



EARTH ENVIRONMENTAL
& GEOTECHNICAL

GEOENVIRONMENTAL
INVESTIGATION

DUVAL HOUSE

HIGH STREET

HARMONDSWORTH

UB7 0BT

REPORT REF: R0438/20

OCTOBER 2020

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INVESTIGATION**

**DUVAL HOUSE,
HIGH STREET,
HARMONDSWORTH,
UB7 0BT**

Report Ref: R0438/20

October 2020

Prepared on Behalf of:

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DUVAL HOUSE, HARMONDSWORTH

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TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	2
2.1	BACKGROUND	2
2.2	TERMS OF REFERENCE.....	2
2.3	LIMITATIONS OF THE STUDY	2
3.0	THE SITE	3
3.1	SITE LOCATION & DESCRIPTION.....	3
3.2	GEOLOGY	3
3.3	PROPOSED DEVELOPMENT.....	4
4.0	PRELIMINARY CONCEPTUAL MODEL	5
5.0	SITE INVESTIGATION	10
5.1	EXPLORATORY FIELDWORK.....	10
5.2	EXPLORATORY HOLE LOCATION RATIONALE	10
5.3	LABORATORY ENVIRONMENTAL TESTING PROGRAMME	12
5.3.1	<i>Environmental Testing</i>	<i>12</i>
5.3.2	<i>Geotechnical Testing</i>	<i>12</i>
6.0	GROUND CONDITIONS ENCOUNTERED & ENGINEERING PROPERTIES	13
6.1	SOIL PROFILE ENCOUNTERED.....	13
6.2	OBSERVABLE INDICATIONS OF CONTAMINATION.....	13
6.3	OBSTRUCTIONS.....	13
6.4	GROUNDWATER	13
6.5	GROUND GAS MONITORING	13
6.6	SOIL SAMPLING.....	14
6.7	ENGINEERING PROPERTIES.....	14
6.7.1	<i>Langley Silt Member – Clay</i>	<i>14</i>
6.7.2	<i>Taplow Gravel Member – Sand and Gravel</i>	<i>15</i>
7.0	GEOTECHNICAL ASSESSMENT.....	17
7.1	PROPOSED DEVELOPMENT.....	17
7.2	GROUND CONDITIONS ENCOUNTERED	17
7.3	FOUNDATIONS.....	17
8.0	SOIL CONTAMINATION GENERIC RISK ASSESSMENT.....	20
8.1	TIER I HUMAN HEALTH RISK ASSESSMENT – FUTURE SITE USERS.....	20
8.2	ASBESTOS.....	22
9.0	GROUND GAS CONTAMINATION RISK ASSESSMENT	23
10.0	REVISED CONCEPTUAL MODEL	25
11.0	CONCLUSIONS AND RECOMMENDATIONS	28
11.1	SOIL CONTAMINATION.....	28
11.2	GROUND GAS.....	28
11.3	GROUNDWATER	28
11.4	SOIL DISPOSAL	28
11.5	SITE PERSONNEL.....	29
11.6	OTHER MATTERS	29
11.7	FURTHER WORKS.....	29

LIST OF FIGURES

Figure 1	Aerial Photograph Showing Site Location
Figure 2	Proposed Site Layout Plan
Figure 3	Proposed New Building and Under-Croft Parking
Figure 4	Exploratory Hole Location Plan
Figure 5	SPT vs Depth Plot

TABLES

Table 1	Preliminary Conceptual Model
Table 2	EEGSL Investigation Boreholes
Table 3	Summary of Exploratory Holes Undertaken
Table 4	Summary of Laboratory Testing Undertaken
Table 5	Summary of Ground Conditions Encountered
Table 6	Summary of Soil Samples Analysed
Table 7	Design Values for Taplow Gravel Member
Table 8	Summary of Allowable Bearing Pressures
Table 9	Summary of Anticipated Foundation Settlements
Table 10	Soil Results Comparison with Defra C4SL HCV/LLTC Values
Table 11	Soil Results Comparison with LQM/CIEH S4UL
Table 12	Modified Wilson & Card Classification (CIRIA Report 665)
Table 13	Revised Preliminary Conceptual Model

APPENDICES

Appendix 1	Exploratory Hole Logs
Appendix 2	Gas/Groundwater Monitoring Results
Appendix 3	Laboratory Results (Contamination)
Appendix 4	Laboratory Results (Geotechnical)
Appendix 5	Plasticity Chart
Appendix 5	Report Limitations

1.0 EXECUTIVE SUMMARY

Appointment	Ground Investigation works were commissioned by TEJ Properties Limited in accordance with EEGSL Proposal Ref: R0438 Dated 8 th September 2020.
Site Name	Duval House, Harmondsworth
Site Description	National Grid Reference 505881, 177816 The site is generally level however does slightly slope down within the northern area (car park) towards the existing property. It is approximately 0.19ha in size. The site is bound to the north by fields, the east and west by residential properties associated with Acacia Mews and Meadowlea Close and Harmondsworth Baptist Church to the south. The site is currently occupied by a three-story office building with a carpark to the rear.
Proposed Development	It is understood that the current building will be converted into residential flats and a separate new building will be constructed within the current car park providing additional flats and under-croft parking.
Site Geology	BGS records indicate superficial geology present beneath the site, consisting of the Langley Silt Member and directly underlying this bedrock geology consisting of the London Clay Member.
Site History	Site has seen development since the 1860's with buildings occupying the majority of site. In 1963 towards the south end of site a Garage was present until approx. 1999, where Duval House consisting of office space and a car park was developed.
Investigation Works Completed	Five window sample boreholes were drilled during the investigation works sunk to a maximum depth of 2.0mbgl, due to refusals within the dense natural strata. Subsequent inspection and contamination and geotechnical sampling of soils were also undertaken as well as installation of a ground gas and water monitoring standpipe within WS03 and WS04.
Ground Conditions Identified	Made Ground was encountered down to a maximum thickness of 0.90mbgl overlying Langley Silt Member and Taplow Gravel Member.
Identified Sources	On site sources include historical development activities, which could cause the presence of Made Ground deposits, including Asbestos to be present on site.
Human Health Risk Assessment	A general lack of contamination has been identified, with the exception of asbestos within WS04 within the made ground materials.
Conclusions and Recommendations	A low risk to current and future site users has been identified from the assessment of soil samples collected at the assessment site. A moderate risk has been identified for construction workers given the presence of asbestos within the area immediately surrounding WS04. Some additional works within the vicinity of WS04 have been recommended.
<i>This Executive Summary is intended to provide a summary only. It does not provide a definitive analysis and should not be relied upon without full review of the following report and associated appendices.</i>	

2.0 INTRODUCTION

2.1 Background

A Geo-Environmental Site Investigation has been commissioned by TEJ Properties Limited (the Client) to examine ground conditions and retrieve soil samples in support of a proposed new residential development at the assessment site.

2.2 Terms of Reference

Earth Environmental and Geotechnical (Southern) Ltd (EEGSL) was commissioned by the Client to undertake the environmental site investigation in accordance with proposal R0438 dated 8th September 2020.

The objectives of this investigation are as follows:

- *Undertake ground investigation works to assess the presence and likely extent of any potential environmental hazards (soil and ground gas contamination) associated with the areas of the site investigated.*
- *Undertake a semi-quantitative risk assessment to identify if unacceptable levels of contamination are present beneath the assessment site.*
- *Undertake ground investigation works to assess ground conditions and provide preliminary geotechnical design information.*

2.3 Limitations of the Study

The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information, improved practices or changes in legislation may require a reinterpretation of the report in whole or in part. EEGSL reserve the right to amend either conclusions or recommendations in light of any further information that may become available. This report is provided for the sole use by the client and is confidential to them.

Recommendations within this report are also based on exploratory records and examination of samples and, where applicable, laboratory tests. No liability can be accepted for conditions not revealed by the boreholes, particularly at intervening locations. Whilst every effort is made to ensure accuracy of data supplied, all opinions expressed as to the spatial distribution of strata between sampling locations is for guidance only and no responsibility is accepted as to its accuracy.

3.0 THE SITE

3.1 Site Location & Description

The site is located at Duval House on the corner of the High Street, Harmondsworth. The site is bounded to the north by fields, the east and west by residential properties associated with Acacia Mews and Meadowlea Close and Harmondsworth Baptist Church to the south. The site is centred on National Grid Reference 505881, 177816 with a postcode of UB7 0BT.

The site location is shown in Figure 1.

Figure 1: Aerial Photograph Showing Site Location



The site covers an area of 0.19 hectares and is generally flat with a slight fall towards to the south. The site is currently occupied by Duval House, a three-storey former office building with hard standing areas and a carpark to the rear.

3.2 Geology

According to the BGS the site is directly underlain by superficial deposits of the Langley Silt Member comprising of clay and silt overlying the London Clay Formation.

The London Clay Formation was formed 47 to 56 million years ago during the Palaeogene period and is described as bioturbated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt with some layers of sandy clay.

The BGS states that the site is not underlain by artificial ground.

3.3 Proposed Development

It is understood that the current building will be converted into residential flats and a separate new building will be constructed within the current car park providing additional flats and under-croft parking. Figures 2 & 3 show the proposed site layout mock-up of the new building

Figure 2: Proposed Site Layout Plan



Figure 3: Proposed New Building and Under-Croft Parking



4.0 PRELIMINARY CONCEPTUAL MODEL

4.1 General

A Phase 1 Desk Study was undertaken previously at the site in September 2020 by EEGSL, for full details reference should be made to the *EEGSL Report Ref: R0428/20*. As part of the desk study a Preliminary Conceptual Model (PCM) was created and is reproduced in Table 1.

The PCM is based on a proposed residential end use.

Table 1: Preliminary Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Potential contamination associated with the sites historical use as a smithy and the presence of an unspecified tank	Dermal contact, ingestion and inhalation of soils dust	Current Site Users	Likely	Moderate	Moderate Risk	Given the identification of historical sources on site and their potential to have caused contamination, the risk to current site users has be calculated as Moderate. However, due to the fact the majority of site is currently covered in permanent hardstanding, there is currently no direct pathway for any potential receptors to be exposed to contamination present beneath site (no direct source / pathway / receptor linkage), and therefore the risk to current site users is considered LOW in this instance.
		Adjacent Land Users	Likely	Moderate	Moderate Risk	Given the identification of sources on site and their potential to have caused contamination, the risk has be calculated as Moderate. However, due to the fact that the majority of site is currently covered in hard standing, and the underlying geology is predominantly cohesive, the likelihood of contamination present beneath site migrating off site is considered to be low. Therefore, the risk to adjacent site users from migrating contamination is considered LOW in this instance.
		Construction Workers	Likely	Moderate	Moderate Risk	The potential for construction workers to be exposed to contaminated materials present beneath site is considered MODERATE . There is a potential for contaminated materials to be present beneath site, which constriction workers may be exposed to during groundworks / foundation excavations. Investigation of the materials present beneath site is therefore recommended prior to any ground works being completed.
		Future Site Users	Likely	Moderate	Moderate Risk	Given the identification of sources on site and their potential to have caused contamination, the risk has be calculated as Moderate. However, due to the fact the majority of site is currently covered in permanent hardstanding, and will remain so once development has been completed, there is currently no direct pathway for any potential receptors to be exposed to contamination present beneath site

