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ASHPLATS HOUSE - EAST GRINSTEAD

PRELIMINARY PHASE 2 SITE INVESTIGATION

NON-TECHNICAL SUMMARY

Lustre Consulting Limited has been commissioned by Anoushka Bos to undertake a Phase 2 Site Investigation with combined environmental and geotechnical reporting for the proposed redevelopment of a site located off Holtye Road, in West Sussex. The proposed development involves the construction of several low-rise residential housing units with car parking and private and communal gardens.

The site investigation involved the advancement of five windowless sample boreholes (with Standard Penetration Tests (SPTs)), one trial pit and three soakage infiltration pits through the Made Ground and into the underlying natural soils. All boreholes were installed with monitoring wells to enable subsequent gas and groundwater monitoring. The three soakage pits were prepared for soil infiltration testing. Four historic boreholes were noted across the site. Two hand dug pits and two surface sample pits were also excavated in the vicinity of the two externally located above ground tanks.

Ground cover across the majority of the site comprised grass over topsoil, described as dark brown / greyish brown clayey slightly gravelly / sandy silt with roots. No evidence of Made Ground was noted to underly the topsoil. Natural soils of the Ardingly Sandstone Member underlay the topsoil, and was described as yellowish light brown slightly sandy SILT/ silty SAND. The natural soils were proved to a maximum depth of 3m bgl. Made Ground comprising brown slightly sandy gravelly clay with man made inclusions of brick, chalk and clinker, which was overlain by a dense layer of gravel (from 0.05m to 0.15m bgl) was identified within the vicinity of the ASTs, however the thickness could not be proven due to the presence of below ground pipework.

Eleven soil samples from the Topsoil, Made Ground and Natural ground were scheduled for chemical testing. One PAH compound were marginally recorded above the respective risk threshold within the topsoil. However given that the development will undergo an initial scrape of the topsoil in preparation for the construction of the residential dwellings, the topsoil within this area is not considered to present a risk to human health. None of the determinands analysed for in the Natural soils exceeded the risk thresholds and the chemical quality of the natural ground is not considered to present a risk to human health. Within the vicinity of the two externally located ASTs elevated concentrations of hydrocarbons were recorded within the shallow soils, in excess of their respective threshold values for human health. Consequently, a **moderate** risk has been identified to future site occupants which will require further investigation / verification associated with these point sources of contamination.

The site has been classified as Characteristic Situation 2 with respect to ground gas risk. As such gas protection measures will be required.

The Ardingly Sandstone Member should be capable of bearing traditional shallow foundations to support the proposed buildings, subject to the loadings that will be imposed. The appraisal suggests that foundations could be designed to an estimated allowable net bearing pressure of up to 200kN/m^2 at which intensity differential settlement would be expected to be within acceptable limits (25mm).

The result of the infiltration testing indicates the use of traditional soakaways should be feasible within the Ardingly Sandstone Member. It is recommended that these are predominantly placed on the eastern side of the site where the soil was more granular.

PROJECT RECORD		
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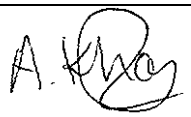
AUTHOR (ENVIRONMENTAL)	AMY KHAN BSc (Hons) CONSULTANT	
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RELIANCE AND LIMITATIONS

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REGISTRATION OF AMENDMENTS

Revision and Date	Amendment Details	Revision Author	Revision Reviewer

1.0 INTRODUCTION

1.1 Lustre Consulting Limited (Lustre) has been commissioned Anoushka Bos to undertake a Phase 2 Site Investigation with combined environmental and geotechnical reporting for the proposed redevelopment of a site located off Holtye Road, in East Grinstead, West Sussex. The assessment has been undertaken in accordance with our fee proposal and scope of works dated 12/10/2018, which was formally approved by Anoushka Bos on 17/10/2018.

1.2 The site, irregular in plan, is centered at National Grid Reference 540840, 139300, and occupies an approximate area of 1.13ha, as shown in Figure 1. The site currently comprises a low rise residential dwelling with private gardens and is located within a mixed forested and residential land use area. Anoushka Bos requires this Phase 2 Site Investigation to support the sale and eventual proposed development relating to construction of several low-rise residential housing units with associated car parking and private gardens, in addition to communal garden areas and driveway / access roads. Figure 2 illustrates the proposed development scheme.

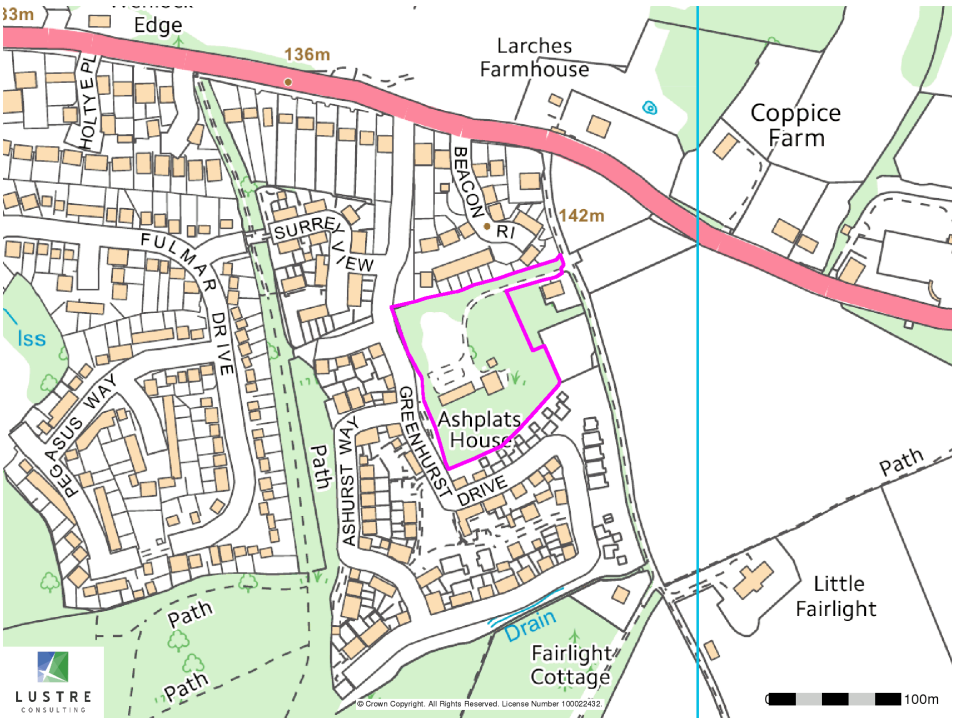

Figure 1: Site Location Plan

Figure 2: Proposed Site Layout

Objective

1.3 The objective of the works was to provide information on the ground conditions prior to marketing the site and support the sales process. Further detail on the scope of works is given below.

Scope of Works

1.4 The scope of works has been based on the findings of a Phase 1 Desk Study[1]. Full reference should be made to the desk study to understand the preliminary conceptual model and basis of this investigation.

[1] Phase 1 Desk Study, Ashplats House, East Grinstead, Lustre Consulting, October 2018, Ref: 2390_FP02.0-2018

1.5 The scope of work adopted to meet the above objectives employed both a targeted and non-targeted approach, is summarised below:

- Ascertain the geological and hydrogeological conditions present at the site by drilling five windowless sample boreholes and excavating one machine dug and four hand dug trial pits;
- Determine the soil infiltration rates of the site by excavating three soakage pits across the site;
- Understand the geotechnical constraints and ground parameters with factual and interpretative observations that may influence foundation design and other geotechnical considerations;
- Identify the chemical quality of soils / groundwater underlying the site with reference to current and historical land uses and determine the presence of any unacceptable risks through sample recovery, chemical analysis and assessment;
- Assess the ground gas regime at the site with reference to potential sources of ground/landfill gas and determine the presence of any unacceptable risks by undertaking three rounds of gas monitoring;
- Validate the preliminary conceptual site model and re-assess the risk ratings using the source – pathway – receptor methodology; and
- Provide conclusions and recommendations to effectively manage and mitigate any unacceptable geoenvironmental risks or liabilities.

1.6 The Phase 2 Site Investigation has been prepared in keeping with best practice and current planning guidance, where practicable and in accordance with the approved scope of work. *The National Planning Policy Framework (NPPF)*[2] advises regulatory consultees to ensure that adequate site investigation information is provided at the initial planning stage, whilst the Environment Agency's *Model Procedures for the Management of Land Contamination (CLR11*[3]*)* requires a phased, risk based approach when dealing with land affected by contamination in the UK.

1.7 This Phase 2 site investigation forms the second stage of an iterative contaminated land assessment, to further investigate the potential sources of contamination and unacceptable risks identified during the Phase 1 Desk Study. The methodology adopted in this Phase 2 site

[2] Department for Communities and Local Government, National Planning Policy Framework, March 2012.
[3] DEFRA/Environment Agency, Model Procedures for the Management of Land Contamination, CLR11, September 2004.

investigation is based on the source-pathway-receptor model as set out in *CLR11*[2]. More information on Lustre's approach to such assessments can be found at the following link: www.lustreconsulting.com/Services/ContaminatedLandAssessment.aspx and in Appendix A.

Statutory Guidance

1.8 References to the term "contaminated land" in this report relate to the statutory definition of contaminated land under the recently published Contaminated Land Statutory Guidance unless otherwise stated (also known as Category 1 and 2 under Part 2A). That definition is: *"any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances on in or under the land that –*

a) Significant harm is being caused or there is a significant possibility of such harm being caused; or

b) Significant pollution of water environment is being caused or there is significant possibility of such pollution being caused".

1.9 Other terms such as "land affected by contamination" or "land contamination" refer to the much broader categories of land where contaminants are present but usually not at a significant level of risk to be classified as contaminated land under the definition Part 2A (also known as Category 3 or Category 4 under Part 2A).

Reliance and Limitations

1.10 This report has been prepared using published information, information obtained during any site visits and information provided by the Client which were made available at the time of writing only. No liability is extended to any information which has become available since this time.

1.11 No third-party liability or duty of care is extended without express permission in writing by Lustre. Third parties using information contained in this report do so at their own risk. For further details please refer to our terms and conditions.

Report Structure

1.12 Chapter 2 presents the intrusive site investigation methodology. The ground conditions encountered during the site works, including a factual account of the soil parameters, are set out in Chapter 3. Chapter 4 provides a geotechnical design appraisal and interpretation of the

ground model with suggested foundation design options. Chapter 5 presents a geoenvironmental assessment of the analytical data gathered and Chapter 6 includes a conceptual model based on the findings of the intrusive site investigation works. Chapter 7 presents a summary of conclusions drawn from the investigation and any consequent recommendations are detailed in Chapter 8. An updated qualitative risk assessment is included after the report text.

2.0 SITE INVESTIGATION METHODOLOGY

Introduction

2.1 The main intrusive site investigation works were undertaken on 17th and 18th October 2018 under the direct co-ordination of a suitably trained and qualified consultant employed by Lustre. Additional shallow soil sampling was also undertaken on the 15th November. The intrusive works were carried out with due regard to existing standards and good practice guidelines including *BS10175: 2011+ A1:2013*[4], *BS5930: 2015*[5] and guidance produced by the *AGS*[6].

Preparatory Works

2.2 Prior to commencing with the intrusive works each exploratory location was checked for any readily detectable shallow services. The method employed to avoid buried services involved the review of up-to-date statutory service plans, on-site checking for shallow services detectible by a Cable Avoidance Tool only by Lustre and obtaining anecdotal evidence from the current land owners.

Windowless sampling rig used on site

Mini digger used on site

[4] British Standard – Code of Practice for Investigation of potentially contaminated sites. BS 10175: 2011 + A1:2013.
[5] British Standard – Code of Practice for Site Investigation. BS 5930: 2015.
[6] Association of Geotechnical & Geoenvironmental Specialists, AGS Guide to Environmental Sampling, 2010.

2.3 Exploratory holes were located to obtain the required information to meet the project objectives, whilst avoiding services, access and egress routes and providing a reasonable coverage across the site. Drawing 2390-001 shows the positions of all exploratory locations.

2.4 Due to the location of underground and overhead services, access restrictions and time scales, two of the above ground fuel storage tanks (ASTs) and the Made Ground in the vicinity of the existing structures has not been investigated as part of the current scope of works.

Windowless Sampling

2.5 A total of five windowless sample boreholes (WS1 to WS5) were drilled to a maximum depth of three meters below ground level (m bgl) through the topsoil and into the underlying natural soils, using a tracked Competitor Dart Terrier Rig. The boreholes were distributed across the site to provide a reasonable coverage whilst also being located directly below the canopy of large mature trees. Standard Penetration Tests (SPTs) were carried out at each location with the corresponding uncorrected 'N' values included on the logs, presented in Appendix B.

2.6 Upon completion all boreholes were installed with monitoring wells to enable subsequent return gas and groundwater monitoring. The wells comprised plain 50mm pipe to 0.5m bgl, with a slotted 50mm diameter pipe to the base of the boreholes. The annulus surrounding the slotted pipe was filled with washed gravel, which was then plugged with a 0.5m bentonite seal surrounding the plain pipe. The monitoring wells were completed with a gas tap and a flush lockable cover and finished to match existing ground cover.

Trial Pits

2.7 One trial pit (TP1) was excavated using a tracked mini-excavator to a maximum depth of 1.6m bgl. The trial pit extended through the topsoil and proved natural strata for at least 1m and was positioned to provide coverage across the accessible areas of site. Upon completion, all excavations were backfilled with arisings and soils compacted with the excavator bucket.

2.8 Two hand dug pits (Tank A HP1 and Tank A HP2) and two surface sample pits (Tank B S1 and Tank B S2) were excavated in the vicinity of the two above ground tanks situated within the soft landscaped areas to obtain environmental samples (hereafter referred to ask Tank A and Tank B and labelled on Drawing 2390-001). The hand pits were extended to a maximum depth of 0.3m bgl and were terminated due to the presence of below ground pipework. Upon completion, the excavations were backfilled with arisings and soils compacted. Surface sampling was only possible in the vicinity of Tank B due to access constraints.

Soakage Pits

2.9 A total of three additional trial pits (Soak 1 to Soak 3) were excavated using a tracked mini-excavator to depths between 0.6m to 2m bgl. The trial pits extended through the topsoil and proved natural strata for at least 1m and were positioned in locations as per the engineers requirements.

2.10 Upon excavation, all excavations were backfilled with clean 20mm shingle in preparation for the soil infiltration tests (details provided below).

Field Observations & Soil Sampling

2.11 All soil arisings recovered from the Made Ground and underlying natural soils were logged to *BS5930: 2015*[7]. Where possible, observations on groundwater ingress and excavation stability were made.

2.12 Soil arisings were inspected for visual and olfactory evidence of contamination with samples recovered at varying depths for chemical and geotechnical analysis. Disturbed and undisturbed samples (where applicable) were deposited in suitable containers, prepared and dispatched to a UKAS (United Kingdom Accreditation Service) accredited laboratory in accordance with good practice guidelines.

In-Situ Field Tests

2.13 At appropriate depths, soil samples were deposited in sealable plastic bags to allow on-site headspace analysis. Samples were left for at least 20 minutes before analysis. A photo-ionisation detector (PID) with 10.6eV lamp was used to measure the concentration of volatile organic compounds (VOC) within the headspace. Soil samples were agitated during analysis to encourage the release of any volatiles.

2.14 Three trial pits were selected by the engineer for soakage testing (Soak 1 to Soak 3) in accordance with BRE Digest 365[8]. At each location, a 50mm diameter slotted standpipe was placed vertically in the pit (at one end) to allow the measurement of the water level during the soakage test. The excavation was then filled with clean shingle to stabilise the pit, that also

[7] British Standard – Code of Practice for Site Investigation. BS 5939: 2015.
[8] BRE Digest 365. Soakaway Design. 3rd Revision, 2007

provided a safe working area and more stable/reliable test pit. Water was then rapidly added to the pit to surcharge up to the base of the Made Ground (where possible), replicating storm conditions. The water level was then recorded using a dip meter at set intervals (e.g. starting at <1 minute intervals and progressing up to 45 minute intervals). Field data and calculation sheets are provided in Appendix D.

Existing boreholes

2.15 Four historic boreholes (EBH1 to EBH4) were noted across the site. From field observations using a small camera, locations EBH1 to EBH3 were noted to comprise 1m of plain pipe, with 0.9m used at EBH4 and slotted pipe to the base of the wells. The base depths of the wells are detailed within the gas monitoring results (Appendix D).

2.16 No information regarding the historic boreholes and previous investigative works has been made available to Lustre for review.

Return Monitoring

2.17 Three rounds of ground gas monitoring were carried out as part of this investigation to gain an understanding of the ground gas regime at the site. The monitoring wells constructed during this investigation were used, in addition to the four historic boreholes. A summary of the gas monitoring results is provided in the Environmental Assessment Appendix. The monitoring was undertaken over a range of atmospheric pressures between 980mb and 2027mb.

2.18 Upon completion of the ground gas monitoring, groundwater levels were recorded using a dip meter.

2.19 Field monitoring records are presented in Appendix D.

Chemical Analysis (Environmental)

2.20 A total of eleven soil samples were scheduled for chemical testing. Samples were analysed for a range of determinands, which considers the potential contaminants associated with the current/historical site uses, as follows:

- Metals: arsenic, cadmium, chromium (inc. hexavalent), mercury, lead, nickel, selenium, water soluble boron, copper and zinc;
- pH and water soluble sulphate;

- Total phenols;
- Speciated Polycyclic Aromatic Hydrocarbons (PAHs, total and speciated EPA 16);
- Speciated Total Petroleum Hydrocarbons (TPH CWG);
- Extractable Petroleum Hydrocarbons;
- BTEX (including MTBE);
- Asbestos screen;
- Total Organic Carbon (TOC).

NB: Not all samples were analysed for the full suite of determinands listed above.

2.21 The environmental analysis was undertaken by DETS Limited at their UKAS accredited laboratory in Lenham Heath, Kent. The results of the chemical analysis are reported in Chapter 5 and copies of the laboratory test certificates are included in Appendix D.

Geotechnical & Geochemical Analysis

2.22 A total of 10 in-situ SPTs were undertaken within the natural soils to ascertain the uncorrected SPT *N*-values. A correction to the measured blow count is then normally applied dependent on various parameters, i.e. non-standard approaches, soil types etc. The principal correction is concerned with the energy delivered to the sampler by the hammer and drill rods used by the drilling rig. The calibration certificate for the SPT equipment employed on this investigation suggests an Energy Ratio, Er, of 81% (windowless sampling rig) should be applied for a corrected *N*-value (N_{60}) in line with recommendations given in BS EN ISO 22476-3[9].

2.23 The corrected SPT N_{60} values have been used to provide an indication of relative soil density and strength at the site. The uncorrected SPTs were carried out at set intervals over a 450mm test depth or until refusal or significant 'chiseling' (>50 blows), whichever comes first. The N_{60} values can be used to determine the effective angle of shearing resistance (ø) for granular soils (mainly sands and gravels). Less reliably, the N_{60} values can also be used to provide an **estimate** on the shear strength soils (C_u) by correlation of the Atterberg Limits in cohesive soils (clays and fine silts). Depending on the type of structures and supporting foundations

[9] BS EN ISO 22476-3:2005, Geotechnical investigations and testing, Field Testing. Part 3: Standard Penetration Test, BSI, 2005

proposed, the N_{60} values recorded in Made Ground is normally ignored. The uncorrected SPT results are shown on the investigation logs enclosed in Appendix B.

2.24 A total of 13 soil samples were scheduled for a variety of geotechnical tests that considers both the ground conditions encountered during the intrusive works and type of development proposed, as follows:

- Moisture content;
- Atterberg classification tests (plastic and liquid limits);
- Particle size distribution (PSD);

2.25 The geotechnical testing was undertaken by i2 at their UKAS accredited laboratory in Poland. The results of the geotechnical testing are reported in Chapters 3 and 4 and copies of the laboratory test certificates included in Appendix D.

2.26 The geochemical analysis was undertaken by DETS Ltd at their UKAS accredited laboratory in Lenham Heath, Kent. The results of the geochemical analysis are reported in Chapter 4 and copies of the laboratory test certificates included in Appendix D.

3.0 GROUND CONDITIONS

Introduction

3.1 This chapter collates all the factual information from the site investigation, including field observations, in-situ testing and geotechnical laboratory analysis, to present a summary of the ground conditions encountered during the intrusive works.

Ground Cover

3.2 Ground cover across the entire site comprised grass over topsoil, described as dark brown / greyish brown clayey slightly gravelly / sandy silt with roots. Gravel was recorded as angular to subangular fine flint, and coal/clinker (WS2). Sand of ash was present in all of the window samples and soakaway trial pits. The topsoil was recorded to a maximum depth of 0.20m bgl (WS2) with an average thickness of 0.1m.

3.3 No visual or olfactory evidence of hydrocarbon or solvent-type contamination was noted within the topsoil.

3.4 In-situ headspace readings within the topsoil did not indicate the presence of volatile compounds with a maximum concentration of 0.3ppm recorded in WS2 at a depth of 0.15m bgl.

Limited topsoil overlying natural soils at WS1

Rare coal/clinker fragments within WS4

Made Ground

3.5 Made Ground was encountered in five exploratory locations, WS4, Soak 3, Tank A HP1, Tank A HP2 and TP1 with recorded depths ranging from 0.20m bgl to 0.30m bgl. Within WS4 and Soak 3 the Made Ground was encountered underlying the Topsoil at 0.10m bgl and 0.05m bgl respectively, within TP1 the Made Ground was encountered from Ground Level. Within Tank A HP1 and Tank A HP2 the Made Ground was encountered underlying a thin layer of leaf mulch at 0.05m bgl. The thickest area of Made Ground was recorded in Soak 3, the average thickness was **0.20m**. However, the thickness of the Made Ground in the vicinity of the Tanks could not be proven during the investigation due to the presence of below ground pipework at 0.3m bgl.

3.6 In terms of composition, the Made Ground was noted to be generally homogenous, with the difference being the composition of the gravel in three of the locations. Within WS4 it was comprised of clinker/coal, in Soak 3 it was comprised of sandstone, brick and plastic fragments, whilst in TP1 it was recorded as brick and flint.

3.7 Within the vicinity of the above ground fuel tanks the Made Ground was recorded as brown slightly sandy gravelly clay with man made inclusions of brick, chalk and clinker, which was overlain by a dense layer of gravel (from 0.05m to 0.15m bgl).

3.8 No visual or olfactory evidence of hydrocarbon or solvent-type contamination was noted within the Made Ground.

Ardingly Sandstone Member

3.9 Ardingly Sandstone Member was encountered in all of the exploratory locations at depths ranging from 0.05m bgl to 0.30m bgl, directly underlying the Topsoil and/or Made Ground. The maximum recorded thickness was **2.89m** within WS3, the base of the strata was not encountered within any of the exploratory hole locations and is expected to be approximately 25m bgl within the region of the site.

3.10 The Ardingly Sandstone Member was encountered as a weathered soil and was noted to be two distinct soil types. Across the majority of the site the soil was recovered as a slightly sandy to sandy, slightly gravelly clayey SILT, which varied in colour between yellow, grey, orange and white.

3.11 On the eastern side of the site the soil was recovered as a silty slightly gravelly SAND, which also varied in colour between yellow, grey, orange and white.

3.12 The sand recovered as both the main component and secondary component is predominantly a fine sand and the gravel comprised fine to medium sandstone and ironstone.

3.13 No visual or olfactory evidence of contamination was noted within the Ardingly Sandstone Member.

3.14 In-situ headspace readings within the Ardingly Sandstone Member did not indicate the presence of volatile compounds.

WS2 – Silt with ironstone band.

WS4 – Fine sand.

Groundwater

3.15 Groundwater strikes were not recorded in the Ardingly Sandstone Member.

Geotechnical Testing & Classification

3.16 It was not possible to classify the soil on site using field tests, as the encountered soils were on the boundary of the coarse/fine soil boundary. This boundary is between soils which stick together and behave in a plastic manner when wet and those that behave as coarse non-plastic materials. The key definition is the proportion of fine soil that needs to be present to make the soil overall behave in a plastic manner, that is to stick together when wet and to remould.

3.17 The testing was able to establish a boundary across the site between the Ardingly Sandstone Member comprising a fine Sand or a Silt, as shown on Drawing 2390-001. The findings indicated that the Ardingly Sandstone Member was encountered as a Silt across the majority

of the site, with the soil comprising principally a fine Sand on the eastern side. This change in classification follows the natural topography of the site.

3.18 Geotechnical testing undertaken in the Ardingly Sandstone Member comprised in-situ uncorrected SPT tests to assess the relative density, moisture content, classification tests and particle size distribution (PSD) tests. Results obtained from field and laboratory testing are summarised in the tables below. The testing will be used to classify the soil for ground engineering purposes and determine the main parameters required to support the geotechnical design appraisal, such as the effective angle of shearing resistance (ø).

Geotechnical Classification – Ardingly Sandstone Member

Geotechnical Classification	Min	Max	Average	No. of Tests
Moisture Content (%)	5.8	17	10.8	8
Liquid Limit (%)	22	34	27.8	8
Plastic Limit (%)	NP	18	16.8 (8)	4 (8)
Plasticity Index (%)	NP	13	11.8 (6)	4 (8)
Passing 0.425 mm (%)	88	100	95	8
Sample Proportion - Cobbles	0	0	0	11
Sample Proportion – Gravel	0.1	19.5	6.7	11
Sample Proportion – Sand	26.40	77.30	48.95	11
Sample Proportion – Silt	7.30	42.60	27.68	11
Sample Proportion - Clay	7.60	26.00	16.65	11

Atterberg Limits & Volume Change Potential

3.19 A total of eight samples were recovered and tested for Atterberg Limits (plastic and liquid limits). The results of the tests are used for classification of clay and silt and providing an indication of the compressibility of the soils. The samples were recovered from a depth of 0.30m to 2.60m bgl across the site. Four of the samples were recorded as being non-plastic. The plasticity index (PI) within the soil ranged between 10% and 12% and the liquid limit ranged between 22% and 34% indicating a low plasticity range within the clay and silt classification as would be expected in Ardingly Sandstone Member.

