GEO-ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

FOR

254 KILBURN HIGH ROAD, LONDON NW6 2BS



Specialists in the investigation & reclamation of brownfield sites



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EXECUTIVE SUMMARY

254 Kilburn HR LLP (the client) commissioned Jomas Associates Ltd ('JAL') to undertake a Geoenvironmental and Geotechnical ground investigation at a site on site 254 Kilburn High Road, London.

The principle objectives of the study were as follows:

- To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;;
- To provide an assessment of the environmental sensitivity at the site and the surrounding area, in relation to any suspected or known contamination which may significantly affect the site and the proposed development;
- To conduct an intrusive investigation, to determine the nature and extent of contaminants potentially present at the site;
- To establish the presence of significant pollutant linkages, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA report R&D CLR 11; and,
- To obtain geotechnical parameters to inform preliminary foundation design.

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis.



Site History and Ground Investigation				
Site History Overview	A Desk Study report produced for the site has been issued separately.			
	A review of historical maps indicates that the site was originally (1866) occupied by gardens to the rear of a row of properties on Edgware Road, with a building noted as Stanmore terrace encroaching on the south-eastern edge of the site. A further building is present in the north-eastern part of the site in 1866. Further buildings are constructed on site by 1893. The structures on site are subsequently modified over the years, with the site appearing similar to the present day by 1995. The site is labelled as a Timber yard in 1935, a Motor Units Factory in 1953, and a Warehouse from 1976.			
	Historically, the surrounding area has been utilised for a variety of uses, with several industrial uses noted from 1871. Notable industrial uses within the surrounding area include railway lines, garage (60m SE and 220m NW), engineering works (150m N, 175m E), gas works (125m NW).			
	Information provided by the British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial or superficial deposits are reported within the site.			
	The deposits directly underlying the site are identified as Unproductive.			
	There is no groundwater abstraction license within 500m. The nearest borehole is reported 1794m east of the site for spray irrigation sourced from Thames Groundwater. There are no surface water abstractions reported within 2km of the site.			
	The site is not reported to lie within a Zone 2 or 3 floodplain.			
Intrusive Investigation	The ground investigation was undertaken on 09 - 16 October 2014, and consisted of the following:			
	• 5No. window sampling boreholes, drilled up to 4.45m below ground level (bgl), with associated in situ testing and sampling;			
	• 2No. cable percussive boreholes, drilled up to 25m bgl with associated in situ testing and sampling;			
	• 7No. hand excavated trial pits, excavated up to 1.7m bgl, with associated in situ testing and sampling			
	• 3No. in situ CBR measurements undertaken to depths of up to 0.9m bgl;			
	Laboratory analysis for chemical and geotechnical purposes,			
Ground Conditions	The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay Formation), encountered to the base of the boreholes at up to 25m bgl.			
	No obvious evidence of contamination was observed during the investigation.			
	Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was not recorded during return monitoring.			



Environmental Considerations	Following generic risk assessments and statistical analysis, the upper ninety fifth percentile values for lead were found to exceed their respective criteria. No other contaminants were reported above their respective criteria and no asbestos fibres were detected.
	Naphthalene was found to exceed the generic assessment criteria for human health within one sample (WS1 @ 1.0m bgl). In all the other 9No. samples which were tested for naphthalene, the detected concentration did not exceed the limit of detection of 0.5mg/kg. It is therefore considered that the made ground in WS1 comprises an isolated hotspot of naphthalene contamination, and therefore statistical assessment is not appropriate for naphthalene. Given the low PID readings recorded during headspace monitoring of the wells, and the absence of any recorded hydrocarbon odours or staining within the soils encountered on site, a potential pollutant linkage via vapour inhalation is not considered to exist.
	Where the site is to be overlain by either proposed building footprint or areas of hardstanding, these concentrations are no considered to pose a significant risk to human health, as the building / surfacing will provide a suitable barrier to potential receptors. Where areas of soft landscaping are proposed, the risks to end users will be controlled by use of a capping layer. This should comprise a minimum 600mm thickness of imported clean topsoil.
	The desk study identified the site to be directly underlain by unproductive deposits (London Clay Formation), with no significant controlled water receptors identified. Groundwater was not encountered during the investigation. Therefore a pollutant linkage is not considered to pose a potential risk to controlled waters.
	The results of waste acceptance criteria testing indicated the Made Ground to be acceptable for disposal as a non-hazardous material, with the underlying natural ground suitable for disposal as inert material.
	The results of soil gas monitoring undertaken to date indicate the site to be classified as Characteristic Situation 2, where basic gas protection measures are required.
	Barrier pipe may be required for the proposed development. The water supply pipe requirements for this site should be discussed at an early stage with the relevant utility provider.
	A remedial strategy will be required for the proposed development.
	As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out, and caution must be exercised during construction works. Should any contamination be encountered, a suitably qualified environmental consultant should be informed immediately, so that adequate measures may be recommended.
Geotechnical Considerations	The desk study report indicates that the site is directly underlain by solid deposits of the London Clay Formation. The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay), encountered to the base of the boreholes at up to 25m bgl.
	Based upon the information obtained to date, it is considered that deep trench fill foundations, constructed at a depth of 3.0m bgl within the underlying London Clay may be designed with an allowable bearing capacity of 120kPa. Alternatively a piled foundation solution within the underlying London Clay should be devised for the proposed development.



The London Clay deposits have been identified as being of moderate to high volume change potential, and this will require consideration when designing foundations for the proposed development, in conjunction with the presence of any existing or proposed trees. Potential for heave should be considered.

The results of in situ CBR testing provided indicative measurements of between 1.2% and 28.4%.

Based on the results the required concrete class for the site is DS-2 assuming an Aggressive Chemical Environment for Concrete classification of AC-2 in accordance with the procedures outlined in BRE Special Digest 1.

To allow for potential volume change within the underlying London Clay, and due to the thickness of Made Ground deposits encountered, all floor slabs should be designed as suspended floors.

Deep excavations will be required at the site during the construction works. These are anticipated to remain stable for the short term only. It is recommended that the stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported or battered back to a safe angle.

Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was note recorded during return monitoring. Any groundwater encountered should be readily dealt with by conventional pumping from a sump or other suitable method. A combination of the Cordek Cellvent panels below the ground floor slab, air brick ventilations and gas resistant membrane on top of the slab is proposed.

The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably qualified Engineer.

4



1 INTRODUCTION

1.1 **Terms of Reference**

- 254 Kilburn HR LLP ("The Client") has commissioned Jomas Associates Ltd ('JAL'), to 1.1.1 assess the risk of contamination posed by the ground conditions at a site on 254 Kilburn High Road, London, and to provide indicative recommendations for foundation design prior to the redevelopment of the site. It is understood that the redevelopment of the site is to comprise construction of a new mixed use development, with ground floor commercial units and residential apartments on upper floors. Minor areas of soft landscaping are anticipated.
- To this end a Desk Study has been produced for the site and issued separately, 1.1.2 followed by an intrusive investigation (detailed in this report). The scope of works is defined in Jomas' fee proposal dated 09 October 2014.

1.2 **Objectives**

- 1.2.1 The objectives of JAL's investigation were as follows:
 - To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;
 - To provide an assessment of the environmental sensitivity at the site and the surrounding area, in relation to any suspected or known contamination which may significantly affect the site and the proposed development;
 - To conduct an intrusive investigation, to determine the nature and extent of contaminants potentially present at the site;
 - To establish the presence of significant pollutant linkages, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA report R&D CLR 11; and,
 - To obtain geotechnical parameters to inform preliminary foundation design.

1.3 Scope of Works

- 1.3.1 The following tasks were undertaken to achieve the objectives listed above:
 - Intrusive ground investigation to determine shallow ground conditions, and potential for contamination at the site;
 - Undertaking of laboratory chemical and geotechnical testing upon samples obtained:
 - The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.4 Limitations

1.4.1 Jomas Associates Ltd ('JAL') has prepared this report for the sole use of 254 Kilburn HR LLP in accordance with the 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 by any other party without the explicit written agreement of JAL. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.



- 1.4.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless JAL has actual knowledge to the contrary, information obtained from public sources or provided to JAL by site personnel and other information sources, have been assumed to be correct. JAL does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.
- 1.4.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.
- 1.4.4 This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.



2 SITE SETTING

2.1 Site Information

2.1.1 The site location plan is appended to this report as Figure 1.

Table 2.1: Site Information				
Name of Site	-			
Address of Site 254 Kilburn High Road, London, NW6 2BS				
Approx. National Grid Ref. 524975, 184276				
Site Ownership	Unknown			
Site Occupation	Office accommodation with associated warehouse and vehicle parking			
Local Authority	London Borough of Camden			
Proposed Site Use	Mixed use development with commercial ground floor units and residential apartments. Minor areas of soft landscaping areas are anticipated.			

Table	2.1:	Site	Inforr	nation

2.2 Desk Study Overview

- 2.2.1 A Desk Study report has been produced for the site and issued separately. A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information.
- 2.2.2 A review of historical maps indicates that the site was originally (1866) occupied by gardens to the rear of a row of properties on Edgware Road, with a building noted as Stanmore Terrace encroaching on the south-eastern edge of the site. A further building is present in the north-eastern part of the site. Further buildings are constructed on site by 1893. The structures on site are subsequently modified over the years, with the site appearing similar to the present day by 1995. The site is labelled as a Timber yard in 1935, a Motor Units Factory in 1953, and a Warehouse from 1976.
- 2.2.3 Historically, the surrounding area has been utilised for a variety of uses, with several industrial uses noted from 1871. Notable industrial uses within the surrounding area include railway lines, garage (60m SE and 220m NW), engineering works (150m N, 175m E), gas works (125m NW), etc.
- 2.2.4 Information provided by the British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial or superficial deposits are reported within the site.
- 2.2.5 The deposits directly underlying the site are identified as Unproductive.
- 2.2.6 There is no groundwater abstraction license within 500m. The nearest borehole is reported 1794m east of the site for spray irrigation sourced from Thames Groundwater. There are no surface water abstractions reported within 2km of the site.
- 2.2.7 The site is not reported to lie within a Zone 2 or 3 floodplain.