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
	Vertical or horizontal migration of ground gas and vapours					(no direct source / pathway / receptor linkage), and therefore the risk to future site users is considered LOW in this instance. (it should be noted that this analysis may require revision if development plans are amended, especially if soft landscaping areas are introduced to the proposed development).
		Current Site Users	Likely	Moderate	Moderate Risk	Given the identification of sources that could produce ground gas (historical development giving rise to the presence of made ground), the risk to current site users from the migration of ground gas is considered to be MODERATE .
		Adjacent Land Users	Likely	Moderate	Moderate Risk	Given the identification of sources that could produce ground gas and potential vapours and the potential for these gases and vapours to migrate offsite, the risk to adjacent site users from the migration of ground gas is considered to be MODERATE .
		Construction Workers	Likely	Moderate	Moderate Risk	The risk to construction workers from exposure to ground gases and VOC vapours present within the shallow soils beneath the assessment site is considered MODERATE . The risk of ground gasses accumulating within excavations and enclosed spaces should be assessed as part of any construction works on site. This will require the motioning of ground gasses prior to earth works being undertaken.
		Future Site Users	Likely	Moderate	Moderate Risk	Given the identification of sources that could produce ground gas (historical development giving rise to the presence of made ground), the risk to future site users from the migration of ground gas is considered to be MODERATE .
Potential contamination present associated with the former off site sources of contamination	Dermal contact, ingestion and inhalation of soils dust	Current Site Users	Likely	Moderate	Moderate Risk	Given the identification of former commercial activities within the vicinity of the assessment site, the risk to current site users from contamination migrating towards site has been calculated as Moderate. However, considering the majority of site is currently covered in permanent

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
(former Works and Factory)						hardstanding, there is currently no direct pathway for any potential receptors to be exposed to contamination present beneath site (no direct source / pathway / receptor linkage), and therefore the risk to current site users from contamination migrating from off site sources is considered LOW in this instance.
		Construction Workers	Likely	Moderate	Moderate Risk	The potential for construction workers to be exposed to contaminated materials present beneath site is considered MODERATE . There is a potential for contaminated materials to be present beneath site, which construction workers may be exposed to during groundworks / foundation excavations. Investigation of the materials present beneath site is therefore recommended prior to any ground works being completed.
		Future Site Users	Likely	Moderate	Moderate Risk	Given the identification of former commercial activities within the vicinity of the assessment site, the risk to current site users from contamination migrating towards site has been calculated as Moderate. However, due to the fact the majority of site is currently covered in permanent hardstanding, and will remain so once development has been completed, there is currently no direct pathway for any potential receptors to be exposed to contamination present beneath site (no direct source / pathway / receptor linkage), and therefore the risk to future site users is considered LOW in this instance. (it should be noted that this analysis may require revision if development plans are amended, especially if soft landscaping areas are introduced to the proposed development).
	Vertical or horizontal migration of ground gas and vapours	Current Site Users	Likely	Moderate	Moderate Risk	There is the potential for offsite historical sources to produce ground gas and potential vapours which could migrate towards the assessment site. The risk to current site users from the migration of ground gas is therefore considered to be MODERATE without ground investigation data.

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
		Construction Workers	Likely	Moderate	Moderate Risk	The risk to construction workers from exposure to ground gases and VOC vapours present from offsite sources is considered MODERATE . The risk of ground gasses accumulating within excavations and enclosed spaces should be assessed as part of any construction works on site. this may require the motioning of gasses prior to entering excavations and or enclosed spaces.
		Future Site Users	Likely	Moderate	Moderate Risk	Given the identification of offsite sources that could produce ground gas and potential vapours, the risk to future site users from the migration of ground gas is considered to be MODERATE without additional ground investigation data.

4.2 Preliminary Risk Assessment

From review of historical and current day information it has been identified that the assessment site has seen historical development since the 1860's with the majority of site having seen some development since this time. Records suggest that a smithy was once present on site, alongside a garage which was present from 1963 until 1998 when the site was redeveloped into Duval House in 1998. Since 1998 the site has been used as commercial offices, although local knowledge would suggest that Duval House has been vacant for the last several years.

Off site sources of contamination have also been identified during the desk study, and include a former factory, a works and a farm, all within the vicinity of the assessment site.

Considering the proposed residential nature of the assessment site, a moderate risk rating was concluded. It should be noted that the predominant risk that has been highlighted is associated with the potential presence of made ground and ground gas generation. Direct exposure pathways have been largely discounted due to the current and future presence of permanent hard standing proposed across the assessment site.

Given the information above, EEGSL have undertaken ground investigation works to further understand the potential contamination risks present at the assessment site and to gather geotechnical design information. The ground investigation works completed are detailed in the following sections of this report.

5.0 SITE INVESTIGATION

5.1 Exploratory Fieldwork

Fieldwork was carried out by EEGSL on the 23rd September 2020 and comprised:

- Five window sample boreholes (designated WS01 to WS05 inclusive) sunk to depths between 1.40 to 2.0m below existing ground level. Refusals in all the boreholes meant original target depth of 4.0m couldn't be reached, due to dense natural strata. Window sampler boring is carried out with a small, track-mounted rig, which uses a chain-driven trip hammer to drive sampling tubes or penetrometers into the ground. These tools are coupled to the anvil of the hammer by solid drill rods. Sampling tubes comprise "windowless samplers", which are plain sampler tubes in which a continuous disturbed sample is recovered within a semi-rigid plastic liner. To reduce friction within the borehole, sampling tubes of progressively smaller diameter are used as the borehole depth increases. Sampler diameters generally range from between approximately 90mm to 50mm. Exploratory Hole logs are included in Appendix 1.
- WS03 and WS04 were installed with ground gas and groundwater monitoring standpipes to allow for subsequent measurement of ground gas concentrations and water levels. Results of the monitoring are included in Appendix 2.

5.2 Exploratory Hole Location Rationale

Table 2: EEGSL Investigation Boreholes

Location	Area of Site	Reason for Investigation
WS01	Car park area closest to existing north western corner of the current building	To allow inspection and subsequent laboratory testing of shallow soils
WS02	Car park area towards the north west corner of the boundary	To allow inspection and subsequent laboratory testing of shallow soils
WS03	Car park area closest to existing northern wall of the current building	To allow inspection and subsequent laboratory testing of shallow soils and installation of standpipe to allow for ground gas and groundwater monitoring
WS04	Centrally in car park area	To allow inspection and subsequent laboratory testing of shallow soils and installation of standpipe to allow for ground gas and groundwater monitoring
WS05	Car park area towards the north east corner of the boundary	To allow inspection and subsequent laboratory testing of shallow soils

The fieldwork was carried out generally in accordance with BS 5930:2015 Code of Practice for Site Investigations and BS10175:2011+A2:2017 (Investigation of potentially contaminated sites. Code of practice) unless otherwise stated. The exploratory hole locations were determined on site by EEGSL and are shown approximately on the Exploratory Hole Location Plan in Figure 3.

Figure 4: Exploratory Hole Location Plan



Each exploratory location was scanned using a Cable Avoidance Tool (CAT) in order to locate unrecorded underground services, and the exploratory locations were repositioned if necessary. On completion, all samples recovered from the site were taken to a specialist laboratory for testing.

All site investigation work was supervised full time by a representative of EEGSL. The logging of soils and rocks has been carried out in accordance with BS5930⁽²⁰¹⁵⁾ except where superseded by the soil and rock description methodology in BS EN14688-1⁽²⁰⁰²⁾, BS EN 14688-2⁽²⁰⁰⁴⁾ and BS EN 14689-1⁽²⁰⁰³⁾.

A summary of exploratory holes undertaken during the investigation is presented in Table 3, below.

Table 3: Summary of Exploratory Holes Undertaken

Hole	Type*	Depth (m)	Date Started	Date Finished	Backfill Details**
WS01	WS	2.00	23/09/2020	23/09/2020	A
WS02	WS	2.00	23/09/2020	23/09/2020	A
WS03	WS	2.00	23/09/2020	23/09/2020	SP
WS04	WS	1.40	23/09/2020	23/09/2020	SP
WS05	WS	1.70	23/09/2020	23/09/2020	A
* WS = Window Sample Borehole, **A= Arisings, SP = Standpipe					

5.3 Laboratory Environmental Testing Programme

5.3.1 Environmental Testing

The environmental chemistry of the ground was investigated by specialist chemical analysis of selected samples, scheduled by EEGSL and carried out by DETS Ltd.

Chemical analyses were carried out on 5 soil samples that were submitted for the following suite of determinants:

Asbestos Screen , Arsenic, Beryllium, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Cyanide, Thiocyanate, Sulphate (SO₄), Sulphide, pH, Sulphur, Soil Organic Matter (soils only), Speciated and Total Petroleum Hydrocarbons (C10-C40) and speciated Polyaromatic Hydrocarbons (PAH).

The results of the laboratory contamination tests are discussed in Section 8 and included in Appendix 3.

5.3.2 Geotechnical Testing

A programme of laboratory testing was carried out on samples taken from the various strata and to assist in classification and determine the engineering properties of the materials underlying the site. The testing was scheduled by EEGSL and carried out by CJ Associates. The test procedures used were generally in accordance with the methods described in BS1377:1990 and BS EN 17892-1:2014. Details of the specific tests used in each case are given in Table 4.

Table 4: Summary of Laboratory Testing Undertaken

TEST	STANDARD	No.
Moisture Content	BS1377:1990 Part 2 Clause 3.2	3
1 Point Liquid & Plastic Limit	BS1377:1990 Part 2, Clause 4/5	3
Particle Size Distribution (Dry sieve)	BS1377:1990 Part 2, Clause 9.2	4
pH / Water & Acid Soluble Sulphate and Total Sulphur	BRE – BR279	7

Full results of laboratory testing undertaken as part of the EEGSL investigation are included in Appendix 4.

6.0 GROUND CONDITIONS ENCOUNTERED & ENGINEERING PROPERTIES

6.1 Soil Profile Encountered

The sequence of strata encountered beneath the site was:

- Made Ground (maximum thickness 0.90m).
- Langley Silt Member
- Taplow Gravel Member

According to the BGS, the site is underlain by superficial deposits of the Langley Silt Member and in four of the five boreholes this comprised of brown silty CLAY. Below this dense Sands and Gravels were identified. The BGS records superficial geology of the Taplow Gravel Member nearby.

The depths of the various materials encountered in each of the exploratory holes are summarised in the following table.

Table 5: Summary of Ground Conditions Encountered

Hole	Depth to Stratum (m)					
	MADE GROUND				LANGLEY SILT MEMBER	TAPLOW GRAVEL MEMBER
	Brick Paving	Yellow brown SAND	Brown clayey gravelly SAND with brick and concrete	Brown/grey gravelly CLAY with brick and concrete	Brown silty CLAY	Brown SAND and GRAVELS
WS01	GL-0.08	0.08-0.10	0.10-0.40	-	-	0.40-2.00
WS02	GL-0.08	0.08-0.12	0.12-0.45	-	0.45-1.55	1.55-2.00
WS03	GL-0.08	0.08-0.12	0.12-0.40	0.40-0.50	0.50-0.60	0.60-2.00
WS04	-	-	GL-0.40	-	0.40-0.95	0.95-1.40
WS05	GL-0.08	0.08-0.18	-	0.18-0.90	0.90-1.35	1.35-2.00

6.2 Observable Indications of Contamination

With the exception of made ground deposits, there were no significant visual or olfactory indications of contamination noted during the intrusive investigation.

6.3 Obstructions

No man-made obstructions were identified during the ground investigation. However, shallow refusals within the dense natural strata meant maximum depths reached were 2.0mbgl.

6.4 Groundwater

No groundwater ingress was observed in any boreholes at the assessment site during the ground investigation or subsequent monitoring visits.

6.5 Ground Gas Monitoring

Three rounds of ground gas monitoring were undertaken between 30th September – 14th October 2020. Detailed results are provided within Appendix 2. During the monitoring visits atmospheric pressures ranging between 1018mb – 994mb were recorded and monitoring rounds were targeted at falling pressure events.