3.20 The modified plasticity index (IP'%) taking into account particles passing the 425 micron sieve, recorded a low volume change potential in accordance with BRE Digest 240[10]. It should be noted that this classification applies to overconsolidated clays, which the Ardingly Sandstone Member is not. In any case, it is advisable that this volume change potential and plasticity range is applied for design purposes especially when building foundations near trees and the ground is particularly susceptible to heave.

Particle Size Distribution (PSD) & Soil Grading

3.21 The results of the PSD's which were taken at a range of depths within the Ardingly Sandstone Member are tabulated below:

Particle Size Distribution – Ardingly Sandstone Member

Location No.	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TP1	1.40 – 1.60	2.90	75.80	7.30	14.00
WS1	1.30 – 1.90	6.30	32.30	41.60	19.80
WS2	0.30 – 0.70	19.50	42.90	20.00	17.60
WS2	1.60 – 1.70	10.90	42.00	30.50	16.60
WS3	0.60 – 0.80	8.70	29.70	41.10	20.50
WS3	0.80 – 1.00	10.20	26.40	42.60	20.80
WS3	1.00 – 1.90	12.80	38.60	35.70	12.90
WS4	0.30 – 1.00	0.50	72.10	12.70	14.70
WS4	1.00 – 1.20	0.10	77.30	15.00	7.60
WS5	0.30 – 0.70	1.90	41.90	30.20	26.00
WS5	0.70 – 1.50	0.10	59.50	27.80	12.60

3.22 The soil can be categorised using two different classification schemes; one for soil description [11] and the second from an earthworks context [12]. Based on geotechnical classification testing undertaken on the samples from the Ardingly Sandstone Member the soils have been classified as per the table below:

[10] BRE 1993. Low-rise buildings on shrinkable clay soils: BRE Digest, Vols. 240, 241 and 242. CRC, London
[11] BS EN ISO 14688:2018 Geotechnical investigation and testing. Identification and classification of soil.
[12] prEN 16907:2015 (E) Earthworks.

Soil Classification – Ardingly Sandstone Member

Location No.	Depth (m)	Description Classification	Earthworks Classification
TP1	1.40 – 1.60	Sand	Intermediate Soil of Low Plasticity
WS1	1.30 – 1.90	Silt	Silt of Low Plasticity
WS2	0.30 – 0.70	Sand	Silt of Low Plasticity
WS2	1.60 – 1.70	Silt	Silt of Low Plasticity
WS3	0.60 – 0.80	Silt	Clay of Low Plasticity
WS3	0.80 – 1.00	Silt	Clay of Low Plasticity
WS3	1.00 – 1.90	Silt	Silt of Low Plasticity
WS4	0.30 – 1.00	Sand	Intermediate Soil of Low Plasticity
WS4	1.00 – 1.20	Sand	Intermediate Soil of Low Plasticity
WS5	0.30 – 0.70	Silt	Clay of Low Plasticity
WS5	0.70 – 1.50	Silt	Intermediate Soil of Low Plasticity

3.23 As can be seen from the above table the majority of the samples are classified as a cohesive material from both a soil description and earthworks classification context. It is noted that the soils are all of **low plasticity** which reduces the compressibility and volume change potential of the soils. Whilst the grading and classification is cohesive, the sandstone would normally be expected to be granular. The higher percentage of fines classifying it as cohesive would be due to the highly 'weathered' proportion of the stratum at near surface, hence the low plasticity and low compressibility nature of the soil.

Standard Penetration Testing (SPT) & Shear Strength

SPT corrected N_{60} values vs. depth – Ardingly Sandstone Member

Depth	Min (N_{60})	Max (N_{60})	Average (N_{60})	No. of Tests
1m – 1.45m	51	68	62	5
2m – 2.45m	63	68	67	4
3m – 3.45m	-	68	-	1

3.24 The corrected SPTs recorded N_{60} values at near surface and a depth shallow foundations are placed within (1m to 2.5m) were recorded as 62 - 65 indicating a very high strength[5]. As described above this is a cohesive soil formed of fines from weathering of the sandstone bedrock. In an overconsolidated clay bedrock such as London Clay Formation, SPT N_{60} values with this range would typically result in an undrained shear strength of >150kN/m^2. Therefore,

for the purposes of preliminary design and to provide an indicative characteristic shear strength, 150kN/m^2 will be assumed for the near surface soils based on the N_{60} values recorded.

3.25 The N_{60} values recorded >2.5m and a depth that will influence the rate of settlement directly below foundations was noted as also being very high strength cohesive material and very dense where recorded as a granular material.

Groundwater

3.26 Groundwater strikes were not recorded in any of the exploratory hole locations.

3.27 During the return monitoring, groundwater was recorded in two locations only (EBH1 and EBH3) at depths ranging between 0.31m bgl (EBH1) and 2.9m bgl (EBH3) within the Ardingly Sandstone Member. Given the variability in groundwater levels recorded it is likely that any shallow groundwater present is perched within the permeable sand lenses of the Ardingly Sandstone Member. Due to the limited data set available the groundwater flow direction can not be determined.

4.0 GEOTECHNICAL DESIGN APPRAISAL

Introduction

4.1 The proposed development involves the construction of several low-rise residential housing units with associated car parking and private gardens, in addition to communal garden areas and driveway / access roads. It is understood that there will be no significant changes in formation level proposed other than an initial 'site scrape' as part of the site clearance and removal of hardstanding/ existing structures. There are no basements, undercroft car parking or other underground structures anticipated other than statutory services.

4.2 No information has been provided by the client at this stage as to their proposed foundation solution or anticipated loadings. However, it is expected that traditional shallow trench filled footings would be preferable, with either a ground bearing floor slab or suspended ground floor slabs used for ground floor. Based on available drawings and information provided at the time of the investigation, Lustre has **estimated** that the proposed development will typically impose a maximum vertical wall line load (un-factored) of 75kN/m typical for low-rise residential housing.

Geotechnical Hazards

Variable Ground Conditions (Composition and Thickness)

4.3 The following ground conditions recorded as part of this site investigation which could influence the ground model and foundation design are summarised below:

- *Topsoil was encountered in all exploratory hole locations bar TP1 and extended to a maximum depth of 0.20m bgl in WS2.*
- *Made Ground was only encountered in WS4, Soak 3 and TP1, was a maximum thickness of 0.25m and extended to a maximum depth of 0.30m bgl in WS4 and Soak 3.*
- *The Ardingly Sandstone Member was present below the Made Ground (from a depth of 0.05m bgl) to basal depths between 0.60m and 2.94m bgl.*
- *The Ardingly Sandstone Member was encountered as a silt across the majority of the site and as a sand on the eastern side.*

- *The placement of shallow foundations will be governed, in part, by the depth to the very dense/high strength Ardingly Sandstone Member which was 1.00m bgl.*
- *The variability in soils may result in bridging of foundations across different soil types, such as clayey silty soils increasing the risk of differential settlement.*

Natural Cavities, Ground Dissolution & Third Party Underground Structures

4.4 No natural cavities, ground dissolution features or third party underground structures have been recorded during the investigation or the Phase 1 Desk Study. The Desk Study identified no hazard potential for ground dissolution hazards such as solution features and natural cavities with none recorded within 1km of the site. Notification of such features was not provided to Lustre as part of this investigation or the assessment of cavities etc was outside the scope of the investigation. Such features are not anticipated based on our current understanding and setting of the site.

Buried Structures, Foundations & Services

4.5 Any current or former structures present on site will have been supported by foundations of unknown construction or trench filled footings based on type of structure present, which may or may not have been removed by the time of groundworks starting on site. Any redundant below ground structures/features still present may have to be removed to permit the founding of the new development. As such, any excavation may require backfilling with a graded granular material and compacted in layers to provide an engineered fill with known geotechnical properties suitable for founding upon, subject to final formation levels. Furthermore, locations of any former infilled excavations will have disturbed ground present which should be inspected for soft spots, with associated weak soil and fill grubbed out and replaced.

4.6 Consideration should also be given to the potential for existing and / or redundant underground services to be present on site. Available service plans should be consulted prior to any excavation works in order to locate any old, remaining services to ensure all disconnections have been made safe and certified.

Volume Change Potential & Ground Desiccation Risk

4.7 Weathered Ardingly Sandstone Member encountered as a cohesive material was present from a depth of approximately 0.20 m bgl and a depth that the effect of shrinkage and swelling from root influence, changes in moisture content or other heave risk factors such as release of overburden pressure following notable changes in ground level will be considered significant.

4.8 The modified plasticity index of the Ardingly Sandstone Member indicates a low volume change potential based on the percentage soil passing the 425 micron sieve.

4.9 There was no observable evidence of any significantly desiccated soils in the Ardingly Sandstone Member**.** A comparison of moisture content percentage v liquid limit percentage in classification samples tested, by application of Driscoll's[13] formula and BRE 412[14] (used with caution and for indicative purposes only) shows no evidence of desiccation (MC > 50% LL) in the soil sample tested from WS3 at 2.50m bgl, the onset of desiccation (MC within 40% to 50% LL) in the soil samples from WS3 at 0.60m and 0.80m bgl and WS5 at 0.30m bgl. The soil samples tested from WS1 at 1.30m bgl, WS2 at 1.60m bgl, WS3 at 1.00m bgl and WS5 at 0.70m bgl had attained significant desiccation (MC < 40% LL). However, the low moisture content records are considered in part to be as a result of the high proportion of granular material within the samples.

Foundations Near Trees

4.10 There were numerous semi-mature and mature trees on-site and in close proximity to the proposed development observed during the investigation that may have a detrimental effect on proposed foundations if they were to remain or be removed. A specialist arborist should be appointed to identify all the species present and those within neighbouring properties immediately within the vicinity of the site, including the spread and height of trees and the distance measured from the proposed building(s). Noting that foundations may be located within the zone of rooting influence, foundations should be designed to the varying depths and construction type recommended in the NHBC Standards Chapter 4.2, 'Building near trees'[15] and/or BRE Digest 298[16] dependent on the species present to avoid foundation damage by root spread and potential heave risks. Any new trees or shrubs planted on site should be checked and verified as suitable by the Structural Engineer using the same foundation depth and distance criteria in the aforementioned guidance.

Heave & Root Protection Measures

4.11 Given the potential for soil moisture levels to change following development works, new tree planting, and potential root intrusion, the Structural Engineer should design foundations and

[13] Geotechnique, Richard Driscoll, The influence of vegetation on the swelling and shrinking of clay soils in Britain. June 1983.
[14] BRE Digest 412. Desiccation in clay soils. 1996.
[15] NHBC Technical Guidance, 4.2 – Building near trees (standards accessed in November 2018)
[16] BRE Digest 298. Low-rise building foundations: the influence of trees in clay soils. 1999.

ground bearing floor slabs to accommodate heave. This may include the placement of a foundation protection board around footings or ground beams, such as a Claymaster or Clayshield type product and placement of a void former with a sufficient void depth such as Cellcore under floor slabs. The depth, thickness and type of the board selected should be confirmed by specialist supplier such as Cordek or similar manufacturer based on the low volume change potential of the soils.

Groundwater

4.12 Groundwater was not recorded during the site works and is not anticipated to significantly impact foundation design or construction. However, the potential for shallow perched groundwater to be present within the Made Ground and shallow natural soils should not be discounted and, if present, may need to be controlled by, say sump pumping, to allow excavation in the dry.

Stability of Excavations & Retaining Structures

4.13 Side support is unlikely to be required for very shallow service trench excavations within the relatively shallow Made Ground or in the underlying Ardingly Sandstone Member. However, as a matter of course, side support may be necessary where the depth of vertically sided excavations exceeds 1.2m in which construction personnel are required to enter and a risk assessment should be undertaken as a statutory requirement to comply with Health and Safety Regulations.

Aggressive Chemical Environment for Buried Concrete

4.14 The analytical data for soil pH and water soluble sulphate is summarised in the Environmental Assessment Appendix, along with the corresponding BRE classification[17]. The 'brownfield' scenario was applied to the results from the Made Ground and the 'natural' scenario to results from the Ardingly Sandstone Member. A static groundwater scenario has been selected for the buried concrete assessment given the recorded groundwater conditions on site (i.e. absence of a continuous body of groundwater within both soil types).

4.15 From the Made Ground, two samples were tested along with five samples from the natural soils. The characteristic values for the Made Ground for pH and water soluble sulphate were

[17]BRE Guidance Special Digest 1. Concrete in Aggressive Ground. 3rd Edition, 2005.

determined as 6.1 and 0.02g/l respectively, giving a Design Sulphate (DS) classification of DS1 and an associated Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1s.

4.16 The characteristic values for the natural soils for pH and water soluble sulphate were determined as 5.7 and 0.07g/l respectively, giving a DS classification of DS1 and an associated ACEC classification of AC-1s.

4.17 The potential for oxidisable sulphide has not been considered in this assessment as either pyrite is unlikely to be present in signficant amounts, or the concrete is unlikley to be exposed to disturbed ground which might be vulnerable to oxidation.

Initial Pavement Design & Earthworks Classification

Vehicular Access and Parking Areas

4.18 It would usually be recommended that the pavement sub-formations for new vehicular access and car parking areas are constructed to bear directly on the Ardingly Sandstone Member directly underlying the Made Ground, for which a California Bearing Ratio (CBR) of 3% may be assumed in the initial pavement design for typical trafficked loads.

Frost Protection

4.19 Frost protection should always be considered where soils contain a variable fines and granular content to guard against heave. Frost sensitive soils may require an alternative approach to pavement construction and the need for deeper sub-base materials.

Infiltration Assessment

4.20 Soil infiltration testing was carried out at three locations (Soak1 – Soak3) using the BRE Digest 365[11] method (within trial pits), as discussed in Chapter 2. Field data and calculation sheets are provided in Appendix D. Soil infiltration rates were calculated as follows:

TP No.	Test Result	Notes
Soak 1	$9.72x10^{-6}$ m/s (35 l/hr)	
Soak 2	$1.86x10^{-6}$ m/s (6 l/hr)	This result is extrapolated as the water did not drop below the 75% effective depth.
Soak 3	$1.90x10^{-5}$ m/s (69 l/hr)	

4.21 The result of the infiltration testing indicates the use of traditional soakaways should be feasible within the Ardingly Sandstone Member across the site; it is recommended that these are predominantly placed on the eastern side of the site where the soil was encountered as having a higher granular content.

Ground Floor Slabs

4.22 Ground floor slabs should be constructed on engineered fill material (such as Type 1) that is suitably compacted directly onto competent natural ground. It is advised that ground floor slabs are reinforcement to provide additional strength and greater resistance from differential settlement or suspended ground floor slabs may be more suitable given the variable percentage of clay, sand and silt content.

Shallow Foundations

4.23 Shallow foundations - i.e. foundations where their width is larger than or equal to the founding depth at which the footing bears on to the soil strata should be considered an acceptable means of supporting new buildings that are not subject to excessive heave or subsidence risk from nearby trees, or foundations will not exceed economically viable excavation depth (normally 2.5m) where permitted. Typically, shallow foundations are constructed in the following type for the proposed development:

- Strip/trench foundations – provide support to a row of columns or wall by adopting a longer rectangular footing. Should differential settlements occur, columns supported by the same strip foundation will fare better due to the stiffness from the longer footing. However, differential settlement between adjacent strip footings may be an issue especially over changes in soil strata.

Characteristic Value

4.24 It is expected that strip and trench fill foundations will need to be founded at a minimum depth of 1m below existing ground levels within the Ardingly Sandstone Member. This depth considers the very high strength of the Ardingly Sandstone Member and recorded shallow depth of Topsoil/Made Ground (up to 0.30m). When the layout of the development is confirmed, plots near semi-mature and mature trees may require a deeper foundation solution based on the types of trees present and the distance to the plots or if localised areas of deeper Made Ground is encountered.

4.25 In view of the general observations of the Ardingly Sandstone Member recorded during the investigation, and correlation of the SPT N_{60} values, a characteristic shear strength value of **150kPa** at a depth of **1m** will be applied for shallow foundation design where the soil was recovered as cohesive. On the eastern side of the site an angle of shearing resistance of **40º** at a depth of **1m** will be applied for shallow foundation design where the soil was recovered as granular.

Ground Model and Preliminary Design Parameters

4.26 The ground model data detailed in Chapter 3 together with the site investigation data collected has been used to generate design parameters to estimate an allowable bearing capacity and determine preliminary foundation design options by application of Eurocode 7[18]. The soil parameters have been adopted using an undrained state for the cohesive Ardingly Sandstone Member and a drained state for the granular Ardingly Sandstone Member. Based on the site investigation findings, groundwater is not considered to be a significant factor influencing the ground model.

[18] British Standards BS EN 1997-2:2007 Eurocode 7 – Geotechnical Design. Part 2: Ground Investigation and Testing.

Preliminary Design Parameters for Foundations

Parameter			Ardingly Sandstone Member (Cohesive)	Ardingly Sandstone Member (Granular)	Data Source
Imposed permanent vertical load	V_G	kN/m	75	75	*Estimated*
Unit weight of soil	Y_{soil}	kN/m^3	20	20	*MJ Tomlinson*[19]
Unit weight of concrete	Y_{conc}	kN/m^3	24	24	-
Characteristic *N*-values	-	-	62	62	*Borehole Logs*
Angle of Shearing Resistance	Ø	degrees	-	40	*MJ Tomlinson/ Peck et al*[20]
Effective Cohesion	c'	kPa	-	0	*Chapter 3*
Characteristic Shear Strength	C_u	kPa	150	-	*Chapter 3*
Groundwater Level	GWL	m bgl	2.90	2.90	*Chapter 3*

Design by Prescriptive Method (Allowable Bearing Capacity)

4.27 It is our opinion that conventional reinforced traditional strip foundations could be adopted to support the proposed new based on the likely wall and column loading. The logs suggest that 0.6m wide strip foundations could be placed within the cohesive Ardingly Sandstone Member at a depth of approximately 1m below existing ground level, and by applying a characteristic shear strength value of 150kPa, foundations could be designed to an estimated allowable net bearing pressure of 200kN/m^2 at which intensity differential settlement would be expected to be within acceptable limits (25mm) based on the proposed structures. This estimation is based on a factor of safety of 3. This takes into account the recorded depth to water table below the final footing depth which would likely be more than footing breath.

[19] MJ Tomlinson, Foundation Design and Construction. Seventh Edition, 2001.
[20] RB Peck, WE Hanson, TH Thornburn, Foundation Engineering, Second Edition, p310, 1967.

5.0 GEOENVIRONMENTAL ASSESSMENT

5.1 Factual information from the site investigation and subsequent analytical data has been subjected to several semi-quantitative risk assessments. The results of these assessments are presented in Appendix E and summarised in this Chapter. The assessments undertaken include:

- Generic quantitative risk assessment (GQRA, human health);
- Water pipeline suitability test;
- Phytotoxicity assessment;
- Waste classification assessment (WM3); and
- Ground gas assessment.

Generic quantitative risk assessment (GQRA, human health)

5.2 The Environment Agency 'Model Procedures for the Management of Land Contamination, CLR 11' report provides a risk management methodology for identifying hazards and assessing risk associated with land affected by contamination. CLR 11 adopts a tiered approach to determining risk, with the first tier involving the evaluation of pollutant linkages using assessment criteria / screening levels for contamination.

5.3 To determine whether contamination presents an unacceptable level of risk to human health, concentrations of potential contaminants are screened against risk threshold values. Historically, these values had been in the form of Generic Assessment Criteria (GAC) and Soil Guideline Values (SGVs), published by regulatory and advisory bodies. However, in response to revised Part 2A Statutory Guidance, Defra published Category 4 Screening Levels (C4SLs) for six determinands to provide a simple test for deciding when land is 'suitable for use' and demonstrably not 'contaminated land'. The supporting documentation from Defra [21] acknowledges that where C4SLs exist, these values represent a greater risk threshold (i.e. low risk) rather than the previous SGVs/GACs (i.e. no risk). Acknowledging that the C4SLs were primarily intended for use under Part 2A Statutory Guidance, LQM in collaboration with the Chartered Institute of Environmental Health (CIEH), subsequently published a third set of

[21] SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document, March 2014

generic assessment criteria known as LQM/CIEH Suitable 4 Use Levels (S4ULs)[22]. The S4ULs are based on the 'minimal or tolerable level of risk' as defined in previous Environment Agency guidance (namely SR2[23]) which underpinned all previous SGVs/GACs.

5.4 The National Planning Policy Framework (NPPF) [24] requires that planning decisions undertaken by the Local Planning Authority should decide if a site is suitable for its new use and not just whether the site is determinable under Part 2A. Whilst Defra states that the C4SLs could be applied under the planning regime, it is acknowledged that these screening levels were primarily published to support the Part 2A Statutory Guidance. Taking this into account, the S4ULs will be used in the first instance. Where an exceedance above these levels is identified, comparison against C4SLs will be undertaken, with consideration given to the applicability of a less conservative threshold.

5.5 Further information on Lustre's approach to human health risk assessment is provided in Appendix A.

5.6 SGVs and GACs for a residential with homegrown produce land use scenario have been adopted with a soil organic matter content parameter of 2.5% for the topsoil and 1% for the Made Ground around the two above ground tanks and the natural soils, based on site-specific organic matter content data. The residential with homegrown produce land use scenario is consistent with the proposed development plans set out in Chapter 1. Chemical analysis data has been compared to these risk thresholds, as presented in the Environmental Assessment Appendix; this screening process forms the generic quantitative risk assessment (GQRA).

Topsoil

5.7 A total of two samples recovered from the topsoil underwent chemical analysis for a range of general determinands, including asbestos, inorganics, metals, PAH, and TPH.

5.8 Testing for asbestos was undertaken on all samples analysed from the topsoil, and was absent in all samples.

[22] The LQM/CIEH S4ULs for Human Health Risk Assessment, 2015. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3455. All rights reserved
[23] Environment Agency, Human Health Toxicological Assessment of Contaminants in Soil (SR2), January 2009
[24] Department for Communities and Local Government, National Planning Policy Framework, March 2012

5.9 Of the determinands tested, a range of inorganics and metals (cyanide (total), cadmium, mercury, selenium), three PAH fractions out of 16 (naphthalene, acenaphthylene, acenaphthene, BTEX (benzene, toluene, ethylbenzene, m & p-xylene, o-xylene), and phenol were not recorded above the limit of detection (LOD).

5.10 Several determinands including a range of inorganics and metals (arsenic, chromium, copper, lead, nickel, zinc) and 12 PAH compounds were recorded above the LOD but below their respective thresholds, as shown in the Environmental Assessment Appendix.

5.11 Concentrations of one PAH fraction (di-benzo(a,h)anthracene), were recorded above the respective risk threshold, in an sample for topsoil taken from WS2 at 0.15m bgl. Di-benzo(a,h)anthracene was recorded at a maximum concentration of 0.41mg/kg above an assessment criteria of 0.28mg/kg. This is likely to be associated with the fragments of ash noted within the topsoil at this location.

5.12 Given that the marginal exceedance of one PAH fraction was recorded within one sample only and that the proposed development plans include an initial scrape of topsoil across the site in preparation for the construction of the residential dwellings, the topsoil within the current garden and soft landscaping areas is not considered to present a risk to human health for future site users.

Made Ground within the vicinity of two of the above ground tanks

5.13 Two samples of Made Ground from the vicinity of Tank A and one sample of Made Ground from the vicinity of Tank B underwent chemical analysis for PAHs and Extractable Petroleum Hydrocarbons (EPH C10 – C40).

5.14 In the vicinity of Tank A EPH C10 – C40 was recorded at concentrations of 26mg/kg (HP2 ground level) and 42mg/kg (HP 1 0.15m bgl). As a conservative comparison these concentrations have been compared against the threshold value for TPH CWG aromatic C10 – C12 band of 74mg/kg, with no exceedances recorded.

5.15 In the vicinity of Tank B EPH C10 – C40 was recorded at a concentration of 4050mg/kg (S2 ground level) which greatly exceeds the conservative threshold value of 74mg/kg.

5.16 Concentrations of one PAH fraction (di-benzo(a,h)anthracene), were recorded above the respective risk threshold, in one sample in the vicinity of Tank A (HP1 0.15m) at a concentration of 0.34mg/kg above an assessment criteria of 0.24mg/kg.

5.17 Concentrations of six PAH fractions (benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and di-benzo(a,h)anthracene), were recorded above their respective threshold values in one sample in the vicinity of Tank B (S2 ground level) as detailed below:

- benzo(a)anthracene – 66.3mg/kg compared to a threshold value of 7.2mg/kg;
- chrysene – 53.3mg/kg compared to a threshold value of 15.0mg/kg;
- benzo(b)fluoranthene – 59.3mg/kg compared to a threshold value of 2.6mg/kg;
- benzo(a)pyrene – 45.2mg/kg compared to a threshold value of 5.0mg/kg;
- indeno(1,2,3-cd)pyrene – 31.1mg/kg comparted to a threshold value of 27.0mg/kg;
- di-benzo(a,h)anthracene – 3.7mg/kg compared to a threshold value of 0.24mg/kg.

5.18 Given the elevated concentrations of PAHs recorded in the vicinity of both Tank A and Tank B and the elevated concentration of EPH (C10 – C40) recorded in the vicinity of Tank B soils within these areas of the site are considered to present a risk to human health for future site users. Given the limited dataset available in the vicinity of the tanks (due to access constraints) it will be necessary to further investigate and validate the condition of the soils within these areas following site clearance.

