey CLAY.

Specimen Details

Specimen conditions	Undisturbed		
Length (mm)	200.3		
Diameter (mm)	103.5		
Water content (%)	25.8		
Bulk density (Mg/m ³)	2.06		
Dry density (Mg/m ³)	1.63		
Test Details	1	2	3
Latex membrane thickness (mm)	0.3	0.3	0.3
Specimen height prior to shearing (mm)	200.3	-	-
Membrane correction (kPa)	0.3	0.6	0.7
Mean rate of shear (%/min)	2.0	2.0	2.0
Cell pressure (kPa)	100	200	400
Strain at failure (%)	3.2	8.0	10.5
Maximum deviator stress (kPa)	194	242	249
Shear Stress Cu (kPa)	97	121	125

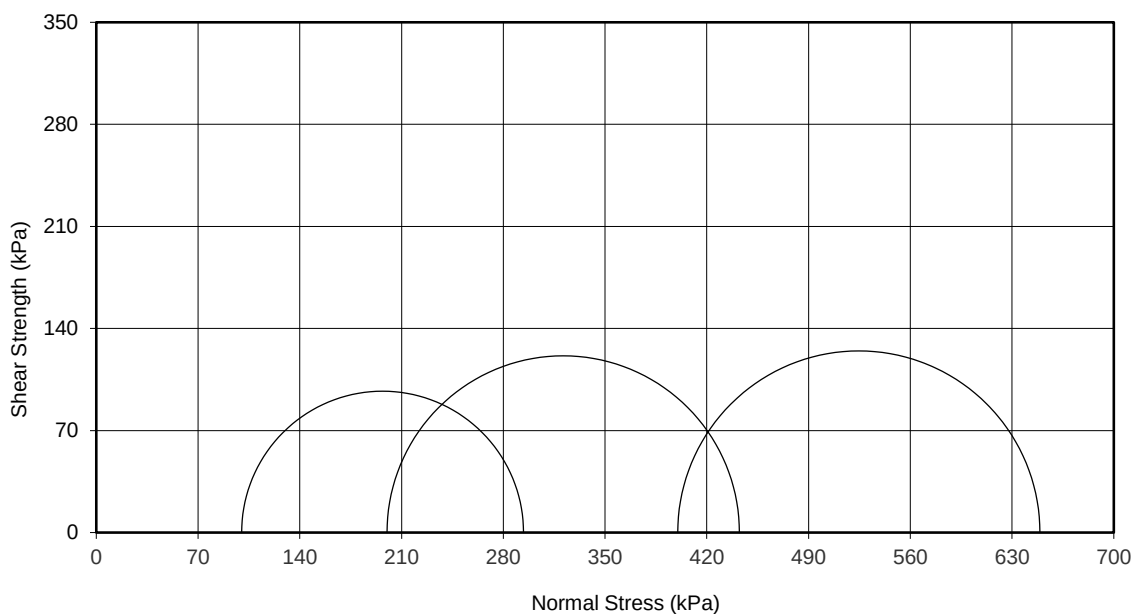
Mode of failure

Orientation of the sample

Vertical

Distance from top of tube mm

25



Tested by AJ

Checked and Approved by

S Burke - Senior Technician
07/09/2023

Project Number:

GEO / 38728

Project Name:

ALEXANDRA PARK SCHOOL, MUSWELL HILL
S.6125

GEOLABS

Ground Investigation Services

40 Home Close
Wooton
Oxon
United Kingdom
OX13 6DD



4225



Attention : Martyn Boughton

Date : 14th September, 2023

Your reference : -

Our reference : Test Report 23/14318 Batch 1

Location : Alexandra Park School, Muswell Hill

Date samples received : 31st August, 2023

Status : Final Report

Issue : 1

Fifteen samples were received for analysis on 31st August, 2023 of which fifteen were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigation Services