The following ranges of gas concentrations were also identified; Carbon Dioxide (CO₂) levels ranging from 0.0% to 2.5% and Oxygen (O₂) levels ranging from 11.1% to 14.3% by volume. Borehole pressures ranging from -0.51 to -0.34pa were recorded over the three visits.

Note: The concentrations of mobile, liquid and gaseous materials are likely to vary over time. The results obtained may therefore be representative of the conditions only at the time of sampling.

6.6 Soil Sampling

During the ground investigation works the following soil samples were collected and sent for analysis as specified within section 5.3.1.

Table 6: Summary of Soil Samples Analysed

Location	Strata	Type*	Depth of Sample
WS01	Made Ground	ES	0.30mbgl
WS01	Natural (sands and gravel)	ES	0.90mbgl
WS01	Natural (sands and gravel)	B	1.00-2.00mbgl
WS02	Made Ground	ES	0.40mbgl
WS02	Natural (clay)	ES & D	1.00mbgl
WS02	Natural (sand and gravel)	B	1.60-2.00mbgl
WS03	Made Ground	ES	0.30mbgl
WS03	Natural (sand and gravel)	ES	0.60mbgl
WS03	Natural (sand and gravel)	B	1.00-2.00mbgl
WS04	Made Ground	ES	0.30mbgl
WS04	Natural (clay)	ES	0.50mbgl
WS04	Natural (clay)	D	0.90mbgl
WS04	Natural (sand and gravel)	B	1.00-1.40mbgl
WS05	Made Ground	ES	0.50mbgl
WS05	Natural (clay)	ES & D	1.00mbgl
WS05	Natural (sand and gravel)	B	1.40-1.70mbgl
*B = Bulk, D = Disturbed, ES = Environmental Sample			

6.7 Engineering Properties

The following section discusses the engineering properties of the strata encountered, based on results of in situ and laboratory testing.

6.7.1 Langley Silt Member – Clay

Atterberg Limit tests undertaken on the clay materials have given values of liquid limit in the range of 34% - 36% and plastic limit values in the range of 15% - 17%, resulting in values of plasticity index with the range of 19% - 22%. These results suggest the samples tested are predominantly clay of Intermediate plasticity, as shown on the Plasticity Chart included in Appendix 5. For design purposes, a value of plasticity index = 22% is recommended.

Two **SPT N** result was obtained within the Langley Silt Member giving values of 9 and 14, as can be seen from the SPT v Depth Plot included as Figure 5. The SPT N value would suggest the clay is firm.

Effective stress strength parameters may also be obtained from correlations with plasticity index. For a plasticity index of 22%:

- BS8002⁽¹⁹⁹⁴⁾, Table 2 gives $\phi'_{crit} \approx 22.6^\circ$;
- Gibson⁽¹⁹⁵³⁾, gives $\phi_d = 28.4^\circ$.

Based on all the above, design values of $\phi'_{crit} = 22.6^\circ$ and $c' = 0\text{kN/m}^2$ are recommended for the Langley Silt Member.

Laboratory tests have given values of **water-soluble sulphate** (SO_4) as between 40-133mg/l and **pH Values** between 7.93-8.60.

6.7.2 Taplow Gravel Member – Sand and Gravel

Six **SPT N** values were obtained from within the Taplow Gravel Member giving a range from 31 to 57, as can be seen from the SPT v Depth Plot presented in Figure 5. These results suggest the Sands and Gravels are dense to very dense.

It is recommended that for assessing ultimate bearing capacities, where the lower values are critical, the lower quartile value of N values is used. For assessing settlements, average ground conditions will give a more realistic value, and the average of N values should be used.

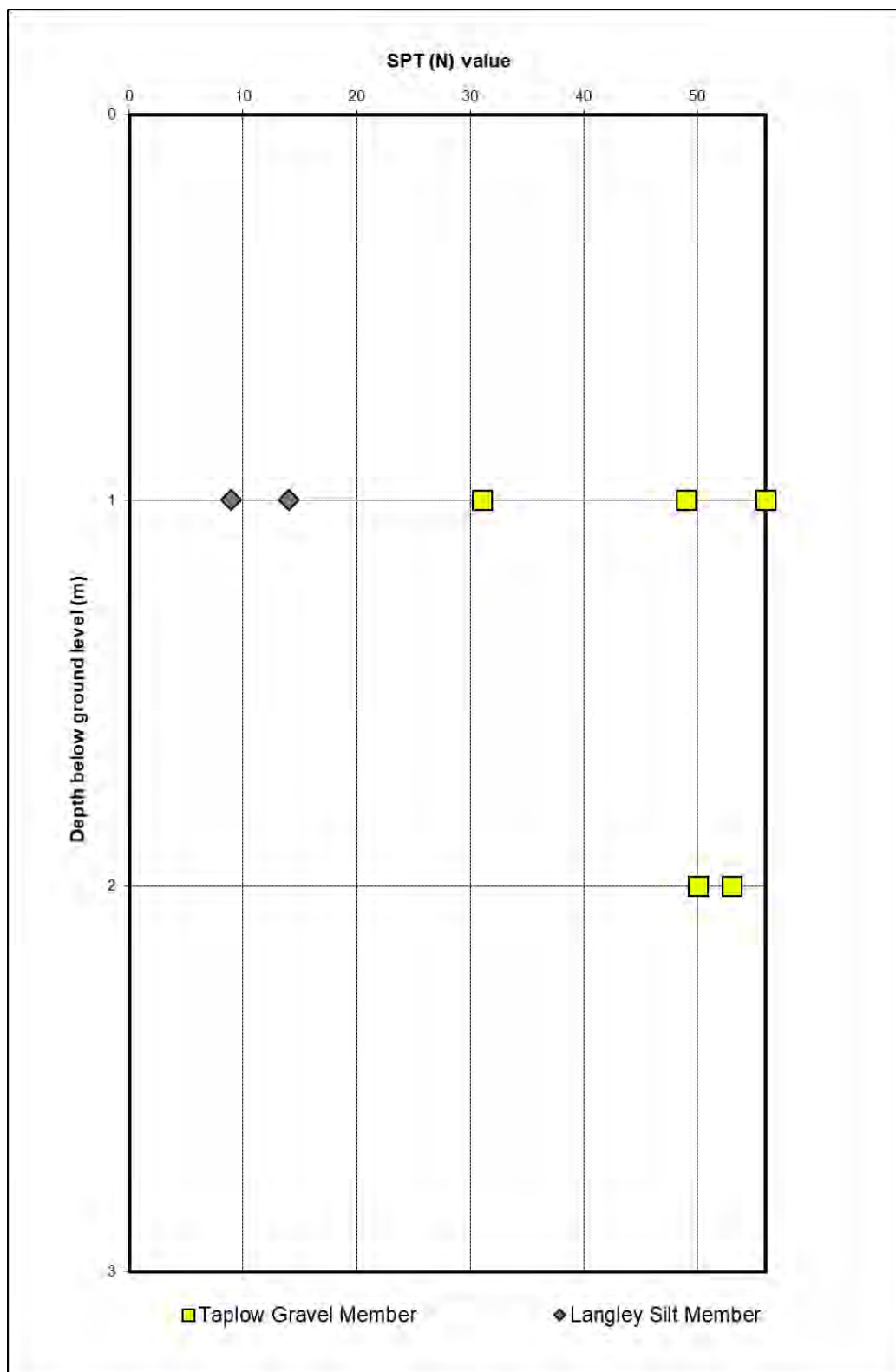
Table 7: Design Values for Taplow Gravel Member

Depth	N Values		Angle of Shearing Resistance (ϕ)*
	Range	Lower Quartile	
1.00m	31-56	31	36.3
2.00m	50-57	50	41.0
*Based on lower quartile N Value and correlation by Peck, Hanson and Thornburn ⁽¹⁹⁷⁴⁾			

Laboratory particle size distribution (PSD) tests suggest the samples tested were predominately Gravel (64-79%) with a sand content of 17-22% and fines content of 3-15%.

Laboratory tests have given a range of values of water-soluble sulphate (SO_4) as between <10-45mg/l and pH Values between 8.12 and 8.48.

Figure 5: SPT VS Depth Plot



7.0 GEOTECHNICAL ASSESSMENT

7.1 Proposed Development

It is understood that the current building will be converted into residential flats and a separate new building will be constructed within the current car park providing additional flats and undercroft parking.

7.2 Ground Conditions Encountered

The boreholes encountered a maximum depth of Made Ground down to 0.90m, whilst all but one hole encountered a band of silty clay (maximum depth of 1.55m) overlying sands and gravels.

7.3 Foundations

Given the ground conditions identified above, foundations should be taken down below any made ground and placed within the dense to very dense sands and gravels of the Taplow Gravel Member. Conventional strip/pad foundations will be suitable, depending on structural loadings and tolerance of structure to settlement. If structural loadings are too high or settlement too large for conventional foundations, alternative foundations such as piles will need to be used.

Both conventional foundations and piled foundations are discussed in the following sections.

7.3.1 Strip/Pad Foundations

Given the variable thickness of the Langley Silt Member across site, this report will consider the bearing capacity of the Taplow Sand and Gravel Member at a depth of 2.00m.

Strip or pad foundations should be placed within the dense to very dense sands and gravels. If any Made Ground, particularly loose or soft materials are encountered at foundation level, this should be either excavated and replaced with suitable granular fill, or the foundation extended to suitable strata.

Table 8 summarises allowable bearing pressures for strip and pad foundations, at 2.00m within the Taplow Gravel Member. The bearing capacities are calculated based on Hansens(1978) method and assuming a factor of safety against bearing capacity failure of 3. Groundwater is assumed to be below 2.0m depth.

Table 8: Summary of Allowable Bearing Pressures

Foundation Depth	Foundation Stratum	Design Value	Foundation Type	Foundation Width / Size	Allowable Bearing Pressure
2.0m	Sands and Gravels	$\phi = 41.0$	Strip	0.6m	591kPa
				1.0m	630kPa
			Pad	0.75m x 0.75m	1002kPa
				1.50m x 1.50m	1016kPa

The following table gives estimates of anticipated settlements for the above foundations, based on correlations by Burland & Burbidge⁽¹⁹⁸⁵⁾ and design values discussed in Section 6 and assuming a foundation load equal to the allowable bearing pressure in Table 8, to give a worse-case scenario.

Table 9: Summary of Anticipated Foundation Settlements

Foundation Depth	Foundation Stratum	Foundation Type	Foundation Size	Foundation Loading	Settlement (mm)		
					Lower Limit	Upper Limit	Best Estimate
2.00m	Sands and Gravels	Strip	0.6m	591kPa	0-5	5-10	0-5
			1.0m	630kPa	0-5	10-15	5-10
		Pad	0.75m x 0.75m	1002kPa	0-5	10-15	5-10
			1.50m x 1.50m	1016kPa	5-10	15-20	5-10

Settlements for other bearing pressures may be estimated on a pro-rata basis but bearing pressures should not exceed the allowable net bearing pressure based on ultimate bearing capacity.

All foundation excavations should be inspected by a suitable qualified engineer to prove that the founding strata is suitable and uniform along the length of the foundation, and capable of taking the anticipated structural loadings.

Should the anticipated structural loadings exceed the allowable bearing pressures above, or anticipated settlements are too large for the proposed structure, alternative foundation options such as piling should be considered.

7.3.2 Piled Foundations

The proposed development may be founded on a system of ground beams spanning onto piles taken down into dense to very dense Taplow Gravel Member.

A variety of pile types may be used, including bored and continuous flight auger (CFA) piles. Driven piles may be suitable, subject to environmental and noise/vibration constraints.