Natural Soils

5.19 A total of six samples recovered from the natural soils underwent chemical analysis for a range of general determinands, including, asbestos, inorganics, metals, PAH, and TPH.

5.20 Testing for asbestos was undertaken on all samples analysed from the natural soils, and was absent in all samples.

5.21 Of the determinands tested, a range of inorganics and metals (cyanide (total), cadmium, mercury, selenium), 11 PAH fractions out of 16 (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, chrysene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, di-benzo(a,h)anthracene, benzo(ghi)perylene, BTEX (benzene, toluene, ethylbenzene, m & p-xylene) and phenol were not recorded above the limit of detection (LOD).

5.22 Several determinands including a range of inorganics and metals (arsenic, chromium, copper, lead, nickel, zinc), five PAH compounds (out of 16) and BTEX (o-xylene) were recorded above

the limit of detection but below their respective threshold, as shown in the Environmental Assessment Appendix.

5.23 In summary, none of the determinands analysed for in the natural soils exceeded the risk thresholds and the chemical quality of the natural ground is not considered to present a risk to human health.

Water Pipeline Suitability Test

5.24 The development is likely to require the installation of new potable water pipes. UK Water Industry Research (UKWIR) guidance[25] sets chemical concentration thresholds that are used to specify a pipe design that is considered safe. Ideally, samples should be taken along the route of the proposed pipeline, but this is not always known or practicable at the time of the investigation. UKWIR also recommends that determinands tested are based on the historical use of the site.

5.25 Available analytical data taken from soils has been compared against the UKWIR thresholds. The assessment of volatile and semi-volatile organic compounds (VOCs/SVOCs), ethers, nitrobenzene, ketones, aldehydes and amines were not considered applicable based on the historical use of the site. The assessment of mineral oil, in this case, comprises speciated TPH which provides a breakdown of the hydrocarbon fractions.

5.26 The available testing results indicate that across the majority of the site the soil concentrations do not pose a risk to potable water pipes. Either PE or PVC pipes can be used for the supply of potable water on site.

5.27 However, within the vicinity of Tanks A and B PE pipes will not be suitable for use due to the elevated concentrations of mineral oils (C11 – C40) recorded. Further investigation of the soils within the vicinity of the Tanks should be undertaken following site clearance to determine whether the use of PVC pipes will also be prohibited.

5.28 Water pipes will likely be placed at a minimum depth of 750mm as normally required by UK water authorities. Across the majority of the site this will be in the Ardingly Sandstone Member. However, the thickness of the Made Ground in the vicinity of the Tanks will need to be

[25] UK Water Industry Research (UKWIR). Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. Ref. 10/WM/03/21. 2010

confirmed following site clearance to determine which strata any potable water pipework will be placed in.

Phytotoxicity Assessment

5.29 The recorded concentrations of copper, nickel and zinc have been compared against the BS3882: 2007[26] thresholds for phytotoxic contaminants in soils to determine if a potential risk to healthy plant growth exists.

5.30 Concentrations of copper, nickel and zinc were recorded below their phytotoxicity threshold values for samples from the topsoil and natural soils.

Waste Classification Assessment

5.31 The development is likely to require soils to be removed as part of the initial groundworks including but not limited to the installation of services, new foundations or soil remedial action. Bulk excavation of soils may also be required during enabling works where final formation levels may change, with excess arisings generated. It is therefore necessary to consider whether soils arising from the site would be re-used on-site, or disposed of off-site.

5.32 Guidance set out in the Waste Framework Directive and the Environment Agency's *Technical Guidance WM3 Hazardous Waste*[27], provides information and controls on how sites should manage and control waste soils. For soils to be re-used on site, these must be uncontaminated naturally occurring soils; natural soils are not considered a waste if re-used on the source site for the purposes of development under the Waste Framework Directive. Man-made or contaminated soils must be disposed of off-site. To enable off-site disposal, the waste soils must be assessed against a series of criteria to understand its hazardous properties and determine the most appropriate disposal route. It is also noted that the guidance requires any mixed wastes to be assessed separately and undergo a form of pre-treatment and/or segregation prior to disposal. Mixed wastes could include soils contaminated with ACM – in this case both the ACM fragments and soils would require separate assessment. Mixing of hazardous wastes and soils with different hazardous substances (hydrocarbons, asbestos etc) is prohibited under the Waste Framework Directive.

[26] British Standard BS 3882:2007 (Specification for topsoil and requirements for use)
[27] Technical guidance WM3: Guidance on the Classification and Assessment of Waste (1st Edition 2015). Environment Agency.

5.33 The first stage of the waste assessment, as set out in Technical Guidance WM3 Hazardous Waste, requires soils to be tested to determine if the material should be classified as hazardous or not hazardous. The second stage requires a Waste Acceptance Criteria (WAC) test to determine the case of inert or non-hazardous waste disposal routes for the soil. Landfills have set criteria for wastes which they can legally accept, and the WAC test therefore provides information on which type of landfill can accept the waste. A Waste Acceptance Criteria (WAC) test to determine the case of inert or hazardous waste for disposal at a landfill was not part of the scope of works. The analytical suite adopted for the chemical testing was based on the historic and current use of the site and any potential contaminants that may be present.

5.34 The results of the laboratory analysis were screened in a propriety hazardous waste assessment tool (CatWasteSoil) to determine if the soils would be considered hazardous from a waste disposal perspective. Concentrations of each contaminant were screened to determine if they exceed any of the sixteen hazardous properties (HP) and/or statements as set out the Environment Agency's Technical Guidance WM3 (Guidance on the classification and assessment of waste, 1st edition 2015).

5.35 None of the determinands analysed for were present at concentrations above any hazardous thresholds and, as such, the topsoil, Natural soils and Made Ground in the vicinity of the external ASTs are considered non-hazardous for waste disposal.

Ground Gas Assessment

5.36 A total of three rounds of ground gas monitoring was carried out as part of this investigation to gain an understanding of the ground gas regime at the site. A summary of the gas monitoring results is provided in the Environmental Assessment Appendix. The monitoring was undertaken over a range of atmospheric pressures between 980mb and 1018mb.

5.37 Methane was detected at a maximum concentration of 0.1% v/v (WS2). In all other monitoring locations methane was not recorded above the limit of detection. Maximum concentrations of carbon dioxide ranged between 0.1% and 5.7% v/v across the wells. Recorded concentrations of oxygen did not indicate depleted or anoxic conditions. Maximum in-situ headspace (PID) readings ranged from 0.0ppm and 0.9ppm, with the maximum reading observed in EBH1. Positive flow was recorded in two boreholes (WS5 and EBH1) with a typical flow of 0.1l/hr. On one monitoring occasion a positive flow rate of 23.9 l/hr was recorded within EBH1, with a relative pressure of 52.3mb. This positive flow rate and relative pressure was attributable to the fact that during the monitoring round the response zone within the borehole was flooded.

Therefore these readings are not considered to representative of actual flow rates at this location and have subsequently been discounted from the ground gas assessment.

5.38 Taking into account the gas monitoring results, in line with CIRIA Report C665, the risk from ground gas has been classified using the Modified Wilson and Card method. Gas Screening Values (GSVs) for carbon dioxide and methane were calculated using the maximum recorded values (as discussed above), and the peak flow reading (of 0.1l/hr). In accordance with the CIRIA guidance, where positive flow/positive concentrations of ground gases are not recorded, the limit of detection should be used in the GSV calculations (i.e. 0.1% v/v or 0.1l/hr respectively). The GSV for carbon dioxide was calculated as 0.0057l/hr and the GSV for methane was calculated as 0.0001l/hr. Based on the Modified Wilson and Card method and the calculated GSVs, the site has been classified as Characteristic Situation 2.

6.0 PHASE 2 CONCEPTUAL MODEL & RISK ASSESSMENT

Introduction

6.1 The findings of the site investigation and subsequent semi-quantitative risk assessments have been used to inform the conceptual model and qualitative risk assessment. A summary of the conceptual model is provided below and the qualitative risk assessment is included at the end of this report.

6.2 Anoushka Bos requires this Phase 2 Site Investigation to support the proposed development relating to construction of several low-rise residential housing units with associated car parking and private gardens, in addition to communal garden areas and driveway / access roads.

Conceptual Model

6.3 The objective of the conceptual model is to firstly identify potential contaminant sources, pathways and receptors relating to the site and surrounding area based on the findings of this investigation. This information is then collated and a qualitative risk assessment carried out in line with good practice and current guidance[28,29] to assess any viable source-pathway-receptor pollution linkages. The potential for a pollution event to occur is then evaluated using a risk classification tool[30]. The level of risk is assigned by considering the likelihood that a pollution event might occur with the consequence its occurrence. The consequence is essentially a measurement of the severity of a hazard or source (e.g. contaminated soil) and sensitivity of the receptor (e.g. aquifer type or end user).

6.4 A preliminary conceptual site model was included within the previous Desk Study report[1], which identified several potential sources of contamination attributable to the historic site uses. This Phase 2 Site Investigation was subsequently designed to further assess the identified potential sources of contamination whilst also gathering information on the environmental setting and receptors (e.g. ground conditions, groundwater etc). A summary of the updated identified sources and receptors have been summarised in the following text.

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[28] Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66, NHBC, 2008.
[29] Construction Industry Research and Information Association (CIRIA). Contaminated Land Risk Assessment. A Guide to Good Practice. CIRIA C552 2001.
[30] Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.

Potential Sources of Contamination

6.5 The following potential sources of contamination have been identified based on the findings of the investigation, in-situ testing and laboratory results (e.g. elevated concentrations of contaminants in soils above assessment criteria):

Initial Phase 1 Potential Sources:

- A layer of Made Ground of unknown thickness and chemical composition present beneath the existing structures which may contain contaminants such as asbestos, metals, inorganics, polyaromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) and BTEX. Depending on the amount of putrescible material present in these soils, the Made Ground may also represent a source of ground gas;

- Above ground fuel storage tanks (ASTs): Two external and two internal ASTs are present in the centre of the site. Three of the four ASTs comprised of rectangular and square metal tanks supported on brick walls directly underlain by hardstanding. The remaining rectangular, metal tank was also supported on a brick wall but was underlain by soft landscaping, with minor evidence of staining noted on the brick. Two of the four tanks are currently in use, storing kerosene. The main contaminants of concern include lead, PAH, solvents, TPH and volatile organic compounds (VOC).

- Historical / local authority / registered landfill sites, registered waste transfer / treatments sites located within 1km of the site. Potential for areas of infilled ground to contain putrescible materials, which over time, degrade and give rise to potentially contaminated leachate and hazardous gases, including methane and carbon dioxide. Potential contaminants associated with these land uses include ground gas (methane, carbon dioxide, hydrogen sulphide and carbon monoxide), metals, inorganic and organic compounds including PAHs in leachate.

Updated information on potential source from Phase 2 Investigation:

- Topsoil: Limited thickness of topsoil is present within the investigated areas of the site (the current areas of garden and soft landscaping). Although several determinands (inorganics, organics and metals) were recorded above the LOD (i.e. present within soils), a majority of determinands were below their respective thresholds for residential use as discussed in Chapter 4. Only a single PAH compound (di-benzo(a,h)anthracene) was marginally recorded above the assessment criteria. It is noted that the areas of the site investigated will predominantly form areas of private

garden under the proposed development plans. Furthermore the proposed development plans also include an initial scrape of topsoil across the site in preparation for the construction of the residential dwellings, which will remove the marginally elevated concentration of di – benzo(a,h)anthracene associated with fragments of ash present within the topsoil.

- Made Ground in the vicinity of the externally located ASTs: Elevated concentrations of PAHs and EPH were recorded within the shallow Made Ground within the vicinity of Tanks A and B (externally located), which exceeded their respective thresholds for residential use. Due to access constraints within the vicinity of Tanks A and B, the extent of the identified hydrocarbon contamination could not be proven laterally or vertically and will require further investigation following site clearance. Such an investigation should also focus on the thickness and condition of the Made Ground beneath existing structures and the condition of the Made Ground within the vicinity of the internally located ASTs, which could not be accessed during the current investigation.

- Ground gases associated with landfill / waste transfer / treatments sites: The data from return monitoring rounds have classified the site as a Characteristic Situation 2, therefore ground gas protection measures will be required within proposed new dwellings.

7.0 CONCLUSIONS

7.1 A Phase 2 Site Investigation has been undertaken to support the proposed redevelopment of a site located off Holtye Road, in East Grinstead, West Sussex. The objective of the works was to provide information on the contaminative status of the site whilst obtaining information on the ground conditions. Comments regarding ground hazards and foundation design options have also been provided.

7.2 It is understood that Anoushka Bos requires this Phase 2 Site Investigation to assist in the discharge of planning conditions relating to the proposed development, understood to comprise construction of several low-rise residential housing units with associated car parking and private gardens, in addition to communal garden areas and driveway / access roads.

Ground Contamination

7.3 This investigation involved drilling five windowless sample boreholes (WS1 to WS5) to a maximum depth of 3m bgl, excavating three trial pits (Soak 1 to Soak 3) at various depths up to 2m bgl in preparation for soakage infiltration testing, and excavating a single trial pit (TP1) to 1.6m bgl, to further determine the geological make-up, with the current investigation focusing on the areas of private garden and soft landscaping only. Across these areas a limited thickness of topsoil was recorded overlying the natural soils. Under the proposed development plans it is understood that this layer of topsoil will be removed as part of the enabling works, thereby removing the marginally elevated concentration of di – benzo(a,h)anthracene associated with fragments of ash present within the topsoil. Based on the understanding that the topsoil will be removed from the site the risks to the identified receptors have been assessed as low to very low.

7.4 Investigation was also undertaken in the vicinity of the two externally located ASTs identified within the Phase 1 Desk Study, to assess the condition of the shallow soils within the vicinity of these potential point sources of contamination. Due to access constraints in the vicinity of these two ASTs the investigation only comprised two hand dug pits (Tank A HP1 and Tank A HP2) and two surface sample pits (Tank B S1 and Tank B S2). Elevated concentrations of EPH and PAHs were recorded within the shallow soils, in excess of their respective threshold values for human health. Consequently, a **moderate** risk has been identified to future site occupants which will require further investigation / verification (as detailed in Chapter 8). The pathway considered relates to inhalation of contaminated dusts vapours, dermal contact, ingestion of soils and soil sorbed to home-grown produce (as well as plant uptake).

7.5 The risk ratings assigned in this report are based on information obtained from the intrusive works, chemical testing and field monitoring (where carried out). The qualitative nature of the risk assessment is not absolute. Although very low and low risks may have been assigned to various pollutant linkages, the risk cannot be completely eliminated (i.e. “no risk”). Therefore, residual risks will remain which should not be discounted on the basis that the risk is low.

Ground Gas Assessment

7.6 Based on the Modified Wilson and Card methodology and the calculated GSVs, the site has been classified as Characteristic Situation 2. As such, a ground gas regime which will require gas protection measures has been identified. A **moderate** risk rating has been assigned to ground gases.

Water Pipeline Suitability Assessment

7.7 The available testing results indicate that across the majority of the site the soil concentrations do not pose a risk to potable water pipes. Either PE or PVC pipes can be used for the supply of potable water on site.

7.8 However, within the vicinity of Tanks A and B PE pipes will not be suitable for use due to the elevated concentrations of mineral oils (C11 – C40) recorded. Further investigation of the soils within the vicinity of the Tanks should be undertaken following site clearance to determine whether the use of PVC pipes will also be prohibited. Until further investigation has been undertaken in the vicinity of the external and internal ASTs a **moderate** risk rating has been assigned to potable water pipes.

Asbestos Containing Materials (ACM) / Asbestos Containing Soils (ACS)

7.9 Testing for asbestos was undertaken on all samples analysed from the Made Ground, and was absent in all samples. A **low risk** rating has been assigned to ACM / ACS.

7.10 This report does not specifically consider the risk from asbestos in soils to construction workers. Further information is provided in Chapter 8.

Phytotoxicity Assessment

7.11 Concentrations of copper, nickel and zinc were recorded below their phytotoxicity threshold values for samples from the Made Ground and natural soils. A **low risk** rating has been assigned to phytotoxicity.

Waste Classification Assessment

7.12 The results of the laboratory analysis were screened in a propriety hazardous waste assessment tool (CatWasteSoil) to determine if the soils would be considered hazardous from a waste disposal perspective. Concentrations of each contaminant were screened to determine if they exceed any of the sixteen hazardous properties (HP) and/or statements as set out the Environment Agency's Technical Guidance WM3 (Guidance on the classification and assessment of waste, 1st edition 2015).

7.13 None of the determinands analysed for were present at concentrations above any hazardous thresholds and, as such, the topsoil, Natural soils and Made Ground in the vicinity of the externally ASTs, are considered non-hazardous for waste disposal.

Geotechnical Design Summary

7.14 A detailed engineering appraisal of the soils and any notable hazards and limitations are provided in Chapter 4. The bearing capacity of the soils suggests that the Ardingly Sandstone Member should be capable of bearing traditional shallow foundations to support the proposed buildings, subject to the loadings that will be imposed. The appraisal suggests that foundations could be designed to an estimated allowable net bearing pressure of 200kN/m^2 at which intensity differential settlement would be expected to be within acceptable limits (25mm). The loadings will dictate the size of the footings, which will need to be at least 0.60m based on the presumed loading applied in the geotechnical design appraisal and by application of Eurocode 7 subject to the limit states calculated not being exceeded. Should loadings be greater than those presumed, or the risk from nearby trees and root spread poses an unacceptable risk to ground movement, or risk of excessive differential settlement, then the use of piles may provide a more reliable and robust foundation solution.

7.15 The result of the infiltration testing indicates the use of traditional soakaways should be feasible within the Ardingly Sandstone Member across the site; it is recommended that these are predominantly placed on the eastern side of the site where the soil was encountered as granular.

Statutory Designation

7.16 The *National Planning Policy Framework (NPPF)* states that "land should be suitable for its new use and as a minimum, after carrying out remediation (if required), the land should **not** be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990". It is our opinion that based on the findings of this Phase 2 Site Investigation; it is unlikely the site would be designated as statutory contaminated land by the Local Authority under the provision of the published Statutory Guidance. It is advisable however, that any recommendations made in Chapter 8 are implemented in line with current guidance and good practise, especially where verification of the risk assessment is necessary.

8.0 RECOMMENDATIONS

8.1 Based on the information collected as part of this investigation, the contaminative status of the site is not considered to be prohibitive to the proposed redevelopment of the site. However, further site investigations are considered necessary to address identified risks to future receptors and determine the nature of the Made Ground underlying the existing builds and within the vicinity of the ASTs. In addition, the management of unforeseen contamination requires formalising. In summary, the following is considered necessary to ensure the site is suitable for use:

- **Supplementary Environmental Investigation**: Given the uncertainty regarding the Made Ground underlying the existing buildings and the identified hydrocarbon contamination within the shallow soils in the vicinity of the external ASTs, a supplementary site investigation is recommended to validate these areas. Due to the constraints on the site with regards to access, as well as the presence of buried services, a full understanding of these potential sources of contamination could not be gained in this investigation. It is therefore recommended that once the site has been cleared of buildings (but after services have been capped and tanks removed), a series of trial pits should be excavated in the area of the former tanks and buildings to inform this assessment. WAC testing of the Made Ground should also be undertaken at this time to inform the waste assessment particularly where soils will require off-site disposal to landfill.

- **Removal of all ASTs and associated fuel pipework**: Considering the end use of the site (low-rise residential dwellings with private and communal gardens), the ASTs and any associated fuel transmission pipework should be removed. This will be expected by Mid-Sussex District Council. Competent contractors should undertake this work to ensure that no deliberate or accidental release of any residual fuel occurs. Sufficient pollution prevention measures should be in place for this work. Further gross contamination may be present directly below the tanks. Following their removal, validation soil samples should be taken to demonstrate no residual contamination remains. Any visually or olfactory contaminated soils should be appropriately stockpiled and classified prior to their disposal off-site. This recommendation can be completed as part of the supplementary works.

- **Gas Protection Measures:** Based on the Modified Wilson and Card method and the calculated GSVs, the site has been classified as Characteristic Situation 2. As such, a ground gas regime which will require gas protection measures has been identified. Further details should be provided in a Remediation Strategy.

- **Upgrading of Potable Water Pipes:** Potable water pipes will require upgrading to PE pipe as a minimum. The local water authority may however require more stringent protection measures. This should be verified as part of the recommended supplementary site investigation detailed above.

Non-specialist Environmental Watching Brief

8.2 It is prudent to ensure a watching brief is carried out by a suitable person on-site throughout the works who is experienced and capable of identifying signs of potential contamination, including, but not limited to, staining, unfamiliar odours and visual evidence of potentially contaminated/ hazardous materials such as asbestos.

8.3 If any suspected ground contamination such as unusual odours, visually impacted materials, suspected asbestos or any potentially hazardous waste not recorded during this investigation is encountered during the works, further sampling and testing should be carried out under supervision by Lustre. This will allow the determination of the appropriate management and mitigation measures to address any potential risks as part of the development of the site. The management of unforeseen contamination should be provided in greater detail as part of a remediation strategy showing clear lines of communication and compliance.

Waste Management Recommendations

8.4 None of the determinands analysed for within the topsoil and natural soils were present at concentrations above any WM3 hazardous waste thresholds and as such these soils are considered not hazardous for waste disposal under WM3. WAC testing was not included as part of this investigation.

8.5 Copies of all signed waste disposal conveyance notes clearly showing the waste receivers address should be obtained for all soils disposed of offsite. The standard landfill rate tax is around £88.95 per tonne. The lower rate landfill tax which applies to less polluting wastes such as naturally occurring soils and rock, concrete etc is around £2.80 per tonne.

Unforeseen Ground Contamination

8.6 A reasonable amount of skill and care, as expected, has been used to deliver this investigation in accordance with the agreed scope of work and meet the required objectives. However, the potential for unforeseen contamination to be present, or encountered during future groundworks, maintenance works and/or site clearance/redevelopment works cannot be entirely eliminated. This will be particularly important when working within the vicinity of areas

that were not investigated, or the method of investigation employed was limited due to safety (i.e. live underground services), access, financial, public relations, third party intervention and/or risk etc. which influenced the scope of the investigation. A site investigation can only provide a snapshot of the ground conditions encountered at the time covering a relatively small proportion of the site, with samples only representing discrete parcels of ground. Care and diligence is still advised even if a site investigation records a low or very low risk of contamination. Lustre cannot be held responsible for unforeseen contamination that may be present or encountered in the future.

DRAWINGS

N

Key

- Site Boundary
- Windowless Sample Borehole
- Historic Windowless Sample Borehole
- Trial Pit
- Soakage Test
- Approximate line between Sand and Silt of the Ardingly Sandstone Member.
- Location of Above Ground Fuel Storage Tanks (ASTs)

Notes

Do not scale from this drawing. Approximate positions only. Report all errors and omissions to author. Current site plan used as base plan.

Rev	Date	Description

Client / Project

Anoushka Bos
Ashplats House
East Grinstead
Holtye Road
RH19 3EZ

Drawing Title

Site Investigation Plan

Project Number	Drawing Number	Date	Designed by	Approved by
2390	001	30/10/18	TA	AK

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APPENDIX A: CONTAMINATED LAND NOTES

CONTAMINATED LAND ASSESSMENT NOTES

LAND USE

This section establishes the former and current land uses which may have caused contamination or given rise to environmental concerns on the site. An inspection of the site has been undertaken to provide further details of the site and neighbouring activities and to observe environmental conditions.

Historical Maps

Information about the history of the site has been obtained primarily through an inspection of historical Ordnance Survey maps. These maps provide an excellent record of the historical uses of a site and can be very important in assessing potential liabilities. Historical maps can show past potentially contaminative uses at a site that would not necessary be obvious during a site inspection, for example storage tanks or previous usage such as a gas works or quarry.

Public Record Information

Information concerning environmental regulations relating to the site has been obtained from a public register which has been accessed from a commercial database operated by the Landmark Information Group. This is the quickest means of gathering publicly available information. The data is supplied from within a 1km radius of a given National Grid Reference of a site. The database contains information from the Environment Agency (EA) and other statutory authorities responsible for monitoring environmental protection measures within the area of a site under existing legislation (see below).

Information has also been obtained directly from the environmental regulators in order to gauge the environmental characteristics of the site in more detail and to establish whether there have been any breaches of environmental regulations or pollution incidents associated with the site. This is used to support the publicly available information gathered from the commercial database. The time in which responses are returned can vary between statutory authorities.

Environmental Legislation

The principal environmental legislation in England consists of the Environmental Protection Act 1990 (EPA 90), the Water Resources Act 1991 and the Environment Act 1995 (EA 95). These Acts prescribe protection measures for all the environmental media (land, water and air) and are regulated by the EA and the Local Authority. Part 1 of the EPA 1990 sets out the statutory framework for Integrated Pollution Control (IPC) and Air Pollution Control (APC).

ENVIRONMENTAL SETTING

This section assesses the environmental sensitivity of the site location to contamination / pollution. It is important to establish the environmental setting because, irrespective of the level of contamination on the site, if its location is not ‘sensitive’ to this contamination / pollution there is a reduced risk of an environmental liability arising.

The sensitivity is assessed using British Geological Survey (BGS) information (such as geological maps and data from the EA (http://www.environment-agency.gov.uk/homeandleisure/117020.aspx)* on groundwater and surface water. Data on abstractions have been obtained from publicly available sources including information supply companies such as Landmark and GroundSure. The vulnerability of surface waters and groundwater is based on sensitivity to pollution, distance from abstractions, type and nature of groundwater and type of overlying strata.