- 2.2.8 The conceptual site model provided within the report identifies the following potential sources, pathways and receptors. The report indicates the following potential sources of contamination:
 - Potential Made Ground associated with previous developments on and off • site
 - Potential for asbestos in soil from demolition of previous buildings on site (S2)
 - Former Timber Yard on site (S3) •
 - Former Motor Units Factory on site (S4) •
 - Current industrial use on site (S5)
 - Current and previous industrial sites and consents/depots/works off site (S6)
- The conceptual site model identifies the following potential pathways: 2.2.9
 - Ingestion and dermal contact with contaminated soil (P1)
 - Inhalation or contact with potentially contaminated dust and vapours (P2)
 - Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3)
 - Horizontal and vertical migration of contaminants within groundwater (P4) •
 - Accumulation and Migration of Soil Gases (P5)
- 2.2.10 The conceptual site model identifies the following potential receptors:
 - Construction workers (R1)
 - Maintenance workers (R2)
 - Neighbouring site users (R3)
 - Future site users (R4)
 - Building foundations and on site buried services (water mains, electricity and sewer) (R5)
 - On site vegetation (R6)
- 2.2.11 Depending on ground conditions encountered i.e., thickness of made ground and depth to London clay deposits, a programme of soil gas monitoring may be required in accordance with CIRIA C665:2007.



3 **GROUND INVESTIGATION**

3.1 Rationale for Ground Investigation

- 3.1.1 The site investigation has been undertaken generally in accordance with Contaminated Land Report 11, BS10175, NHBC Standards Chapter 4.1, and other associated Statutory Guidance. If required, further targeted investigations and remedial option appraisal would be dependent on the findings of this site investigation.
- 3.1.2 The soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).
- 3.1.3 The sampling proposal was designed in order to gather data representative of the site conditions.

3.2 Scope of Ground Investigation

- 3.2.1 The ground investigation was undertaken on 09 16 October 2014.
- 3.2.2 The work was undertaken in accordance with BS5930 'Code of Practice for Site Investigation' and BS10175 'Investigation of Potentially Contaminated Sites'. All works were completed without incident.
- 3.2.3 The investigation focused on collecting data on the following:
 - Quality of Made Ground/ natural ground within the site boundaries;
 - Presence of groundwater beneath the site (if any), perched or otherwise;
- 3.2.4 A summary of the fieldwork carried out at the site, with justifications for exploratory hole positions, are offered in Table 3.1 below.

Investigation Type	Number of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (m BGL)	Justification
Window Sample Boreholes	5	WS1 - 5	Up to 4.45m bgl	Assess ground conditions and obtain samples for contamination testing and geotechnical analysis.
Cable Percussive boreholes	2	BH1 - 2	Up to 25m bgl	Obtain deeper ground profile and samples for geotechnical analysis
Hand Excavated trial pits	7	TP1 - 7	Up to 1.7m bgl	Obtain shallow samples from areas of restricted access
In Situ CBR Measurements	3	CBR1 - 3	Up to 0.9m bgl	Provide initial value for road pavement design
Installation of combined gas and groundwater monitoring wells	2	BH2, WS3	Up to 20m bgl	Permit return visits to site to monitor soil gas and groundwater levels.

Table 3.1 – Scope of Intrusive Investigation



- 3.2.5 The exploratory holes were completed to allow soil samples to be taken in the areas of interest identified in Table 3.1 above. In all cases, all holes were logged in accordance with BS5930:1999.
- 3.2.6 Exploratory hole positions were measured in using tape and reel, as shown in the exploratory hole location plan presented in Appendix 1. The exploratory hole records are included in Appendix 2.
- 3.2.7 Where no monitoring wells were installed, the exploratory holes were backfilled with the arisings (in the reverse order in which they were drilled) and the ground surface was reinstated so that no depression was left.

3.3 Standard Penetration Tests (SPTs)

- 3.3.1 In-situ standard/cone penetration tests were undertaken in the boreholes in accordance with BS EN ISO 22476-2 'Methods of Test on Soils for Engineering Purposes (Part 9)'; to determine the relative density of the underlying soil, and therefore give an indication of soil 'strength'.
- 3.3.2 The results are presented on the individual exploratory hole records in Appendix 2.

3.4 In Situ CBR Measurements

- 3.4.1 A total of 3No. in situ CBR measurements were undertaken to provide indicative CBR values for pavement design.
- 3.4.2 The results are presented as Appendix 7, and discussed in Section 9 of this report.

3.5 Sampling Rationale

- 3.5.1 Our soil sampling rationale for the site investigation was developed with reference to EA guidance 'Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination' (Technical Report P5-066/TR).
- 3.5.2 The exploratory holes were positioned by applying a combined non-targeted sampling strategy, as well as sample locations positioned with reference to sources identified from the desk study.
- 3.5.3 Soil samples were taken from across the site at various depths as shown in the exploratory hole logs.
- 3.5.4 JAL's engineers normally collect samples at appropriate depths based on field observations such as:
 - appearance, colour and odour of the strata and other materials, and changes in these;
 - the presence or otherwise of sub-surface features such as pipework, tanks, foundations and walls; and,
 - areas of obvious damage, e.g. to the building fabric.
- 3.5.5 A number of the samples were taken from the top 0-1m to aid in the assessment of the pollutant linkages identified at the site. In addition, some deeper samples were taken to aid in the interpretation of fate and transport of any contamination identified.



- 3.5.6 Samples were stored in cool boxes (<4°C) and preserved in accordance with laboratory guidance.
- 3.5.7 Bulk samples were collected for geotechnical analysis.
- 3.5.8 Groundwater strikes noted during drilling, are recorded within the exploratory hole records in Appendix 2.

3.6 Laboratory Analysis

3.6.1 A programme of chemical laboratory testing, scheduled by JAL, was carried out on selected samples of Made Ground and natural strata.

Chemical Testing

- 3.6.2 Soil samples were submitted to The Environmental Laboratory Ltd, East Sussex (a UKAS and MCerts accredited laboratory), for analysis.
- 3.6.3 The samples were analysed for a wide range of contaminants as shown in Table 3.2 below:

Test Suite No. of tests				
	Made Ground	Natural		
Basic Suite 2	9	1		
Total Organic Carbon	4	2		
Water Soluble Sulphate	9	9		
Asbestos Screen	4	-		

Table 3.2: Chemical Tests Scheduled

3.6.4 The determinands contained in the basic suite are as detailed in Table 3.3 below:



Table 3.3: Basic Suite of Determinands					
DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE		
Arsenic	5	Y (MCERTS)	ICPMS		
Cadmium	0.5	Y	ICPMS		
Chromium	1	Y (MCERTS)	ICPMS		
Chromium (Hexavalent)	2	Ν	Colorimetry		
Lead	1	Y (MCERTS)	ICPMS		
Mercury	0.5	Y	ICPMS		
Nickel	1	Y (MCERTS)	ICPMS		
Selenium	1	PENDING	ICPMS		
Copper	1	Y (MCERTS)	ICPMS		
Zinc	1	Y (MCERTS)	ICPMS		
Boron (Water Soluble)	0.5	PENDING	ICPMS		
pH Value	0.1 units	Y (MCERTS)	Electrometric		
Sulphate (Water Soluble)	0.01ug/l	Y	Ion Chromatography		
Total Cyanide	1	Y (MCERTS)	Colorimetry		
Speciated PAH	0.5	Y (MCERTS)	GCFID		
Phenols	1	Y (MCERTS)	HPLC		
Total Petroleum Hydrocarbons (banded)	5	Y (MCERTS)	Gas Chromatography		

- 3.6.5 To support the derivation of appropriate tier 1 screening values, 6 No. samples were also analysed for total organic carbon.
- 3.6.6 Laboratory test results are summarised in Section 6, with raw laboratory data included in Appendix 3.

Geotechnical Laboratory Testing

- 3.6.7 In addition to the contamination assessment, soil samples were submitted to the UKAS Accredited laboratory of PSL for the following assessment.
 - 5No. samples for Moisture Content and Atterberg Limit Determination in accordance with BS 1377
 - 11No. sample for Quick Undrained Triaxial Compression Tests in accordance with BS 1377
- 3.6.8 The results of the geotechnical laboratory testing are presented as Appendix 4 and discussed in Section 9 of this report.



4 **GROUND CONDITIONS**

4.1 Soil

Ground conditions were logged in accordance with the requirements of BS5930:1999. 4.1.1 Detailed exploratory hole logs are provided in Appendix 2. The ground conditions encountered are summarised in Table 4.1 below, based on the strata observed during the investigation.

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
TARMAC and CONCRETE over MADE GROUND – Brown/black/orange sandy gravelly clay to clayey gravelly sand. Gravel is of brick, concrete, flint, mortar, ash and glass.	0.0	0.7 – 2.1	0.7 – 2.1
Orange brown sandy to silty patched blue grey CLAY with occasional flints, becoming predominantly blue grey with depth Encountered to base of window sample and cable percussive boreholes.	0.7 – 2.1	>25.0	>24.3

Table 4 1	Ground	Conditions	Encountered
1 abie 4.1	Ground	Conditions	LIICOUIIIEIEU

4.2 Hydrogeology

4.2.1 Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was not recorded during return monitoring.

4.3 Physical and Olfactory Evidence of Contamination

No visual or olfactory evidence of potential contamination was reported during the 4.3.1 course of the investigation.



5 **RISK ASSESSMENT – ANALYTICAL FRAMEWORK**

5.1 **Context and Objectives**

- 5.1.1 This section seeks to evaluate the level of risk pertaining to human health and the environment which may result from both the existing use and proposed future use of the site. It makes use of the site investigation findings, as described in the previous sections, to evaluate further the potential pollutant linkages identified in the desk study. A combination of qualitative and quantitative techniques is used, as described below.
- 5.1.2 The purpose of generic quantitative risk assessment is to compare concentrations of contaminants found on site against screening level generic assessment criteria (GAC) to establish whether there are actual or potential unacceptable risks. It also determines whether further detailed assessment is required. The approaches detailed all broadly fit within a tiered assessment structure in line with the framework set out in the Department of Environment, Food and Rural Affairs (DEFRA), EA and Institute for Environment and Health Publication, Guidelines for Environmental Risk Assessment and Management.
- 5.1.3 It should be noted that the statistical tests carried out in this report in accordance with CL:AIRE and CIEH (2008) recommendations, are for guidance purposes only and the conclusions of this report should be approved by the local authority prior to any redevelopment works being undertaken.