Report : Solid

Reference: -

Location: Alexandra Park School, Muswell Hill

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Martyn Boughton

EMT Job No: 23/14318

EMT Sample No.	1-2	3	4	5	6	7	8-9	10	11	12	Please see attached notes for all abbreviations and acronyms		
Sample ID	BH1	BH1	BH1	BH1	BH1	BH1	BH2	BH2	BH2	BH2			
Depth	0.10-0.20	1.00	3.00	6.50	9.50	15.0	0.10-0.20	0.50	1.30	4.00			
COC No / misc													
Containers	J B	J	T	T	T	T	J B	J	T	T			
Sample Date	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023	LOD/LOR	Units	Method No.
Arsenic [#]	12.9	4.3	-	-	-	-	5.7	15.2	-	-	<0.5	mg/kg	TM30/PM15
Beryllium	0.9	0.6	-	-	-	-	<0.5	1.0	-	-	<0.5	mg/kg	TM30/PM15
Cadmium [#]	<0.1	0.3	-	-	-	-	<0.1	<0.1	-	-	<0.1	mg/kg	TM30/PM15
Chromium [#]	79.0	62.8	-	-	-	-	148.1	56.9	-	-	<0.5	mg/kg	TM30/PM15
Copper [#]	22	43	-	-	-	-	23	48	-	-	<1	mg/kg	TM30/PM15
Lead [#]	62	32	-	-	-	-	63	224	-	-	<5	mg/kg	TM30/PM15
Mercury [#]	<0.1	<0.1	-	-	-	-	0.1	0.4	-	-	<0.1	mg/kg	TM30/PM15
Nickel [#]	17.5	58.7	-	-	-	-	16.8	21.3	-	-	<0.7	mg/kg	TM30/PM15
Selenium [#]	<1	<1	-	-	-	-	1	<1	-	-	<1	mg/kg	TM30/PM15
Sulphur as S	-	-	0.02	0.16	0.36	0.27	-	0.10	0.12	0.02	<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	-	-	0.19	0.49	0.04	0.14	-	0.10	0.06	0.04	<0.01	%	TM50/PM29
Vanadium	63	52	-	-	-	-	30	42	-	-	<1	mg/kg	TM30/PM15
Water Soluble Boron [#]	0.7	0.3	-	-	-	-	0.4	0.3	-	-	<0.1	mg/kg	TM74/PM32
Zinc [#]	83	49	-	-	-	-	69	208	-	-	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene [#]	<0.04	0.14	-	-	-	-	0.07	0.09	-	-	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.92	-	-	-	-	0.25	0.20	-	-	<0.03	mg/kg	TM4/PM8
Acenaphthene [#]	<0.05	0.45	-	-	-	-	0.06	0.08	-	-	<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04	0.52	-	-	-	-	0.07	0.08	-	-	<0.04	mg/kg	TM4/PM8
Phenanthrene [#]	0.11	7.10	-	-	-	-	0.91	1.38	-	-	<0.03	mg/kg	TM4/PM8
Anthracene [#]	<0.04	3.39	-	-	-	-	0.45	0.48	-	-	<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	0.31	19.06	-	-	-	-	2.85	3.64	-	-	<0.03	mg/kg	TM4/PM8
Pyrene [#]	0.29	15.96	-	-	-	-	2.57	3.08	-	-	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	0.17	9.35	-	-	-	-	1.59	1.68	-	-	<0.06	mg/kg	TM4/PM8
Chrysene [#]	0.17	8.66	-	-	-	-	1.65	1.82	-	-	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [#]	0.35	15.60	-	-	-	-	2.98	3.21	-	-	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	9.86	-	-	-	-	1.86	1.79	-	-	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene [#]	0.14	6.36	-	-	-	-	1.27	1.26	-	-	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04	1.27	-	-	-	-	0.22	0.25	-	-	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	0.16	6.53	-	-	-	-	1.26	1.24	-	-	<0.04	mg/kg	TM4/PM8
PAH 16 Total	1.7	105.2	-	-	-	-	18.1	20.3	-	-	<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.25	11.23	-	-	-	-	2.15	2.31	-	-	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.10	4.37	-	-	-	-	0.83	0.90	-	-	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	100	95	-	-	-	-	95	96	-	-	<0	%	TM4/PM8
Natural Moisture Content	19.6	4.3	-	-	-	-	6.9	10.7	-	-	<0.1	%	PM4/PM0
Hexavalent Chromium [#]	<0.3	<0.3	-	-	-	-	<0.3	<0.3	-	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) [#]	-	-	0.0681	2.5544	NDP	NDP	-	0.1887	0.1401	0.1735	<0.0015	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext)	-	-	-	-	0.4836	0.3162	-	-	-	-	<0.0015	g/l	TM38/PM60
Organic Matter	4.1	6.7	-	-	-	-	1.6	3.5	-	-	<0.2	%	TM21/PM24

Element Materials Technology

Client Name: Ground Investigation Services
Reference: -
Location: Alexandra Park School, Muswell Hill
Contact: Martyn Boughton
EMT Job No: 23/14318

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Element Materials Technology

Client Name: Ground Investigation Services

Report : Solid

Reference: -

Location: Alexandra Park School, Muswell Hill

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Martyn Boughton

EMT Job No: 23/14318

EMT Sample No.	13	14-15	16-17	18	19						Please see attached notes for all abbreviations and acronyms		
Sample ID	BH2	IP1	IP2	SA1	SA2								
Depth	7.00	0.20	0.20	0.10	0.10								
COC No / misc													
Containers	T	J B	J B	J	J								
Sample Date	25/08/2023	25/08/2023	25/08/2023	25/08/2023	25/08/2023								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	31/08/2023	31/08/2023	31/08/2023	31/08/2023	31/08/2023						LOD/LOR	Units	Method No.
Arsenic [#]	-	7.8	11.0	14.6	11.1						<0.5	mg/kg	TM30/PM15
Beryllium	-	0.7	1.0	1.8	1.0						<0.5	mg/kg	TM30/PM15
Cadmium [#]	-	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM30/PM15
Chromium [#]	-	62.6	96.8	76.8	100.1						<0.5	mg/kg	TM30/PM15
Copper [#]	-	28	43	29	27						<1	mg/kg	TM30/PM15
Lead [#]	-	97	112	44	76						<5	mg/kg	TM30/PM15
Mercury [#]	-	0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM30/PM15
Nickel [#]	-	12.6	19.7	47.1	19.6						<0.7	mg/kg	TM30/PM15
Selenium [#]	-	<1	<1	<1	1						<1	mg/kg	TM30/PM15
Sulphur as S	0.54	-	-	-	-						<0.01	%	TM30/PM15
Total Sulphate as SO4 BRE	1.53 ^{AA}	-	-	-	-						<0.01	%	TM50/PM29
Vanadium	-	31	44	100	59						<1	mg/kg	TM30/PM15
Water Soluble Boron [#]	-	0.4	0.6	1.0	0.7						<0.1	mg/kg	TM74/PM32
Zinc [#]	-	134	148	94	83						<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene [#]	-	0.06	0.07	<0.04	<0.04						<0.04	mg/kg	TM4/PM8
Acenaphthylene	-	0.17	0.23	<0.03	0.08						<0.03	mg/kg	TM4/PM8
Acenaphthene [#]	-	0.08	0.07	<0.05	<0.05						<0.05	mg/kg	TM4/PM8
Fluorene [#]	-	0.06	0.12	<0.04	<0.04						<0.04	mg/kg	TM4/PM8
Phenanthrene [#]	-	0.87	1.47	0.05	0.31						<0.03	mg/kg	TM4/PM8
Anthracene [#]	-	0.28	0.74	<0.04	0.25						<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	-	2.15	2.91	0.19	0.94						<0.03	mg/kg	TM4/PM8
Pyrene [#]	-	1.90	2.47	0.18	0.87						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene [#]	-	1.10	1.35	0.13	0.39						<0.06	mg/kg	TM4/PM8
Chrysene [#]	-	1.16	1.51	0.11	0.46						<0.02	mg/kg	TM4/PM8
Benzo(b)fluoranthene [#]	-	2.17	2.63	0.18	0.83						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	-	1.34	1.64	<0.04	0.45						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene [#]	-	0.86	1.04	0.05	0.30						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	-	0.09	0.19	<0.04	0.07						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	-	0.93	1.10	0.06	0.32						<0.04	mg/kg	TM4/PM8
PAH 16 Total	-	13.2	17.5	1.0	5.3						<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	-	1.56	1.89	0.13	0.60						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	-	0.61	0.74	0.05	0.23						<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	-	95	98	94	100						<0	%	TM4/PM8
Natural Moisture Content	-	11.5	13.4	26.1	15.5						<0.1	%	PM4/PM0
Hexavalent Chromium [#]	-	<0.3	<0.3	<0.3	<0.3						<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) [#]	0.0944	-	-	-	-						<0.0015	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext)	-	-	-	-	-						<0.0015	g/l	TM38/PM60
Organic Matter	-	2.1	2.3	1.2	2.9						<0.2	%	TM21/PM24