Aquifer Designations

In 1 April 2010 the EA began using aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The BGS maps are generally split into two different type of aquifer designation:

- **Superficial (Drift)**: permeable unconsolidated (loose) deposits. For example, terrace sands and gravels.
- **Bedrock:** solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations, and the corresponding colours beside the text are also represented on the Environment Agency's website*:

Principal Aquifers (formally Major Aquifers)

These are highly permeable layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may be highly productive and able to support large abstractions, public water supply and/or river base flow on a strategic scale.

Secondary Aquifers (formally Minor Aquifers)

These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Although these aquifers will not normally produce large quantities of water for abstraction, they are important for local supplies (such as irrigation) and supplying base flow to rivers. Secondary aquifers are subdivided into two types:

Secondary A: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers; and

Secondary B: predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Undifferentiated: has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata

These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Source Protection Zones (SPZs)

The EA have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. **The closer the activity, the greater the risk.** The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which we occasionally apply, to a groundwater source.

Flood Risk

The Flood Map combines detailed local data with information from a new national model of England and Wales and indicates where flooding from rivers, streams and watercourses is possible. Under Section 105 of the Water Resources Act 1991 the EA has a duty to survey matters relating to flooding.

RISK ASSESSMENT

This section assesses the potential for the site to give rise to environmental risks and whether or not the risks are acceptable or if further assessment or remedial action is required.

The qualitative risk assessment firstly considers the source of contamination and potential contaminants associated with the source(s) (or hazards). As well as the type of source, the extent, concentration and availability of a contaminant is also assessed.

The effect of a hazard on an identified receptor is largely governed by the sensitivity of a receptor. Receptors may typically include people, buildings, animals, plants and local resources (such as groundwater, surface waters, mines etc.).

A change in the receptor should be considered if the end-use of the site changes, for example, if a commercial site is to be redeveloped into a residential housing estate as a residential occupier is considered more sensitive than a commercial occupier.

The presence of contamination (as a potential hazard) does not necessary mean that there is a risk. It is the exposure pathway and the quantity of contamination that reaches the receptor which may determine the effect on a receptor (such as the integrity of a barrier between a contamination source and receptor).

The risk classifications for both likelihood and consequence is based on methodology presented in Contaminated Land Risk Assessment, A Guide to Good Practice (CIRIA C552, 2001) and has been developed from procedures outlined in the EA's CLR11 Model Procedures. The Department for the Environment Transport and the Regions (DETR),, with the EA and Institute of Environment & Health, has also published guidance on risk assessment (Guidelines for Environmental Risk Assessment and Management). The guidance states that the designation of risk is based upon a consideration of both:

- The magnitude of the potential consequence (severity) of risk occurring which takes into account both the potential severity of the hazard and the sensitivity of the receptor; and
- The likelihood of an event occurring (probability) which takes into account the both the presence of the hazard and receptor and the integrity of the pathway.

The magnitude of consequence (severity) and likelihood (probability) is defined in the CIRIA guidance, together with examples. The two classifications are then compared (as shown on Table 1) to obtain an estimation of risk for each pollution linkage, ranging from "very high risk" to "very low risk". A description of the risks and likely actions required is presented in Table 2. The benefit of estimating the risk in this way is that it can be revised after each investigation phase as the conceptual model and corresponding pollution linkages are refined.

Table 1: Comparison of Consequence VS. Probability

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Likelihood	**High likelihood**	Very high risk	High risk	Moderate risk	Moderate/ low risk
	Likely	High risk	Moderate risk	Moderate/ low risk	Low risk
	Low likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low Risk

Table 2: Description of the Classified Risks and Likely Action Required

Level of Risk	Description of Classification
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, or, there is evidence that severe harm to a designated receptor is currently happening. If this risk is realised, it is likely to result in significant environmental and financial liability to current and/ or future site owners/ occupiers. Urgent investigation (if not already undertaken) and remediation is likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. If risk is realised, it is likely to present a sizeable environmental and financial liability to current and/ or future site owners/ occupiers. Urgent investigation is required and remediation work may be necessary in the short term and likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the potential environmental liability. Some remedial works may be required over the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild. Limited investigation may be recommended to clarify the risk, dependant on the sensitivity of the receptor and view point of those of interest. Any remedial works are likely to be fairly limited.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is likely to be mild or minor.

The acceptability of risk will always depend upon the view point of those of interest, whether it is an occupier of a site, a regulator or stakeholder. As a result, it could be that action will be required to deal with a level of risk even if it is classified as very low.

APPENDIX B: EXPLORATORY HOLE LOGS

Trial Pit Log

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Trialpit No **TP1** Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: - Level:	Date
Location: East Grinstead		Dimensions (m): Depth 1.60	Scale 1:25
Client: DHA Group			Logged AK

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			Firm dark brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick and flint. Frequent roots and rootlets. (MADE GROUND)
	0.50 - 0.80	B		0.50			Firm brown slightly sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular fine to medium of sandstone. (ARDINGLY SANDSTONE)
				1.00			Firm greyish brown sandy slightly gravelly clayey SILT with a medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of sandstone, cobbles are subangular of sandstone. Frequent rootlets. (ARDINGLY SANDSTONE)
				1.20			Light yellowish whitish brown very silty slightly gravelly SAND. Sand is predominantly fine. Gravel is angular to subangular fine of sandstone. (ARDINGLY SANDSTONE)
	1.40 - 1.60	B		1.60			Light brownish white silty slightly gravelly fine SAND with a low cobble content. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone. (ARDINGLY SANDSTONE)
							End of pit at 1.60 m

Remarks:

Stability:

AGS

LUSTRE CONSULTING

Trial Pit Log

Trialpit No
TPS1
Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: - Level:	Date
Location: East Grinstead		Dimensions (m): Depth 2.00	Scale 1:25
Client: DHA Group			Logged AK

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.05			Grass over firm dark brown clayey SILT with rare ash and frequent rootlets. (TOPSOIL)
							Firm greyish brown sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to medium of ironstone. Rare rootlets. (ARDINGLY SANDSTONE)
	0.70	B		0.70			Firm light yellowish orangish brown mottled black slightly sandy to sandy, slightly gravelly clayey SILT. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone. (ARDINGLY SANDSTONE)
				1.10			Light brownish white silty fine SAND. (ARDINGLY SANDSTONE)
				1.20			Firm light brownish white sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular, fine to medium of sandstone. (ARDINGLY SANDSTONE)
				1.60			Very soft light greyish brown mottled grey and orange slightly sandy silty CLAY. Sand is fine to medium. (ARDINGLY SANDSTONE)
				2.00			End of pit at 2.00 m

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4
5

Remarks:

Stability:

AGS

LUSTRE CONSULTING

Trial Pit Log

Trialpit No
TPS2
Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: - Level:	Date
Location: East Grinstead		Dimensions (m): Depth 1.00	Scale 1:25
Client: DHA Group			Logged AK

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.05			Grass over firm dark brown clayey SILT with rare ash and frequent rootlets. (TOPSOIL)
							Firm brown slightly sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular fine to medium of sandstone. (ARDINGLY SANDSTONE)
				0.70			Light brownish white silty fine SAND. (ARDINGLY SANDSTONE)
				1.00			End of pit at 1.00 m

Remarks:

Stability:

AGS

Trial Pit Log

Trialpit No **TPS3**

Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: - Level:	Date
Location: East Grinstead		Dimensions (m): Depth 0.60	Scale 1:25
Client: DHA Group			Logged AK

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.05			Grass over firm dark brown clayey SILT with rare ash and frequent rootlets. (TOPSOIL)
	0.30 - 0.60	B		0.30			Firm brown slightly dandy slightly gravelly clayey SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, brick and plastic fragments. (MADE GROUND)
				0.60			Light brown clayey slightly gravelly SAND. Sand is predominantly fine. Gravel is angular fine of sandstone. (ARDINGLY SANDSTONE)
							End of pit at 0.60 m

1
2
3
4
5

Remarks:

Stability:

LUSTRE CONSULTING

Borehole Log

Borehole No. **WS1**

Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: -	Hole Type WS
Location: East Grinstead		Level:	Scale 1:50
Client: DHA Group		Dates: -	Logged By AK

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES	PID=3	0.10			Grass over firm dark brown clayey SILT with rare ash and frequent rootlets. (TOPSOIL)
		0.30	B		0.30			Firm greyish brown sandy slightly gravelly clayey SILT with a low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of sandstone, cobbles are subangular of sandstone. Frequent rootlets. (ARDINGLY SANDSTONE)
		0.50	ES	PID=0	0.75			Light greyish brown slightly silty slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular fine to coarse of sandstone. (ARDINGLY SANDSTONE)
		1.30 - 1.90	ES		1.10			Light brownish white silty fine SAND. (ARDINGLY SANDSTONE)
					1.30			Firm light orangish brown mottled dark brown sandy slightly gravelly clayey SILT. Sand is predominantly fine. Gravel is subangular fine of sandstone. (ARDINGLY SANDSTONE)
					1.90			Firm light orangish brown slightly sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular fine to medium of sandstone. (ARDINGLY SANDSTONE)
								End of borehole at 1.90 m

Remarks
SPT refusal.

AGS

Borehole Log

Borehole No. **WS2**

Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: -	Hole Type WS
Location: East Grinstead		Level:	Scale 1:50
Client: DHA Group		Dates: -	Logged By AK

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.15	ES	PID=0	0.20			Grass over firm dark brown clayey SILT with rare coal/clinker gravel, ash and frequent rootlets. (TOPSOIL)
		0.30	ES	PID=0				Light brown to light orangish brown very silty gravelly SAND. Sand is fine to coarse. Gravel is angular to subangular, fine to medium of sandstone and ironstone. (ARDINGLY SANDSTONE)
		0.30 - 0.70	B		0.76			Light brown to light orangish brown silty slightly gravelly SAND. Sand is fine to medium. Gravel is angular to subangular fine to medium of sandstone and ironstone. (ARDINGLY SANDSTONE)
		1.00 - 1.70	B		1.60			*Lense of fine sand.*
					1.76			Firm light brownish white sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular, fine to medium of sandstone. (ARDINGLY SANDSTONE)
								End of borehole at 1.76 m

Remarks
SPT refusal.

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Borehole Log

Borehole No. **WS3**

Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: -	Hole Type WS
Location: East Grinstead		Level:	Scale 1:50
Client: DHA Group		Dates: -	Logged By AK

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES	PID=0	0.05			Grass over firm dark brown clayey SILT with rare ash and frequent rootlets. (TOPSOIL)
		0.60 - 0.80	B		0.60			Firm greyish brown sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to medium of ironstone. Rare rootlets. (ARDINGLY SANDSTONE)
		0.80	ES	PID=0	0.80			Firm brown slightly sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular fine to medium of sandstone. (ARDINGLY SANDSTONE)
		0.80 - 1.00	B					Firm light yellowish orangish brown mottled black slightly sandy to sandy, slightly gravelly clayey SILT. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone. (ARDINGLY SANDSTONE)
		1.00 - 1.90	B		1.90			*Lense of fine sand.*
					2.20			Dark purplish brown silty sandy angular fine to medium GRAVEL of ironstone. (ARDINGLY SANDSTONE)
					2.50			Light orangish brown silty slightly gravelly fine SAND. Gravel is subangular to subrounded fine to medium of sandstone and ironstone. Rare rootlets. (ARDINGLY SANDSTONE)
					2.70			Very soft light greyish brown mottled grey and orange slightly sandy silty CLAY. Sand is fine to medium. (ARDINGLY SANDSTONE)
					3.00			Light brownish orangish grey silty gravelly SAND. Sand is predominantly fine. Gravel is angular to subangular fine to medium of sandstone and ironstone. (ARDINGLY SANDSTONE)
								End of borehole at 3.00 m

Remarks
Hand dug pit to 1.2m. SPT refusal.

AGS

Borehole Log

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Borehole No. **WS4**

Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: -	Hole Type WS
Location: East Grinstead		Level:	Scale 1:50
Client: DHA Group		Dates: -	Logged By AK

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES	PID=0	0.10			Grass over firm dark brown clayey SILT with rare ash and frequent rootlets. (TOPSOIL)
		0.30 - 1.00	B		0.30			Firm brown slightly sandy slightly gravelly clayey SILT. Sand is fine to medium, Gravel is angular to subangular fine of clinker/coal. (ARDINGLY SANDSTONE)
		0.40	ES	PID=0				Light yellowish whitish brown very silty slightly gravelly SAND. Sand is predominantly fine. Gravel is angular to subangular fine of sandstone. (ARDINGLY SANDSTONE)
		1.00 - 1.20	B		1.00			Light grey mottled orange very silty slightly gravelly SAND. Sand is predominantly fine. Gravel is angular to subangular fine of sandstone. (ARDINGLY SANDSTONE)
					1.20			End of borehole at 1.20 m

Remarks
Hand dug pit to 1.0m. SPT refusal.

AGS

Borehole Log

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Borehole No. **WS5**

Sheet 1 of 1

Project Name: Ashplats House	Project No. 2390	Co-ords: -	Hole Type WS
Location: East Grinstead		Level:	Scale 1:50
Client: DHA Group		Dates: -	Logged By AK

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES	PID=4	0.05			Grass over firm greyish brown slightly sandy SILT with frequent roots and rootlets. Sand is fine to coarse. (TOPSOIL)
		0.30 - 0.70	B		0.30			Firm greyish brown slightly sandy slightly gravelly SILT with occasional rootlets. Sand is fine to medium. Gravel is angular to subangular fine to coarse of ironstone. (ARDINGLY SANDSTONE)
		0.50	ES	PID=0	0.70			Firm brown sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is angular to subangular of sandstone. (ARDINGLY SANDSTONE)
		0.70 - 1.50	B		1.50			Firm light yellowish brown sandy clayey SILT. Sand is fine. (ARDINGLY SANDSTONE)
								End of borehole at 1.50 m

Remarks
Hand dug pit to 0.9m.

AGS

APPENDIX C: LABORATORY TEST CERTIFICATES

4480

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Lustre Consulting Ltd
Admiral's Offices
The Historic Dockyard
Chatham
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DETS Ltd
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Rose Lane
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ME17 2JN
t: 01622 850410
russell.jarvis@dets.co.uk

DETS Report No: 18-83794

Site Reference:	Ashplatts, East Aminstead
Project / Job Ref:	2390
Order No:	2390
Sample Receipt Date:	18/10/2018
Sample Scheduled Date:	18/10/2018
Report Issue Number:	1
Reporting Date:	25/10/2018

Authorised by:

Russell Jarvis
Associate Director of Client Services

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Soil Analysis Certificate							
DETS Report No: 18-83794	Date Sampled	17/10/18	17/10/18	17/10/18	17/10/18	17/10/18
Lustre Consulting Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 2390	Additional Refs	NAT	NAT	NAT	NAT	MG
Order No: 2390	Depth (m)	0.20	0.15	0.20	0.80	0.20
Reporting Date: 25/10/2018	DETS Sample No	366947	366948	366949	366950	366951

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	6.2	7.2	6.2	6.8	6.1
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	65	25	15	25	13
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.07	0.02	0.02	0.03	0.01
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.1	1.8	0.9	0.4	1.3
Arsenic (As)	mg/kg	< 2	MCERTS	5	6	5	4	7
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	11	11	11	13	11
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	11	13	11	7	12
Lead (Pb)	mg/kg	< 3	MCERTS	17	37	15	7	66
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	10	10	10	5	10
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	60	230	40	22	86
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

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

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Soil Analysis Certificate							
DETS Report No: 18-83794	Date Sampled	17/10/18	17/10/18			
Lustre Consulting Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS4	WS5			
Project / Job Ref: 2390	Additional Refs	NAT	NAT			
Order No: 2390	Depth (m)	0.40	0.10			
Reporting Date: 25/10/2018	DETS Sample No	366952	366953			

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	5.7	5.7			
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	11	< 10			
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.01	< 0.01			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.3	0.8			
Arsenic (As)	mg/kg	< 2	MCERTS	3	5			
W/S Boron	mg/kg	< 1	NONE	< 1	< 1			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	9	10			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	5	11			
Lead (Pb)	mg/kg	< 3	MCERTS	6	24			
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	5	9			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Zinc (Zn)	mg/kg	< 3	MCERTS	19	31			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			

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

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Soil Analysis Certificate - Speciated PAHs							
DETS Report No: 18-83794	**Date Sampled**	17/10/18	17/10/18	17/10/18	17/10/18	17/10/18
Lustre Consulting Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Ashplatts, East Aminstead	**TP / BH No**	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 2390	**Additional Refs**	NAT	NAT	NAT	NAT	MG
Order No: 2390	**Depth (m)**	0.20	0.15	0.20	0.80	0.20
Reporting Date: 25/10/2018	**DETS Sample No**	366947	366948	366949	366950	366951

Determinand	**Unit**	**RL**	**Accreditation**					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	0.11	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.63	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.19	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	1.46	< 0.1	< 0.1	0.26
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	1.24	< 0.1	< 0.1	0.20
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.68	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.62	< 0.1	< 0.1	0.12
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.36	1.09	< 0.1	< 0.1	0.48
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.36	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.77	< 0.1	< 0.1	0.25
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.75	< 0.1	< 0.1	0.47
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.41	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	0.48	< 0.1	< 0.1	0.28
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	8.8	< 1.6	< 1.6	2.1

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

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Soil Analysis Certificate - Speciated PAHs							
DETS Report No: 18-83794	Date Sampled	17/10/18	17/10/18			
Lustre Consulting Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS4	WS5			
Project / Job Ref: 2390	Additional Refs	NAT	NAT			
Order No: 2390	Depth (m)	0.40	0.10			
Reporting Date: 25/10/2018	DETS Sample No	366952	366953			

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.27			
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.24			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.34			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6			

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

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Soil Analysis Certificate - TPH CWG Banded							
DETS Report No: 18-83794	**Date Sampled**	17/10/18	17/10/18	17/10/18	17/10/18	17/10/18
Lustre Consulting Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Ashplatts, East Aminstead	**TP / BH No**	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 2390	**Additional Refs**	NAT	NAT	NAT	NAT	MG
Order No: 2390	**Depth (m)**	0.20	0.15	0.20	0.80	0.20
Reporting Date: 25/10/2018	**DETS Sample No**	366947	366948	366949	366950	366951

Determinand	**Unit**	**RL**	**Accreditation**					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42

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

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Soil Analysis Certificate - TPH CWG Banded							
DETS Report No: 18-83794	Date Sampled	17/10/18	17/10/18				
Lustre Consulting Ltd	Time Sampled	None Supplied	None Supplied				
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS4	WS5				
Project / Job Ref: 2390	Additional Refs	NAT	NAT				
Order No: 2390	Depth (m)	0.40	0.10				
Reporting Date: 25/10/2018	DETS Sample No	366952	366953				

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10			
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21			
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3			
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10			
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21			
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42			

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

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Soil Analysis Certificate - BTEX / MTBE							
DETS Report No: 18-83794	Date Sampled	17/10/18	17/10/18	17/10/18	17/10/18	17/10/18
Lustre Consulting Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 2390	Additional Refs	NAT	NAT	NAT	NAT	MG
Order No: 2390	Depth (m)	0.20	0.15	0.20	0.80	0.20
Reporting Date: 25/10/2018	DETS Sample No	366947	366948	366949	366950	366951

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

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

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Soil Analysis Certificate - BTEX / MTBE							
DETS Report No: 18-83794	**Date Sampled**	17/10/18	17/10/18			
Lustre Consulting Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Ashplatts, East Aminstead	**TP / BH No**	WS4	WS5			
Project / Job Ref: 2390	**Additional Refs**	NAT	NAT			
Order No: 2390	**Depth (m)**	0.40	0.10			
Reporting Date: 25/10/2018	**DETS Sample No**	366952	366953			

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

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

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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 18-83794	
Lustre Consulting Ltd	
Site Reference: Ashplatts, East Aminstead	
Project / Job Ref: 2390	
Order No: 2390	
Reporting Date: 25/10/2018	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
366947	WS1	NAT	0.20	11.8	Brown sandy clay with vegetation
366948	WS2	NAT	0.15	12.8	Brown sandy clay with vegetation
366949	WS3	NAT	0.20	11.8	Brown sandy clay with stones
366950	WS3	NAT	0.80	10.2	Orange sandy clay
366951	WS4	MG	0.20	14.8	Brown sandy clay with vegetation
366952	WS4	NAT	0.40	4.4	Orange sandy clay
366953	WS5	NAT	0.10	11.9	Brown sandy clay with vegetation

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

Insufficient Sample I/S

Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 18-83794
Lustre Consulting Ltd
Site Reference: Ashplatts, East Aminstead
Project / Job Ref: 2390
Order No: 2390
Reporting Date: 25/10/2018

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

4480

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DETS Report No: 18-84257

Site Reference:	Ashplatts, East Aminstead
Project / Job Ref:	2390
Order No:	2390
Sample Receipt Date:	18/10/2018
Sample Scheduled Date:	26/10/2018
Report Issue Number:	1
Reporting Date:	01/11/2018

Authorised by:

Russell Jarvis
Associate Director of Client Services

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Soil Analysis Certificate							
DETS Report No: 18-84257	**Date Sampled**	17/10/18					
Lustre Consulting Ltd	**Time Sampled**	None Supplied					
Site Reference: Ashplatts, East Aminstead	**TP / BH No**	WS2					
Project / Job Ref: 2390	**Additional Refs**	None Supplied					
Order No: 2390	**Depth (m)**	0.30					
Reporting Date: 01/11/2018	**DETS Sample No**	368880					

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected				
pH	pH Units	N/a	MCERTS	7.8				
Total Cyanide	mg/kg	< 2	NONE	< 2				
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	13				
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.01				
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.5				
Arsenic (As)	mg/kg	< 2	MCERTS	5				
W/S Boron	mg/kg	< 1	NONE	< 1				
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2				
Chromium (Cr)	mg/kg	< 2	MCERTS	15				
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2				
Copper (Cu)	mg/kg	< 4	MCERTS	11				
Lead (Pb)	mg/kg	< 3	MCERTS	12				
Mercury (Hg)	mg/kg	< 1	NONE	< 1				
Nickel (Ni)	mg/kg	< 3	MCERTS	13				
Selenium (Se)	mg/kg	< 3	NONE	< 3				
Zinc (Zn)	mg/kg	< 3	MCERTS	114				
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2				

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

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Soil Analysis Certificate - Speciated PAHs							
DETS Report No: 18-84257	Date Sampled	17/10/18					
Lustre Consulting Ltd	Time Sampled	None Supplied					
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS2					
Project / Job Ref: 2390	Additional Refs	None Supplied					
Order No: 2390	Depth (m)	0.30					
Reporting Date: 01/11/2018	DETS Sample No	368880					

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1				
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1				
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluoranthene	mg/kg	< 0.1	MCERTS	0.17				
Pyrene	mg/kg	< 0.1	MCERTS	0.13				
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.19				
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.28				
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.16				
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1				
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1				
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6				

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

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Soil Analysis Certificate - TPH CWG Banded							
DETS Report No: 18-84257	Date Sampled	17/10/18					
Lustre Consulting Ltd	Time Sampled	None Supplied					
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS2					
Project / Job Ref: 2390	Additional Refs	None Supplied					
Order No: 2390	Depth (m)	0.30					
Reporting Date: 01/11/2018	DETS Sample No	368880					

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2				
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21				
Total >C5 - C35	mg/kg	< 42	NONE	< 42				

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

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Soil Analysis Certificate - BTEX / MTBE							
DETS Report No: 18-84257	Date Sampled	17/10/18					
Lustre Consulting Ltd	Time Sampled	None Supplied					
Site Reference: Ashplatts, East Aminstead	TP / BH No	WS2					
Project / Job Ref: 2390	Additional Refs	None Supplied					
Order No: 2390	Depth (m)	0.30					
Reporting Date: 01/11/2018	DETS Sample No	368880					

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

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

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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 18-84257	
Lustre Consulting Ltd	
Site Reference: Ashplatts, East Aminstead	
Project / Job Ref: 2390	
Order No: 2390	
Reporting Date: 01/11/2018	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
368880	WS2	None Supplied	0.30	7.2	Brown sandy loam

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

Insufficient Sample I/S

Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 18-84257
Lustre Consulting Ltd
Site Reference: Ashplatts, East Aminstead
Project / Job Ref: 2390
Order No: 2390
Reporting Date: 01/11/2018

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

4480

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DETS Report No: 18-85360

Site Reference:	Ashplats House - East Grinstead
Project / Job Ref:	2390
Order No:	None Supplied
Sample Receipt Date:	19/11/2018
Sample Scheduled Date:	19/11/2018
Report Issue Number:	1
Reporting Date:	23/11/2018

Authorised by:

Kevin Old
Associate Director of Laboratory

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4480

Soil Analysis Certificate							
DETS Report No: 18-85360	**Date Sampled**	15/11/18	15/11/18	15/11/18		
Lustre Consulting Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: Ashplats House - East Grinstead	**TP / BH No**	Tank A HP1	Tank A HP2	Tank B S2		
Project / Job Ref: 2390	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	**Depth (m)**	0.15	GL	GL		
Reporting Date: 23/11/2018	**DETS Sample No**	373148	373149	373150		

Determinand	Unit	RL	Accreditation					
EPH (C10 - C40)	mg/kg	< 6	MCERTS	42	26	4050		

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

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Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Speciated PAHs							
DETS Report No: 18-85360	Date Sampled	15/11/18	15/11/18			
Lustre Consulting Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Ashplats House - East Grinstead	TP / BH No	Tank A HP1	Tank B S2			
Project / Job Ref: 2390	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.15	GL			
Reporting Date: 23/11/2018	DETS Sample No	373148	373150			