5.2 **Analytical Framework – Soils**

- 5.2.1 There is no single methodology that covers all the various aspects of the assessment of potentially contaminated land and groundwater. Therefore, the analytical framework adopted for this investigation is made up of a number of procedures, which are outlined below. All of these are based on a Risk Assessment methodology centred on the identification and analysis of Source – Pathway – Receptor linkages.
- 5.2.2 The CLEA model provides a methodology for quantitative assessment of the long term risks posed to human health by exposure to contaminated soils. Toxicological data have been used to calculate Soil Guideline Values (SGV) for individual contaminants, based on the proposed site use; these represent minimal risk concentrations and may be used as screening values.
- 5.2.3 In the absence of any published SGVs for certain substances, or where the assumptions made in generating the SGVs do not apply to the site, JAL have derived Tier 1 screening values for initial assessment of the soil, based on available current UK guidance including the LQM/CIEH generic assessment criteria. Site-specific assessments are undertaken wherever possible and/or applicable. All assessments are carried out in accordance with the CLEA protocol.
- 5.2.4 CLEA requires a statistical treatment of the test results to take into account the normal variations in concentration of potential contaminants in the soil and allow comparisons to be made with published guidance.
- 5.2.5 The assessment criteria used for the screening of determinands within soils are identified within Table 5.1.



Substance Group	Determinand(s)	Assessment Criteria
		Selected
Organic Substances		
Non-halogenated Hydrocarbons	Total Petroleum Hydrocarbons (TPHCWG banded)	LQM/CIEH
	Total Phenols	CLEA v1.06
Polycyclic Aromatic Hydrocarbons (PAH-16)	Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene	LQM/CIEH
Volatile Organic Compounds (VOCs/sVOCs).	Toluene, Ethylbenzene	CLEA v1.06
(**************************************	Benzene, Xylenes	CLEA v1.06
Inorganic Substances		'
Heavy Metals and Metalloids	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium	CLEA v1.06
	Copper, Zinc	LQM/CIEH
Cyanides	Free Cyanide	CLEA v1.06
Sulphates	Water Soluble Sulphate	BRE Special Digest 1:2005

Table 5.1: Selected Assessment Criteria – Contaminants in Soils

BRE

The BRE Special Digest 1:2005, 'Concrete in Aggressive Ground' is used with soluble 5.2.6 sulphate and pH results to assess the aggressive chemical environment of future underground concrete structures at the site.

5.3 Analytical Framework – Groundwater and Leachate

- 5.3.1 The groundwater quality assessment is undertaken in accordance with the EA P20 Document.
- 5.3.2 The criteria used by JAL in the assessment of groundwater and leachate quality are shown in Table 5.2.



Substance Group	Determinand(s)	Assessment Criteria Selected
Metals	Arsenic, Copper, Cyanide, Mercury, Nickel, Lead, Zinc, Chromium	EQS/DWS
	Selenium	DWS/WHO
PAHs	(Sum of Four – benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, indeno(1,2,3- c,d)pyrene)	DWS
PAHs	Anthracene, Benzo(a)pyrene, Fluoranthene, Naphthalene	EQS
Total Petroleum Hydrocarbons	Aliphatic C5-C6, Aliphatic >C6-C8, Aliphatic >C8-C10. Aliphatic >C10-C12, Aliphatic >C12-C16, Aliphatic >C16-C21, Aromatic C5-C7, Aromatic >C7-C8, Aromatic >C8-C10, Aromatic >C10-C12, Aromatic >C12-C16, Aromatic >C16-C21, Aromatic >C16-C21, Aromatic >C21-C35	Dutch Intervention Values/DWS/WHO
Benzene	Benzene	DWS
Toluene	Toluene	EQS
Ethylbenzene	Ethylbenzene	EQS
Xylene	Xylene	EQS
Oxygen Demand	Chemical Oxygen Demand and Biological Oxygen Demand	Urban Waste Water Treatment (England and Wales) Regulations

Table 5.2: Selected Assessment Criteria – Contaminants in Water

Environmental Quality Standards EQS

Environmental Quality Standards (EQS) have been released by the EA for dangerous substances, as identified by the EC Dangerous Substances Directive. EQS can vary for each substance, for the hardness of the water and can be different for fresh, estuarine or coastal waters.

Lowest Effect Concentration (LEC)

These criteria relate to the concentration of PAHs in groundwater. They are taken from the EA R&D Technical Report P45 – Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environmental Quality Standard Development (2001).

WHO Health

These screening criteria have been taken from the World Health Organisation Guidelines for Drinking Water Quality (1984). The health value is a guideline value representing the concentration of a contaminant that does not result in any significant risk to the receptor over a lifetime of exposure.

Further criteria have been obtained from 'Petroleum Products in Drinking-water' -Background document for development of WHO Guidelines for Drinking-water Quality (2005).



UK Drinking Water Standards (DWS)

These comprise screening criteria provided by the Drinking Water Inspectorate (DWI) in the Water Supply (Water Quality) Regulations 2006,

Dutch Intervention Values (DIV)

The Dutch Institute and Human Toxicology data are used for speciated TPH. Whilst they do not have force of law in the UK, they are recognised as a valid source of information by the EA. For example, they are recommended in the EA document 'Biological Test Methods for Assessing Contaminated Land'.

Urban Waste Water Treatment (England and Wales) Regulations - UWWT Regs The Urban Waste Water Treatment (England and Wales) Regulations SI/1994/2841 as amended by SI/2003/1788 sets down minimum standards for the discharge of treated effluent from wastewater treatment works to inland surface waters, groundwater, estuaries or coastal waters. Standards of (125mg/L) COD and (25mg/L) BOD have been set.

Generic Assessment Criteria

5.3.3 The criteria adopted in the selection of correct screening criteria from published reports as previously described, are provided within Tables 5.3.

Table 5.3: Site Specific Data					
Input Details	Value				
Land Use	Residential with plant uptake				
Soil Organic Matter	2.5%				

- 5.3.4 As the published reports only offer the option of selecting an SOM value of 1%, 2.5% or 6%, an SOM value of 2.5% has been used for the generation of generic assessment criteria, as 2.09% was the mean value obtained from laboratory analysis.
- It is understood that the redevelopment of the site is to comprise a multi-storey mixed 5.3.5 use development, with commercial ground floor units and residential apartments on upper floors. Minor areas of soft landscaping are anticipated. Consequently, the site has been assessed as Residential with Plant Uptake.



6 GENERIC QUANTITATIVE RISK ASSESSMENT

6.1 Screening of Soil Chemical Analysis Results – Human Health Risk Assessment

- 6.1.1 To focus on the contaminants of potential concern (COPC), the results have been compared with the respective SGV/GAC. Those contaminants which exceed the SGV/GAC are considered to be the COPC. Those which do not exceed the respective SGV/GAC are not considered to be COPC and as such do not require further assessment in relation to the proposed development of the site.
- 6.1.2 Laboratory analysis for soils are summarised in Tables 6.1 to 6.3. Raw laboratory data is included in Appendix 3.

Determinand	Unit	No. samples tested	Screening Criteria		Min	Мах	No of Exceedences
Arsenic	mg/kg	10	37	S4UL	10.6	33.7	0
Cadmium	mg/kg	10	11	S4UL	<0.5	1.3	0
Chromium	mg/kg	10	910	S4UL	15.9	48.4	0
Lead	mg/kg	10	200	C4SL	38.4	2530	7No WS1 @ 1.00 WS2 @ 2.00 WS3 @ 1.50 WS4 @ 0.50 WS4 @ 1.00 WS5 @ 0.30 WS5 @ 1.00
Mercury	mg/kg	10	40	S4UL	<0.5	2.3	0
Nickel	mg/kg	10	180	S4UL	15.7	36	0
Copper	mg/kg	10	2400	S4UL	21.2	204	0
Zinc	mg/kg	10	3700	S4UL	54.5	837	0
Total Cyanide ^A	mg/kg	10	33	CLEA v 1.06	<1	<1	0
Selenium	mg/kg	10	250	S4UL	<1	2.2	0
Boron Water Soluble	mg/kg	10	290	S4UL	1.4	5.1	0
Phenols	mg/kg	10	120	S4UL	<5	<5	0

Table 6.1: Soil Laboratory Analysis Results – Metals, Metalloids, TPH

Notes: ^A Generic assessment criteria derived for free inorganic cyanide.



Determinand	Unit	No. Samples Tested	Screening Criteria		Min	Max	No. Exceeded
Naphthalene	mg/kg	10	S4UL	5.6	<0.5	10.7	1No. WS1 @ 1.0m
Acenaphthylene	mg/kg	10	S4UL	420	<0.5	<0.5	0
Acenaphthene	mg/kg	10	S4UL	510	<0.5	1.9	0
Fluorene	mg/kg	10	S4UL	400	<0.5	0.6	0
Phenanthrene	mg/kg	10	S4UL	220	<0.5	2.2	0
Anthracene	mg/kg	10	S4UL	5400	<0.5	1.6	0
Fluoranthene	mg/kg	10	S4UL	560	<0.5	2.5	0
Pyrene	mg/kg	10	S4UL	1200	<0.5	2.2	0
Benzo(a)anthracene	mg/kg	10	S4UL	11	<0.5	1.7	0
Chrysene	mg/kg	10	S4UL	22	<0.5	1.9	0
Benzo(b)fluoranthene	mg/kg	10	S4UL	3.3	<0.5	1.1	0
Benzo(k)fluoranthene	mg/kg	10	S4UL	93	<0.5	1.8	0
Benzo(a)pyrene	mg/kg	10	S4UL	2.7	<0.5	1.7	0
Indeno(123-cd)pyrene	mg/kg	10	S4UL	36	<0.5	0.9	0
Dibenz(ah)anthracene	mg/kg	10	S4UL	0.28	<0.5	<0.5	0
Benzo(ghi)perylene	mg/kg	10	S4UL	340	<0.5	0.8	0
Total PAH	mg/kg	10	-		<2.0	18.0	

Table 6.2: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs)

Table 6.3: Soil Laboratory Analysis- Total Petroleum Hydrocarbons (TPH)

TPH Band	Unit	No. Samples Tested	Screening Criteria		Min	Мах	No. Exceeded	
C ₈ -C ₁₀	mg/kg	10	S4UL	65	<1.0	8.1	0	
>C ₁₀ -C ₁₂	mg/kg	10	S4UL	180	<1.0	55.6	0	
>C ₁₂ -C ₁₆	mg/kg	10	S4UL	330	<1.0	135	0	
>C ₁₆ -C ₂₁	mg/kg	10	S4UL	540	<1.0	77.8	0	
>C ₂₁ -C ₃₅	mg/kg	10	S4UL	1500	2.1	32.8	0	
Total TPH	mg/kg	10	-	-	2.1	314	-	
Note: *The lowe	Note: *The lower value of guidelines for Aromatic/Aliphatics has been selected							

6.2 Statistical Analysis

6.2.1 Where samples tested exceeded the selected screening criteria, and the minimum numbers of samples were more than six, statistical analyses of the dataset are undertaken.