Element Materials Technology

Client Name: Ground Investigation Services

Report : Solid

Reference: -

Location: Alexandra Park School, Muswell Hill

Solids: V=60g VOC jar. J=250g glass jar. T=plastic tub

Contact: Martyn Boughton

EMT Job No: 23/14318

[illegible]

Note:

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where trace asbestos is reported the amount of asbestos will be <0.1%.

QF-PM 3.1.15 v10

Matrix : Solid

—

Alexandra Park School, Muswell Hill

Martyn Boughton

[illegible]

Client Name: Ground Investigation Services

Reference: -

Location: Alexandra Park School, Muswell Hill

Contact: Martyn Boughton

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/14318

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

EMT Job No: 23/14318

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.			AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	PM0	No preparation is required.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes

EMT Job No: 23/14318

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.			AD	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes

Ground Investigation Services

40 Home Close
Wooton
Oxon
United Kingdom
OX13 6DD



4225



Attention : Martyn Boughton

Date : 4th October, 2023

Your reference : -

Our reference : Test Report 23/14405 Batch 1

Location : Alexandra Park School, Muswell Hill

Date samples received : 1st September, 2023

Status : Final Report

Issue : 1

Three samples were received for analysis on 1st September, 2023 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 7.24 kg of CO2

Scope 1&2&3 emissions - 17.11 kg of CO2

Authorised By:**Phil Sommerton BSc**

Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigation Services
Reference: -
Location: Alexandra Park School, Muswell Hill
Contact: Martyn Boughton
EMT Job No: 23/14405

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	5-6												
Sample ID	BH1												
Depth	1.00												
COC No / misc													
Containers	J T												
Sample Date	30/08/2023												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	01/09/2023												
											Please see attached notes for all abbreviations and acronyms		
											LOD/LOR	Units	Method No.
PAH MS													
Naphthalene #	<0.40 ^{AA}										<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.85 ^{AA}										<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.50 ^{AA}										<0.05	mg/kg	TM4/PM8
Fluorene #	0.53 ^{AA}										<0.04	mg/kg	TM4/PM8
Phenanthrene #	6.32 ^{AA}										<0.03	mg/kg	TM4/PM8
Anthracene #	3.15 ^{AA}										<0.04	mg/kg	TM4/PM8
Fluoranthene #	18.34 ^{AA}										<0.03	mg/kg	TM4/PM8
Pyrene #	15.61 ^{AA}										<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	8.79 ^{AA}										<0.06	mg/kg	TM4/PM8
Chrysene #	8.35 ^{AA}										<0.02	mg/kg	TM4/PM8
Benzo(b)fluoranthene #	15.86 ^{AA}										<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	9.90 ^{AA}										<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	5.63 ^{AA}										<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	1.18 ^{AA}										<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	5.98 ^{AA}										<0.04	mg/kg	TM4/PM8
Coronene	1.02 ^{AA}										<0.04	mg/kg	TM4/PM8
PAH 17 Total	101.51 ^{AA}										<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	11.42 ^{AA}										<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	4.44 ^{AA}										<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	97 ^{AA}										<0	%	TM4/PM8
Mineral Oil (C10-C40)	455										<30	mg/kg	TM5/PM8/PM16
MTBE #	<5										<5	ug/kg	TM36/PM12
Benzene #	<5										<5	ug/kg	TM36/PM12
Toluene #	<5										<5	ug/kg	TM36/PM12
Ethylbenzene #	<5										<5	ug/kg	TM36/PM12
m/p-Xylene #	<5										<5	ug/kg	TM36/PM12
o-Xylene #	<5										<5	ug/kg	TM36/PM12
PCB 28 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
PCB 52 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
PCB 101 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
PCB 118 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
PCB 138 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
PCB 153 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
PCB 180 #	<50 ^{AA}										<5	ug/kg	TM17/PM8
Total 7 PCBs #	<350 ^{AA}										<35	ug/kg	TM17/PM8
Natural Moisture Content	10.7										<0.1	%	PM4/PM0
Total Organic Carbon #	2.29										<0.02	%	TM21/PM24

Element Materials Technology

Client Name: Ground Investigation Services
Reference: -
Location: Alexandra Park School, Muswell Hill
Contact: Martyn Boughton
EMT Job No: 23/14405

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Element Materials Technology