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	2.78			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	0.41			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	29.10			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	25.20			
Phenanthrene	mg/kg	< 0.1	MCERTS	0.82	16.50			
Anthracene	mg/kg	< 0.1	MCERTS	0.16	48.10			
Fluoranthene	mg/kg	< 0.1	MCERTS	2.15	184			
Pyrene	mg/kg	< 0.1	MCERTS	1.96	162			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.98	66.30			
Chrysene	mg/kg	< 0.1	MCERTS	0.94	53.30			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	1.24	59.30			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.30	21.30			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.85	45.20			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.73	31.10			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.34	3.70			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.50	19.30			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	11	767			

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

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 18-85360	
Lustre Consulting Ltd	
Site Reference: Ashplats House - East Grinstead	
Project / Job Ref: 2390	
Order No: None Supplied	
Reporting Date: 23/11/2018	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
373148	Tank A HP1	None Supplied	0.15	13.9	Brown sandy clay with stones and concrete
373149	Tank A HP2	None Supplied	GL	15.3	Black sandy clay with stones and vegetation
373150	Tank B S2	None Supplied	GL	14.1	Black sandy clay with stones and vegetation

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

Insufficient Sample I/S

Unsuitable Sample U/S

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Lenham Heath
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Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 18-85360
Lustre Consulting Ltd
Site Reference: Ashplats House - East Grinstead
Project / Job Ref: 2390
Order No: None Supplied
Reporting Date: 23/11/2018

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

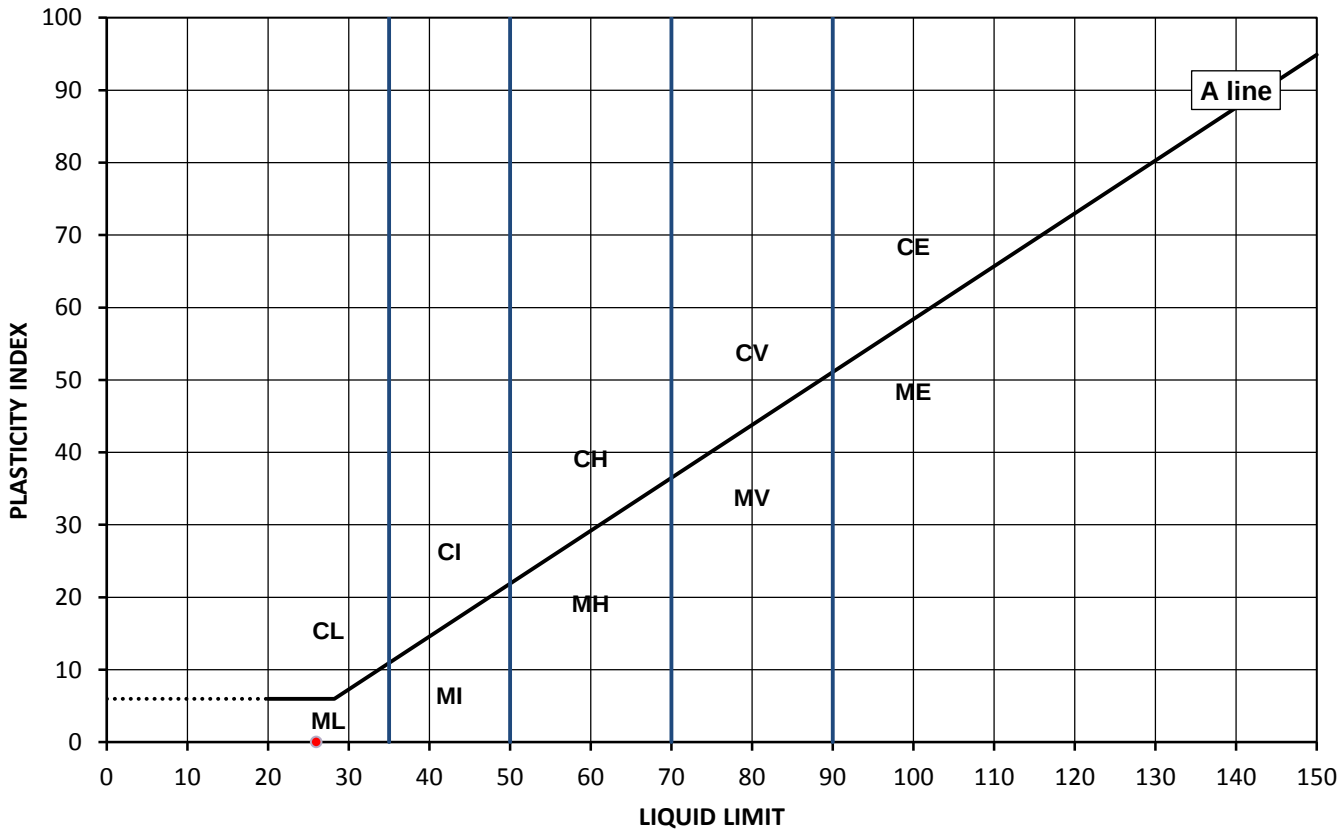
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	05/11/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075214	Depth Top [m]:	1.30
Hole No.:	WS1	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown slightly gravelly slightly clayey sandy SILT		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
9.7	26	NP	NP.	96



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

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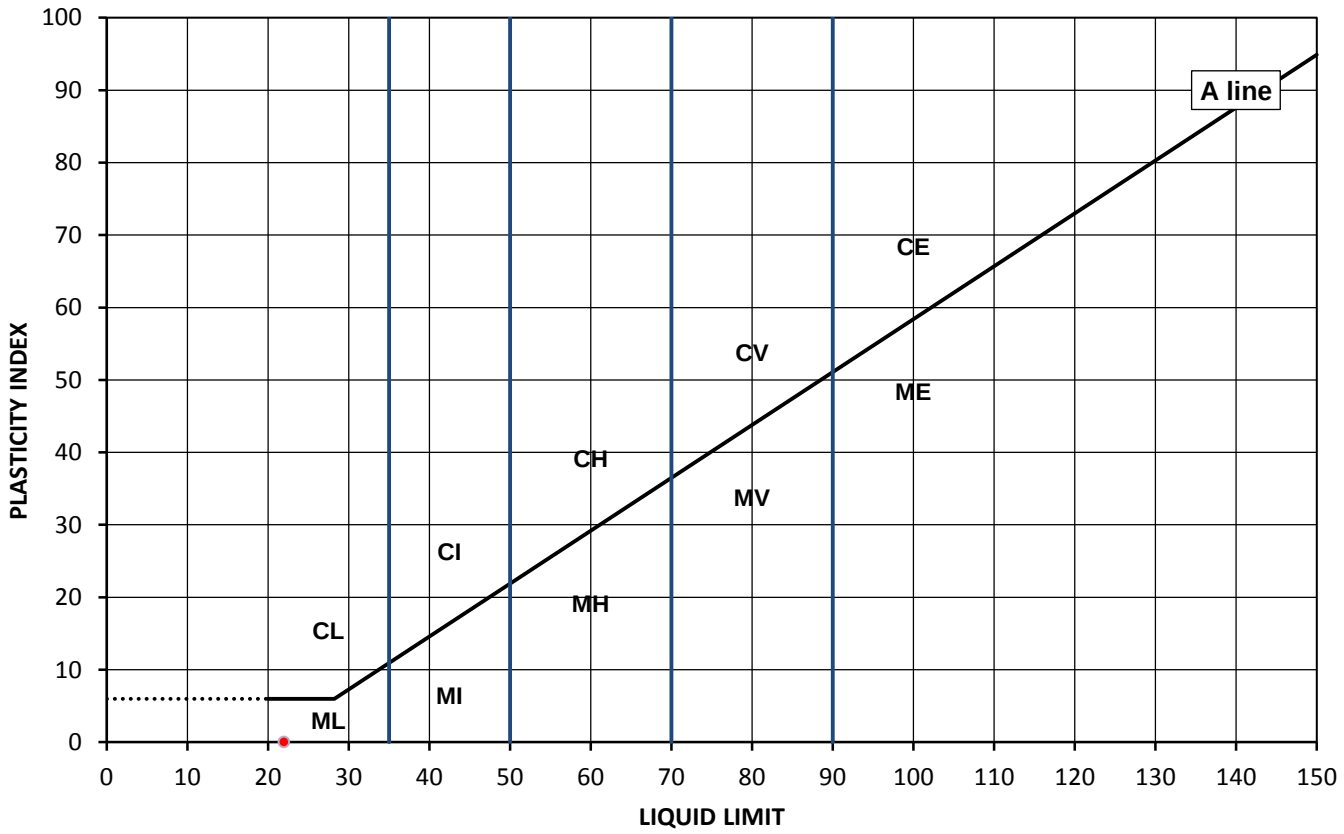
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	05/11/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075216	Depth Top [m]:	1.60
Hole No.:	WS2	Depth Base [m]:	1.70
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Light brown slightly gravelly slightly clayey silty SAND		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
5.8	22	NP	NP.	93



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

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7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

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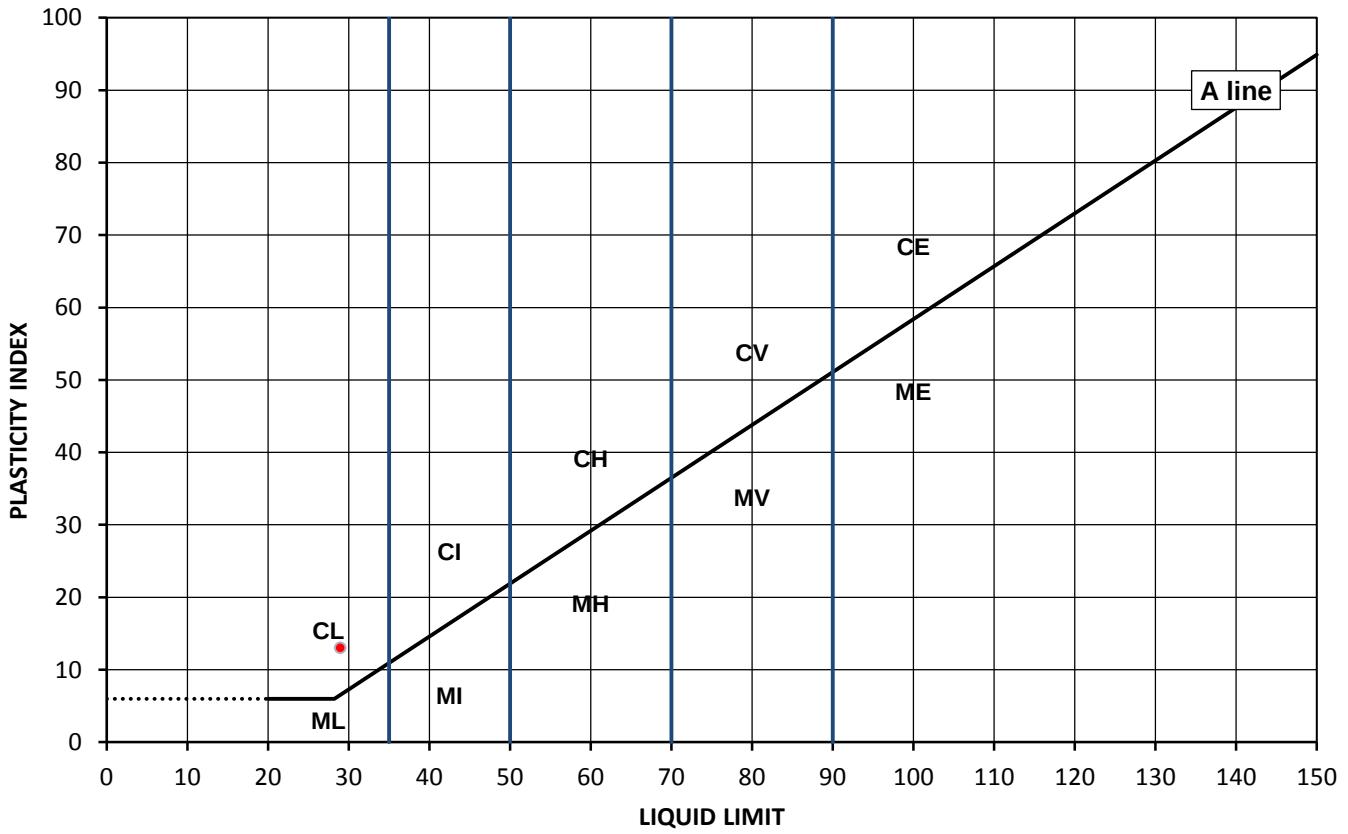
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075217	Depth Top [m]:	0.60
Hole No.:	WS3	Depth Base [m]:	0.80
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown slightly gravelly slightly clayey sandy SILT		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
14	29	16	13	88



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

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Liquid and Plastic Limits

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Croxley Green Business Park
Watford Herts WD18 8YS

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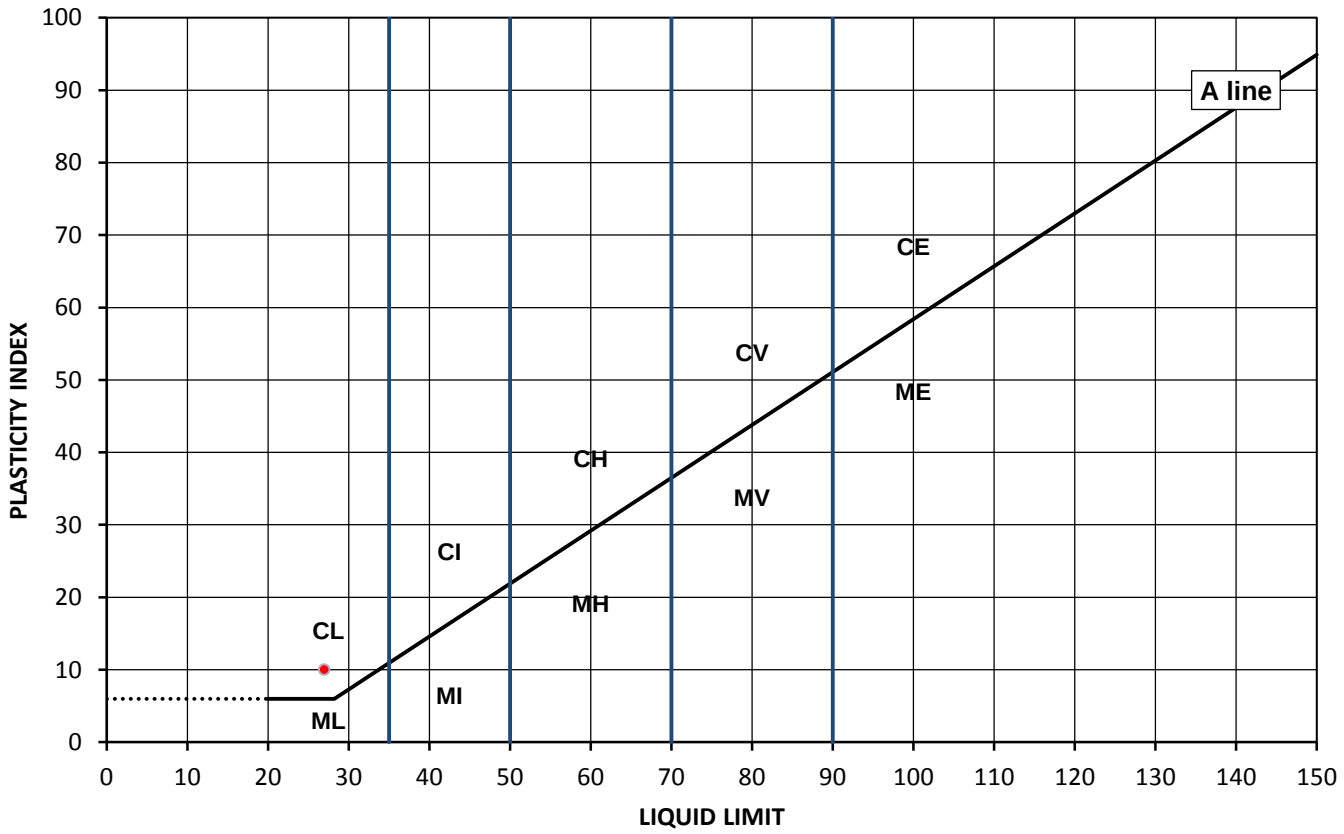
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	07/11/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075218	Depth Top [m]:	0.80
Hole No.:	WS3	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown slightly gravelly slightly clayey sandy SILT		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
13	27	17	10	90



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

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7 Woodshots Meadow
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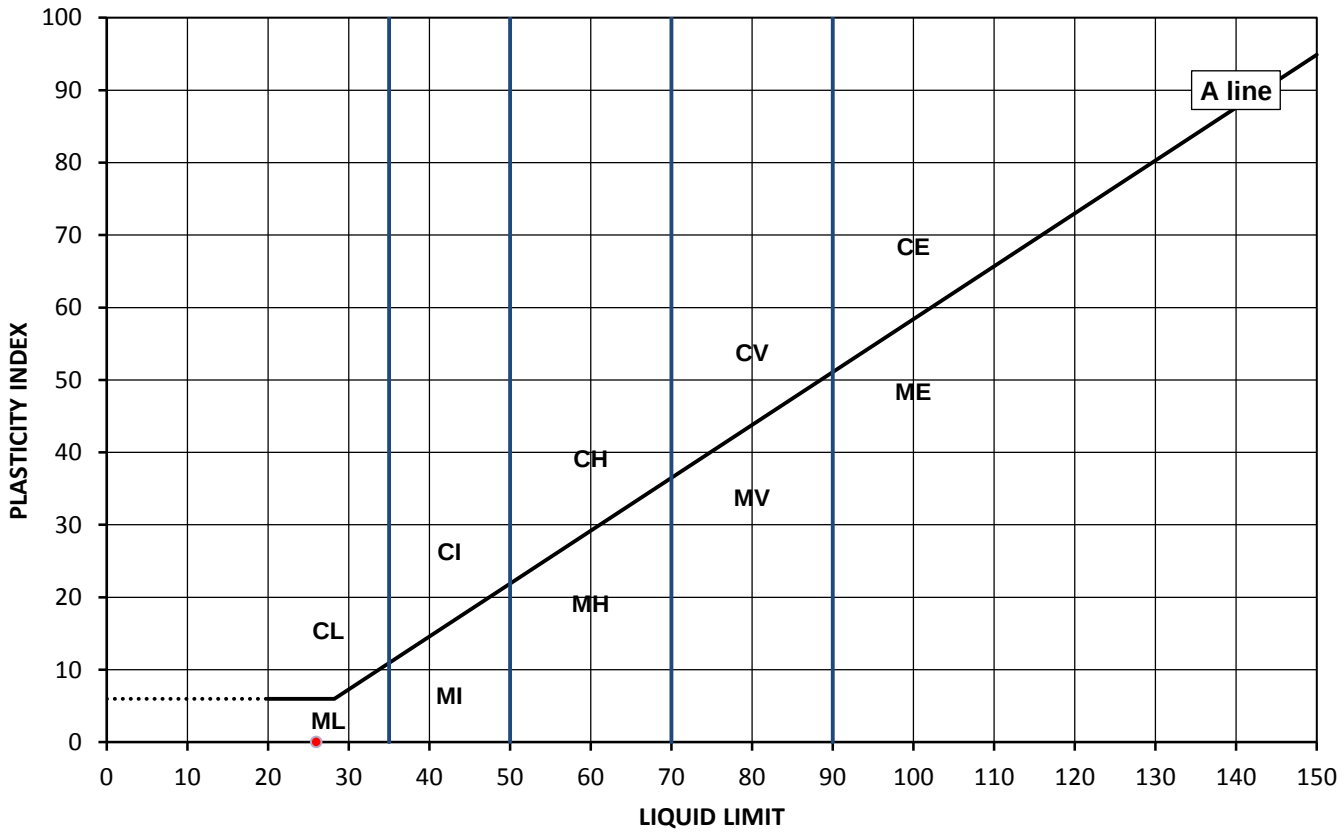
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	05/11/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075219	Depth Top [m]:	1.00
Hole No.:	WS3	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellowish brown slightly gravelly slightly clayey silty SAND		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
10	26	NP	NP.	91



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

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Liquid and Plastic Limits

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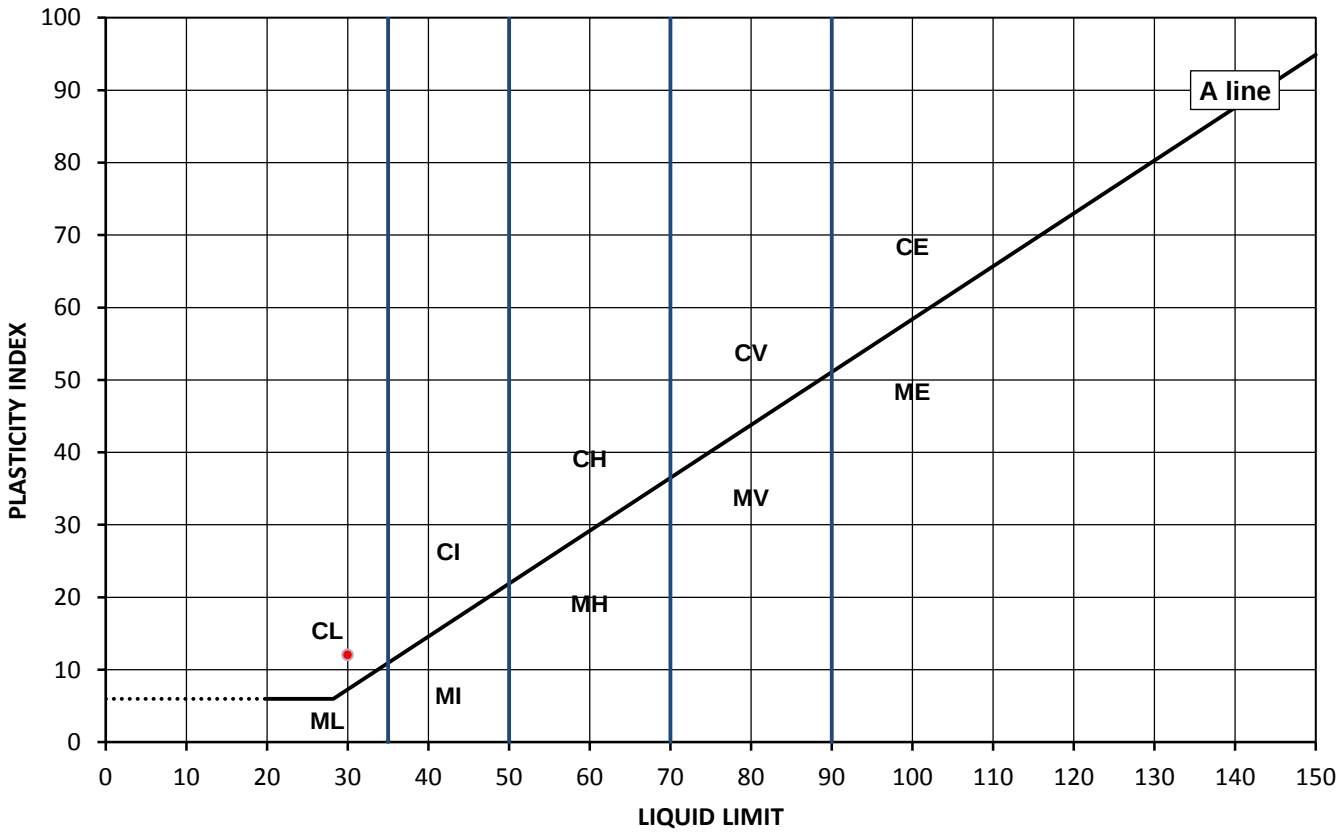
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075220	Depth Top [m]:	2.50
Hole No.:	WS3	Depth Base [m]:	2.60
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Light brown very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
17	30	18	12	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Liquid and Plastic Limits

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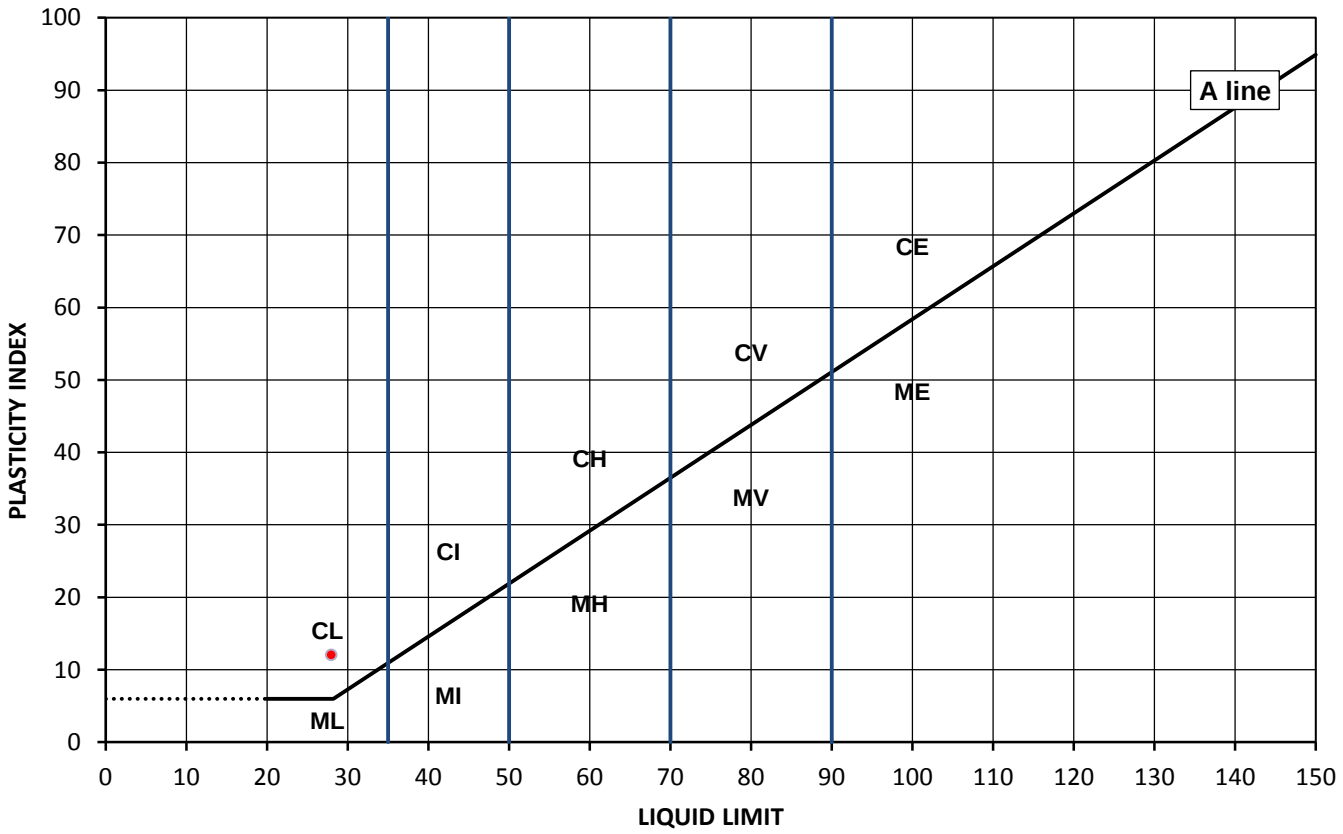
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	05/11/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075223	Depth Top [m]:	0.30
Hole No.:	WS5	Depth Base [m]:	0.70
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown silty clayey SAND		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	28	16	12	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Liquid and Plastic Limits