Because of the various advantages and limitations of each pile type, and the cost implications, advice should be sought from specialist piling contractors to determine the most suitable and cost-effective type. They should also be able to give recommended pile diameters and depths and likely pile capacities, with guaranteed performance. Given the shallow depth of refusal within the recent ground investigation, it is recommended that a pile test be carried out to confirm pile capacities. In assessing the pile capacities, contractors should make an allowance for the effects of negative skin friction, particularly in the near surface Made Ground.

It is essential the advice of a specialist piling contractor is sought and that positive assurances are provided by the piling contractor that their proprietary system is capable of providing the required working loads in the ground conditions encountered.

7.4 Chemical Attack on Buried Concrete

Chemical tests (see Appendix 2) show low levels of water soluble sulphates and near neutral conditions. Based on these conditions, it is recommended that for foundations the Design Sulphate Class for the site, as defined in BRE Special Digest 1(2005), be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1s. The recommendations of BRE Special Digest 1 should be followed for concrete foundations and ground bearing floor slabs.

7.5 Suitability of Excavated Materials

Acceptability criteria and testing, and methods of compaction/placement will depend on the type of contract and specification used for the construction of the proposed development and it is recommended that earthworks specifications are reviewed by a suitably qualified engineer, once these have been prepared by the relevant parties.

Any Made Ground or near surface soft clay is unlikely to be suitable as structural fill and should be used for landscaping purposes only, providing it is not contaminated. The natural sand and gravel could be re-used as structural fill, providing it is not contaminated and does not contain excessive amounts of clay.

7.6 Temporary Works

Formations will be susceptible to damage both by weather and trafficking, and should be protected immediately on exposure, particularly in areas where construction plant will access the site.

Excavations in made ground and natural sand and gravel have the potential to be unstable and should be battered back to an angle of 1 in 2, or a system of close sheeting and shoring adopted to ensure stability, and in particular where personnel are required to enter excavations.

All excavations should be adequately supported where personnel are required to enter.

All natural materials on site should be capable of being excavated using conventional excavating machinery.

8.0 SOIL CONTAMINATION GENERIC RISK ASSESSMENT

8.1 Tier I Human Health Risk Assessment – Future Site Users

As part of the contamination assessment, the chemical results obtained by EEGSL have been screened against accepted compliance criteria, namely:

- Tier 1 assessment values - based on LQM/CIEH Sutable 4 Use Levels ⁽²⁰¹⁵⁾ (S4ULs), where available; and
- Defra C4SL Health Criteria Values (March 2014).

As a preliminary screening assessment, all results have been compared to residential end use criteria.

The comparison of results is summarised in the following tables:

Table 10: Soil Results Comparison with Defra C4SL HCV/LLTC Values

Determinand	C4SL (mg/kg)*			Min. (mg/kg)	Max. (mg/kg)	No. of Samples with Exceedances
	Residential with home grown produce (1)	Residential without home grown produce (2)	Commercial (3)			
Arsenic	37	40	640	2	11	-
Benzo(a)pyrene	5.0	5.3	76	<0.1	0.81	-
Cadmium	26	149	410	<0.2	<0.2	-
Chromium VI	21	21	9.1	<0.2	<0.2	-
Lead	200	310	2300	<3.0	69	-
*Minimal risk Health Criteria Values						

The comparison within Table 10 has shown no elevated levels of contaminants in excess of the C4SLs for residential end use within the made ground or shallow natural clay present beneath site.

The following contaminants were not assessed with respect to risks posed to Human Health, as they are not generally considered to represent a significant risk (CLR 8)

- Sulphate and Sulphide.

For contaminants not covered by the Defra C4SLs, reference is made to the Sutable for Use Levels (S4ULs) derived by The Land Quality Management Ltd & Chartered Institute of Environmental Health ⁽²⁰¹⁵⁾ and summarised in Table 11 overleaf. The S4ULs are based on 1% Soil Organic Matter (SOM) as this represents the conservative approach.

Table 11: Soil Results Comparison with LQM/CIEH S4UL

Determinant	Suitable 4 Use Levels (mg/kg)*			Min. (mg/kg)	Max. (mg/kg)	No of Exceedences
	Residential		Commercial (3)			
	with homegrown produce (1)	without homegrown produce (2)				
Metals						
Beryllium	1.7	1.7	12	<0.5	0.7	-
Boron	290	11000	240000	<1	<1	-
Chromium	910	910	8600	8	23	-
Copper	2400	7100	68000	<4	30	-
Mercury	1.2	1.2	58	<1	<1	-
Nickel	180	180	980	3	22	-
Selenium	250	430	12000	<3	<3	-
Vanadium	410	1200	9000	10	41	-
Zinc	3700	4000	730000	8	115	-
Polycyclic Aromatic Hydrocarbons						
Naphthalene	2.3	2.3	190	<0.1	<0.1	-
Acenaphthylene	170	2900	83000	<0.1	<0.1	-
Acenaphthene	210	3000	84000	<0.1	<0.1	-
Fluorene	170	2800	63000	<0.1	<0.1	-
Phenanthrene	95	1300	22000	<0.1	0.71	-
Anthracene	2400	31000	520000	<0.1	0.21	-
Fluoranthene	280	1500	23000	<0.1	1.53	-
Pyrene	620	3700	54000	<0.1	1.33	-
Benz(a)anthracene	7.2	11	170	<0.1	0.86	-
Chrysene	15	30	350	<0.1	0.52	-
Benzo(b)fluoranthene	2.6	3.9	44	<0.1	0.88	-
Benzo(k)fluoranthene	77	110	1200	<0.1	0.37	-
Indeno(1,2,3-cd)pyrene	27	45	500	<0.1	0.49	-
Dibenz(a,h)anthracene	0.24	0.31	3.5	<0.1	<0.1	-
Benzo(ghi)perylene	320	360	3900	<0.1	0.46	-
Speciated TPH						
Aliphatic >C5 - C6	42	42	3200	<0.01	<0.01	-
Aliphatic >C6 - C8	100	100	7800	<0.05	<0.05	-
Aliphatic >C8 - C10	27	27	2000	<2.0	<2.0	-
Aliphatic >C10 - C12	130	130	9700	<2.0	<2.0	-
Aliphatic >C12 - C16	1100	1100	59000	<3.0	<3.0	-
Aliphatic >C16 – C21	65000	65000	1600000	<3.0	<3.0	-
Aromatic >C5 - C7	70	370	26000	<0.01	<0.01	-
Aromatic >C7 - C8	130	860	56000	<0.05	<0.05	-
Aromatic >C8 - C10	34	47	3500	<2.0	<2.0	-
Aromatic >C10 - C12	74	250	16000	<2.0	<2.0	-
Aromatic >C12 - C16	140	1800	36000	<2.0	<2.0	-
Aromatic >C16 - C21	260	1900	28000	<3.0	<3.0	-
Aromatic >C21 - C35	1100	1900	28000	<10	<10	-
BTEX						
Benzene	0.087	0.38	27	<0.002	<0.002	-
Toluene	130	880	56000	<0.005	<0.005	-
Ethylbenzene	47	83	5700	<0.002	<0.002	-
P & m-xylene	60	88	6600	<0.002	<0.002	-
O-xylene	59	82	6200	<0.002	<0.002	-
MTBE	56	79	5900	<0.005	<0.005	-

The comparison within Table 11 has shown no elevated levels of Toxic Metals, TPH, PAH and BTEX in excess of the S4ULs for residential end use.

8.2 Asbestos

Asbestos was identified within one of the six the samples tested during this investigation. Chrysotile in visible cement was identified in WS04 at 0.30m.

9.0 GROUND GAS CONTAMINATION RISK ASSESSMENT

A preliminary gas risk assessment has been completed for the assessment site based on monitoring data collected from two installations constructed as part of the recent ground investigation works. The installations have response zones across the natural strata's.

Results obtained during the three monitoring visits undertaken between the 30th September 2020 – 14th October 2020 indicated Oxygen (O₂) levels ranging from 11.1% to 14.3% by volume, and Carbon Dioxide (CO₂) levels ranging from 0.0% to 2.5% by volume. A maximum positive gas flow of 1.7 l/hr was recorded within WS04 and atmospheric pressures recorded were between 1018mb – 994mb over the three visits.

The potential risk associated with ground gases (whether from natural or man-made sources) is dependent on the concentration of gas and its flow rate to the surface. These factors are assessed by the monitoring of borehole installations over varying atmospheric conditions. The variable nature of gas generation and the effect of barometric pressure on gas flow, means that the volume of gas potentially reaching the ground surface can vary over time.

For the assessment of sites, in terms of the potential for ground gas to present a hazard, the risk-based methodology detailed in the CIRIA C665⁽²⁰⁰⁷⁾ is used. This is a risk-based approach that is designed to allow the quick and easy design of gas protection for development by comparing the measured gas emission rates to Characteristic Situations, based on risk-based Gas Screening Values (GSVs). The GSVs equate to the borehole gas volume flow rate as defined by Wilson and Card ⁽¹⁹⁹⁹⁾ and are calculated as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.

For the purposes of this evaluation, the calculations will be carried out carbon dioxide. A peak flow rate of 1.7 l/hr will be used as this represents the worst-case scenario recorded during the recent monitoring works.

- Carbon dioxide: maximum flow rate = 1.7 l/hr, max concentration = 2.5%

Based on the above figures, the GSVs are calculated as:

- Carbon dioxide: GSV = 0.1 x 0.025 = 0.0425l/hr

The above results would suggest the site can be given a Characteristic Situation of (1), i.e. 'Very Low Risk', in accordance with Table 12.

Table 12: Modified Wilson & Card Classification (CIRIA Report 665)

<i>Characteristic Situation (CIRIA Report 149)</i>	<i>Risk Classification</i>	<i>GSV (CH₄ or CO₂) (l/hr)</i>	<i>Additional Factors</i>	<i>Typical Source of Generation</i>
1	Very Low Risk	<0.07	Typically methane ≤1%v/v and/or carbon dioxide ≤5% v/v. Otherwise consider increase to Situation 2.	Natural Soils with low organic content. "Typical" Made Ground.
2	Low Risk	<0.7	Borehole flow rate not to exceed 70l/hr. Otherwise increase to Situation 3.	Natural soil, high peat/organic content. "Typical" Made Ground.
3	Moderate Risk	<3.5		Old landfill, inert waste, mineworking flooded.
4	Moderate to High Risk	<15	Quantitative risk assessment required to evaluate scope of measures required.	Mineworking susceptible to flooding, completed landfill (WMP 26B criteria)
5	High Risk	<70		Mineworking unflooded inactive with shallow workings near surface.
6	Very High Risk	>70		Recent landfill site.

Therefore, according to Table 8.6 of CIRIA Report 665 no special precautions are expected to be required in terms of ground gas mitigation measures.

10.0 REVISED CONCEPTUAL MODEL

Taking into consideration the results of the soil, groundwater and ground gas sampling undertaken as part of the ground investigation, the conceptual site model for the assessment site has been updated and is presented within Table 13.