Client Name: Ground Investigation Services
Reference: -
Location: Alexandra Park School, Muswell Hill
Contact: Martyn Boughton
EMT Job No: 23/14405

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-2	3-4	5-6								Please see attached notes for all abbreviations and acronyms		
Sample ID	SA1	SA2	BH1										
Depth	0.30	0.50	1.00										
COC No / misc													
Containers	J T	J T	J T										
Sample Date	30/08/2023	30/08/2023	30/08/2023										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	01/09/2023	01/09/2023	01/09/2023								LOD/LOR	Units	Method No.
Dissolved Arsenic #	<2.5	<2.5	-								<2.5	ug/l	TM30/PM14
Dissolved Beryllium #	<0.5	<0.5	-								<0.5	ug/l	TM30/PM14
Dissolved Boron #	<12	16	-								<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	-								<0.5	ug/l	TM30/PM14
Dissolved Chromium #	<1.5	<1.5	-								<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	-								<7	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	-								<5	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	-								<1	ug/l	TM30/PM14
Dissolved Nickel #	<2	<2	-								<2	ug/l	TM30/PM14
Dissolved Selenium #	<3	<3	-								<3	ug/l	TM30/PM14
Dissolved Vanadium #	2.9	2.4	-								<1.5	ug/l	TM30/PM14
Dissolved Zinc #	8	4	-								<3	ug/l	TM30/PM14
PAH MS													
Naphthalene	<0.1	<0.1	-								<0.1	ug/l	TM4/PM30
Acenaphthylene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Acenaphthene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Fluorene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Phenanthrene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Anthracene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Fluoranthene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Pyrene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Benzo(a)anthracene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Chrysene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.008	<0.008	-								<0.008	ug/l	TM4/PM30
Benzo(a)pyrene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene	<0.005	<0.005	-								<0.005	ug/l	TM4/PM30
PAH 16 Total	<0.173	<0.173	-								<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.008	<0.008	-								<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.008	<0.008	-								<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	69 ^{SV}	65 ^{SV}	-								<0	%	TM4/PM30
EPH (C8-C40)	<10	<10	-								<10	ug/l	TM5/PM30
Mass of raw test portion	0.1091	0.1058	0.1051									kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09									kg	NONE/PM17
Hexavalent Chromium	<0.006	<0.006	-								<0.006	mg/l	TM38/PM0
pH	8.11	8.11	-								<0.01	pH units	TM73/PM0

Element Materials Technology

Client Name: Ground Investigation Services
Reference: -
Location: Alexandra Park School, Muswell Hill
Contact: Martyn Boughton
EMT Job No: 23/14405

Report : CEN 10:1 1 Batch (Duplicate results)

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Element Materials Technology

Client Name: Ground Investigation Services
Reference: -
Location: Alexandra Park School, Muswell Hill
Contact: Martyn Boughton
EMT Job No: 23/14405

Report : CEN 10:1 1 Batch (Duplicate results)

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

[illegible]

Mass of sample taken (kg)	0.1051	Moisture Content Ratio (%) =	16.6
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	85.8
Particle Size <4mm =	>95%		
EMT Job No	23/14405	Landfill Waste Acceptance Criteria Limits	
Sample No	6		
Client Sample No	BH1		
Depth/Other	1.00		
Sample Date	30/08/2023		
Batch No	1		
Solid Waste Analysis		Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non- Hazardous Landfill
Total Organic Carbon (%)	2.29	3	5
Loss on Ignition (%)	4.3	-	10
Sum of BTEX (mg/kg)	<0.025	6	-
Sum of 7 PCBs (mg/kg)	<0.350	1	-
Mineral Oil (mg/kg)	455	500	-
PAH Sum of 17(mg/kg)	101.51	100	-
pH (pH Units)	8.49	-	>6
ANC to pH 7 (mol/kg)	<0.03	-	to be evaluated
ANC to pH 4 (mol/kg)	0.22	-	to be evaluated
Eluate Analysis	10:1 conc ⁿ leached		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg
	C ₁₀ mg/l	A ₁₀ mg/kg	
Arsenic	<0.0025	<0.025	0.5
Barium	0.007	0.07	2
Cadmium	<0.0005	<0.005	100
Chromium	<0.0015	<0.015	0.04
Copper	<0.007	<0.07	1
Mercury	<0.001	<0.01	5
Molybdenum	<0.002	<0.02	0.5
Nickel	<0.002	<0.02	10
Lead	<0.005	<0.05	0.4
Antimony	<0.002	<0.02	10
Selenium	<0.003	<0.03	0.5
Zinc	0.004	0.04	50
Chloride	<0.3	<3	0.06
Fluoride	0.6	6	0.7
Sulphate as SO ₄	0.7	7	5
Total Dissolved Solids	54	540	0.1
Phenol	<0.01	<0.1	0.5
Dissolved Organic Carbon	3	30	7
			4
			50
			200
			800
			15000
			25000
			10
			150
			500
			1000
			20000
			50000
			4000
			60000
			100000
			1
			-
			-
			500
			800
			1000

Client Name:	Ground Investigation Services
Reference:	-
Location:	Alexandra Park School, Muswell Hill
Contact:	Martyn Boughton

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[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

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NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/14405

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x10 Dilution

EMT Job No: 23/14405

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.			AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	PM0	No preparation is required.	Yes		AD	Yes

EMT Job No: 23/14405

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.			AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM77	Modified DDCEN/TS method 15364:2006. Determination of Acid Neutralization Capacity by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	No

EMT Job No: 23/14405

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM170	Determination of Trace Metals by ICP-MS (Inductively Coupled Plasma – Mass Spectrometry): Modified USEPA Method 200.8, Rev. 5.4, 1994; Modified EPA Method 6020A, Rev.1, Feb 2007; Modified BS EN ISO 17294-2:2016	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

HUMAN HEALTH RISK ASSESSMENT

1.1 Introduction

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

1.2 General Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

1.2.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

- EA Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
- EA Science Report SC050021/SR3: Updated technical background to the CLEA model.
- EA CLEA Bulletin (2009).
- CLEA software version 1.04 (2009)
- Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

1. do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.
2. do not cover risks to the environment, such as groundwater, ecosystems or buildings.
3. do not provide a definitive test for telling when human health risks are significant.
4. are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.