- 6.2.2 The CL:AIRE/CIEH Guidance 'Guidance on Comparing Soil Contamination Data with a Critical Concentration' (2008) describes the new approach to statistical analysis of datasets generated through the investigation of contaminated land. This includes differing statistical methodologies for the analysis of normally and non-normally distributed data. Different approaches to datasets being analysed under Part IIA and under the planning regime are also presented.
- 6.2.3 Chemical data from the laboratory testing has been assessed in accordance with the CL:AIRE/CIEH Guidance under a planning scenario. The purpose of the assessment is to determine if the land is suitable for the proposed development. Under the planning scenario, the key question is 'is there sufficient evidence that the true mean concentration of the contaminant within the data set (μ) is less than the critical concentration (Cc, in this instance the derived GAC). This is assessed by calculation of the upper confidence limit (UCL). The statistical test assesses the 95th percentile of contaminant populations across a site, and compares this value against the relevant GAC. Furthermore, the test determines statistically whether contaminants exceeding the soil guideline value could be regarded as outliers. Outliers are contaminant values which indicate a localised area of contamination or error in sampling, and may not be a member of the underlying population.
- 6.2.4 The statistical tests were run for:
 - Lead
- 6.2.5 Statistical assessment has not been undertaken for naphthalene, as exceedance of the limit of detection was detected in one sample only WS1 @ 1.0m bgl. In all the other 9No. samples which were tested for naphthalene, the detected concentration did not exceed the limit of detection of 0.5mg/kg. It is therefore considered that the made ground in WS1 comprises an isolated hotspot of naphthalene contamination, and therefore statistical assessment is not appropriate.
- 6.2.6 6.2.7 The results of statistical tests are presented in Appendix 5. Table 6.4 below provides the summary of statistical tests.

Table: 6.4: Statistical Test Results					
Determinand	95% UCL	Cc/GAC	GAC Exceeded		
Lead	1561	200	Y		

- . . . C. A. Statistical Test D

6.3 Asbestos in Soil

- 6.3.1 4No. random samples of the made ground were screened in the laboratory for the presence of asbestos. These comprised samples taken from;
 - WS1 0.50m bgl
 - WS3 0.50m bgl •
 - WS3 1.50m bgl
 - WS4 0.50m bgl

6.3.2 No asbestos fibres were detected.

6.4 Screening of Soil Chemical Analysis Results - Potential Risks to Plant Growth



- 6.4.1 Zinc, copper and nickel are phytotoxins and could therefore inhibit plant growth in soft landscaped areas. Concentrations measured in soil for these determinands have been compared with the pH dependent values given in BS3882:2007.
- 6.4.2 Adopting a pH value of greater than 7, as indicated by the results of the laboratory analysis, the following is noted;
 - Zinc concentrations revealed by this investigation ranged from 54.5mg/kg to • 837mg/kg, with 3No. samples exceeding the threshold of 300mg/kg.
 - Copper concentrations revealed by this investigation ranged from 21.2mg/kg • to 204mg/kg, with 1No. sample (WS1 @0.5m bgl) exceeding the threshold of 200mg/kg.
 - Nickel concentrations revealed by this investigation ranged from 15.7mg/kg to • 36mg/kg, below the threshold of 110mg/kg.

Screening for Water Pipes 6.5

6.5.1 The results of the analysis have been assessed for potential impact upon water supply pipes. Table 6.5 below summarises the findings of the assessment:

	No. of	Threshold	Value for sit	te data (mg/kg)	
Determinand	tests	adopted for PE (mg/kg)	Min	Мах	No of Exceedances
Total VOCs	-	0.5	N/A	N/A	-
BTEX	2	0.1	<0.01	<0.01	-
MTBE	-	0.1	N/A	N/A	-
EC5-EC10	10	1	<0.1*	8.1	1No. WS1 @1.0m
EC10-EC16	10	10	<2.0*	190.6	1No. WS1 @1.0m
EC16-EC40	10	500	3.5	115.1	-
Naphthalene	10	5	<0.05	10.7	1No. WS1 @1.0m
Phenols	10	2	<5*	<5*	-

Table 6.5: Screening Guide for Water Pines

*Laboratory detection limit

- Determinands marked "N/A" were not analysed for as no evidence of their presence 6.5.3 was obtained from the Desk Study.
- 6.5.4 The above suggests that upgraded pipe work may be required.
- 6.5.5 Alternatively, it may be possible to utilise other protection methods including (but not limited to):
 - diversion of the pipe,
 - localised remediation
- 6.5.6 The water supply pipe requirements for this site should be discussed at an early stage with the relevant utility provider.



6.6 Waste Disposal

- 6.6.1 In order to provide an assessment of likely disposal requirements for site spoil, 1No. sample of the Made Ground and 1No. sample of the underlying natural ground were submitted for Waste Acceptance Criteria testing.
- 6.6.2 The results of the testing would indicate the underlying natural ground to be classified as Inert for the purposes of disposal, with the Made Ground classified as Non-hazardous.



7 SOIL GAS RISK ASSESSMENT

7.1 Soil Gas Results

- 7.1.1 A total of 3No. return monitoring visits to site have been undertaken to the site.
- 7.1.2 The results of the monitoring undertaken to date are summarised in Table 7.1 below, with the monitoring records presented in Appendix 6.

Hole Nr.	CH4 (%)	CO2 (%)	O2(%)	H2S (ppm)	Atmospheric Pressure (mb)	VOCs	Flow Rate (I/hr)	Depth to water	Depth of hole
WS3	<0.1	8.4 - 9.4	9.9 – 11.0	<0.1	983 - 1009	<0.1 – 0.3	0.2 – 0.8	Dry	2.54
BH2	<0.1	0.5 – 0.7	20.0 - 20.5	<0.1	983 - 1009	<0.1 – 0.3	0.2 – 0.4	Dry	18.54

Table 7.1 : Summary of Gas Monitoring Data

7.2 Screening of Results

- 7.2.1 As shown in Table 7.1, no methane has been recorded to date. Carbon dioxide has been reported to a maximum concentration of 9.4% v/v. Oxygen concentrations varied between 9.9% and 20.5%, with volatile organic compounds reported to a maximum concentration of 0.3ppm. A maximum flow rate of 0.8l/hr has been reported.
- 7.2.2 In the assessment of risks posed by hazardous ground gases and selection of appropriate mitigation measures, BS8485 (2015) identifies four types of development, termed Type A to Type D.
- 7.2.3 Type B buildings are defined as
- 7.2.4 " private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels."
- 7.2.5 Type B has been adopted as the relevant category for the proposed development.
- 7.2.6 The soil gas assessment method is based on that proposed by Wilson & Card (1999), which was a development of a method proposed in CIRIA publication R149 (CIRIA, 1995). The method uses both gas concentrations and borehole flow rates to define a characteristic situation based on the limiting borehole gas volume flow for methane and carbon dioxide. In both these methods, the limiting borehole gas volume flow is renamed as the Gas Screening Value (GSV).
- 7.2.7 The Gas Screening Value (litres of gas per hour) is calculated by using the following equation

GSV = (Concentration/100) X Flow rate



Where concentration is measured in percent (%) and flow rate is measured in litres per hour (I/hr)

- 7.2.8 The Characteristic Situation is then determined from Table 8.5 of CIRIA C665.
- 7.2.9 To accord with C665, worst case conditions are used in the calculation of GSVs for the site.
- 7.2.10 A worst case flow rate of 0.8l/hr (maximum reported) will be used in the calculation of GSVs for the site.

For carbon dioxide and methane, the worst-case conditions and the corresponding GSV is presented below.

•	Conservative flow rate:	0.8 I/hr flow rate
•	Highest CO₂ concentration: GSV Value:	9.4% v/v 0.0752l/hr i.e. CS2
•	Highest CH₄ concentration: GSV Value:	0.1% v/v 0.0008l/hr i.e. CS1

- 7.2.11 The result of the calculation would indicate that the site may be classified as Characteristic Situation 2, where basic gas protection measures are required.
- 7.2.12 For a Type B development with a Characteristic Situation 2 classification, ground gas protection measures should be installed with a minimum gas protection score of 3.5 points in accordance with BS8485:2015.
- 7.2.13 With respect to the exceedance of naphthalene in WS1, given the low PID readings recorded during headspace monitoring of the wells, and the absence of any recorded hydrocarbon odours or staining within the soils encountered on site, a potential pollutant linkage via vapour inhalation is not considered to exist.



8 SUMMARY OF RESULTS

8.1 Risk Assessment - Land Quality Impact Summary

- 8.1.1 Following the quantitative risk assessments, the following is noted:
 - It is understood that the proposed development comprises demolition of the existing building and construction of a new multistorey mixed use development, with commercial ground floor units and residential apartments. Minor areas of soft landscaping areas are anticipated.
 - Following generic risk assessments and statistical analysis, the upper ninety fifth percentile values for lead were found to exceed their respective criteria. No other contaminants were reported above their respective criteria and no asbestos fibres were detected.
 - Naphthalene was found to exceed the generic assessment criteria for human health within one sample (WS1 @ 1.0m bgl). In all the other 9No. samples which were tested for naphthalene, the detected concentration did not exceed the limit of detection of 0.5mg/kg. It is therefore considered that the made ground in WS1 comprises an isolated hotspot of naphthalene contamination, and therefore statistical assessment is not appropriate for naphthalene. Given the low PID readings recorded during headspace monitoring of the wells, and the absence of any recorded hydrocarbon odours or staining within the soils encountered on site, a potential pollutant linkage via vapour inhalation is not considered to exist.
 - Where the site is to be overlain by either proposed building footprint or areas of hardstanding, these concentrations are no considered to pose a significant risk to human health, as the building / surfacing will provide a suitable barrier to potential receptors. Where areas of soft landscaping are proposed, the risks to end users will be controlled by use of a capping layer. This should comprise a minimum 600mm thickness of imported clean topsoil.
 - The desk study identified the site to be directly underlain by unproductive deposits (London Clay Formation), with no significant controlled water receptors identified. Groundwater was not encountered during the



investigation. Therefore a pollutant linkage is not considered to pose a potential risk to controlled waters.