Table 13: Revised Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Potential contamination associated with the sites historical use as a smithy and the presence of an unspecified tank	Dermal contact, ingestion and inhalation of soils dust	Current Site Users	Unlikely	Moderate	Low Risk	Asbestos has been identified within one sample (WS04) at a depth of 0.3m. Currently this area of site is paved and is used as a car park. Given the current hardstanding at this location will prevent exposure at the surface, the risk to current site users is considered Low. No other contamination above the screening criteria was identified during the ground investigation works. The risk to current site users is therefore considered to be LOW .
		Adjacent Land Users	Unlikely	Moderate	Low Risk	The risk to adjacent site users is considered LOW . The only contamination found present on site was cement bonded asbestos present beneath a car park. Given the current hardstanding and proposed hardstanding covering this area of contamination, the risk of migration occurring and impacting off site receptors is considered to be minimal.
		Construction Workers	Likely	Moderate	Moderate Risk	The potential for construction workers to be exposed to contaminated materials present beneath site is considered MODERATE given the presence of asbestos identified within WS04. It is recommended further works will be required to reduce this risk prior to development in the area.
		Future Site Users	Low Likelihood	Moderate	Low to Moderate Risk	The current proposal is for the development of a new residential building within the northern area of site. At present, the current plans show no soft landscaping areas proposed, except from the existing beds with hedges and trees around the boundary of site. Even though the presence of asbestos was identified within WS04,

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
	Vertical or horizontal migration of ground gas and vapours					this is where the new building is located, so there will be no direct pathway for any potential receptors to be exposed to contamination present beneath site (no direct source / pathway / receptor linkage), and therefore the risk to future site users is considered LOW in this instance. (it should be noted that this analysis may require revision if development plans are amended, especially if soft landscaping areas are introduced to the proposed development).
		Current Site Users	Unlikely	Moderate	Low Risk	Given the lack of ground gas identified during the monitoring visits, the risk to current site users from the migration of ground gas is considered to be LOW .
		Adjacent Land Users	Unlikely	Moderate	Low Risk	Given the lack of ground gas identified during the monitoring visits, the risk to adjacent site users from the migration of ground gas is considered to be LOW .
		Construction Workers	Unlikely	Moderate	Low Risk	Given the lack of ground gas identified during the monitoring visits, the risk to construction workers from the migration of ground gas is considered to be LOW .
		Future Site Users	Unlikely	Moderate	Low Risk	Given the lack of ground gas identified during the monitoring visits, the risk to future site users from the migration of ground gas is considered to be LOW .
Potential contamination present associated with the former off site sources of contamination (former Works and Factory)	Dermal contact, ingestion and inhalation of soils dust	Current Site Users	Unlikely	Moderate	Low Risk	Asbestos has been identified within one sample (WS04) at a depth of 0.3m. Currently this area of site is paved and is used as a car park. Given the current hardstanding at this location will prevent exposure at the surface, the risk to current site users is considered LOW . No other contamination above the screening criteria was identified during the ground investigation works.
		Construction Workers	Likely	Moderate	Moderate Risk	The potential for construction workers to be exposed to contaminated materials present beneath site is considered MODERATE given the presence of asbestos identified within WS04. It is recommended further

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
						works will be required to reduce this risk prior to development in the area.
		Future Site Users	Unlikely	Moderate	Low Risk	The current proposal is for the development of a new residential building within the northern area of site. At present, the current plans show no soft landscaping areas proposed, except from the existing beds with hedges and trees around the boundary of site. Even though the presence of asbestos was identified within WS04, this is where the new building is located, so there will be no direct pathway for any potential receptors to be exposed to contamination present beneath site (no direct source / pathway / receptor linkage), and therefore the risk to future site users is considered LOW in this instance. (it should be noted that this analysis may require revision if development plans are amended, especially if soft landscaping areas are introduced to the proposed development).
	Vertical or horizontal migration of ground gas and vapours	Current Site Users	Unlikely	Moderate	Low Risk	Given the lack of ground gases identified during the monitoring visits, the risk to current site users from the migration of ground gas is therefore considered to be LOW .
		Construction Workers	Unlikely	Moderate	Low Risk	Given the lack of ground gases identified during the monitoring visits, the risk to construction workers from the migration of ground gas is therefore considered to be LOW .
		Future Site Users	Unlikely	Moderate	Low Risk	Given the lack of ground gases identified during the monitoring visits, the risk to future site users from the migration of ground gas is therefore considered to be LOW .

11.0 CONCLUSIONS AND RECOMMENDATIONS

The following section provides a summary of the works undertaken and conclusions and recommendations based on its findings.

A Geo-Environmental Site Investigation has been commissioned by TEJ Properties Limited (the Client) to examine ground conditions and retrieve soil samples in support of a proposed new residential development at the assessment site.

Ground investigation works included the drilling of five window sample boreholes, the collection of representative soil samples and three rounds of gas and groundwater monitoring. All samples were sent for chemical and geotechnical analysis at accredited testing laboratories.

Preliminary screening of the laboratory results against currently accepted assessment criteria was then undertaken. The results of this screening assessment have been used to assess if the site is fit for its current and proposed use.

11.1 Soil Contamination

As discussed in Section 8 of this report, testing of soils representative of the materials beneath the assessment site has been undertaken, and the results of which are provided within Appendix 3.

Preliminary screening against currently accepted assessment criteria for residential end use has proven a lack of contamination in excess of the recommended soil guideline values, with the exception of one instance of asbestos contamination identified within WS04 (0.3m depth).

The presence of asbestos at WS04 is not expected to pose a risk to current or future site users due to this location being covered by permanent hardstanding prior to and post development. However, there is a potential risk to construction workers during any excavation works within this area. Given the potential risk to construction workers, some additional works / mitigation measures have been proposed in Section 11.7 of this report.

11.2 Ground Gas

As discussed within Section 9 of this report, three rounds of ground gas monitoring were undertaken as part of this investigation. The current data shows no elevated levels of ground gas. From an initial gas risk assessment, the site has been classed as a Characteristic Situation of (1) i.e. Very Low Risk. It is therefore recommended that no special precautions related to ground gas mitigation are required in this instance.

11.3 Groundwater

No shallow groundwater was identified during the ground investigation process and subsequent monitoring rounds.

11.4 Soil Disposal

Soils excavated and removed from site should be disposed of at a suitable site registered to take the levels of contamination encountered. Attention is drawn to the soil analysis results within Section 8, identifying asbestos within WS04.

11.5 Site Personnel

As with all construction sites, personnel working on the site during the construction period should be encouraged to maintain a high standard of personal hygiene and on-site washing facilities should be made available. The potential presence of asbestos identified within the shallow soils around WS04 beneath site should be highlighted to all construction staff and this report made available for reference during the construction works.

11.6 Other Matters

Due diligence is required during every project, and should any new evidence of contamination be found, appropriate investigation and / or remediation should be undertaken. The significance of any contamination not discovered by this investigation is outside the scope of this report.

11.7 Further works

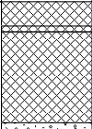
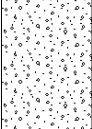
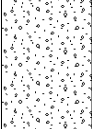
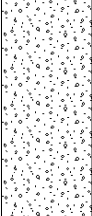
In areas immediately surrounding WS04, care should be taken during any excavation or when the current hardstanding is replaced during development. As a precaution it is recommended that when undertaking these works, all operators should wear suitable personal protective equipment and any excavated materials should be segregated on site and additional testing for asbestos contamination should be completed prior to the materials being disposed of offsite.

APPENDIX 1

EXPLORATORY BOREHOLE LOGS

Percussion Drilling Log

Project Name: Duval House		Client: TEJ Properties Limited		Date: 23/09/2020	
Location: Duval House, High Street, Harmondsworth		Contractor: Borehole Solutions			
Project No. : R0438		Crew Name:		Drilling Equipment:	
Borehole Number WS01	Hole Type BH	Level	Logged By LC	Scale 1:25	Page Number Sheet 1 of 1

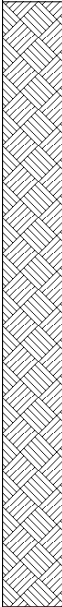
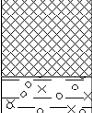
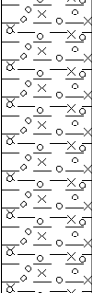
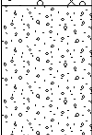
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.08 0.10 0.40		   	Brick Paving Yellow brown fine to medium SAND (MADE GROUND) Brown/grey slightly clayey gravelly SAND with rare angular cobbles of red brick and concrete. Sand is fine to medium (MADE GROUND). Brown SAND and GRAVELS. Gravels are angular subangular fine to coarse of flint. Sand is fine to medium (TAPLOW GRAVEL MEMBER).	1
		0.90 1.00 - 2.00 1.00	ES B SPT	N=49 (10,12/12,12,13,12)					
		2.00	SPT	N=53 (11,12/13,12,14,14)	2.00			End of Borehole at 2.000m	2
									3
									4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Percussion Drilling Log

Project Name: Duval House		Client: TEJ Properties Limited		Date: 23/09/2020	
Location: Duval House, High Street, Harmondsworth		Contractor: Borehole Solutions			
Project No. : R0438		Crew Name:		Drilling Equipment:	
Borehole Number WS02	Hole Type BH	Level	Logged By LC	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.08			0.08			Brick Paving	
		0.12			0.12			Yellow brown fine to medium SAND (MADE GROUND).	
		0.40	ES		0.45			Brown slightly clayey gravelly SAND with occasional subangular cobbles of red brick and fragments of plastic. Gravels are angular to subangular fine to coarse of red and yellow brick and concrete (MADE GROUND)	
		1.00	D					Soft brown silty CLAY with rare subangular to subrounded fine gravels of flint (LANGLEY SILT MEMBER)	1
		1.00	ES						
		1.00	SPT	N=9 (1,2/2,2,2,3)					
		1.60 - 2.00	B		1.55			Brown slightly clayey SAND and GRAVELS. Gravels are angular subangular fine to coarse of flint. SAND is fine to medium (TAPLOW GRAVEL MEMBER).	
		2.00	SPT	N=57 (1,2/12,14,15,16)	2.00			End of Borehole at 2.000m	2
									3
									4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks



Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.08			Brick Paving	1 2 3 4 5
					0.12			Yellow brown fine to medium SAND.	
								Brown/grey slightly clayey gravelly SAND with rare angular cobbles of red brick and concrete. Sand is fine to medium (MADE GROUND)	
								Soft dark brown gravelly CLAY. Gravels are subangular fine to coarse of various lithologies including redbrick (MADE GROUND).	
								Soft brown silty CLAY (LANGLEY SIT MEMBER).	
		0.60	ES		0.40			Brown SAND and GRAVELS. Gravels are angular subangular fine to coarse of flint. Sand is fine to medium (TAPLOW GRAVEL MEMBER).	
					0.50				
					0.60				
1.00 - 2.00 1.00	B SPT	N=31 (3,3/6,8,8,9)							
2.00	SPT	N=50 (10,11/12,12,12,14)	2.00		End of Borehole at 2.000m				

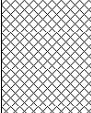
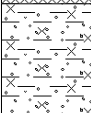
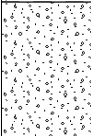
[illegible]

Hole collapsed to 1.40m.