1.3 Soil Guideline Values (2009)

The EA are publishing a series of SGV reports for a selection of common contaminants relevant to the assessment of land contamination. SGV's are generic assessment criteria based on CLEA standard land-uses and can be used to simplify the assessment of human health risks from long-term exposure to

chemical contamination in soil. They do not cover short-term exposure (i.e. construction and maintenance workers), acute exposure or other risks such as fire, suffocation or explosion, as might arise from an accumulation of gases such as methane and carbon dioxide, or either odour or aesthetic issues. SGV's represent 'trigger values', indicators that soil concentrations above the SGV level may pose a possibility of *significant harm* to human health. The converse, where soil concentrations are less than the SGV, is that the long-term human health risks are considered to be tolerable or minimal.

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

1.4 Ongoing development of CLEA based guidance

The EA is involved in a programme of publishing SGV's and related toxicity data (the TOX reports). As at July 2009 ten SGV's and matching TOX reports had been published. Soil Assessment Criteria (SAC's) may be derived using toxicity data from the updated TOX reports, where these are published, or from the original TOX reports. SGV reports also take account of recent updates for plant uptake and other factors.

- GAC's developed by CLEA guidance and given in this report will need to be assessed against updated TOX reports and SGV's when these are published.
- SGV reports may give values that differ from the GAC's used in this report.
- These variations may materially alter the remediation requirement for the site, requiring either an increase or decrease in the extent, type and cost of remediation.

1.5 Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

- *ICRCL 70/90: Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing.*
- *BS 3882:2015 Specification for topsoil*

1.6 Other Generic Assessment Criteria

If an SGV is not available for a substance identified in the soil then the range of Generic Assessment Criteria published from a collaborative research by Land Quality Management Limited (LQM) and the Chartered Institute of Environmental Health (CIEH) are used for example. In the case of Lead, Category 4 screening levels (C4SLs) have replaced the AtRisk Soil SSV.

1.6.1 EIC/AGS/CL: AIRE

The report represents the collaborative effort of risk assessors from 26 EIC and AGS member companies to produce generic assessment criteria (GAC) for soils for human health risk assessment. The project involved the collation and review of physico-chemical data, toxicological data and information on background

exposure for 44 contaminants sometimes encountered on land affected by contamination in the UK and the derivation of GAC for 351 of these using the CLEA model (v1.06). The GAC are intended to complement soil guideline values (SGV) produced by the Environment Agency of England and Wales and the 2nd edition GAC produced by LQM and CIEH (Nathanail et al, 2009). All three sets of assessment criteria have been derived in general accordance with the Environment Agency of England and Wales Contaminated Land Exposure Assessment (CLEA) guidance and thus the combined efforts of these three groups have resulted in a useful set of screening criteria for the assessment of risks to human health from soil contamination for more than 120 potentially contaminative substances.

1.6.2 Category 4 screening levels (C4SLs) (2014)

A new statutory DEFRA guidance recently (i.e. August 2014) published some GACs with a more pragmatic (but still strongly precautionary) approach in their derivation called the Category 4 screening levels (C4SLs). These values provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land. They are intended as generic screening values, (ii) they describe a level of risk that whilst above 'minimal' is still 'low' and (iii) they provide a 'higher simple test' for deciding that land is suitable for use and definitely not contaminated. These values were derived for four generic land uses: residential, commercial, allotments, and public open space.

1.6.3 LQM/CIEH Suitable 4 Use Level (S4UL) (2015)

The new S4UL's ((Nathanail *et al*, 2015), was developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants. The S4ULs were:

- based on Health Criteria Values, updated to reflect changes since 2009
- derived for the standard CLEA land uses and the two public open space scenarios developed by Defra SP1010
- developed for ca 85 substances (those previously covered by the LQM/CIEHGAC and the SGV substances);
- Compliant with SR2 and the long standing principle of 'suitable for use' and reflecting changes to exposure parameters produced by Defra SP101

For derivation of these Generic Assessment Criteria reference must be made to: Nathanail, P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A., Ogden, R., Scott, D. *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (3rd edition)*. **Land Quality Press**. 2015.

1.7 Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

1.7.1 Residential

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of home-grown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home-grown vegetables will not occur.

1.7.2 Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

1.7.3 Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

1.7.4 Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
- Predominantly used by children for playing and may be used for activities such as a football kick about
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
- older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
- ingestion rate 75 mg.day⁻¹

1.7.5 Public Open Space Park

This generic scenario refers to any public park that is more than 0.5ha in area:

- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
- Female child age classes 1-6
- Soil ingestion rate of 50 mg.day⁻¹
- Occupancy period outdoors = 2 hours.day⁻¹
- Exposure frequency of 170 days.year⁻¹ for age classes 2-18 and 85 days.year⁻¹ for age class 1
- Outdoor exposure pathways only (no tracking back).

1.8 Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of an SGV/GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a DQRA may be undertaken to develop site specific values for relevant soil contaminants.

- Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.
- Developing more accurate parameters using site data.

1.9 Current Criteria

Table 1 presents the current Generic Assessment Criteria and reference should be made to the original publications if needed.