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Croxley Green Business Park
Watford Herts WD18 8YS

4041

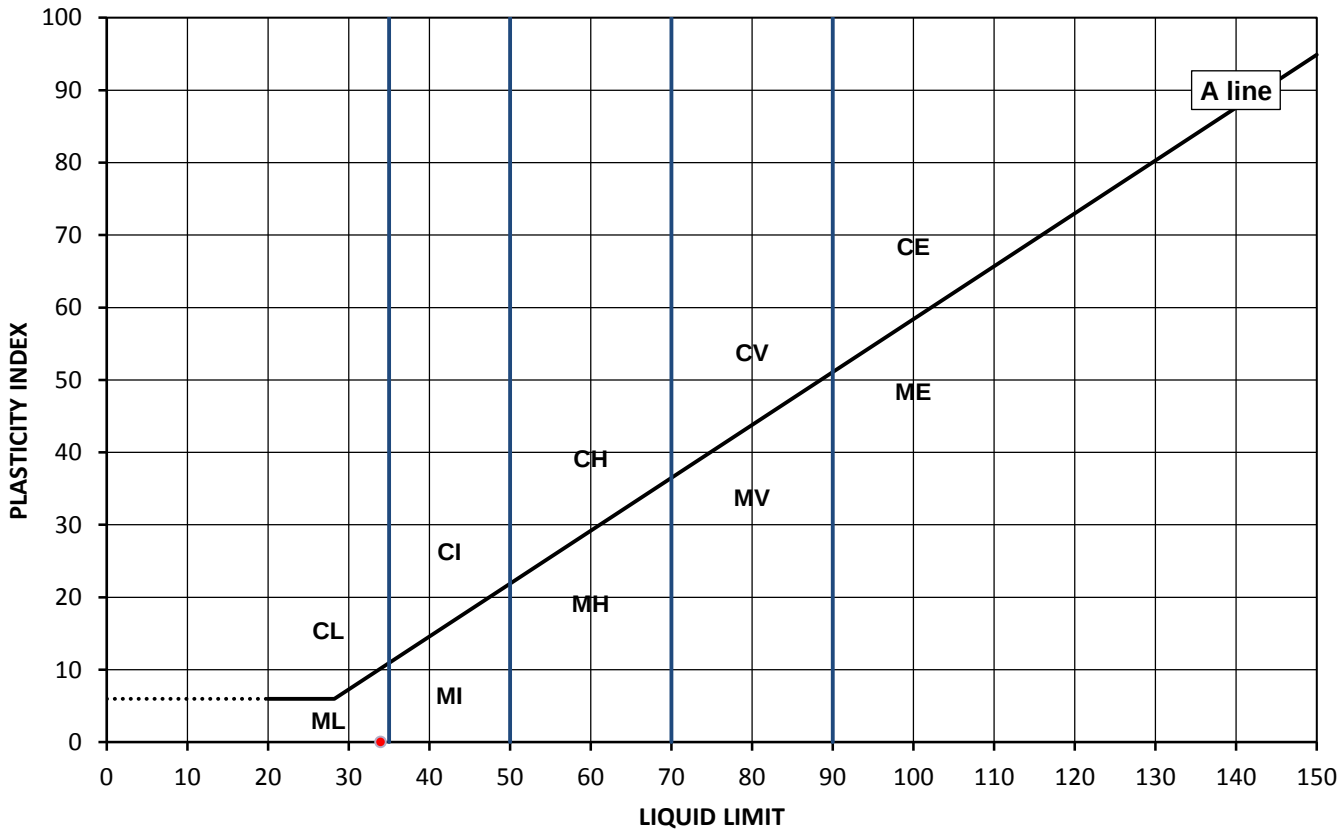
Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard, Chatham Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	05/11/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results

Laboratory Reference:	1075224	Depth Top [m]:	0.70
Hole No.:	WS5	Depth Base [m]:	1.50
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Yellow slightly clayey silty SAND		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
6.2	34	NP	NP.	100



Legend, based on BS 5930:2015 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks: NP – non plastic

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 232.3

for and on behalf of i2 Analytical Ltd

SUMMARY REPORT

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Environmental Science

Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; Atterberg by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990: Clause 8.2

Client: Lustre Consulting Ltd

Client Address: Admiral's Offices
The Historic Dockyard, Chatham
Kent, ME4 4TZ

Contact: Morwenna Corry

Site Name: Ashplats House

Site Address: Not Given

Client Reference: 2390

Job Number: 18-15678

Date Sampled: 17/10/2018

Date Received: 22/10/2018

Date Tested: 29/10 - 07/11/2018

Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC#	Atterberg#				Density		Total Porosity				
		Reference	Depth Top m	Depth Base m	Type			%	% Passing 425um %	LL %	PL %	PI %	bulk Mg/m3	PD Mg/m3	Mg/m3				
1075214	WS1	Not Given	1.30	1.90	B	Yellowish brown slightly gravelly slightly clayey sandy SILT	Atterberg 1 Point	9.7	96	26	NP	NP.							
1075216	WS2	Not Given	1.60	1.70	B	Light brown slightly gravelly slightly clayey silty SAND	Atterberg 1 Point	5.8	93	22	NP	NP.							
1075217	WS3	Not Given	0.60	0.80	B	Brown slightly gravelly slightly clayey sandy SILT	Atterberg 1 Point	14	88	29	16	13							
1075218	WS3	Not Given	0.80	1.00	B	Yellowish brown slightly gravelly slightly clayey sandy SILT	Atterberg 1 Point	13	90	27	17	10							
1075219	WS3	Not Given	1.00	1.90	B	Yellowish brown slightly gravelly slightly clayey silty SAND	Atterberg 1 Point	10	91	26	NP	NP.							
1075220	WS3	Not Given	2.50	2.60	D	Light brown very sandy CLAY	Atterberg 1 Point	17	100	30	18	12							
1075223	WS5	Not Given	0.30	0.70	B	Brown silty clayey SAND	Atterberg 1 Point	11	100	28	16	12							
1075224	WS5	Not Given	0.70	1.50	B	Yellow slightly clayey silty SAND	Atterberg 1 Point	6.2	100	34	NP	NP.							

Note: # UKAS accredited; NP - Non plastic

Comments:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 234.4

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

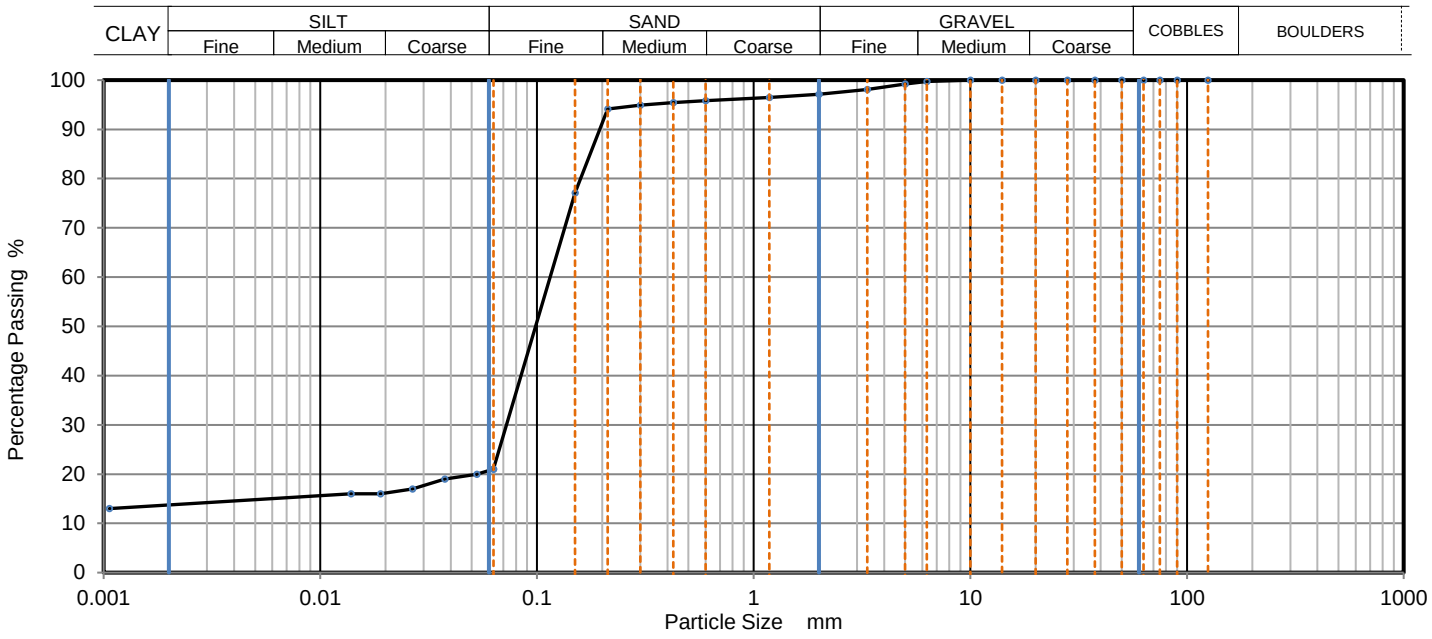
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	18/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075213	Depth Top [m]:	1.40
Hole No.:	TP1	Depth Base [m]:	1.60
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Yellowish brown slightly gravelly silty clayey SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	21
90	100	0.0527	20
75	100	0.0375	19
63	100	0.0267	17
50	100	0.0190	16
37.5	100	0.0138	16
28	100	0.0011	13
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	98		
2	97		
1.18	97		
0.6	96	Particle density	(assumed)
0.425	95	2.65	Mg/m3
0.3	95		
0.212	94		
0.15	77		
0.063	21		

Dry Mass of sample [g]: 200

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	2.90
Sand	75.80
Silt	7.30
Clay	14.00

Grading Analysis		
D100	mm	10
D60	mm	0.115
D30	mm	0.0721
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

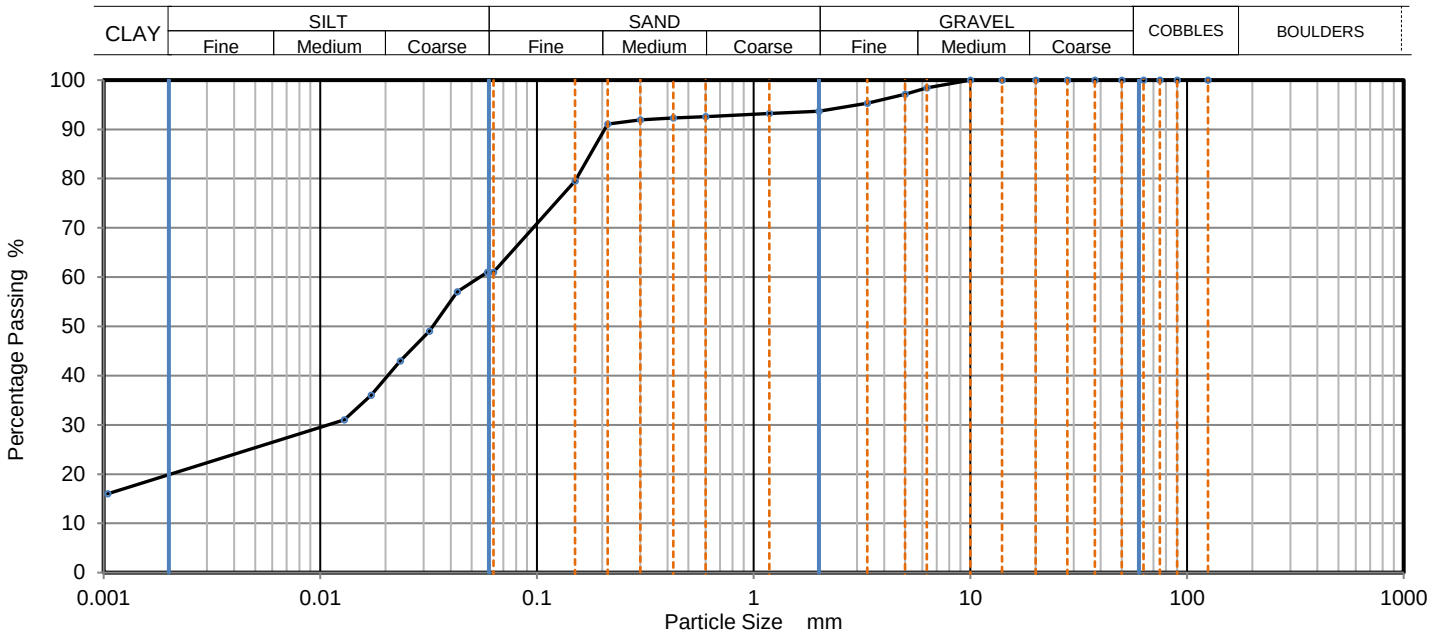
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075214	Depth Top [m]:	1.30
Hole No.:	WS1	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Yellowish brown slightly gravelly slightly clayey sandy SILT		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0589	61
90	100	0.0428	57
75	100	0.0319	49
63	100	0.0234	43
50	100	0.0172	36
37.5	100	0.0129	31
28	100	0.0010	16
20	100		
14	100		
10	100		
6.3	98		
5	97		
3.35	95		
2	94		
1.18	93		
0.6	93	Particle density	(assumed)
0.425	92	2.65	Mg/m3
0.3	92		
0.212	91		
0.15	80		
0.063	61		

Dry Mass of sample [g]: 194

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	6.30
Sand	32.30
Silt	41.60
Clay	19.80

Grading Analysis		
D100	mm	10
D60	mm	0.0527
D30	mm	0.0114
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

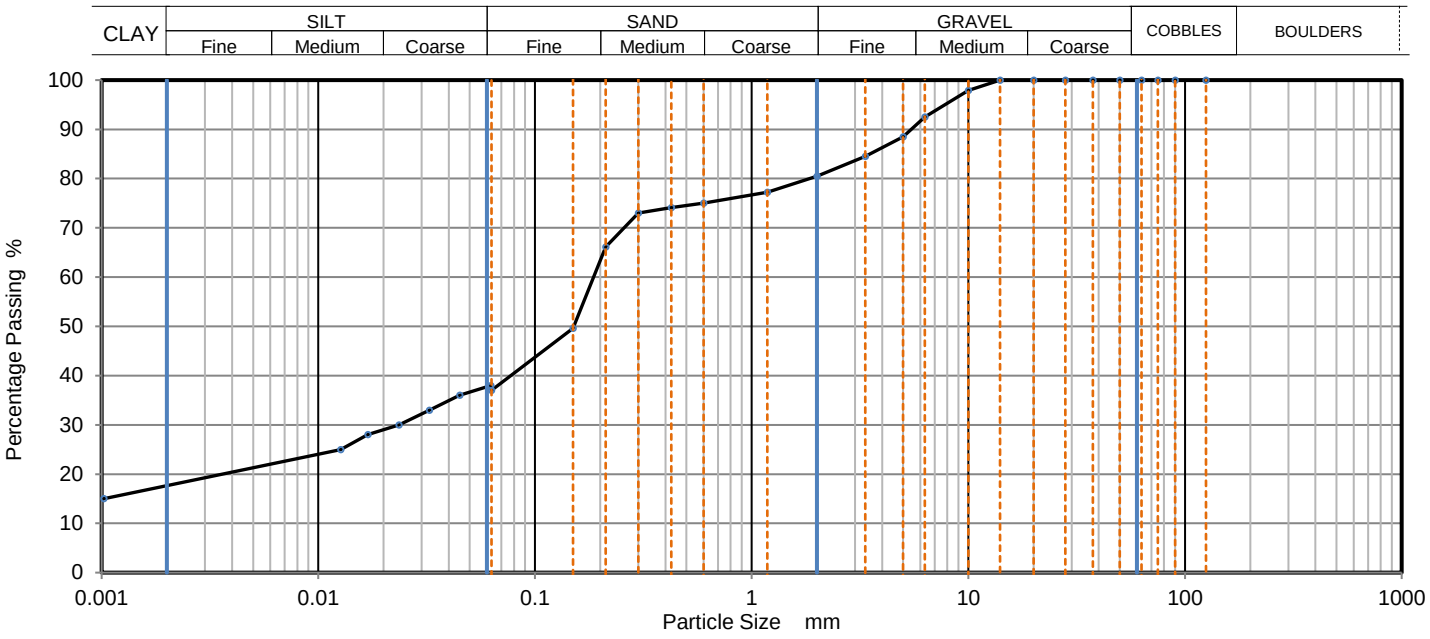
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075215	Depth Top [m]:	0.30
Hole No.:	WS2	Depth Base [m]:	0.70
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Orangish brown slightly clayey slightly gravelly silty SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0626	38
90	100	0.0450	36
75	100	0.0326	33
63	100	0.0236	30
50	100	0.0169	28
37.5	100	0.0127	25
28	100	0.0010	15
20	100		
14	100		
10	98		
6.3	93		
5	89		
3.35	85		
2	81		
1.18	77		
0.6	75	Particle density	(assumed)
0.425	74	2.65	Mg/m3
0.3	73		
0.212	66		
0.15	50		
0.063	38		

Dry Mass of sample [g]: 213

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	19.50
Sand	42.90
Silt	20.00
Clay	17.60

Grading Analysis		
D100	mm	14
D60	mm	0.186
D30	mm	0.0229
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

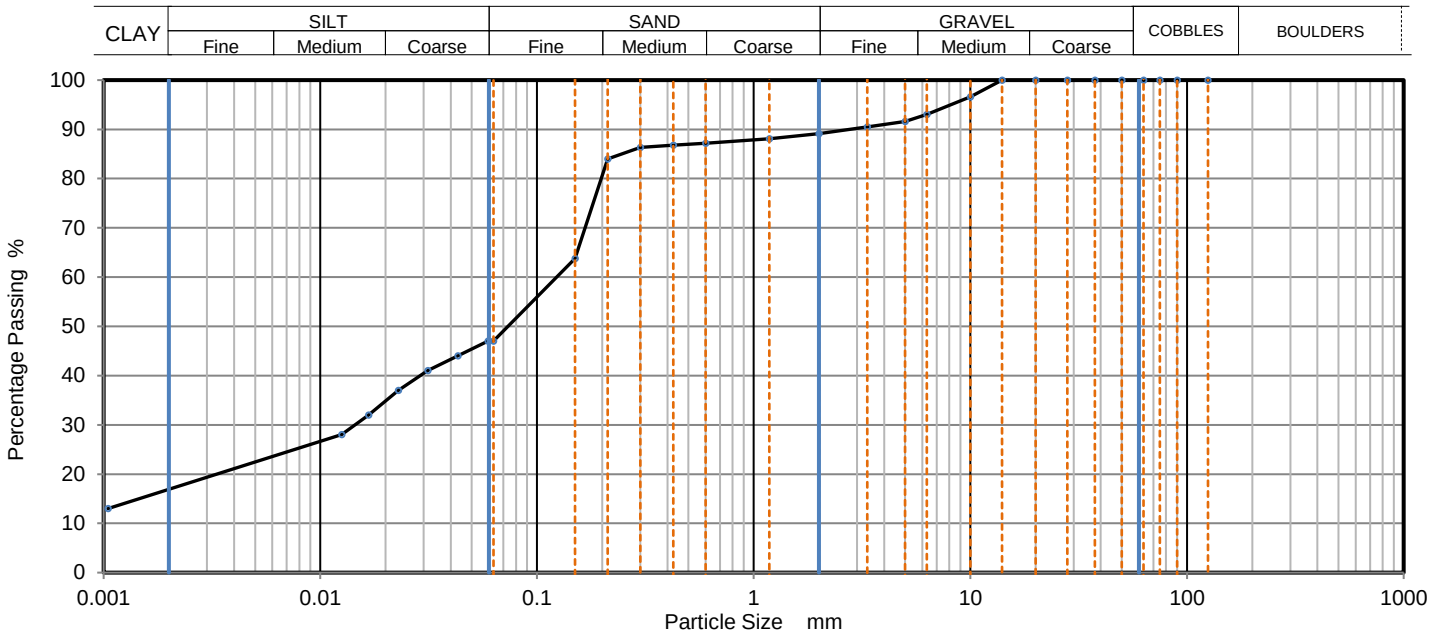
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075216	Depth Top [m]:	1.60
Hole No.:	WS2	Depth Base [m]:	1.70
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Light brown slightly gravelly slightly clayey silty SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0594	47
90	100	0.0432	44
75	100	0.0313	41
63	100	0.0229	37
50	100	0.0167	32
37.5	100	0.0125	28
28	100	0.0010	13
20	100		
14	100		
10	97		
6.3	93		
5	92		
3.35	91		
2	89		
1.18	88		
0.6	87	Particle density	(assumed)
0.425	87	2.65	Mg/m3
0.3	86		
0.212	84		
0.15	64		
0.063	47		

Dry Mass of sample [g]: 198

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	10.90
Sand	42.00
Silt	30.50
Clay	16.60

Grading Analysis		
D100	mm	14
D60	mm	0.123
D30	mm	0.0142
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

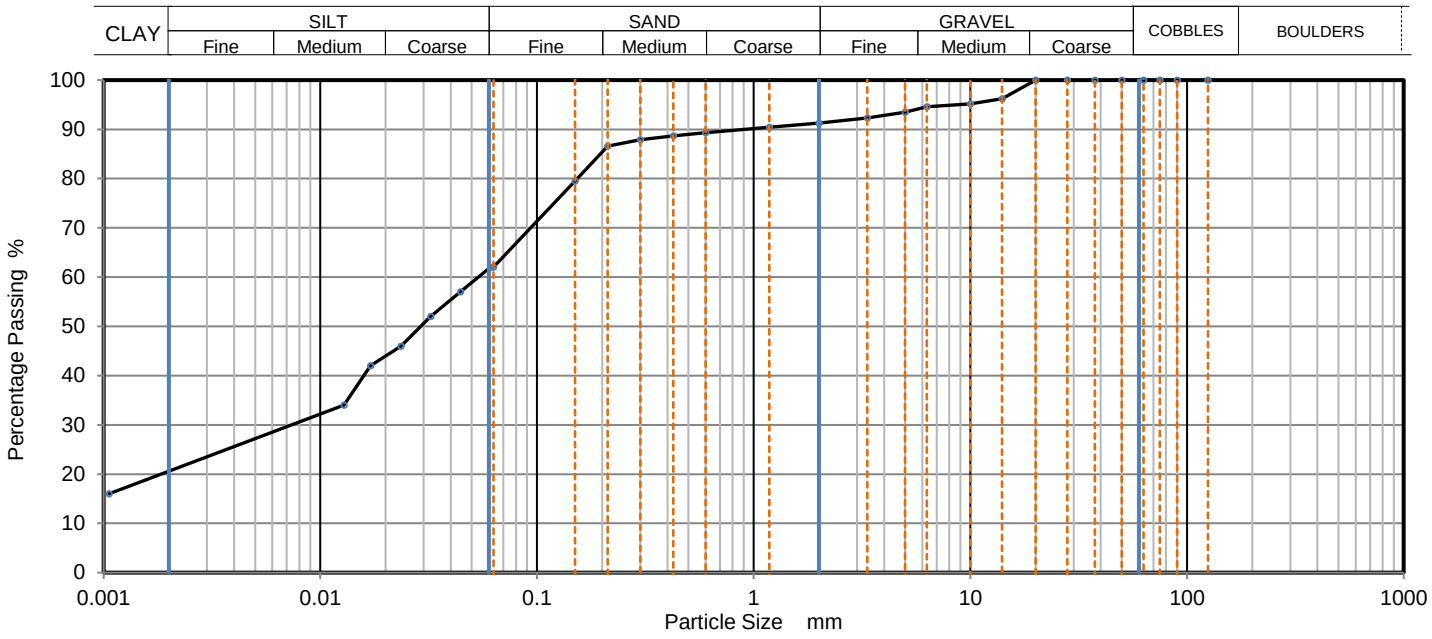
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075217	Depth Top [m]:	0.60
Hole No.:	WS3	Depth Base [m]:	0.80
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown slightly gravelly slightly clayey sandy SILT		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0610	62
90	100	0.0443	57
75	100	0.0323	52
63	100	0.0236	46
50	100	0.0170	42
37.5	100	0.0129	34
28	100	0.0011	16
20	100		
14	96		
10	95		
6.3	95		
5	94		
3.35	92		
2	91		
1.18	90		
0.6	89	Particle density	(assumed)
0.425	89	2.65	Mg/m3
0.3	88		
0.212	87		
0.15	80		
0.063	62		