Percussion Drilling Log

Project Name: Duval House		Client: TEJ Properties Limited		Date: 23/09/2020	
Location: Duval House, High Street, Harmondsworth		Contractor: Borehole Solutions			
Project No. : R0438		Crew Name:		Drilling Equipment:	
Borehole Number WS04	Hole Type BH	Level	Logged By LC	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.40			Light brown/grey slightly clayey gravelly SAND with rare root (2cm). Gravels are subangular fine to coarse of various lithologies including redbrick (MADE GROUND).	1
		0.50	ES					Soft to stiff brown silty CLAY with occasional rootlets (<1mm) and rare fine flint gravels (LANGLEY SILT MEMBER).	
		0.90 1.00 - 1.40 1.00	D B SPT	N=56 (7,7/12,14,13,17)	0.95			Brown SAND and GRAVELS. Gravels are angular to subangular fine to coarse of flint. Sand is fine to medium (TAPLOW GRAVEL MEMBER).	
					1.40			End of Borehole at 1.400m	2
									3
									4
									5

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks



EARTH ENVIRONMENTAL
& GEOTECHNICAL

APPENDIX 2

GAS/GROUNDWATER MONITORING RESULTS

Gas Monitoring Record

Project Number:	R0438
Project Name:	Duval House, harmondsworth
Date:	30/09/2020
Logger	LC

Weather:	Cloudy
----------	--------

*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	WS03	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0								Dry	1.1	
Flow Rate (l/hr)	0.1	CO2 (%)	0	0.3	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7										
Atmospheric Pressure (mbar)	1006	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0										
Borehole Pressure (Pa)	-0.34	O2 (%)	14.1	14	13.8	13.8	13.8	13.7	13.7	13.7	13.7	13.7	13.7										
Time	09:40	LEL (%)	0	0	0	0	0	0	0	0	0	0	0										
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0										

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID	WS04	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	DRY	1.4	
Flow Rate (l/hr)	0	CO2 (%)	0	0.7	2.1	2.1	2.1	2	2	2	2	2	2	2	2	2	2	2	1.9	1.9			
Atmospheric Pressure (mbar)	1006	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Borehole Pressure (Pa)	-0.41	O2 (%)	14.2	14	13.1	12.7	12.5	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.5			
Time	09:30	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Peak VOC		CO (ppm)	0	0	2	3	3	4	4	5	5	5	5	5	5	6	5	5	5	5			

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID		CH4 (%)																					
Flow Rate (l/hr)		CO2 (%)																					
Atmospheric Pressure (mbar)		H2S (ppm)																					
Borehole Pressure (Pa)		O2 (%)																					
Time		LEL (%)																					
Peak VOC		CO (ppm)																					

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl*)	Borehole Base (mbgl*)	Comments
Borehole ID		CH4 (%)																					
Flow Rate (l/hr)		CO2 (%)																					
Atmospheric Pressure (mbar)		H2S (ppm)																					
Borehole Pressure (Pa)		O2 (%)																					
Time		LEL (%)																					
Peak VOC		CO (ppm)																					

Gas Monitoring Record	
Project Number:	R0438
Project Name:	Duval House, harmondsworth
Date:	06/10/2020
Logger	LC

Weather:	Sunny
----------	-------

*mbgl - Meters below Ground Level

			Initial	10 secs	20 secs	30 secs	40 secs	50 secs	60 secs	70 secs	80 secs	90 secs	100 secs	110 secs	120 secs	130 secs	140 secs	150 secs	180 secs	300 secs	Groundwater Level (mbgl ⁺)	Borehole Base (mbgl ⁺)	Comments
Borehole ID	WS03	CH4 (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0					Dry	1.12	
Flow Rate (l/hr)	0	CO2 (%)	0	0.8	2.3	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.5							
Atmospheric Pressure (mbar)	994	H2S (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Borehole Pressure (Pa)	-0.41	O2 (%)	14.3	14.2	12.6	11.8	11.4	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3							
Time	09:45	LEL (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Peak VOC		CO (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0							

[illegible][illegible][illegible]

Gas Monitoring Record	
Project Number:	R0438
Project Name:	Duval House, harmondsworth
Date:	14/10/2020
Logger	LC

Weather:	Sunny & Cool
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*mbgl - Meters below Ground Level

[illegible][illegible][illegible][illegible]

APPENDIX 3

LABORATORY TESTING RESULTS (CONTAMINATION)



John Grace
Earth Environmental & Geotechnical (Southern Ltd)
Kingsbury House
Kingsbury Square
Melksham
Wiltshire
SN12 6HL

DETS Ltd
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Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 20-11263

Site Reference: Duval House

Project / Job Ref: R0438

Order No: R438

Sample Receipt Date: 29/09/2020

Sample Scheduled Date: 29/09/2020

Report Issue Number: 1

Reporting Date: 09/10/2020

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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



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Soil Analysis Certificate						
DETS Report No: 20-11263	Date Sampled	23/09/20	23/09/20	23/09/20	23/09/20	23/09/20
Earth Environmental & Geotechnical (Southern Ltd)	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Duval House	TP / BH No	WS01	WS01	WS02	WS03	WS04
Project / Job Ref: R0438	Additional Refs	MG	CLAY	MG	MG	MG
Order No: R438	Depth (m)	0.30	0.90	0.40	0.30	0.30
Reporting Date: 09/10/2020	DETS Sample No	501924	501925	501926	501927	501928

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Detected
Sample Matrix ^(S)	Material Type	N/a	NONE					Chrysotile in visible cement
Asbestos Type ^(S)	PLM Result	N/a	ISO17025					Chrysotile
pH	pH Units	N/a	MCERTS	8.8	8.5	9.1	9.1	8.4
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Complex Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Free Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE	379	< 200	2128	< 200	5369
Total Sulphate as SO ₄	%	< 0.02	NONE	0.04	< 0.02	0.21	< 0.02	0.54
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	57	13	201	21	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.06	0.01	0.20	0.02	< 0.01
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter	%	< 0.1	MCERTS	0.2	< 0.1	0.8	0.2	1.1
Arsenic (As)	mg/kg	< 2	MCERTS	4	2	10	4	9
Barium (Ba)	mg/kg	< 2.5	MCERTS	20	8	107	13	74
Beryllium (Be)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	0.6	< 0.5	0.6
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	8	9	22	8	21
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	18	< 4	30	20	14
Lead (Pb)	mg/kg	< 3	MCERTS	3	< 3	69	3	21
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	4	3	13	4	13
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	26	10	41	29	32
Zinc (Zn)	mg/kg	< 3	MCERTS	30	8	80	25	45
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°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 20-11263		Date Sampled	23/09/20			
Earth Environmental & Geotechnical (Southern Ltd)		Time Sampled	None Supplied			
Site Reference: Duval House		TP / BH No	WS05			
Project / Job Ref: R0438		Additional Refs	MG			
Order No: R438		Depth (m)	0.50			
Reporting Date: 09/10/2020		DETS Sample No	501929			

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected			
Sample Matrix ^(S)	Material Type	N/a	NONE				
Asbestos Type ^(S)	PLM Result	N/a	ISO17025				
pH	pH Units	N/a	MCERTS	8.0			
Total Cyanide	mg/kg	< 2	NONE	< 2			
Complex Cyanide	mg/kg	< 2	NONE	< 2			
Free Cyanide	mg/kg	< 2	NONE	< 2			
Total Sulphate as SO ₄	mg/kg	< 200	NONE	844			
Total Sulphate as SO ₄	%	< 0.02	NONE	0.08			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	177			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.18			
Sulphide	mg/kg	< 5	NONE	< 5			
Organic Matter	%	< 0.1	MCERTS	1.6			
Arsenic (As)	mg/kg	< 2	MCERTS	11			
Barium (Ba)	mg/kg	< 2.5	MCERTS	69			
Beryllium (Be)	mg/kg	< 0.5	MCERTS	0.7			
W/S Boron	mg/kg	< 1	NONE	< 1			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	23			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	21			
Lead (Pb)	mg/kg	< 3	MCERTS	23			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	22			
Selenium (Se)	mg/kg	< 2	MCERTS	< 3			
Vanadium (V)	mg/kg	< 1	MCERTS	35			
Zinc (Zn)	mg/kg	< 3	MCERTS	115			
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°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 20-11263	Date Sampled	23/09/20	23/09/20	23/09/20	23/09/20	23/09/20
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Duval House	TP / BH No	WS01	WS01	WS02	WS03	WS04
Project / Job Ref: R0438	Additional Refs	MG	CLAY	MG	MG	MG
Order No: R438	Depth (m)	0.30	0.90	0.40	0.30	0.30
Reporting Date: 09/10/2020	DETS Sample No	501924	501925	501926	501927	501928

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	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.71	< 0.1	0.50
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.21	< 0.1	0.13
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.53	< 0.1	1.20
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	1.33	< 0.1	0.96
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.86	< 0.1	0.60
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.52	< 0.1	0.35
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.88	< 0.1	0.58
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.37	< 0.1	0.25
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.81	< 0.1	0.46
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.49	< 0.1	0.31
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.46	< 0.1	0.27
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	8.2	< 1.6	5.6



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 20-11263	Date Sampled	23/09/20				
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied				
Site Reference: Duval House	TP / BH No	WS05				
Project / Job Ref: R0438	Additional Refs	MG				
Order No: R438	Depth (m)	0.50				
Reporting Date: 09/10/2020	DETS Sample No	501929				

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	< 0.1			
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1			
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			



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 20-11263	Date Sampled	23/09/20	23/09/20	23/09/20	23/09/20	23/09/20
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Duval House	TP / BH No	WS01	WS01	WS02	WS03	WS04
Project / Job Ref: R0438	Additional Refs	MG	CLAY	MG	MG	MG
Order No: R438	Depth (m)	0.30	0.90	0.40	0.30	0.30
Reporting Date: 09/10/2020	DETS Sample No	501924	501925	501926	501927	501928

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	41	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	45	< 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	45	< 42



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 20-11263	Date Sampled	23/09/20				
Earth Environmental & Geotechnical (Souther	Time Sampled	None Supplied				
Site Reference: Duval House	TP / BH No	WS05				
Project / Job Ref: R0438	Additional Refs	MG				
Order No: R438	Depth (m)	0.50				
Reporting Date: 09/10/2020	DETS Sample No	501929				

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			



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



Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 20-11263	Date Sampled	23/09/20	23/09/20	23/09/20	23/09/20	23/09/20
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Duval House	TP / BH No	WS01	WS01	WS02	WS03	WS04
Project / Job Ref: R0438	Additional Refs	MG	CLAY	MG	MG	MG
Order No: R438	Depth (m)	0.30	0.90	0.40	0.30	0.30
Reporting Date: 09/10/2020	DETS Sample No	501924	501925	501926	501927	501928

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



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 20-11263	Date Sampled	23/09/20				
Earth Environmental & Geotechnical (Southern)	Time Sampled	None Supplied				
Site Reference: Duval House	TP / BH No	WS05				
Project / Job Ref: R0438	Additional Refs	MG				
Order No: R438	Depth (m)	0.50				
Reporting Date: 09/10/2020	DETS Sample No	501929				

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			



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 20-11263	
Earth Environmental & Geotechnical (Southern Ltd)	
Site Reference: Duval House	
Project / Job Ref: R0438	
Order No: R438	
Reporting Date: 09/10/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
501924	WS01	MG	0.30	3.1	Brown sandy gravel with stones and concrete
501925	WS01	CLAY	0.90	3.4	Light brown sandy gravel with stones
501926	WS02	MG	0.40	12.7	Brown sandy gravel with stones and concrete
501927	WS03	MG	0.30	2.4	Brown sandy gravel with stones and concrete
501928	WS04	MG	0.30	12.6	Brown loamy sand with stones and brick
501929	WS05	MG	0.50	15.1	Brown loamy sand with stones

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-11263

Earth Environmental & Geotechnical (Southern Ltd)

Site Reference: Duval House

Project / Job Ref: R0438

Order No: R438

Reporting Date: 09/10/2020

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 diphencylcarbazine 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

APPENDIX 4

LABORATORY TESTING RESULTS (GEOTECHNICAL)

Laboratory Test Certificate

Site Duval House
Client Earth Environmental & Geotechnical (Southern) Ltd

F.A.O. John Grace
Address 200 Brook Drive
Green Park
Reading
Berkshire
RG2 6UB

cjassociates

Order Number R0438
Job Number 2071416
Lab Number L14584

Number of samples submitted for testing:	7	sample (s)
--	---	------------

Natural Water Content	3	test(s)
Atterberg Limits	3	test(s)
Particle Size Distribution	4	test(s)
pH	7	test(s)
Water Soluble Sulphate	7	test(s)

Results apply to the sample(s) as received.

Date (s) sample (s) received at laboratory:	24	Sep-20
Date of receipt of testing instructions	24	Sep-20
Date testing started:	1	Oct-20
Date of issue:	8	Oct-20

Please note that we will keep the sample (s) for one month after submission of our report and will then dispose of them without notice unless you ask us to store them. We will then make a separate charge for this.