1.10 Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) and Category 4 screening levels (C4SLs) (2014) addressed the statistical treatment of test results and their comparison to Soil Guideline Values. Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach ('the way forward') (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CL:AIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CL:AIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots

- A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
- Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

Tier 1 Soil Guidance Values

The following table presents the Tier 1 Soil Guidance Values (SGVs) Revision 002 based on LQM/CIEH Sutable 2 Use Levels (S4UL) for Human Health Assessment (unless stated otherwise).

Land-Use Scenario

Determinant	Residential with Homegrown Produce	Residential without Homegrown Produce	Public Open Space (POS) Residential	Public Open Space (POS) Park	Allotment	Commercial and Industrial
Metals and Metalloids						
Arsenic	37	40	79	170	43	640
Boron	290	11000	21000	46000	45	240000
Cadmium	11	85	120	532	1.9	190
Chromium (Hexavalent)	6	6	7.7	220	1.8	33
Chromium	910	910	1500	33000	18000	8600
Copper	2400	7100	12000	44000	520	68000
Lead (C4SL Criteria)	200	310	630	1300	80	2330
Elemental Mercury	1.2	1.2	16	30	21	58
Inorganic Mercury	40	56	120	240	19	1100
Nickel	180	180	230	3400	230	980
Selenium	250	430	1100	1800	88	12000
Vanadium	410	1200	2000	5000	91	9000
Zinc	3700	40000	81000	170000	620	730000
Other Inorganics						
pH	6-9 Units					
Asbestos	If Detected					
Cyanide (Dutch Intervention Value)	20	20	20	20	20	-
Phenol (based on 2.5% SOM)						
Phenol (Total)	550	1300	760	760	66	760
Total Petroleum Hydrocarbons (TPH) (based on 2.5% SOM)						
Aliphatic (5-6)	78	78	570000	95000	730	3200
Aliphatic (6-8)	230	230	600000	150000	2300	7800
Aliphatic (8-10)	65	65	13000	14000	320	2000
Aliphatic (10-12)	330	330	13000	21000	2200	9700
Aliphatic (12-16)	2400	2400	13000	25000	11000	59000
Aliphatic (16-35)	65000	92000	250000	450000	260000	1600000
Aliphatic (35-44)	65000	92000	250000	450000	260000	1600000
Aromatic (5-7 benzene)*	140	690	72(56000)	90(76000)	0.017(13)	27(26000)
Aromatic (7-8 toluene)	290	1800	56000	87000	22	56000
Aromatic (8-10)	83	110	5000	7200	8.6	3500
Aromatic (10-12)	180	590	5000	9200	13	16000
Aromatic (12-16)	330	2300	5100	10000	23	36000
Aromatic (16-21)	540	1900	3800	7600	46	28000
Aromatic (21-35)	1500	1900	3800	7800	370	28000
Aromatic (35-44)	1500	1900	3800	7800	370	28000
BTEX (based on 2.5% SOM)						
Benzene	0.17	0.7	73	110	0.075	90
Toluene	290	1900	56000	100000	120	180000
Ethylbenzene	110	190	25000	27000	91	27000
m-Xylene	140	190	43000	32000	170	31000
p-Xylene	130	180	43000	31000	160	30000
o-Xylene	140	210	43000	33000	160	33000

All values in mg/kg unless stated otherwise

* Benzene values to be used as a conservative screen for TPH Aromatic C5-C7 range hydrocarbons if Speciated BTEX results are not available. If Speciated BTEX are available then TPH Aromatic C5-C7 screening value in () can be adopted.

Tier 1 Soil Guidance Values (Cont.)

Land-Use Scenario

Determinant	Residential with Homegrown Produce	Residential without Homegrown Produce	Public Open Space (POS) Residential	Public Open Space (POS) Park	Allotment	Commercial and Industrial
Polycyclic Aromatic Hydrocarbons (PAH) (based on 2.5% SOM)						
Naphthalene	5.6	5.6	4900	1200	4.1	190
Acenaphthene	510	35000	15000	29000	34	84000
Acenaphthylene	420	4600	30000	29000	28	83000
Fluorene	400	3800	9900	20000	27	63000
Anthracene	5400	35000	74000	150000	380	520000
Fluoranthene	560	1600	3100	6300	52	23000
Phenanthrene	220	1500	3100	6200	15	22000
Pyrene	1200	3800	7400	15000	110	54000
Benzo(a)anthracene	11	14	29	49	2.9	170
Chrysene	22	31	57	93	4.1	350
Benzo(b)fluoranthene	3.3	4	7.2	13	0.99	44
Benzo(k)fluoranthene	93	110	190	370	37	1200
Benzo(ghi)perylene	340	360	640	1400	290	3900
Benzo(a)pyrene	2.7	3.2	5.7	11	0.97	35
Dibenzo(ah)anthracene	0.28	0.32	0.57	1.1	0.14	3.5
Indeno(123-cd)pyrene	36	46	82	150	9.5	500

All values in mg/kg unless stated otherwise

References

LQM/CIEH Suitable 2 Use Levels (S4UL) for Human Health Assessment – Land Quality Management Limited (LQM) and Chartered Institute of Environmental Health (CIEH) Land Quality Press (2015)

SP1010: Development of Category 4 Screening Levels (C4SL) for Assessment of Land Affected by Contamination - Department for Environment, Food and Rural Affairs (2014)

Dutch Target and Intervention Values (the New Dutch List) (2000)

Descriptions of Public Open Space (POS): Section 1.4.2 of The LQM S4UL for Human Health Assessment

POS Residential: Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930s-1970s housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

POS Park: An area of open space, usually owned and maintained by the Local Authority, provided for recreational uses including family visits and picnics, children's play area, informal sporting activities such as football (but not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into the place of residence will be negligible.

SOM – Soil Organic Matter

Soil Guidance Values for Organics are presented are based on 2.5% SOM. In the event of exceedance, the actual SOM content of the sample(s) should be reviewed to determine if a lower value based on 1.0% or 6.0% can be adopted.