- The results of waste acceptance criteria testing indicated the Made Ground to be acceptable for disposal as a non-hazardous material, with the underlying natural ground suitable for disposal as inert material.
- The results of soil gas monitoring undertaken to date indicate the site to be classified as Characteristic Situation 2, where basic gas protection measures are required.
- Barrier pipe may be required for the proposed development. The water supply pipe material requirements for this site should be discussed at an early stage with the relevant utility provider.
- A remedial strategy will be required for the proposed development.
- As with any ground investigation, the presence of further hotspots between sampling points cannot be ruled out, and caution must be exercised during construction works. Should any contamination be encountered, a suitably qualified environmental consultant should be informed immediately, so that adequate measures may be recommended.
- 8.1.2 The above conclusions are made subject to approval by the statutory regulatory bodies.

8.2 Review of Pollutant Linkages Following Site Investigation

8.2.1 The site CSM has been revised and updated from that suggested in the desk study in view of the ground investigation data, including soil laboratory analysis results. Table 8.1 highlights whether pollutant linkages identified in the original CSM are still relevant following the risk assessment, or whether pollutant linkages, not previously identified, exist.



Table 8.1: Plausible Pollutants Linkages Summary (Pre Remediation)
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Potential Source (from desk study)	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
 Potential Made Ground associated with previous developments – on and off site Potential for asbestos in soil from demolition of previous buildings – on site (S2) Former Timber Yard – on site (S3) Former Motor Units Factory – on site (S4) 	 Ingestion and dermal contact with contaminated soil (P1) Inhalation or contact with potentially contaminated dust and vapours (P2) Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6) 	 Construction workers (R1) Maintenance workers (R2) Neighbouring site users (R3) Future site users (R4) Building foundations and on site buried services (water mains, electricity and sewer) (R5) Bioaccumulation within plants (R6) 	Y	see 9.1 above for remedial measures. The findings of this report should be included in the construction health and safety file, with adequate measures put in place for the protection of construction and maintenance workers.
 Current industrial use – on site (S5) Current and previous 	e (S5) migration of soil gases (P5) Leaching through permeable soils,		Y	Gas Protection measures required
industrial sites and consents/depots/works – off site (S6)		 Neighbouring site users (R3) Building foundations and on site buried services (water mains, electricity and sewer) (R5) 	Y	Remedial measures required and set out in Section 9.1. Contact should be made with relevant utility providers to confirm if upgraded materials are required.



9 **GEOTECHNICAL ENGINEERING RECOMMENDATIONS**

9.1 Ground Investigation Summary

- 9.1.1 No detailed structural engineering design information, with respect to the type of construction and associated structural loadings, was provided at the time of preparing this report.
- 9.1.2 Consequently, a detailed discussion of all the problems that may arise during the proposed redevelopment scheme is beyond the scope of this report. Practical solutions to the difficulties encountered, both prior to, and during construction, are frequently decided by structural constraints or economical factors. For these reasons, this discussion is predominantly confined to remarks of a general nature, which are based on site conditions encountered during the intrusive investigations.
- 9.1.3 It is understood that the proposed development comprises demolition of the existing building and construction of a new multistorey mixed use development, with commercial ground floor units and residential apartments. Minor areas of soft landscaping areas are anticipated.
- 9.1.4 The desk study report indicates that the site is directly underlain by solid deposits of the London Clay Formation. The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay Formation), encountered to the base of the boreholes at up to 25m bgl.
- 9.1.5 A summary of ground conditions obtained from the ground investigation and subsequent laboratory testing, is provided in Table 9.1 and 9.2 overleaf.

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
TARMAC and CONCRETE over MADE GROUND – Brown/black/orange sandy gravelly clay to clayey gravelly sand. Gravel is of brick, concrete, flint, mortar, ash and glass.	0.0	0.7 – 2.1	0.7 – 2.1
Orange brown sandy to silty patched blue grey CLAY with occasional flints, becoming predominantly blue grey with depth Encountered to base of window sample and cable percussive boreholes.	0.7 – 2.1	>25.0	>24.3

Table 9.1 : Ground Conditions Encountered



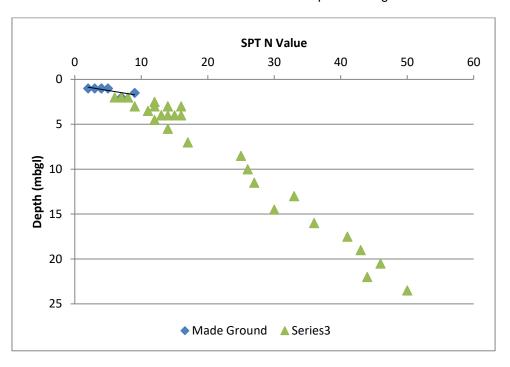
Table 9.2 – Preliminary Geotechnical Parameters

Strata	SPT 'N' Value	Shear Strength (kPa)	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (plasticity term)	Particle Size Distribution (% passing 0.425mm)	NHBC Volume Change Classification
TARMAC and CONCRETE over MADE GROUND – Brown/black/orange sandy gravelly clay to clayey gravelly sand. Gravel is of brick, concrete, flint, mortar, ash and glass.	2 - 9	-	-	-	-	-	-	-
Orange brown sandy to silty patched blue grey CLAY with occasional flints, becoming predominantly blue grey with depth Encountered to base of window sample and cable percussive boreholes.	6 - >50	27 - 225	26 - 31	54 - 77	25 - 30	29 - 47	100	Moderate - High

SECTION 9 GEOTECHNICAL ENGINEERING RECOMMENDATIONS



9.1.6 The results of the ground investigation indicated a ground profile comprising a variable thickness of Made Ground (1.3m to 4.3m bgl depth), overlying an orange brown patched blue grey silty clay (considered to represent the London Clay Formation), encountered to the base of the boreholes at up to 25m bgl.



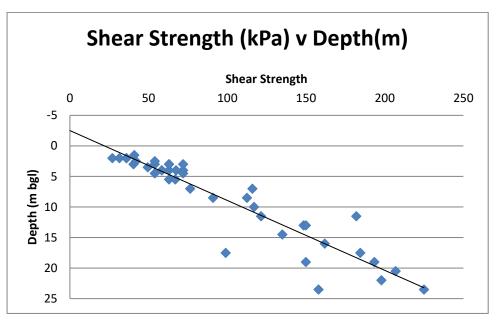
9.1.7 The shear strength of the London Clay Formation varies with depth, and is shown in Figure below. This shows the results of the triaxial testing and the undrained shear strength inferred by the correlation suggested by Stroud (1974),

 $c_u = f1 \times N$ can be applied,

in which c_u= mass shear strength (kN) f1 = constant (use value of 4.5 for London Clay Formation) N = SPT Value achieved during boring operations

9.1.8 The graph below shows the shear strength profile of the London Clay Formation encountered at the site, based on the SPT to shear strength correlation described above, as well as the results of undrained triaxial tests on undisturbed samples taken from the boreholes.





9.2 Hand Excavated Trial Pits

9.2.1 Hand pits excavated to expose the existing foundations of the building on site, revealed traditional foundations extending up to 1.6mbgl.

9.3 Foundations

- 9.3.1 Based upon the information obtained to date, an allowable bearing capacity in the order of 120kPa has been calculated for foundations constructed at a depth of 3.0m bgl within the underlying London Clay Formation. A piled foundation end bearing in the Clay is anticipated for the proposed development.
- 9.3.2 The piled foundations will carry their working load in a combination of skin friction along the sides of the pile and end bearing at the base of the pile, with the former likely to provide the greater part of the allowable load. The piles should be designed by a specialist piling contractor using a factor of safety of 3.0 and with the settlement at working load specified to meet any structural requirements. Table 11.3 below provides some indicative capacities for a single pile for the diameter and depths shown.

Pile diameter (m)	0.45	0.6	0.9
Pile length (m)			
15m	330	470	800
20m	530	760	1260
25m	760	1070	1750

Table 11.3 – Indicative Piles Capacities (kN)

9.3.3 Should any loading be placed directly on the ground which cause the ground to settle relative to the piles then additional negative skin friction loads could be imposed on the piles.



- 9.3.4 The London Clay Formation have been identified as being of moderate to high volume change potential, and this will require consideration when designing foundations for the proposed development, in conjunction with the presence of any existing or proposed trees. The potential for heave should be considered.
- 9.3.5 The above comments are indicative only based on limited ground investigation data. Foundations should be designed by a suitably gualified Engineer.

9.4 In Situ CBR Measurements

- 9.4.1 In order to provide indicative CBR measurements for road pavement design, a total of 3No. in situ CBR measurements were taken across the site at depths of up to 0.9m bgl.
- 9.4.2 The results of the testing provided indicative measurements of between 1.2% and 28.4%.

9.5 Concrete in the Ground

- 9.5.1 Sulphate attack on building foundations occurs where sulphate solutions react with the various products of hydration in Ordinary Portland Cement (OPC) or converted High-Alumina Cement (HAC). The reaction is expansive, and therefore disruptive, not only due to the formation of minute cracks, but also due to loss of cohesion in the matrix.
- 9.5.2 In accordance with BRE Special Digest 1, in a data set where there are more than 10No. results available, assessment should be made against the mean value of the maximum 20% of concentrations obtained.
- 9.5.3 18No. samples were analysed for water soluble sulphate concentration, with a mean 20% concentration of 537.5mg/l calculated. Associated pH concentrations ranged from 7.1 to 11.1.
- 9.5.4 Based on the results the required concrete class for the site is DS-2 assuming an Aggressive Chemical Environment for Concrete classification of AC-2 in accordance with the procedures outlined in BRE Special Digest 1.

9.6 **Ground Bearing Slabs**

- 9.6.1 Formations of the structures should be inspected by a competent person. Any loose or soft material should be removed and replaced with well-graded, properly compacted granular fill or lean mix concrete. The formation should be blinded if left exposed for more than a few hours or if inclement weather is experienced.
- 9.6.2 To allow for potential volume change within the underlying London Clay Formation, and due to the thickness of Made Ground deposits encountered, suspended floor slabs are recommended.

9.7 **Excavations**

- 9.7.1 Deep excavations will be required at the site during the construction works. These are anticipated to remain stable for the short term. It is recommended that the stability of all excavations should be assessed during construction.
- 9.7.2 The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported or battered back to a safe angle.



9.8 **Groundwater Control**

- 9.8.1 Groundwater was reported during intrusive works as standing at a depth of 1.3m bgl within trial pit TP1. Groundwater was not reported within the remaining exploratory holes. Groundwater was not recorded during return monitoring.
- 9.8.2 Any groundwater encountered should be readily dealt with by conventional pumping from a sump.