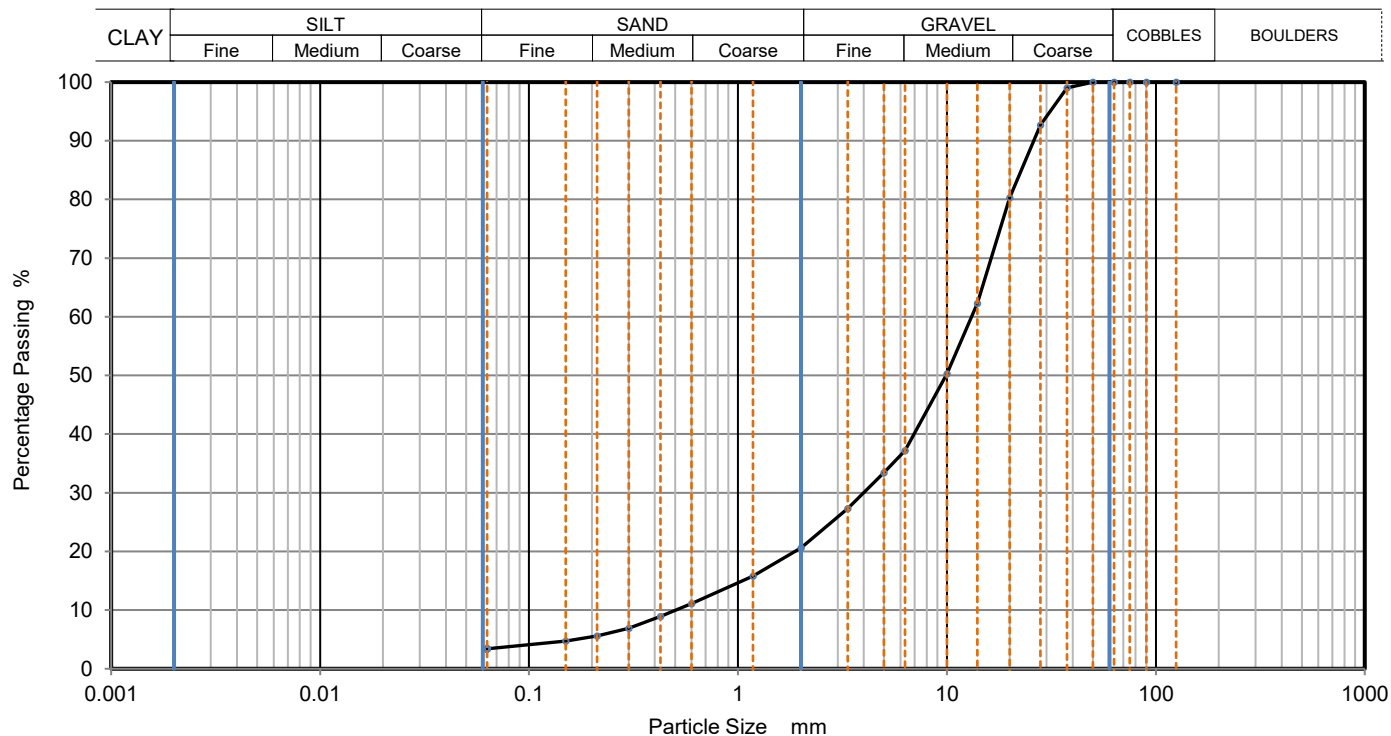
Approved by :
Lisa Maiden

L Maiden



All tests performed in accordance with BS1377:1990 unless specified otherwise						
Water Content Performed in accordance with BS EN ISO 17892-1 : 2014						
Key			Date Printed	Approved By	Table	
Density test	Liquid Limit	Particle density	10/08/2020 00:00	Lisa Maiden	1	
Linear measurement unless :	4pt cone unless :	sp - small pyknometer			sheet	
wd - water displacement	cas - Casagrande method	gj - gas jar			1	
wi - immersion in water	1pt - single point test					

cjassociates	PARTICLE SIZE DISTRIBUTION			Job Ref	2071416
				Borehole/Pit No.	WS01
Site Name	Duval House			Sample No.	
Soil Description	Grey brown slightly silty sandy GRAVEL			Depth, m	1.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	CJA_202009280



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	99		
28	93		
20	80		
14	62		
10	50		
6.3	37		
5	33		
3.35	27		
2	21		
1.18	16		
0.6	11		
0.425	9		
0.3	7		
0.212	6		
0.15	5		
0.063	3		

Dry Mass of sample, g

8258

Sample Proportions	% dry mass
Very coarse	0
Gravel	79
Sand	17
Fines <0.063mm	3

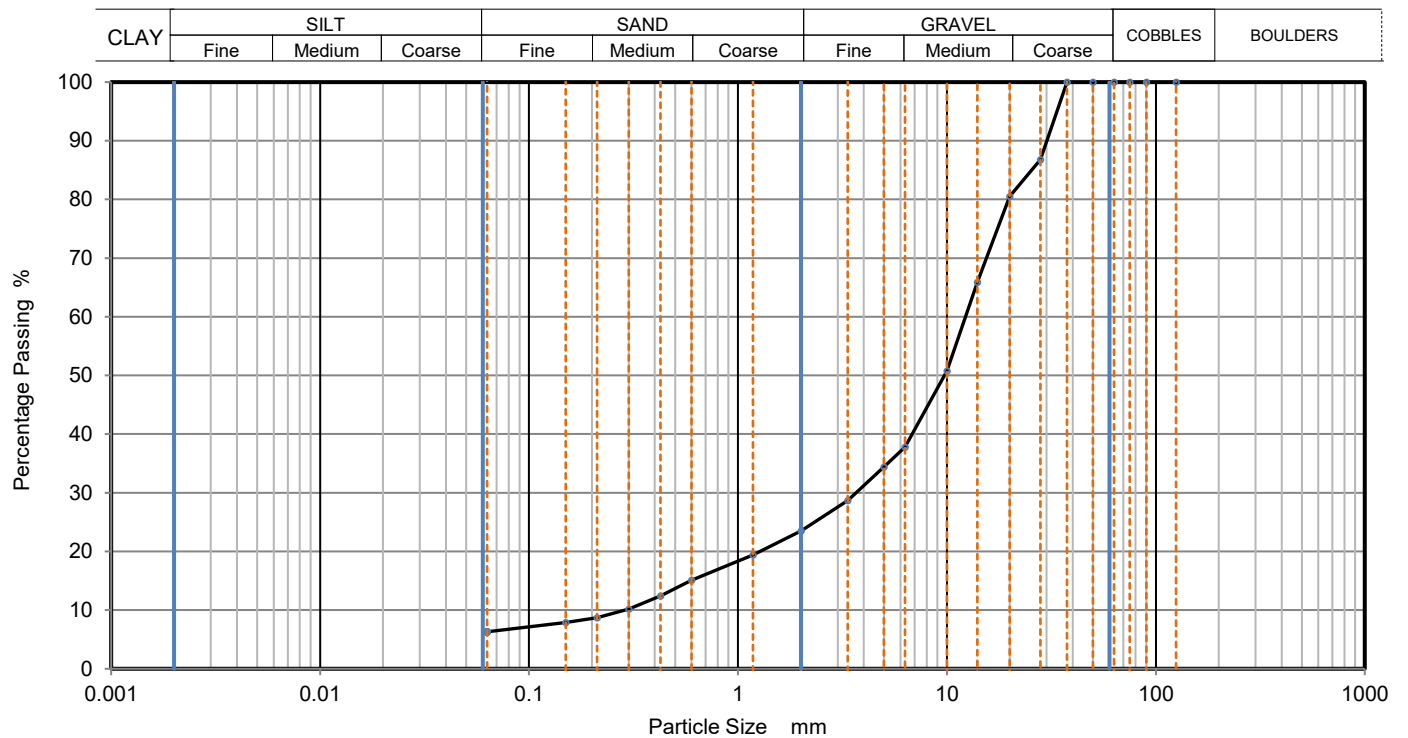
Grading Analysis		
D100	mm	
D60	mm	13.1
D30	mm	4
D10	mm	0.504
Uniformity Coefficient		26
Curvature Coefficient		2.4

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 1
		Lisa Maiden	08/10/2020 15:29	
				Sheet

	PARTICLE SIZE DISTRIBUTION		Job Ref	2071416	
			Borehole/Pit No.	WS02	
Site Name	Duval House		Sample No.		
Soil Description	Grey brown silty sandy GRAVEL		Depth, m	1.60	
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2		KeyLAB ID	CJA_202009282	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	87		
20	81		
14	66		
10	51		
6.3	38		
5	34		
3.35	29		
2	24		
1.18	19		
0.6	15		
0.425	12		
0.3	10		
0.212	9		
0.15	8		
0.063	6		

Dry Mass of sample, g	2796
-----------------------	------

Sample Proportions		% dry mass
Very coarse		0
Gravel		77
Sand		17
Fines <0.063mm		6

Grading Analysis		
D100	mm	
D60	mm	12.3
D30	mm	3.67
D10	mm	0.288
Uniformity Coefficient		43
Curvature Coefficient		3.8

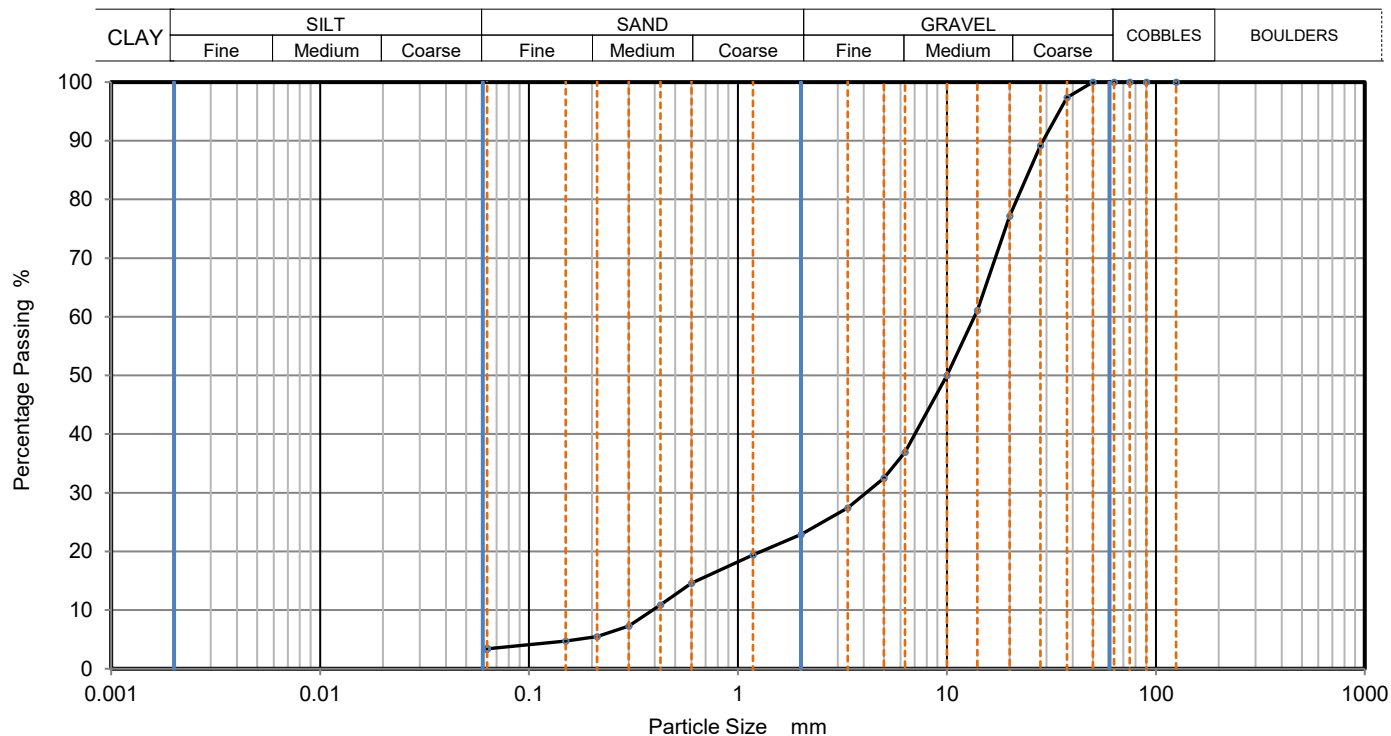
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Insufficient material was supplied to provide a representative sample.