Selected water quality standards

The following selected water-quality standards are to be used in assessing the presence of pollution in controlled waters. It is important to note that the tables are for general guidance only and care should be exercised when applying these for specific purposes. This information is necessarily summarised. It may be necessary to refer back to the original source of the data for qualifying/clarifying information.

Water-quality standards should be used only where they are relevant to the site being assessed.

Key to standards referenced

1 Figures for Environmental Quality Standards (EQS) are Annual Average Concentrations with Maximum Allowable Concentrations in brackets.

Where a range of EQS for freshwater is given, it depends on the hardness of the water. Seek further advice from the Agency.

2 World Health Organisation (WHO) *Guidelines for Drinking Water Quality*, 1984.

The health value is a guideline value representing the concentration of a constituent that does not result in any significant risk to the consumer over a lifetime of exposure.

The ATO is the concentration of the substance, at or below the health-based guideline value, which may affect the appearance, taste or odour of the water. The concentrations given are those likely to give rise to consumer complaints.

3 Council Directive 98/83/EC on the quality of water intended for human consumption.

4 UK Drinking Water Standards taken from:

- Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) (as amended);
- Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) (as amended).

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
Acrylamide	ug/l			0.5		0.1	0.1
Alachlor	ug/l			20		0.1	0.1
Aldicarb	ug/l			10		0.1	0.1
Aldrin	ug/l	0.01	0.01	0.03		0.03	0.03
Aluminium	ug/l				200	200	200
Ammonia (NH ₃ as N)	mg/l	0.015	0.021		1.5		
Ammonium (as NH ₄ ⁺)	mg/l					0.5	0.5
Antimony	ug/l			5		5	5
Arsenic	ug/l	50	25	10		10	10
Atrazine	ug/l	2	2	2		0.1	0.1
Azinphos-methyl	ng/l	10 (40)	10 (40)			100	100
Barium	mg/l			0.7			1
Bentazone	mg/l	0.5	0.5	0.03		0.1	0.1
Benzene	ug/l	30 (300)	30 (300)	10		1	1
Benzo [a] pyrene	ug/l			0.7		0.01	0.01
Biphenyl	ug/l	25	25				
Boron	mg/l	2	7	0.3		1	1
Bromate	ug/l					10	10
Bromoxynil	ug/l	100 (1000)	100 (1000)			0.1	0.1
Cadmium	ug/l	5	2.5	3		5	5
Calcium	mg/l						250
Carbofuran	ug/l			5		0.1	0.1
Chlordane (all isomers)	ug/l			0.2		0.1	0.1
Chlorfenvinphos	ug/l	0.01 (0.1)	0.01 (0.1)			0.1	0.1
Chloride	mg/l	250			250	250	250
Chlorine	ug/l	2	10				
Chloroform	ug/l	12	12	200			
Chloroform extractable substances	ug/l						1000
Chlorophenylid	ug/l	0.05	0.05			0.1	0.1
Chloronitrotoluenes	ug/l	10	10				
Chlorothalonil	ug/l	0.1	0.1			0.1	0.1
Chlorpropham	ug/l	10	10			0.1	0.1
Chlorotoluron	ug/l	2	2	30		0.1	0.1
Chromium	ug/l	5 - 250	15	50		50	50
Copper	ug/l	1 - 28	5	2000	1000	2000	2000
Coumaphos	ug/l	0.01 (0.1)	0.04 (0.4)			0.1	0.1
Cyanide	ug/l			70		50	50
Cyfluthrin	ug/l	0.001	0.001			0.1	0.1

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
2,4-dichlorophenoxyacetic acid (2,4-D), (ester form)	ug/l	1	1	30		0.1	0.1
Demetons	ug/l	0.5	0.5			0.1	0.1
Diazinon	ug/l	0.01 (0.1)	0.015 (0.15)			0.1	0.1
Dichlorodiphenyltrichloroethane (all isomers)	ug/l	0.025	0.025				
Para, para-DDT	ug/l	0.01	0.01	2		0.1	0.1
1 ,2-Dichloroethane (1 ,2-DCA)	ug/l	10	10	30		3	3
1,1 -Dichloroethene (1,1 -DCE)	ug/l			30			
1 ,2-Dichloroethene (1 ,2-DCE)	ug/l			50			
1 ,2-dibromo-3-chloropropane	ug/l			1		0.1	0.1
1 ,2-Dichlorobenzene	ug/l			1000	1 to 10		
1 ,2-Dichloropropane	ug/l			20		0.1	0.1
1 ,3-Dichloropropene	ug/l			20		0.1	0.1
1 ,4-Dichlorobenzene	ug/l			300	0.3 to 30		
Di(2-ethylhexyl)adipate	ug/l			80			
Di(2-ethylhexyl)phthalate	ug/l			8			
Dichloromethane	ug/l			20			
Dichlorprop (DCPP)	ug/l			100		0.1	0.1
Dichlorvos	ng/l	1	40			100	100
Dieldrin	ug/l	0.01	0.01	0.03		0.03	0.03
Dimethoate	ug/l	1	1			0.1	0.1
Drins (total)	ug/l	0.03	0.03			0.1	0.1
Edetic Acid (EDTA)	ug/l			200			
Endosulfan	ng/l	3	3			100	100
Endrin	ug/l	0.005	0.005			0.1	0.1
Epichlorohydrin	ug/l			0.4		0.1	0.1
Ethylbenzene	ug/l			300	2 to 200		
Fenchlorphos	ug/l	0.01 (0.1)	0.01 (0.1)			0.1	0.1
Fenoprop	ug/l			9		0.1	0.1
Fenitrothion	ng/l	10 (250)	10 (250)			100	100
Flucifuron	ug/l	1				0.1	0.1
Fluoride	ug/l			1500		1500	1500
Formaldehyde	ug/l	5 (50)	n/a	900		0.1	0.1
Heptachlor	ug/l			0.03		0.03	0.03
Hexachlorobenzene	ug/l	0.03	0.03	1		0.1	0.1
Hexachlorobutadiene	ug/l	0.1	0.1	0.6			
Hexachlorocyclohexane (lindane)	ug/l	0.1	0.02	2		0.1	0.1
Hydrocarbons (dissolved/emulsions)	ug/l			300			10
Hydrogen sulphide (H2S as S)	ug/l	0.25 to 1.0	10				