10 REFERENCES

BRE Report BR211 ;Radon: Protective measures for new dwellings, 2007

BRE Special Digest 1: Concrete in Aggressive Ground, 2005

British Standards Institution (2011) BS 10175:2011 Code of practice for the investigation of potentially contaminated sites. Milton Keynes: BSI

British Standards Institution (1999) BS 5930:1999 Code of practice for site investigations. Milton Keynes: BSI

CIEH & CL:AIRE (2008) *Guidance on comparing soil contamination data with a critical concentration*. London: Chartered Institute of Environmental Health (CIEH) and CL:AIRE

Environment Agency (2004) *Model procedures for the management of land contamination*. CLR11. Bristol: Environment Agency

Environment Agency, NHBC & CIEH (2008) *Guidance for the safe development of housing on land affected by contamination*. R & D Publication 66. London: Environment Agency

Jeffries, J. (2009) *CLEA Software (Version 1.05) handbook.* Science report: SC050021/SR4. Bristol: Environment Agency

Jeffries, J. & Martin, I. (2009) *Updated Technical Background to the CLEA Model*. Science Report No. SC050021/SR3. Bristol: Environment Agency.

Environment Agency Technical Report P45 "Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environment Quality Standard Development

Gething, J. Tetramethyl lead absorption: a report of human exposure to a high level of tetramethyl lead.1: Br J Ind Med. 1975 Nov; 32(4): 329-33

Grubb, F. E. et al, Extension of Samples Sizes and Percentage Points for Significance Tests of Outlying Observation. Technometrics, Vol 14, No. 4, November 1972

<u>http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_9801</u> - USEPA online toxicity and chemical parameters database

LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition. LQM, 2009

National Planning Policy Framework. Department for Communities and Local Government, March 2012



APPENDICES



APPENDIX 1 – FIGURES



Project Name	Kilburn High Road, London	Client	254 Kilburn HR LLP
Title	Exploratory Holes	Dwg No.	P8591J338 - October 2014



JOMAS ASSOCIATES LTD

Project Name	254 Kilburn High Road	Client	254 Kilburn HR LLP
Title	TP & WS Photo log	Dwg No.	P8591J338

Photo 1: TP1



Photo 3: TP2



Photo 2 TP2



Photo 4: TP3





JOMAS ASSOCIATES LTD

Project Name	254 Kilburn High Road	Client	254 Kilburn HR LLP
Title	TP & WS Photo log	Dwg No.	P8591J338

Photo 5: TP4



Photo 7: TP6



Photo 6: TP6



Photo 8: TP7





JOMAS ASSOCIATES LTD

Project Name	254 Kilburn High Road	Client	254 Kilburn HR LLP
Title	TP & WS Photo log	Dwg No.	P8591J338

Photo 9: WS1



Photo 11: WS3



Photo 10: WS2



Photo 12: WS4





Project Name	254 Kilburn High Road	Client	254 Kilburn HR LLP
Title	TP & WS Photo log	Dwg No.	P8591J338

Photo 13: WS5





APPENDIX 2 – EXPLORATORY HOLE RECORDS

	Specia	alists	in the) inve	stigati	ion &	reclar	Exploratory Hole No WS1								
Site A	ddress								-		oad, London	Project No		P8592J338		
Client									254 Kilbur			Ground Level		105525550		
	- ersonne	1							TC, LP		·	Commenced		13.10.14		
									-,			Completed		13.10.14		
Type an	d diame	ter o	fequ	uipm	ent:						Premier 110	0				
	evels rec					ng, m	1									
Date																
Hole De																
Casing [
	evel on s															
Remark	evel afte	er 201	nins													
1.	3															
2.																
2. 3.																
4																
	9	Samp	oles d	or Te	sts						Strata					
				R	lesul	ts							Strata Descrip	tion		
Туре	Depth								Depth				2			
	(m)	75	75	75	75	75	75	Ν	(m)		Legend	CONCRETE				
									0.15			CONCRETE Black fine to medium	ashy SAND (MADE)	GROUND)		
Р	0.5															
Р	1.0															
SPT	1.0	1	1	1	2	1	1	5	1.00							
												Dark brown/black car	adv CLAX with from	ont find to modium flints		
													Ink brown/black sandy CLAY with frequent fine to medium flints d brick fragments (MADE GROUND)			
									1.10							
D	1.5								1.40	-		Firm orange brown p	atched blue grev sil	ty CLAV		
U	1.5											Finite orange brown p	Jatened blue grey si	LY CLAT		
D	2.0							_								
SPT	2.0	1	2	2	2	1	2	7								
										<u> </u>						
D	3.0															
SPT	3.0	2	1	2	3	2	2	9								
										\parallel						
D	4.0															
SPT	4.0	1	3	3	2	4	4	13	4.00							
	Sampli	ng Co	de: U	- Undi	sturb					-			(U*) Non recovery	of Sample		
											use, 1 Furzeground Way,					
						T:	0189	5 77 2	187 E: info@j	oma	sassociates.com W: www	.jomasassociates.com	n			

	Speci	alists	in the		stigati	ion &	reclar	nation	5 of brownfie	ld sit	95	Exploratory Hole No	WS2
Site A	ddress								254 Kilbur	n Ro	ad, London	Project No	P8592J338
Client									254 Kilbur	n Hl	R LLP	Ground Level	
Site P	ersonne	el							TC, LP			Commenced	13.10.14 13.10.14
īvne an	d diame	ter o	fea	linm	ent [.]						Premier 11	Completed 0	13.10.14
	evels rec						ı					-	
Date													
Hole De													
Casing D Nater L	evel on :	strike	2										
	evel afte												
Remark	s												
L. 2.													
 3.													
1													
	:	Samp	oles d	or Te	sts						Strata	-	
Туре	Depth			F	Resul	ts				Strata D	escription		
11	(m)	75	75	75	75	75	75	N	Depth (m)				
									0.20				
		-			-	-			0.20	╟┤		Fine to coarse GRAVEL comprising	g of flint brick and concrete (MAD
Р	0.4											GROUND)	
									0.50	╟┥		Soft dark brown/black sandy CLA	with froquest fine to modify
												flints and brick fragments (MADE	
_													
P SPT	1.0 1.0	1	0	1	0	1	2	4					
51.1	1.0	Ĺ	ľ	1	ľ	Ĺ		⁻					
									1.20				Y.
												Soft orange brown fine sandy CLA	ΥY
D	1.5												
										\square			
D	2.0												
SPT	2.0	1	2	2	3	2	1	8		\parallel			
									2.20				
												Firm becoming stiff orange browr	n patched blue grey silty CLAY
D	3.0												
SPT	3.0	2	2	3	4	3	4	14					
										\parallel			
_													
D SPT	4.0 4.0	2	4	4	5	3	4	16					
511	4.0	⁻	"	1]	-						
									4.45				
				-					4.43	╟┤			
	6-0-1	inc C	de: 11	114.25		od P	Larr :	Diet	shod		D. Small Diate at 12	Weter (119) bi	anyony of County
	Sampl	ing Co	ae: U	- Undi						le Hr	D - Small Disturbed use. 1 Furzeground Way	W - Water (U*) Non re . Stockley Park, UB11 1BD	covery of Sample
											sassociates.com W: www		

	Speci	alists	in the		stigati	ion &	reclar	matio	S n of brownfiel	ld sit	tes	Exploratory Ho	ble No	WS3
Site A	ddress								254 Kilbur	n R	oad, London	Project No		P8591J338
Client									254 Kilbur	n H	R LLP	Ground Level		
Site P	ersonne	el –							TC, LP			Commenced		13.10.14
Tuno an	d diame	toro	for	uinm	ont						Premier 11	Completed		13.10.14
	evels red					ng. m	1				Trefiner 11	0		
Date						.0,	-							
Hole De														
Casing D	Depth evel on :		_											
	evel on : evel afte													
Remark														
1.		In	stall	ed 50	Omm	pipe	to 2	.50m	า					
2.														
3. 4														
+		Samp	oles	or Te	sts						Strata			
					Resul	ts							Strata Descrip	otion
Туре	Depth	75							Depth		Lesson 1		2	
	(m)	75	75	75	75	75	75	N	(m) Legend 0.15 CONCRETE Light brown slightly claves fine to medium					
Р	0.2								0.10	╟─		Light brown slightly o		m SAND with frequent fine
									0.30	∥		to medium angular fl	ints (MADE GROUN	D)
Р	0.5													nix concrete, brick, flint and
												ash in a fine sand (M	ADE GROUND)	
Р	1.0													
SPT	1.0	1	1	1	0	1	0	2						
					-				1.20	╟─				
												Dark brown fine sand brick fragments (MAI		nt fine to medium flints and
Р	1.5											STICK TRABILIERIUS (IVIAI		
Р	2.0				_		_							
SPT	2.0	1	2	1	2	2	2	7	2.10	┣—				
									2.10	╟─		Firm orange brown p	atched blue grey sil	ty CLAY
D	2.5													
	2.3									⊫				
	2.0													
D SPT	3.0 3.0	2	3	4	4	3	5	16						
D	4.0													
SPT	4.0	2	2	4	3	3	4	14						
										\parallel				
									4.45					
										⊩				
										⊩				
	Sampl	ing Co	de: U	- Undi	isturb	ed B -	Large	Distu	rbed	4	D - Small Disturbed	W - Water	(U*) Non recovery	of Sample
											ouse, 1 Furzeground Way,			
						T:	0189	5 77 2	187 E: info@j	joma	asassociates.com W: www	v.jomasassociates.cor	n	

	-	/	6									Exploratory Ho	ole No	WS4
Cite		alists	in the	e inve	stigati	ion &	reclar	natio				Desired No.		505021220
Client	ddress								254 Kilbur 254 Kilbur		d, London	Project No Ground Level		P8592J338
	ersonne								TC, LP			Commenced		13.10.14
									,			Completed		13.10.14
Type an											Premier 11	.0		
Water l	evels rec	orde	ed du	iring	boriı	ng, m	1		[
Date Hole De	nth													
Casing E														
Water L														
Water L Remark		er 201	mins											
1.	5													
2.														
3.														
4		Samr	oles	or Te	sts					_	trata			
		Strata Docaria	tion											
Туре	Depth				lesul				Strata Descrip	uon				
	(m)	75	75	75	75	75	75	N	(m)		Legend	CONCRETE		
												CONCILIE		
Р	0.5							Soft dark brown/blac	ck sandy CLAY with fr	equent fine to medium				
	0.0											flints and brick fragm		
Р	1.0													
SPT	1.0	1	0	1	1	1	0	3						
D	1.5								1.50	-		Firm orange brown p	atched blue grev silt	V CLAY
												in the orange brown p	atched blue grey sht	
D SPT	2.0 2.0	1	2	2	1	2	1	6						
-														
D	3.0					2	2	12						
SPT	3.0	2	3	3	4	2	3	12						
D	4.0													
SPT	4.0	1	3	3	4	4	4	15						
									4.45					
	Sampli	ng Co	de: U	- Undi	sturb						D - Small Disturbed		(U*) Non recovery	of Sample
											se, 1 Furzeground Way issociates.com W: www			
												,		