Operator	Checked	Approved	Sheet printed	Fig 1 Sheet
		Lisa Maiden	08/10/2020 15:29	

cjassociates	PARTICLE SIZE DISTRIBUTION			Job Ref	2071416
				Borehole/Pit No.	WS03
Site Name	Duval House			Sample No.	
Soil Description	Grey brown slightly silty sandy GRAVEL			Depth, m	1.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	CJA_202009283



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	97		
28	89		
20	77		
14	61		
10	50		
6.3	37		
5	33		
3.35	27		
2	23		
1.18	19		
0.6	15		
0.425	11		
0.3	7		
0.212	6		
0.15	5		
0.063	3		

Dry Mass of sample, g

7276

Sample Proportions	% dry mass
Very coarse	0
Gravel	77
Sand	19
Fines <0.063mm	3

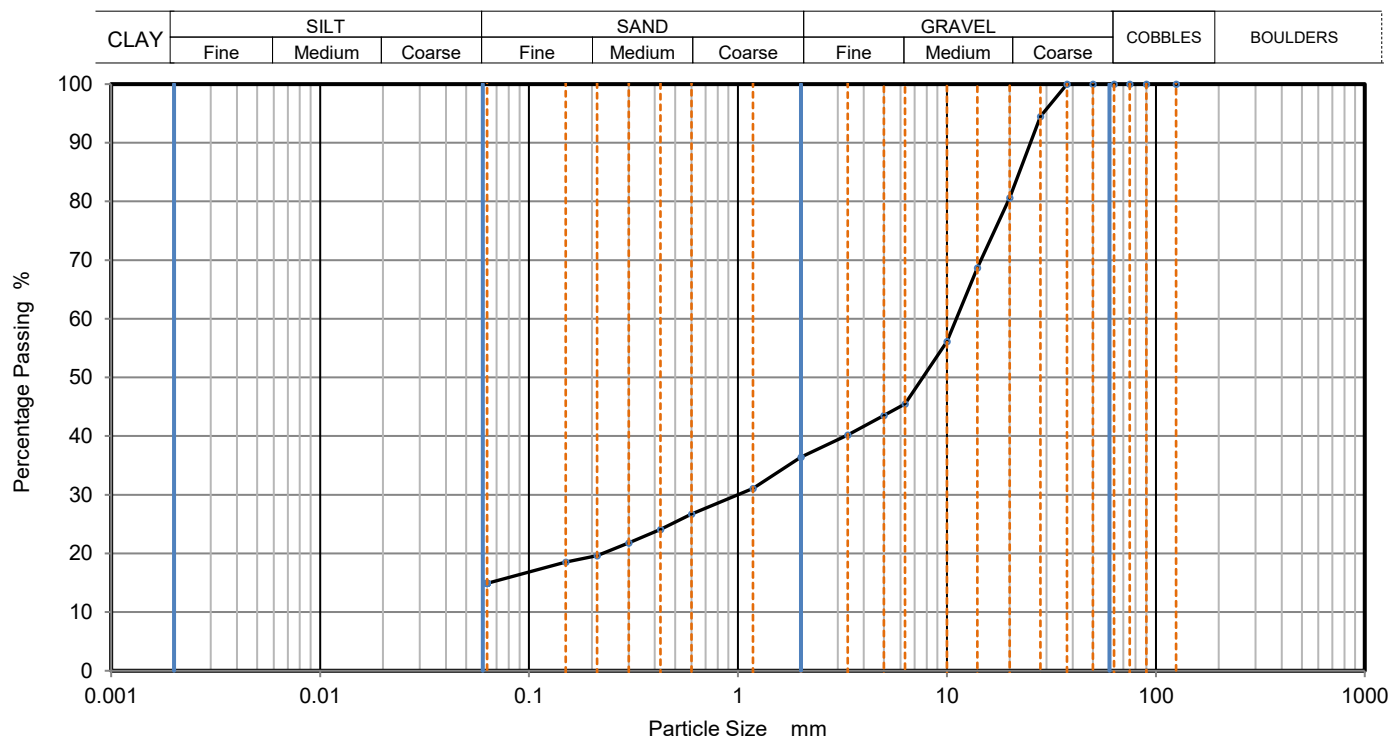
Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	35
Curvature Coefficient	3.2

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 1
		Lisa Maiden	08/10/2020 15:29	
				Sheet

cjassociates	PARTICLE SIZE DISTRIBUTION			Job Ref	2071416
				Borehole/Pit No.	WS05
Site Name	Duval House			Sample No.	
Soil Description	Grey brown silty very sandy GRAVEL			Depth, m	1.40
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	CJA_202009286



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	95		
20	81		
14	69		
10	56		
6.3	46		
5	44		
3.35	40		
2	36		
1.18	31		
0.6	27		
0.425	24		
0.3	22		
0.212	20		
0.15	19		
0.063	15		

Dry Mass of sample, g

2265

Sample Proportions	% dry mass
Very coarse	0
Gravel	64
Sand	22
Fines <0.063mm	15

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 1
		Lisa Maiden	08/10/2020 15:29	
				Sheet

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/08179
Issue Number: 1

Date: 02 October, 2020

Client: CJ Associates
King Road
Bristol
BS11 9HF

Project Manager: Admin/Lorna Logan
Project Name: Duval House'
Project Ref: 2071416-I14584-S8142
Order No: N/A
Date Samples Received: 28/09/20
Date Instructions Received: 28/09/20
Date Analysis Completed: 02/10/20

Prepared by:



Sophie France
Client Service Manager

Approved by:



Danielle Brierley
Client Manager

Envirolab Job Number: 20/08179

Client Project Name: Duval House'

Client Project Ref: 2071416-I14584-S8142

Lab Sample ID	20/08179/1	20/08179/2	20/08179/3	20/08179/4	20/08179/5	20/08179/6	20/08179/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS02	WS03	WS04	WS05	WS05			
Depth to Top	1.00	1.00	1.60	1.00	0.90	1.00	1.40			
Depth To Bottom	2.00		2.00	2.00			1.70			
Date Sampled	23-Sep-20	23-Sep-20	23-Sep-20	23-Sep-20	23-Sep-20	23-Sep-20	23-Sep-20			
Sample Type	Soil - B	Soil - D	Solid	Solid	Soil - D	Soil - D	Solid			
Sample Matrix Code	4A	5AE	7	7	5A	5AE	7			
% Stones >10mm _A	56.0	<0.1	<0.1	<0.1	5.4	<0.1	<0.1	% w/w	0.1	A-T-044
pH BRE _D ^{MF}	8.12	8.08	8.48	8.27	8.60	7.93	8.39	pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D	<10	40	15	13	33	133	45	mg/l	10	A-T-026s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: CJ Associates, King Road , Bristol, BS11 9HF

Project No: 20/08179

Project: Duval House'

Date Received: 28/09/2020 (am)

Clients Project No: 2071416-114584-S8142

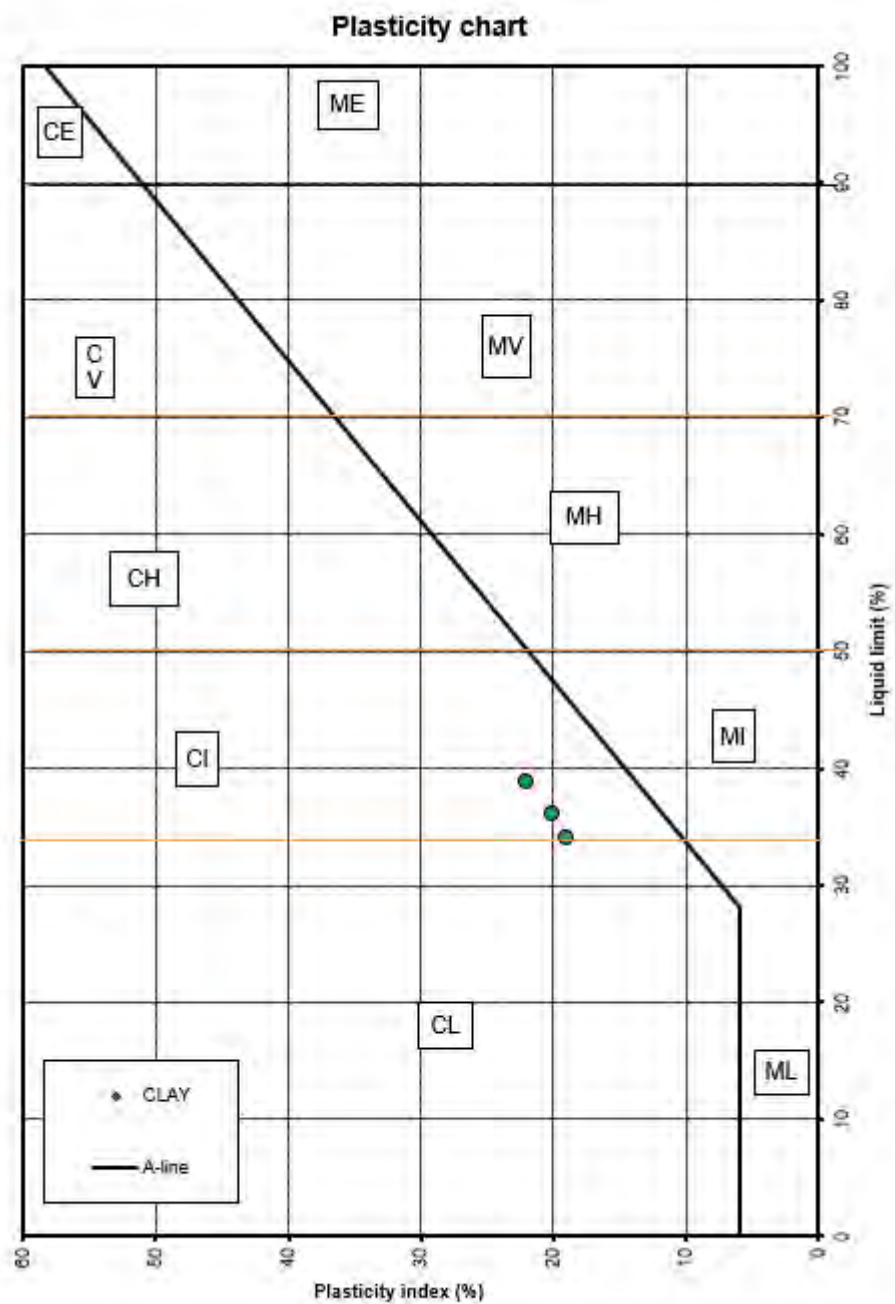
Cool Box Temperatures (°C): 7.5

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

APPENDIX 5

PLASTICITY CHART



APPENDIX 6

REPORT LIMITATIONS

REPORT LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget and staff resources allocated to the project.

Other than that, expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important factor in determining the scope and level of the services. Should the purpose for which the report is used, or the proposed use of the site change, this report will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2020 and should be read in light of any subsequent changes in legislation, statutory requirements and industry best practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth

Environmental & Geotechnical Ltd interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.