Dry Mass of sample [g]: 201

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	8.70
Sand	29.70
Silt	41.10
Clay	20.50

Grading Analysis		
D100	mm	20
D60	mm	0.0541
D30	mm	0.00715
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

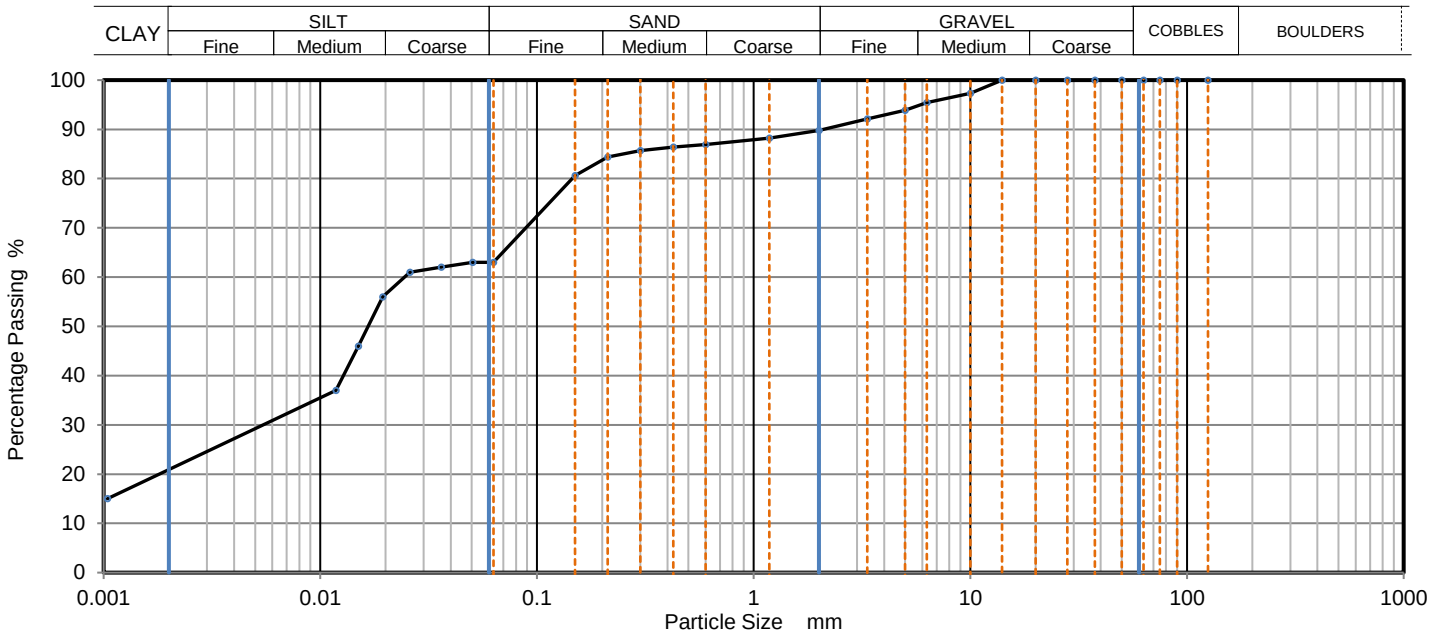
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075218	Depth Top [m]:	0.80
Hole No.:	WS3	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Yellowish brown slightly gravelly slightly clayey sandy SILT		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0505	63
90	100	0.0361	62
75	100	0.0259	61
63	100	0.0194	56
50	100	0.0150	46
37.5	100	0.0118	37
28	100	0.0010	15
20	100		
14	100		
10	97		
6.3	95		
5	94		
3.35	92		
2	90		
1.18	88		
0.6	87	Particle density	(assumed)
0.425	86	2.65	Mg/m3
0.3	86		
0.212	84		
0.15	81		
0.063	63		

Dry Mass of sample [g]: 209

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	10.20
Sand	26.40
Silt	42.60
Clay	20.80

Grading Analysis		
D100	mm	14
D60	mm	0.0241
D30	mm	0.0055
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

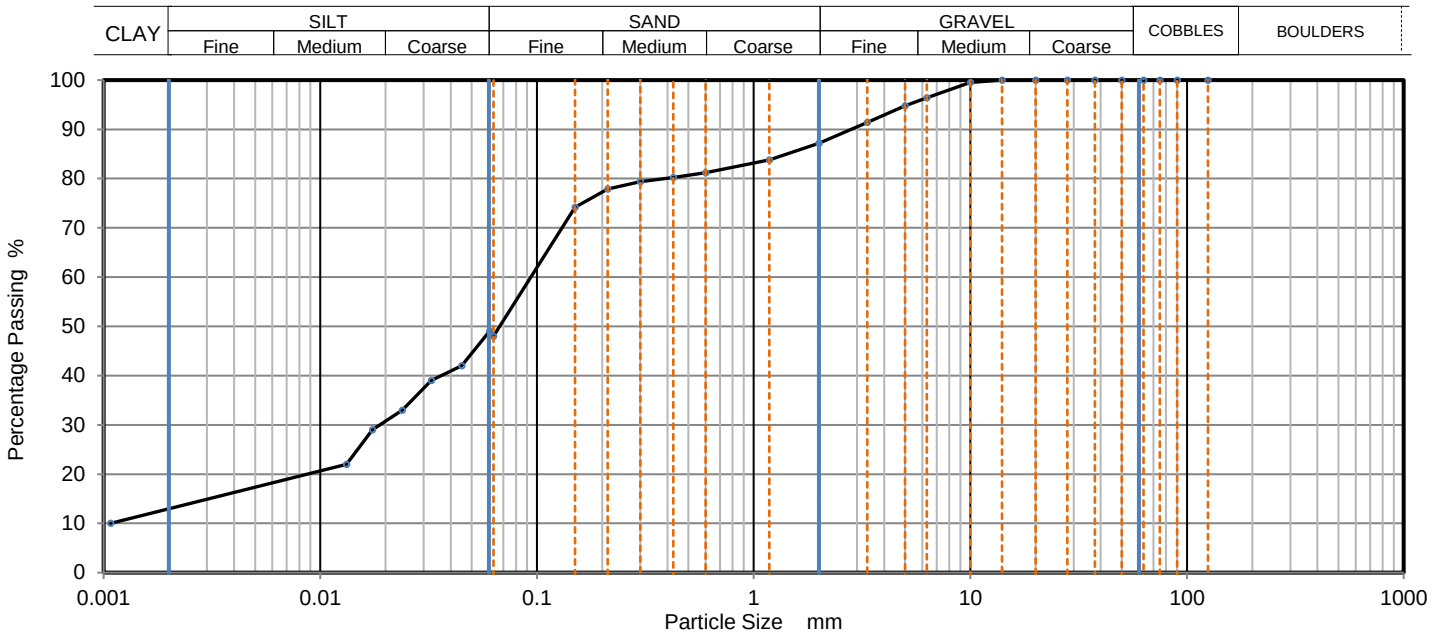
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075219	Depth Top [m]:	1.00
Hole No.:	WS3	Depth Base [m]:	1.90
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Yellowish brown slightly gravelly slightly clayey silty SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0605	49
90	100	0.0450	42
75	100	0.0326	39
63	100	0.0239	33
50	100	0.0174	29
37.5	100	0.0132	22
28	100	0.0011	10
20	100		
14	100		
10	100		
6.3	96		
5	95		
3.35	91		
2	87		
1.18	84		
0.6	81	Particle density	(assumed)
0.425	80	2.65	Mg/m3
0.3	79		
0.212	78		
0.15	74		
0.063	49		

Dry Mass of sample [g]: 241

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	12.80
Sand	38.60
Silt	35.70
Clay	12.90

Grading Analysis		
D100	mm	14
D60	mm	0.0926
D30	mm	0.0191
D10	mm	0.00109
Uniformity Coefficient		85
Curvature Coefficient		3.6

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

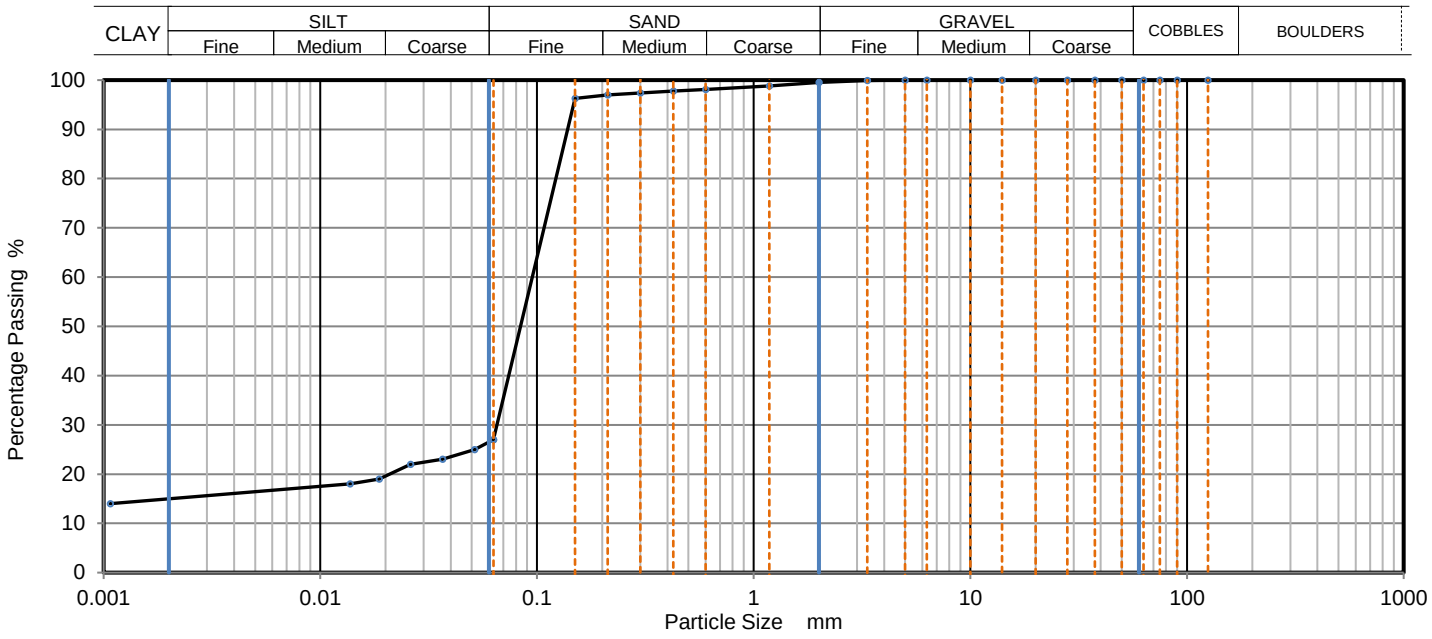
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075221	Depth Top [m]:	0.30
Hole No.:	WS4	Depth Base [m]:	1.00
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Light brown slightly silty slightly clayey SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	27
90	100	0.0515	25
75	100	0.0367	23
63	100	0.0261	22
50	100	0.0187	19
37.5	100	0.0137	18
28	100	0.0011	14
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	98	2.65	Mg/m3
0.3	97		
0.212	97		
0.15	96		
0.063	27		

Dry Mass of sample [g]: 217

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.50
Sand	72.10
Silt	12.70
Clay	14.70

Grading Analysis		
D100	mm	5
D60	mm	0.095
D30	mm	0.0651
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

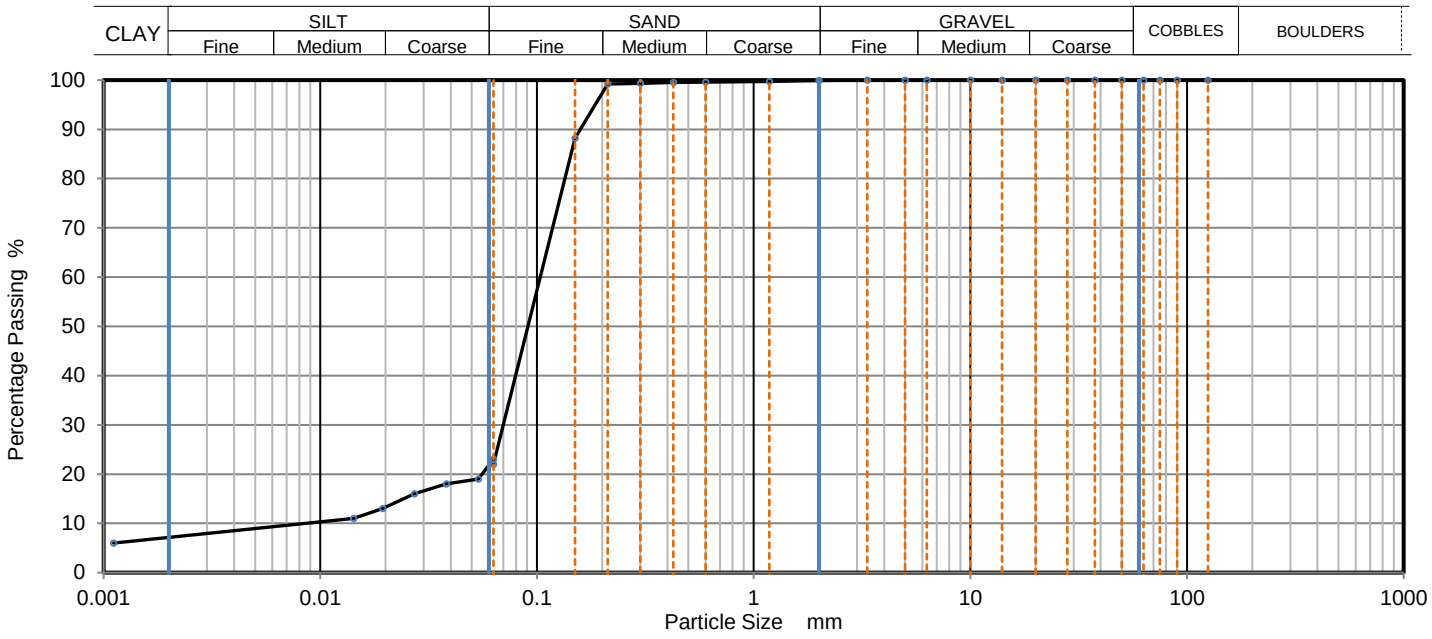
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075222	Depth Top [m]:	1.00
Hole No.:	WS4	Depth Base [m]:	1.20
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Yellowish brown slightly clayey slightly silty SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	23
90	100	0.0536	19
75	100	0.0381	18
63	100	0.0271	16
50	100	0.0194	13
37.5	100	0.0142	11
28	100	0.0011	6
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	99		
0.212	99		
0.15	88		
0.063	23		

Dry Mass of sample [g]: 194

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.10
Sand	77.30
Silt	15.00
Clay	7.60

Grading Analysis		
D100	mm	5
D60	mm	0.103
D30	mm	0.0695
D10	mm	0.00718
Uniformity Coefficient		14
Curvature Coefficient		6.5

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

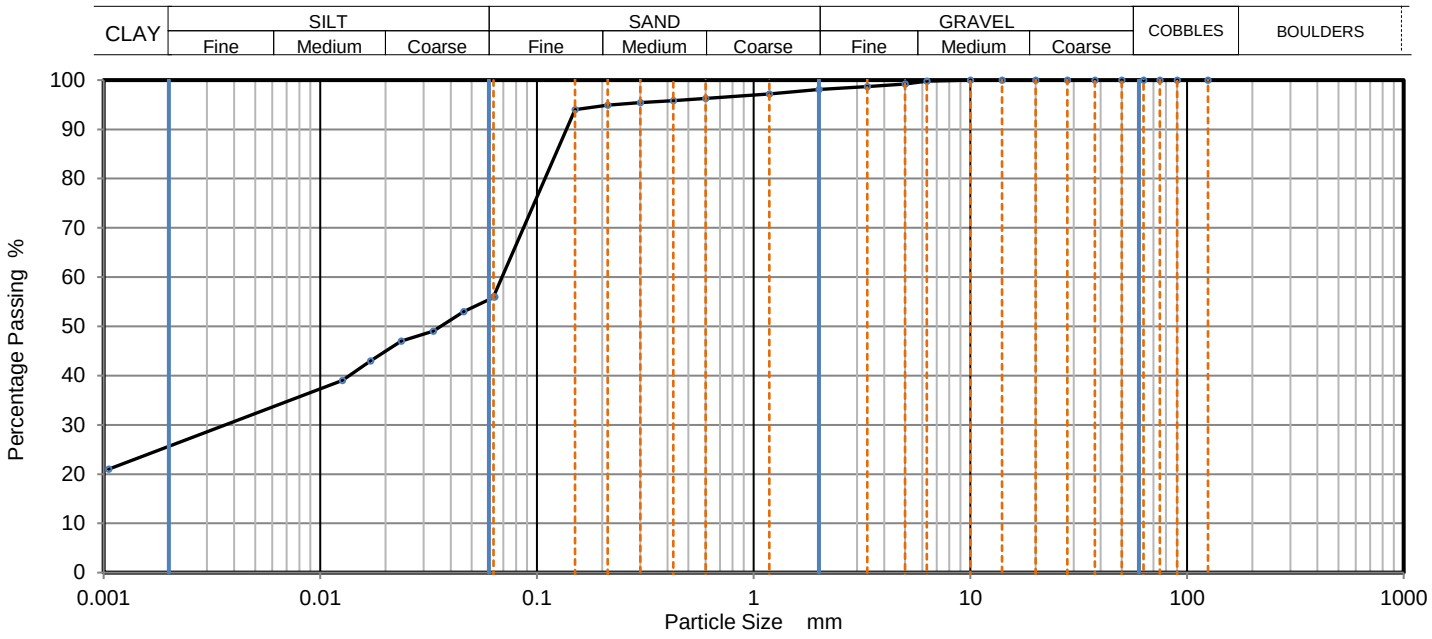
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075223	Depth Top [m]:	0.30
Hole No.:	WS5	Depth Base [m]:	0.70
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown silty clayey SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0638	56
90	100	0.0458	53
75	100	0.0331	49
63	100	0.0236	47
50	100	0.0171	43
37.5	100	0.0126	39
28	100	0.0011	21
20	100		
14	100		
10	100		
6.3	100		
5	99		
3.35	99		
2	98		
1.18	97		
0.6	96	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	95		
0.15	94		
0.063	56		

Dry Mass of sample [g]: 175

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	1.90
Sand	41.90
Silt	30.20
Clay	26.00

Grading Analysis		
D100	mm	10
D60	mm	0.0695
D30	mm	0.00347
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

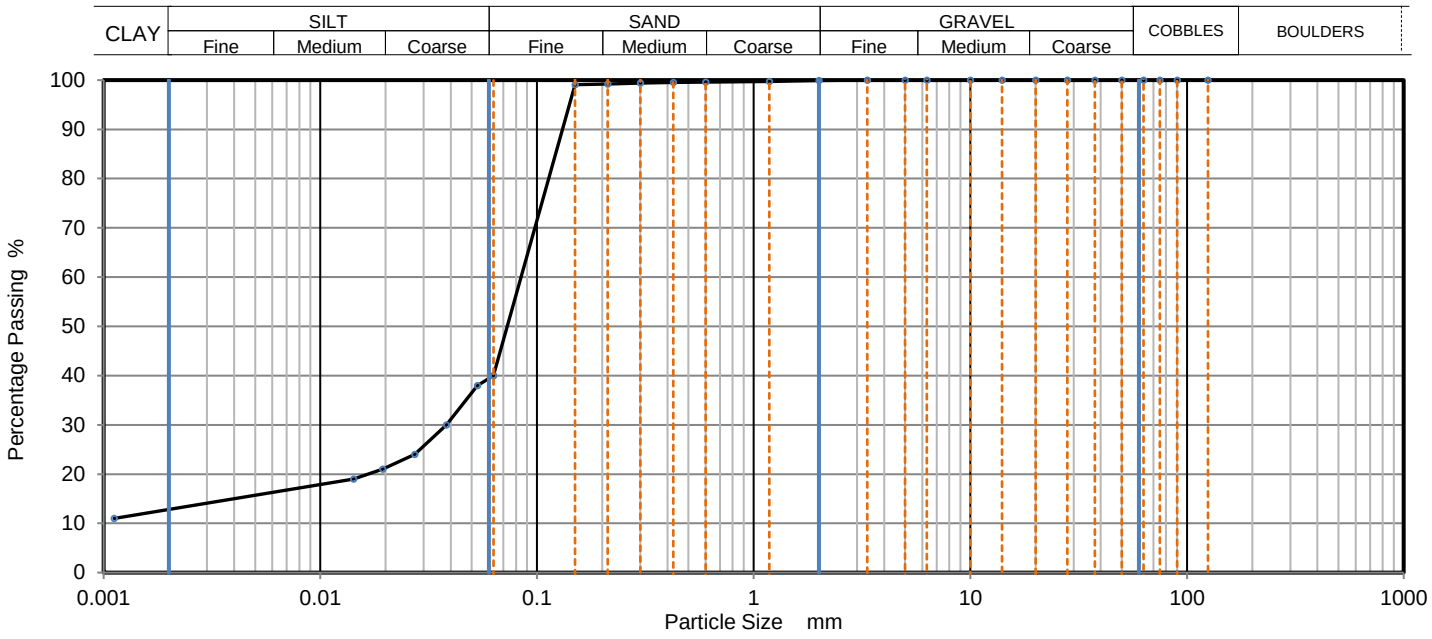
i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Client:	Lustre Consulting Ltd	Client Reference:	2390
Client Address:	Admiral's Offices The Historic Dockyard Chatham, Kent, ME4 4TZ	Job Number:	18-15678
		Date Sampled:	17/10/2018
		Date Received:	22/10/2018
Contact:	Morwenna Corry	Date Tested:	29/10/2018
Site Name:	Ashplats House	Sampled By:	Not Given
Site Address:	Not Given		

Test Results:

Laboratory Reference:	1075224	Depth Top [m]:	0.70
Hole No.:	WS5	Depth Base [m]:	1.50
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Yellow slightly clayey silty SAND		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	40
90	100	0.0530	38
75	100	0.0382	30
63	100	0.0273	24
50	100	0.0194	21
37.5	100	0.0142	19
28	100	0.0011	11
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100	Particle density	(assumed)
0.425	100	2.65	Mg/m3
0.3	99		
0.212	99		
0.15	99		
0.063	40		

Dry Mass of sample [g]: 181

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	0.10
Sand	59.50
Silt	27.80
Clay	12.60

Grading Analysis		
D100	mm	5
D60	mm	0.0842
D30	mm	0.0389
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 07/11/2018

Signed: Darren Berrill
Geotechnical General Manager

GF 100.10

for and on behalf of i2 Analytical Ltd

APPENDIX D: FIELD MONITORING RECORDS

SOILS GAS MONITORING

ROUND 1

Project Number: 2390 **Site Location:** Ashplatts House - East Grinstead **Date:** 25/10/2018 **Logged By:** AK

Atm. Pressure (start): 2027 **Atm. Pressure (finish):** 2018 **24 hr Trend:** Decreasing

Monitoring Point Reference	Flow Range (Litres / hr)	Relative Pressure (mb)	Methane % V\V		Methane % LEL (Lower Explosive Limit)		Carbon Dioxide % V\V		Oxygen % V\V		CO/ H_2S		Water level (m bgl)		PID (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady	CO	H_2S	Top	Base	Peak	Steady
WS1	0	-	0	0	0	0	1.7	1.6	19.3	19.4	1	0	DRY	1.92	0	0
WS2	0	-0.02	0.1	0	2	0	2	2	19.8	19.8	0	0	DRY	1.6	0.1	0.1
WS3	-0.1	-0.07	0	0	0	0	1.8	1.8	20.2	20.8	0	0	DRY	2.94	0.1	0.1
WS4	0	-0.1	0	0	0	0	2.3	2.3	19	19.1	0	0	DRY	1.06	0	0
WS5	-0.1	-0.1	0	0	0	0	0.1	0.1	21.5	22.1	0	0	DRY	1.61	0	0
EBH1	0	0.02	0	0	0	0	2.5	2.5	19.4	19.4	0	0	DRY	1.68	0.1	0
EBH2	0	0	0	0	0	0	1.9	1.9	19.5	19.5	1	0	DRY	2.65	0.1	0
EBH3	0	-0.03	0	0	0	0	4.7	4.7	15.5	15.5	0	0	2.9	2.99	0.1	0
EBH4	-0.1	-0.03	0	0	0	0	1.4	1.2	20.5	20.6	0	0	DRY	2.32	0	0

Weather: Dry, cool, overcast. Remarks: EBH1 and EBH4: loose tap. EBH3 - Pumping gas for 250 seconds. Gradually increasing with time.