	Speci	alists	in the		stigati	ion &	reclar	nation	5 n of brownfie	ld si	5	Exploratory Hole No		WS5
Site A	ddress								254 Kilbur	n R	ad, London	Project No		P8592J338
Client									254 Kilbur			Ground Level		
Site P	ersonne	l							TC, LP			Commenced		13.10.14
Type an	d diame	ter o	feni	linm	ent:						Premier 11	Completed		13.10.14
	evels rec					ng, m	1							
Date				0		0,								
Hole De														
Casing D	Depth evel on s	trike												
	evel offs													
Remark					1				1			I		
1.														
2.														
3. 1														
T	:	Samp	oles d	or Te	sts						Strata			
					lesul	te						Stra	ta Descrinti	ion
Туре	Depth								Depth		Strata Description			
	(m)	75	75	75	75	75	75	N	(m) 0.05	ľ	Legend	BLACKTOP		
									0.05	╟─		CONCRETE		
Р	0.3											Soft dark brown/black sandy	CLAY with fre	quent fine to medium
Р	0.5											flints and brick fragments (N		•
r	0.5													
P SPT	1.0 1.0	1	0	0	1	2	1	4						
	1.0			ľ	-	-		Ĺ						
									1.20					
												Firm orange brown silty CLA	Y with find to .	medium angular flints
D	1.5									╟─			with the to f	
-														
D	2.0									-				
SPT	2.0	1	1	2	3	1	2	8						
										-				
									2.40					
												Firm orange brown patched	blue grey silty	CLAY
										╟─				
D	3.0			_	<u>,</u>		-	14						
SPT	3.0	2	2	3	2	4	5	14		⊩				
										┢				
	4.0													
D SPT	4.0 4.0	2	3	3	3	3	4	13						
									4.45					
									4.43	╟─				
			الا بما	- Undi	sturb	ed B -	Large	Distu	rhed		D - Small Disturbed	14/ 14/stan (11%) N	on recovery o	f Commile
	Sampli	ng Co	ue. 0	•								, Stockley Park, UB11 1BD	on recovery o	r Sample

			C				Exploratory Hole No TP1							
	Speci	alists	in the	inve:	stigat	ion &								
	Address							Project No		P8591J338				
Client							Ground Level							
Site P	Personne	el 👘							TC, LP			Commenced		09/10/2014
												Completed		10/10/2014
	d diame										Hand Digg	ging		
	evels red	corde	ed du	iring	bori	ng, m	1		1			1		
Date														
Hole De														
Casing [evel on :	-+rike												
	evel afte													
Remark		.1 20										1		
1.	SWL	- 1.3	m											
2.	• • • •													
3.														
4														
	Samples or Tests Strata													
				R	lesul	ts							Strata Descriptio	on
Туре	Depth								Depth				2 00011010	
	(m)	75	75	75	75	75	75	N	(m)		Legend	Acabalt to 0.02	CONCRETE	
												Asphalt to 0.03m ove		
									0.30	╟─		Dark brown / black a	shy, very sandy CLAY	with frequent brick.
р	0.5						[MADE GROUND]							
									1.00					
Р	1								1.00	╟─		Orange brown silty C	I AV with occasional	hrick fragments
												[MADE GROUND]	Ert with occusional	brick nuginents.
									1.30					
												Orange brown silty C	LAY.	
Р	1.5													
									1.60	╟─				
										┢─				
	Sampl	ing Co	de: U	- Undi	sturb	ed B -	Large	Distu	rbed		D - Small Disturbe	ed W - Water	(U*) Non recovery	of Sample
												, Stockley Park, UB11 v.jomasassociates.cor		

	Speci	alists	in the		stigati	ion &	reclan	natio	5 n of brownfiel	d sit	es	Exploratory Ho	ole No	TP2
Site A	ddress								254 Kilbur			Project No		P8591J338
Client									254 Kilbur			Ground Level		
	ersonne	1							TC, LP			Commenced		09/10/2014
												Completed		10/10/2014
	d diame										Hand Digg			
	evels rec	orde	d du	ring	borir	ng, m								
Date														
Hole De														
Casing E Water I	evel on s	strike	2											
Water L														
Remark														
1.														
2.														
3.														
4		Samr	oles c	or Te	sts					SI	trata			
													Strata Deserie ti	
Туре	Depth			R	lesul	ts			Depth				Strata Descriptio	on
	(m)	75	75	75	75	75	75	Ν	(m)		Legend			
									0.15	╟╢		CONCRETE Limestone (MADE G		
												Limestone (MADE G	ROUND)	
									0.40					
р	0.5											Dark brown / black v		frequent brick and
												concrete fragments.	[MADE GROUND]	
Р	1													
									1.10					
										\vdash				
										H				
										\mathbb{H}				
										\mathbb{H}				
										Ш				
									L					
	Sampli	ng Co	de: U-	- Undi	Jom	as As	sociate	es Ltd	- Lakeside Ho			d W - Water , Stockley Park, UB11 v.jomasassociates.cor		of Sample

	Speci	alists	in the		stigati	ion &	reclan	natior	5 n of brownfield	Exploratory H	ole No	TP3		
Site 4	ddress								254 Kilburi			Project No		P8591J338
Clien									254 Kilburi 254 Kilburi			Ground Level		F83311338
	ersonne	1							TC, LP			Commenced		09/10/2014
once i									10, 11			Completed		10/10/2014
Type an	d diame	ter o	of equ	uipm	ent:						Hand Digg			_,, _ _ , _ _ ,
	evels rec					ng, m	1							
Date														
Hole De	pth													
Casing [
	evel on s													
	evel afte	er 20	mins											
Remark	S													
1. 2.														
2. 3.														
5. 4														
	1	Sami	oles d	or Te	sts					S	trata			
													Strate Day 1	
Туре	Depth			R	lesul	LS			Depth				Strata Description	
	(m)	75	75	75	75	75	75	Ν	(m)		Legend			
									0.05	\square		Screed flooring over		
									0.20	\parallel		Concrete with 6mm	-	deat fine to a
р	0.40											Dark brown / grey cl concrete and brick g	ayey SAND with abur ravel. [MADE GROUN	
Р Р	0.40													
Р	0.75								0.75					
	Sampli	ing Co	de: U	- Undi	Jom	as As	sociate	es Ltd	- Lakeside Ho			ed W - Water , Stockley Park, UB11 v.jomasassociates.co		of Sample

	Speci	alists	in the	inves	stigati	ion &	reclan	natio	5 n of brownfiel	Exploratory Ho	ole No	TP4		
Site 4	ddress	_	_	_	_	_			254 Kilbur			Project No		P8591J338
Clien									254 Kilbur			Ground Level		F03311330
	Personne	1					_		TC, LP			Commenced		09/10/2014
Siler	ersonne								IC, LP					10/10/2014
Turne er	d diame		f								Hand Digg	Completed		10/10/2014
	evels rec					ng, m	I					Sing	•	
Date														
Hole De														
Casing [
	evel on s													
	evel afte	er 20	mins											
Remark	S													
1.														
2.														
3.														
4		Same	oles d	n Te	ste			_		c	trata			
		Jainp	JIES (1					
Туре	Depth			R	esul	ts			Depth				Strata Descriptio	on
	(m)	75	75	75	75	75	75	Ν						
									Legend	Screed flooring.				
									0.05			Concrete with 6mm	reinforcing bar.	
									0.30					
														with abundant fine to
Р	0.5										medium brick and fli	nt gravel. [MADE GR	OUND]	
									0.00					
									0.80	╟─		Dark brown / black v	erv sandy CLAY with	frequent fine to
Р	1								1.00	-		medium angular flint		
	-								1.00	⊩		fragments. [MADE G		
	Sampli	ng Co	de: U	Undi	sturb	ed B -	Large	Distu	rbed		D - Small Disturbe	ed W - Water	(U*) Non recovery	of Sample
	1	5			Jom	as As	sociate	es Ltd	- Lakeside Ho		1 Furzeground Way	, Stockley Park, UB11 w.jomasassociates.cor	1BD	-

	Speci	alists	in the		stigati	ion &	reclar	natior	5 n of brownfie	Exploratory Ho	ole No	TP5		
Site A	ddress								254 Kilbur	n Hi	gh Road	Project No		P8591J338
Client									254 Kilbur			Ground Level		
	ersonne	el							TC, LP			Commenced		09/10/2014
									,			Completed		10/10/2014
Type an	d diame	ter o	of equ	uipm	ent:						Hand Dig			· · · · ·
	evels rec						1							
Date														
Hole De												1		
Casing D														
	evel on s													
Water L		er 20	mins											
Remark	S													
1. 2.														
2. 3.														
3. 4														
		Samp	oles d	or Te	sts									
					lesul	ts			Strata Descriptio	n -				
Туре	Depth								Strata Descriptio					
	(m)	75	75	75	75	75	75	Ν						
									Screed flooring.					
						<u> </u>			0.25		Concrete	El of briels ar sussi	and mortages and	
									0.40			Fine to coarse GRAVI [MADE GROUND]	L OI DIICK, CONCrete	and mortar aggregate.
									0.40		Dark brown ashy, ver	ry sandy CLAY with n	nuch brick and flint.	
								[MADE GROUND]	, ,					
Р	1.0													
									1.40					
						-			1.40	╟──		Firm orange brown C	CLAY.	
										╟				
									1.70					
												1		
												1		
												1		
										⊩		1		
												1		
												1		
												1		
												1		
												1		
												1		
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												1		
												1		
												1		
												1		
						<u> </u>			L			<u> </u>	4	
	Sampli	ing Co	de: U	- Undi							D - Small Disturbe		(U*) Non recovery	ot Sample
												, Stockley Park, UB11 w.jomasassociates.cor		