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
Ioxynil	ug/l	10 (100)	10 (100)			0.1	0.1
Iron	mg/l	1	1		0.3	0.2	0.2
Isodrin	ug/l	0.005	0.005			0.1	0.1
Isoproturon	ug/l	2 to 20		9		0.1	0.1
Lead (inorganic - dissolved)	ug/l	4 - 250	25	10		10	25 (reducing to 10)
Linu ron	ug/l	2	2			0.1	0.1
Magnesium	mg/l						50
Malachite green	ug/l	0.5 (100)					
Malathion	ng/l	10 (500)	20 (500)			100	100
Manganese	ug/l			500	100	50	50
MCPA	ug/l	2	2	2		0.1	0.1
Mecoprop (MCP)	ug/l	20 (200)	20 (200)	10		0.1	0.1
Mercury	ug/l	1	0.3	1		1	1
Methylbenzene	ug/l	50 (500)	40				
Methoxychlor	ug/l			20		0.1	0.1
Metolachlor	ug/l			10		0.1	0.1
Molinate	ug/l			6		0.1	0.1
Molybdenum	ug/l			70			
Monochlorobenzene	ug/l			300	10 to 120		
Naphthalene	ug/l	10 (100)	5 (80)				
Nickel	ug/l	50 - 200	30	20		20	20
Nitrate (as NO3)	mg/l			50		50	50
Nitrite (as NO2)	ug/l			3		500	100
Nitriloacetic acid	ug/l			200			
Oils/hydrocarbons (by Pet Ether extract)	ug/l						10
Omethoate	ug/l	0.01				0.1	0.1
Polycyclic Aromatic (PAH) Hydrocarbons	ug/l					0.1	0.1
Pendimethalin	ug/l			20		0.1	0.1
Pentachlorophenol	ug/l	2	2	9		0.1	0.1
Permethrin	ug/l	0.01		20		0.1	0.1
Pesticides (individual species, unless specified)	ug/l					0.1	0.1
Pesticides (total)	ug/l					0.5	0.5
Phenol	ug/l	30 (300)	30 (300)			0.5	0.5
Pirimicarb	ug/l	1	1			0.1	0.1
Phosphorous	ug/l					400 (5000)	2200
Potassium	mg/l					10 (12)	12

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
Propanil	ug/l			20		0.1	0.1
Propetamphos	ug/l	0.01 (0.1)	0.01 (0.1)			0.1	0.1
Pryidate	ug/l			100		0.1	0.1
Selenium	ug/l			10		10	10
Silver	ug/l	0.05 (0.1)	0.5 (1)				10
Simazine	ug/l	2 (10)	2 (10)	2		0.1	0.1
Sodium	mg/l	170			200	200	200
Styrene	ug/l	50 (500)	50 (500)	20	4 to 2600		
Sulcofuron	ug/l	25	25			0.1	0.1
Sulphate	mg/l	400	250		250	250	250
Sulphide	ug/l	0.25	n/a				
Surfactants	ug/l						200
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)	ug/l			9		0.1	0.1
Tecnazene	ug/l	1 (10)	1				
Tetrachloroethene (PCE)	ug/l	10	10	40		10 (with TCE)	10 (with TCE)
Tetrachloromethane (PCM, carbon tetrachloride)	ug/l	12	12	2			3
Thiabendazole	ug/l	5	5			0.1	0.1
Tin (inorganic)	ug/l	25	10				
Toluene	ug/l	50 (500)	40 (400)	700	24 to 170		
Triazophos	ng/l	5 (50)	5 (50)			100	100
Tributyltin (oxide)	ug/l	0.02	0.02	0.02			
1,1,1-Trichloroethane (1,1,1-TCA)	ug/l	100 (1000)	100 (1000)				
1,1,2-Trichloroethane (1,1,2-TCA)	ug/l	400 (4000)	300 (3000)				
Trichloroethene (TCE)	ug/l	10	10	70		10 (with PCE)	10 (with PCE)
Trichlorobenzenes (total)	ug/l	0.4	0.4	20	5 to 50		
2,4,6-Trichlorophenol	ug/l			200		2-300	
Trihalomethanes (total)	ug/l					150 reducing to 100 by 2008	100
Trifluralin	ug/l	0.1 (1)	0.1 (1)	20		0.1	0.1
Triphenyltin	ug/l	0.02	0.008				
Vanadium	ug/l	20 - 60	100				
Vinyl chloride (chloroethene)	ug/l			5		0.5	0.5
Xylene	ug/l	30	30	500	20 to 1800		
Zinc	ug/l	8 - 500			3000		5000

Note: A range of values may be given for the Environmental Quality Standard (EQS) for an individual substance in the table above.

Typically, a range for metals (for example, vanadium: 20 – 60 µg/l) relates to an acceptable concentration in waters of different hardness. Where the hardness of the receiving waters is not known, it will be appropriate to use the lowest (most stringent value).

Some organic contaminants are given two values (for example, toluene: 50 (500) µg/l). These values normally relate to an acceptable annual average concentration, followed in brackets by a maximum admissible peak concentration. It is appropriate to consider the annual average (that is, the first and lower value) in assessing the pollution potential over a period of time.