SOILS GAS MONITORING

ROUND 2

Project Number: 2390 **Site Location:** Ashplatts House - East Grinstead **Date:** 07/11/2018 **Logged By:** AK

Atm. Pressure (start): 998 **Atm. Pressure (finish):** 980 **24 hr Trend:** Decreasing

Monitoring Point Reference	Flow Range (Litres / hr)	Relative Pressure (mb)	Methane % V\V		Methane % LEL (Lower Explosive Limit)		Carbon Dioxide % V\V		Oxygen % V\V		CO/ H_2S		Water level (m bgl)		PID (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady	CO	H_2S	Top	Base	Peak	Steady
WS1	-0.1	-0.03	0	0	0	0	1	1	19.7	19.7	0	0	DRY	1.92	0.2	0
WS2	0	0	0	0	0	0	1.4	1.4	19.9	19.9	4	0	DRY	1.6	0.2	0
WS3	0	-0.02	0	0	0	0	0.1	0.1	21.1	21.1	1	0	DRY	2.94	0.2	0.2
WS4	0	0.02	0	0	0	0	2.9	2.9	18.7	18.7	0	0	DRY	1.06	0.1	0
WS5	0.1	0.1	0	0	0	0	1.5	1.5	19	19	0	0	DRY	1.61	0	0
EBH1	23.9	52.3	0	0	0	0	4.4	4.4	16.4	16.4	0	0	0.31	1.68	0.9	0.2
EBH2	0	-0.1	0	0	0	0	2.9	2.9	19	19.1	1	0	DRY	2.65	0.2	0
EBH3	-0.1	-0.05	0	0	0	0	5.7	5.7	16.3	16.3	1	0	2.9	2.99	0.1	0
EBH4	0	-0.07	0	0	0	0	3.4	3.4	17.5	17.5	0	0	DRY	2.32	0	0

Remarks / Weather: EBH1: Flow left for 3 seconds to advoid escape of gas, but slowly decreasing.

SOILS GAS MONITORING

ROUND 3

Project Number: 2390 **Site Location:** Ashplatts House - East Grinstead **Date:** 15.11.18 **Logged By:** CJ

Atm. Pressure (start): **Atm. Pressure (finish):** **24 hr Trend:**

Monitoring Point Reference	*	Relative Pressure (mb)	Methane % V\V		Methane % LEL (Lower Explosive Limit)		Carbon Dioxide % V\V		Oxygen % V\V		CO/ H_2S		Water level (m bgl)		PID (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady	CO	H_2S	Top	Base	Peak	Steady
WS1	-0.1	0.07	0.2	0	4	0	0.7	0.7	20.4	20.4	0	0	1.9	1.91	0.8	0.8
WS2	0	0.05	0.1	0.1	2	2	1.5	1.5	19.5	19.5	0	0	ND	1.6	1.2	1.2
WS3	0	-0.02	0.1	0.1	2	2	0.3	0.3	21	21	0	0	ND	2.94	1.5	1.5
WS4	0	-0.12	0.1	0.1	2	2	3.8	3.8	17.3	17.3	0	0	ND	1.05	0.6	0.6
WS5	-0.1	-0.31	0.1	0.1	2	2	2.1	2.1	19	19	0	0	1.59	1.61	0.8	0.8
HBH1	-17.4	-52.78	0.1	0	2	0	2.6	2.6	19.7	19.8	0	0	0.88	1.71	1.1	1
HBH2	0	0.03	0.1	0.1	2	2	3.8	3.8	17.9	17.9	0	0	2.6	2.65	1.1	1.1
HBH3	0.1	-0.19	0.1	0	2	0	6.1	6.1	15.1	15.1	0	0	2.9	2.98	0.6	0.6

Remarks / Weather: -12.1 after 60 secs. 90 secs - 10.6 2.5-8.6 Resp Zone Flooded

SOAKAGE TESTING TO DETERMINE INFILTRATION RATE (BRE)

LUSTRE CONSULTING

PROJECT NAME:	Ashplatts House	PROJECT NO.:	2390
LOCATION	East Grinstead	CONSULTANT:	AK
DATE:	18/10/2018	WEATHER:	Dry, overcast, warm

Soakage Pit Number:	SOAK1	Length (m):	1.4	Width (m):	0.3	Depth (m):	2
Shingle Size (mm):	20			Slotted Pipe Diameter (mm):			10

BRE DIGEST 365 - SOAKAGE TEST 1							
Filling Start Time (hh/mm):	11:20	Filling End Time (hh/mm):		11:20	Start Water Depth (m bgl):		0.29
Effective Depths (m):	75%:	0.72	50%:	1.15	25%:	1.57	

BRE DIGEST 365 - SOAKAGE TEST 2							
Filling Start Time (hh/mm):		Filling End Time (hh/mm):			Start Water Depth (m bgl):		
Effective Depths (m):	75%:	0.50	50%:	1.00	25%:	1.50	

BRE DIGEST 365 - SOAKAGE TEST 3							
Filling Start Time (hh/mm):		Filling End Time (hh/mm):			Start Water Depth (m bgl):		
Effective Depths (m):	75%:	0.50	50%:	1.00	25%:	1.50	

FIELD MEASUREMENTS

SOAKAGE TEST 1			SOAKAGE TEST 2			SOAKAGE TEST 3		
TIME		DEPTH	TIME		DEPTH	TIME		DEPTH
(min)	(sec)	(m bgl)	(min)	(sec)	(m bgl)	(min)	(sec)	(m bgl)
0	0	0.29						
0.5	30	0.32						
1	60	0.33						
1.5	90	0.335						
2	120	0.34						
3	180	0.36						
4	240	0.375						
5	300	0.39						
6	360	0.4						
7	420	0.415						
8	480	0.43						
9	540	0.445						
10	600	0.46						
12	720	0.49						
14	840	0.51						
16	960	0.535						
18	1080	0.56						
20	1200	0.58						
25	1500	0.64						
30	1800	0.685						
35	2100	0.73						
40	2400	0.77						
45	2700	0.81						
50	3000	0.85						
55	3300	0.885						
60	3600	0.92						
75	4500	1.01						
120	7200	1.24						
245	14700	1.66						

SOAKAGE TESTING TO DETERMINE INFILTRATION RATE (BRE)

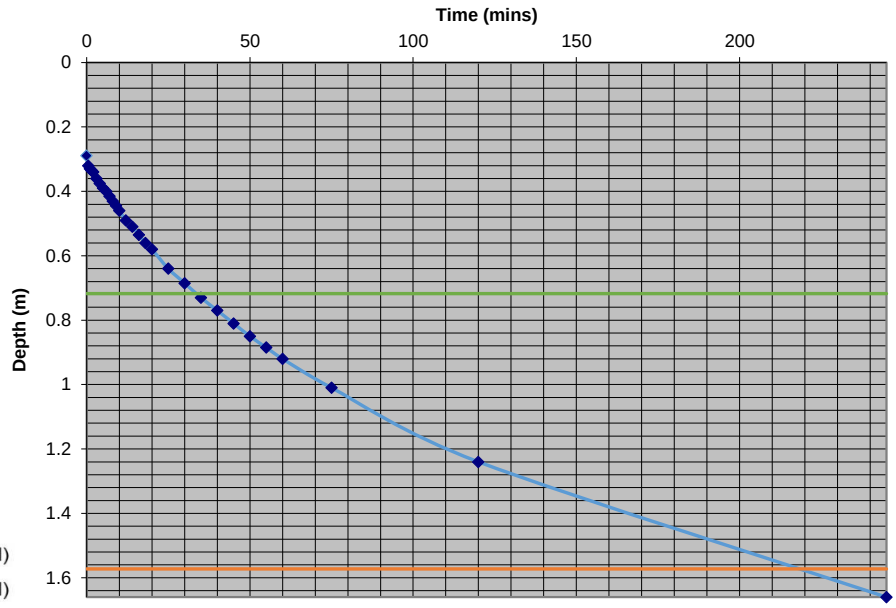
LUSTRE CONSULTING

PROJECT NAME:	Ashplatts House			PROJECT NO.:		2390	
DATE:	18/10/2018			WEATHER:		Dry, overcast, warm	
Soakage Pit Number:	SOAK1	Length (m):	1.4	Width (m):	0.3	Depth (m):	2

Comments:	

SOAK1 SOAKAGE TEST 1

Time at 75% eff. depth:
33
Time at 25% eff. depth:
218
Volume of outflow (75% - 25%, m^3):
0.3591
Mean surface area of outflow (m^2):
3.327
Time for outflow (75% - 25% eff. depth (mins)):
185



Soil infiltration rate (m/s):	9.72388E-06	@	35.00597	litres/hour

SOAKAGE TESTING TO DETERMINE INFILTRATION RATE (BRE)

LUSTRE CONSULTING

PROJECT NAME:	Ashplatts House	PROJECT NO.:	2390
SITE NAME:	East Grinstead	CONSULTANT:	AK
DATE:	18/10/2018	WEATHER:	Dry, overcast, warm

Soakage Pit Number:	SOAK2	Length (m):	1.1	Width (m):	0.3	Depth (m):	1
Shingle Size (mm):	20			Slotted Pipe Diameter (mm):			50

BRE DIGEST 365 - SOAKAGE TEST 1							
Filling Start Time (hh/mm):	12:10	Filling End Time (hh/mm):		12:10	Start Water Depth (m bgl):		0.18
Effective Depths (m):	75%:	0.39	50%:	0.59	25%:	0.80	

BRE DIGEST 365 - SOAKAGE TEST 2							
Filling Start Time (hh/mm):		Filling End Time (hh/mm):			Start Water Depth (m bgl):		
Effective Depths (m):	75%:	0.25	50%:	0.50	25%:	0.75	

BRE DIGEST 365 - SOAKAGE TEST 3							
Filling Start Time (hh/mm):		Filling End Time (hh/mm):			Start Water Depth (m bgl):		
Effective Depths (m):	75%:	0.25	50%:	0.50	25%:	0.75	

FIELD MEASUREMENTS

SOAKAGE TEST 1			SOAKAGE TEST 2			SOAKAGE TEST 3		
TIME		DEPTH	TIME		DEPTH	TIME		DEPTH
(min)	(sec)	(m bgl)	(min)	(sec)	(m bgl)	(min)	(sec)	(m bgl)
0	0	0.18						
0.5	30	0.18						
1	60	0.18						
1.5	90	0.18						
2	120	0.19						
3	180	0.2						
4	240	0.21						
5	300	0.21						
6	360	0.22						
7	420	0.225						
9	540	0.23						
10	600	0.24						
12	720	0.245						
14	840	0.25						
16	960	0.26						
19	1140	0.27						
20	1200	0.27						
25	1500	0.275						
30	1800	0.28						
35	2100	0.29						
40	2400	0.295						
50	3000	0.31						
55	3300	0.315						
60	3600	0.32						
210	12600	0.395						
360	21600	0.47						
510	30600	0.545						
660	39600	0.62						
810	48600	0.695						
960	57600	0.77						
1110	66600	0.845						
1260	75600	0.92						
1410	84600	0.995						
1560	93600	1.07						
1710	102600	1.145						

SOAKAGE TESTING TO DETERMINE INFILTRATION RATE (BRE)

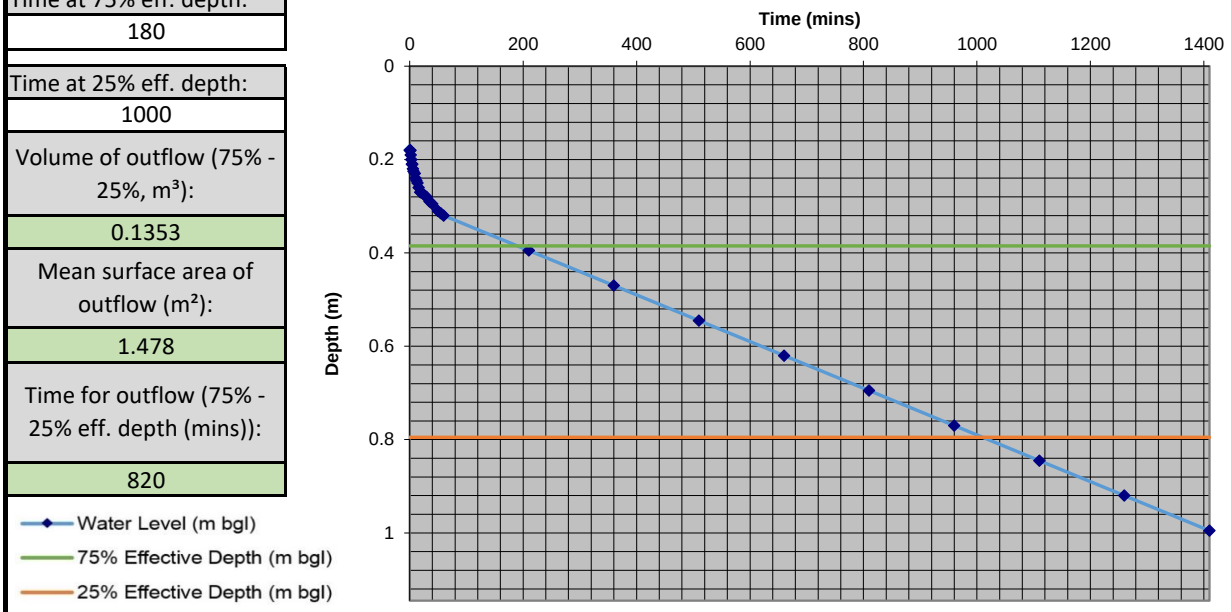
LUSTRE CONSULTING

PROJECT NAME:	Ashplatts House			PROJECT NO.:		2390	
DATE:	18/10/2018			WEATHER:		Dry, overcast, warm	
Soakage Pit Number:	SOAK2	Length (m):	1.1	Width (m):	0.3	Depth (m):	1

Comments:	Data highlighted in red (from 360 minutes) has been extrapolated to obtain effective depth measurements.

SOAK2 SOAKAGE TEST 1

Time at 75% eff. depth:
180
Time at 25% eff. depth:
1000
Volume of outflow (75% - 25%, m^3):
0.1353
Mean surface area of outflow (m^2):
1.478
Time for outflow (75% - 25% eff. depth (mins)):
820



Soil infiltration rate (m/s):	1.86062E-06	@	6.698241	litres/hour

SOAKAGE TESTING TO DETERMINE INFILTRATION RATE (BRE)

LUSTRE CONSULTING

PROJECT NAME:	Ashplatts House	PROJECT NO.:	2390
SITE NAME:	East Grinstead	CONSULTANT:	AK
DATE:	18/10/2018	WEATHER:	Dry, overcast, warm

Soakage Pit Number:	SOAK3	Length (m):	0.9	Width (m):	0.3	Depth (m):	0.7
Shingle Size (mm):	20			Slotted Pipe Diameter (mm):			50

BRE DIGEST 365 - SOAKAGE TEST 1							
Filling Start Time (hh/mm):	14:30	Filling End Time (hh/mm):		14:30	Start Water Depth (m bgl):		0.17
Effective Depths (m):	75%:	0.30	50%:	0.44	25%:	0.57	

BRE DIGEST 365 - SOAKAGE TEST 2							
Filling Start Time (hh/mm):		Filling End Time (hh/mm):			Start Water Depth (m bgl):		
Effective Depths (m):	75%:	0.18	50%:	0.35	25%:	0.53	

BRE DIGEST 365 - SOAKAGE TEST 3							
Filling Start Time (hh/mm):		Filling End Time (hh/mm):			Start Water Depth (m bgl):		
Effective Depths (m):	75%:	0.18	50%:	0.35	25%:	0.53	

FIELD MEASUREMENTS

SOAKAGE TEST 1			SOAKAGE TEST 2			SOAKAGE TEST 3		
TIME		DEPTH	TIME		DEPTH	TIME		DEPTH
(min)	(sec)	(m bgl)						
0	0	0.17						
0.5	30	0.18						
1	60	0.19						
1.5	90	0.19						
2	120	0.195						
3	180	0.195						
4	240	0.2						
5	300	0.205						
6	360	0.21						
7	420	0.215						
8	480	0.215						
9	540	0.215						
10	600	0.22						
12	720	0.23						
14	840	0.235						
16	960	0.25						
18	1080	0.26						
20	1200	0.275						
35	2100	0.35						
40	2400	0.38						
45	2700	0.4						
50	3000	0.42						
60	3600	0.46						
110	6600	0.62						

SOAKAGE TESTING TO DETERMINE INFILTRATION RATE (BRE)

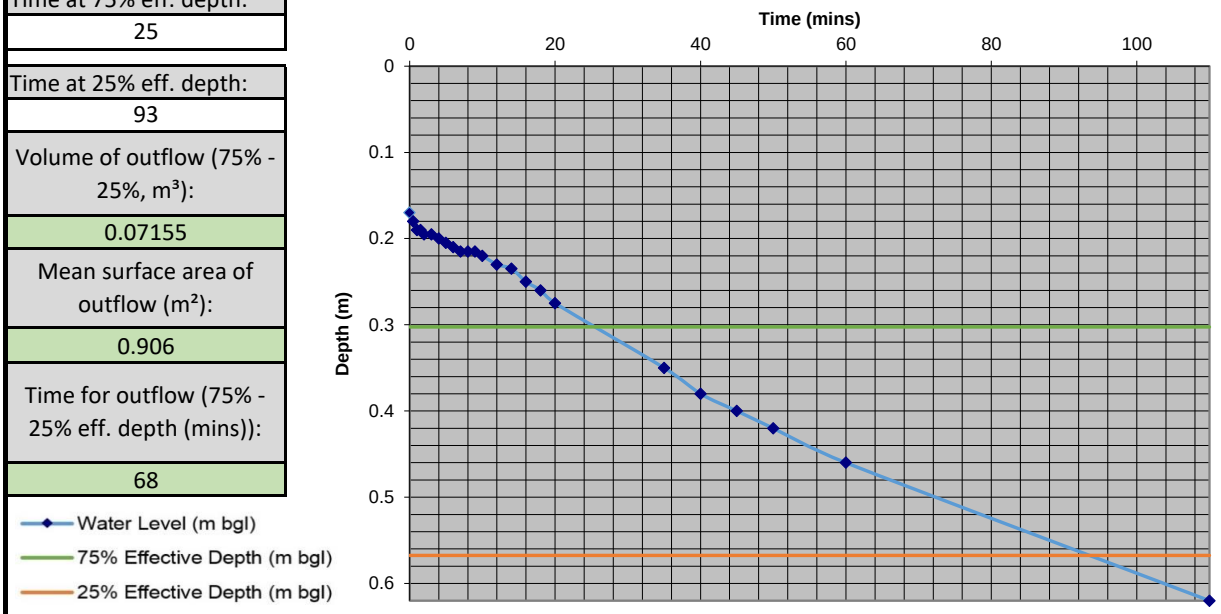
LUSTRE CONSULTING

PROJECT NAME:	Ashplatts House			PROJECT NO.:		2390	
DATE:	18/10/2018			WEATHER:		Dry, overcast, warm	
Soakage Pit Number:	SOAK3	Length (m):	0.9	Width (m):	0.3	Depth (m):	0.7

Comments:	

SOAK3 SOAKAGE TEST 1

Time at 75% eff. depth:
25
Time at 25% eff. depth:
93
Volume of outflow (75% - 25%, m^3):
0.07155
Mean surface area of outflow (m^2):
0.906
Time for outflow (75% - 25% eff. depth (mins)):
68



Soil infiltration rate (m/s):	1.93563E-05	@	69.68251	litres/hour

APPENDIX E: ENVIRONMENTAL ASSESSMENT TABLES

HUMAN HEALTH QUANTITATIVE RISK ASSESSMENT - SOILS
MADE GROUND
2390
Ashplatts House - East Grinstead

LUSTRE CONSULTING

Assessment Scenario: Residential with homegrown pro
Assessment Criteria Source: SGVs, GACs, S4ULs & C4SLs
Soil Organic Matter (%): SOM = 1%

DETERMINAND	UNITS	MINIMUM	AVERAGE	MAXIMUM	No. of TESTS	ASSESSMENT CRITERIA	No. > AC	Tank A HP1	Tank A HP2	Tank B S2		
								0.15	*GL*	*GL*		
Naphthalene	mg/kg	<LOD	1.42	2.78	2	2.30	1	< 0.1	-	**2.78**	-	-
Acenaphthylene	mg/kg	<LOD	0.23	0.41	2	170.00	0	< 0.1	-	0.41	-	-
Acenaphthene	mg/kg	<LOD	14.58	29.10	2	210.00	0	< 0.1	-	29.1	-	-
Fluorene	mg/kg	<LOD	12.63	25.20	2	170.00	0	< 0.1	-	25.2	-	-
Phenanthrene	mg/kg	0.82	8.66	16.50	2	95.00	0	0.82	-	16.5	-	-
Anthracene	mg/kg	0.16	24.13	48.10	2	2400.00	0	0.16	-	48.1	-	-
Fluoranthene	mg/kg	2.15	93.08	184.00	2	280.00	0	2.15	-	184	-	-
Pyrene	mg/kg	1.96	81.98	162.00	2	620.00	0	1.96	-	162	-	-
Benzo(a)anthracene	mg/kg	0.98	33.64	66.30	2	7.20	1	0.98	-	**66.3**	-	-
Chrysene	mg/kg	0.94	27.12	53.30	2	15.00	1	0.94	-	**53.3**	-	-
Benzo(b)fluoranthene	mg/kg	1.24	30.27	59.30	2	2.60	1	1.24	-	**59.3**	-	-
Benzo(k)fluoranthene	mg/kg	0.30	10.80	21.30	2	77.00	0	0.3	-	21.3	-	-
Benzo(a)pyrene	mg/kg	0.85	23.03	45.20	2	5.00	1	0.85	-	**45.2**	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.73	15.92	31.10	2	27.00	1	0.73	-	**31.1**	-	-
Di-benzo(a,h)anthracene	mg/kg	0.34	2.02	3.70	2	0.24	2	**0.34**	-	**3.7**	-	-
Benzo(ghi)perylene	mg/kg	0.50	9.90	19.30	2	320.00	0	0.5	-	19.3	-	-

POTABLE WATER PIPELINE RISK ASSESSMENT

2390

Ashplatts House - East Grinstead

TABLE SHOWING WATER PIPELINE ASSESSMENT

DETERMINAND	UNITS	THRESHOLD		THRESHOLD		MAXIMUM CONCENTRATION
		PE	EXCEEDED	PVC	EXCEEDED	
GROUP 1						
Total VOC (with TICs)*	µg/kg	500.00	NO	125.00	NO	
BTEX & MTBE	µg/kg	100.00	NO	30.00	NO	<LOD
GROUP 2						
**Total SVOC Suite (with TIC)	mg/kg	2.00	NO	1.40	NO	
Phenols	mg/kg	2.00	NO	0.40	NO	<LOD
Cresols & Chlorinated Phenols	mg/kg	2.00	NO	0.04	NO	
†Ethers	mg/kg	0.50	-	1.00	-	-
†Nitrobenzene	mg/kg	0.50	-	0.40	-	-
†Ketones	mg/kg	0.50	-	0.02	-	-
†Aldehydes	mg/kg	0.50	-	0.02	-	-
GROUP 3						
Mineral Oils (C11 to C20)	mg/kg	10.00	YES	No effect	NO	26.00
GROUP 4						
Mineral Oils (C21 to C40)	mg/kg	500.00	YES	No effect	NO	4050.00
GROUP 5^						
Conductivity	µ2/cm	-	-	-	-	-
Redox Potential	mV	-	-	-	-	-
pH	-	-		-		6.80
GROUP 6						
†Amines	ug/kg	N/A	-	No effect	-	-

NOTES:

*Minus total concentration of BTEX + MTBE.

**Minus total concentration of phenols, cresols and chlorinated phenols.

†Only required if current or historical site use indicates they may be present.

^Only applicable when selecting suitable barrier pipe (see UKWIR Guidance document)

RISK CRITERIA:

UK Water Industry Research (UKWIR). Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. Ref. 10/WM/03/21. 2010

APPENDIX F: NOTES ON LIMITATIONS

LUSTRE CONSULTING, ENVIRONMENTAL AND GEOTECHNICAL CONSULTANCY SERVICES
NOTES ON LIMITATIONS

General

Lustre Consulting have completed the attached report for the use of the Client detailed on the front cover and those parties to whom Lustre Consulting has agreed to provide and has provided an executed warranty agreement, or to whom an assignment of the benefit of this report has been agreed.

Third parties are not entitled to use or rely upon the contents of the report unless written approval has been given by Lustre Consulting; (due to legal requirements, a charge may be levied as a condition of such approval, in which case approval shall not be effective unless and until such a charge has been paid in full).

Lustre Consulting accepts no responsibility or liability for:

a) any use of this report for any purpose or project other than that for which it was commissioned, and

b) any use of this report by any third party to whom approval for use has not been given and any conditions applicable to such use have been met.

Phase I Environmental Risk Assessments, Desk Studies and Site Audits

The work completed and utilised to provide this report comprises a study of available documentation. The opinions and results presented in this report have been arrived at by utilising the finite amount of data available at the time of writing and are relevant only to the purpose for which the report was commissioned. The data which has been reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative information pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, Lustre Consulting reserves the right to review this information and, if warranted, to modify the opinions presented in the report accordingly.

It should be noted that the risks which are identified in this report are perceived risks based on the available information at the time of writing and that the actual risks associated can only be assessed following a physical investigation of the site.

Phase II Site Investigations

The intrusive investigation has been completed to provide information concerning the type and degree of contamination present along with ground and groundwater conditions which facilitates a reasonable risk assessment to be completed. The stated objectives of the ground investigation have been limited to assessing the proven risks which are associated with potential human targets, building materials, the environment (including adjacent land), and to surface water and groundwater.

The amount of exploratory work, chemical testing and monitoring completed as part of this project has potentially been restricted by the short timescale available, and the locations of exploratory holes undertaken have potentially been restricted to areas unoccupied by buildings(s) and buried services. A more comprehensive post demolition / decommission investigation may be required if the site is to be redeveloped. For these reasons any costs included in relation to site remediation must be considered as tentative only at this time.

The exploratory holes investigate only a small volume of the ground in relation to the size of the site and therefore, can only provide a “snap shot” or general indication of ground conditions located on the site. The fact that the site has been investigated does not preclude the existence of localised “hotspots” of contamination where concentrations may be significantly higher than those actually encountered.

The risk assessment and opinions provided in this report take into account currently available guidance values relating to acceptable contamination concentrates; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

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