	Speci	alists	in the		stigat	ion &	reclar	natior	5 n of brownfiel	d sit	es	Exploratory H	ole No	TP6
Site A	ddress		_	_	_	_			254 Kilbur			Project No		P8591J338
Client									254 Kilbur			Ground Level		103311330
	ersonne	1	_	_	_			_	TC, LP			Commenced		09/10/2014
Siter	croonine								10, 11			Completed		10/10/2014
Type an	d diame	ter o	fear	Jinm	ent:				I		Hand Digg			10/ 10/ 2014
	evels rec						1							
Date				0		.0,	-						1	
Hole De	pth													
Casing D														
	evel on s	strike	2											
Water L	evel afte	er 20ı	mins											
Remark	s													
1.														
2.														
3.														
4		C		T.	***		_			C 4	wete			
		Samp	Jies (brie	sts					<u> </u>	trata	-		
Туре	Depth			R	lesul	ts			Depth				Strata Description	on
Type	(m)	75	75	75	75	75	75	Ν	(m)		Legend			
	()	,,,,,	,,,,,	,,,,,	,,,,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,,,,,		(,			Concrete floor to 0.0	2m then Marble, tile	, paper, general waste.
									0.20			[MADE GROUND]		
									0.35			CONCRETE		
										$\ $		Dark reddish brown		h abundant fine to
Р	0.5										medium brick and fli	nt gravel.		
						-			0.70			Dark brown / black s	andy CLAY with free	uent fine to medium
												brick and flint gravel		
Р	1													
									1.05					
										\mathbb{H}				
	Sampli	ing Co	de: U	Undi							D - Small Disturbe		(U*) Non recovery	of Sample
												, Stockley Park, UB11 v.jomasassociates.coi		

	Speci	alists	in the) inve	stigat	ion &	reclar	natio	5 n of brownfiel	ld sit	es	Exploratory H	ole No	TP7
Site A	ddress								254 Kilbur	n Hi	gh Road	Project No		P8591J338
Client									254 Kilbur			Ground Level		10331330
	ersonne	<u></u>							TC, LP			Commenced		09/10/2014
Siter	cisonine								, , , ,			Completed		10/10/2014
Tuno an	d diame	toro	for	uinm	onti						Hand Digg			10/10/2014
	evels rec											6,,,9		
Date	eveisiet	Jorue	uuu	1116		116, 11	•							
Hole De	nth													
Casing [
	evel on s	strike	2											
	evel afte													
Remark			-											
1.														
2.														
3.														
4														
		Samp	oles d	or Te	sts					S	trata			
				P	lesul	ts							Strata Descriptio	n
Туре	Depth								Depth				strata bescriptit	
	(m)	75	75	75	75	75	75	Ν	(m)		Legend			
										2m then Marble, tile	, paper, general waste.			
						-	<u> </u>		0.20	╟─		[MADE GROUND]		
									0.35	╟─		CONCRETE Dark reddish brown		h abundant fina ta
Р	0.5											medium brick and fli		
' '	0.5									⊩			in Braten (in in in 2 of it	, , , , , , , , , , , , , , , , , , , ,
									0.70					
												Dark brown / black s	andy CLAY with frequ	uent fine to medium
												brick and flint gravel	[MADE GROUND]	
Р	1													
									1.10					
	_		<u> </u>			<u> </u>			I		l	I	4	
	Sampli	ing Co	de: U	- Undi							D - Small Disturbe		(U*) Non recovery	ot Sample
												, Stockley Park, UB11 v.jomasassociates.coi		

	Specia	alists	in the) inve	stigati	ion &	reclar	natio	5 of brownfiel	Exploratory Ho	ole No	BH1			
Site A	Address								Kilburn Hig			Project No		P8591J338	
Clien									254 Kilbur			Ground Level		10001000	
Site F	Personne	1							SK BD			Commenced		15/10/2014	
												Completed		16/10/2014	
Type an	d diame	ter o	of eq	uipm	ent:						DANDO 1				
Water I	evels rec	orde	ed du	ring	boriı	ng, m	ı								
Date															
Hole De															
Casing I															
	evel on s														
	evel afte	er 20	mins												
Remark							25	1							
1. 2.	150m	i diai	mete	r boi	renoi	eto	25mi	ogi							
2. 3.															
3. 4															
•		Samı	ples	or Te	sts					St	rata				
						+0							Strata Decemini		
Туре	Depth			H	Resul	15			Depth				Strata Descriptio		
	(m)	75	75	75	75	75	75	Ν	(m)		Legend				
									0.20	⊫∣		CONCRETE			
												MADE GROUND - Bri	ck		
									0.70						
			-		-	-				Firm brown grev CI A	Y				
	U 1.5-1.95 35 0 0.70 Firm brown grey CLAY														
U															
										H					
s	2.5-2.95	2	3	3	3	3	3	12							
	2.5 2.55					ľ		12							
D	3.2									П					
U	3.5-3.95	40													
										H					
S	4.5-4.95	2	3	3	3	3	3	12							
D	5.2									\mathbb{H}					
ľ	5.2									\parallel					
U	5.5-5.95	50													
										Ш					
										\parallel					
S	7-7.45	3	3	4	4	4	5	17		\square					
										\parallel					
										\parallel					
D	8.0									\parallel					
										H					
U	8.5-8.95	60										becoming stiff			
										⊫∣					
										\parallel					
S	10-10.45	4	5	6	6	7	7	26							
	-		<u> </u>	<u> </u>					I				(
	Sampli	ng Co	de: U	- Undi							D - Small Disturbe		(U*) Non recovery	of Sample	
												, Stockley Park, UB11 v.jomasassociates.cor			
							11								

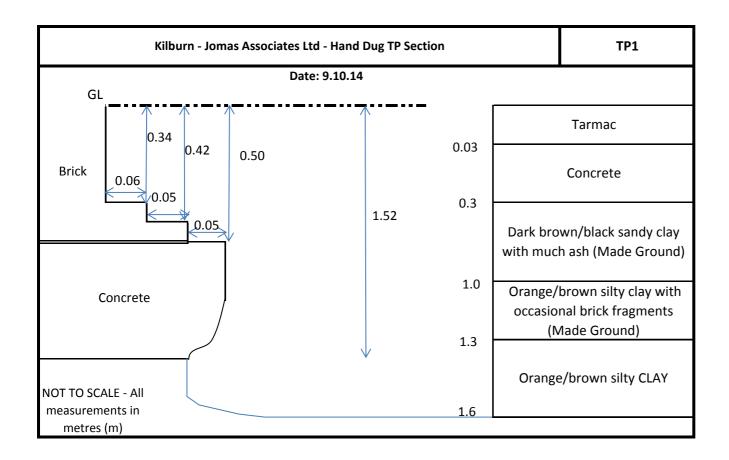
	Specia	alists	in the		stigati	ion &	reclar	natior	5 of brownfield	Exploratory Hol	e No	BH1	
Site A	ddress								Kilburn Hig		Project No		P8591J338
Client									254 Kilburr		Ground Level		
	ersonne								SK BD		Commenced		15/10/2014
											Completed		16/10/2014
Type an	d diame	ter o	of equ	uipm	ent:					DANDO			
Water l	evels rec	orde	ed du	ring	borir	ng, m	ı						
Date													
Hole De													
Casing [_										
	evel on s evel afte												
Remark		1 20			I						1 1		
1.	-												
2.													
3.													
4		•						_		C 1 1 1			
		sam	pies	or Te	sts					Strata	-		
Туре	Depth			R	lesul	ts			Depth		S	trata Descriptio	on
.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(m)	75	75	75	75	75	75	Ν	(m)	Legend			
											Continued from previo	ous page	
D	11.0												
									11.30				
U	11.5-11.95	55									Stiff to very stiff blue g	grey CLAY	
s	13-13.95	5	7	8	8	8	9	33					
5	15-15.55	5	Ĺ					55					
D	14												
U	14												
U	14.5-14.95	65											
c l	10 10 15	-	_				10	20					
S	16-16.45	7	7	8	9	9	10	36					
_													
D	17												
U	17.5-17.95	85											
S	19-19.45	8	9	10	10	11	12	43					
D	20.0												
	C		do: L'	11	at wet		Larer	Dict	rhod	D. Grand Diate d	ad 14/ 14/at /	(11*) Non	offormla
	Sampli	ng CO	ue: U	- υπαι						D - Small Disturb use. 1 Furzeground Way	ed W - Water (, Stockley Park, UB11 1	(U*) Non recovery BD	or sample
										associates.com W: www			

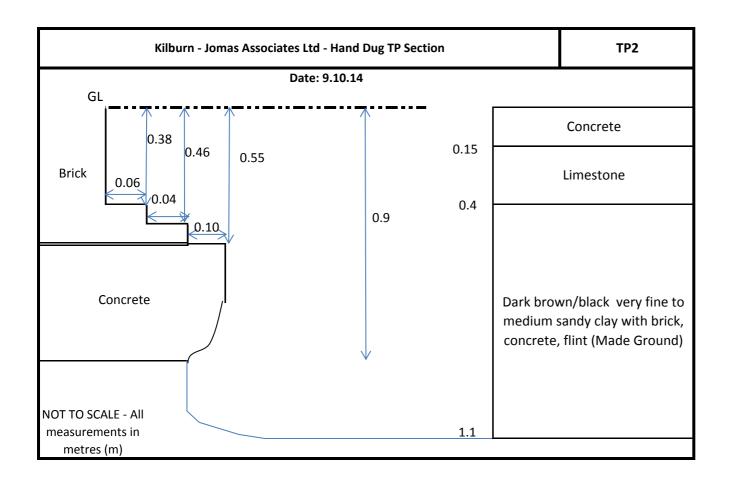
									5			Exploratory H	ole No	BH1	
- C'4		alists	in the	inves	stigati	ion &	reclar	natio							
	ddress								Kilburn Hi			Project No		P8591J338	
Clien									254 Kilbur	n H	K LLP	Ground Level			
Site F	Personne	el							SK BD			Commenced		15/10/2014	
											DAVIDO -	Completed		16/10/2014	
	d diame										DANDO 1	./5			
	evels red	lorde	a du	ring	porii	ng, m			1						
Date Hole De	nth														
Casing [
Water I	evel on	strike	2												
	evel afte														
Remark									•			.	.		
1.															
2.															
3.															
4	Samples or Tests Strata														
	Type Depth Results Depth Strata Description														
Type	Denth			R	lesul	ts			Depth				Strata Description	on	
.ype	(m)	75	75	75	75	75	75								
	()	,,,,	,,,,,	, , , , , , , , , , , , , , , , , , , ,	,,,,,	,,,,,	,,,,,	Continued from prev	vious page						
U	20.5-20.95	120	NR												
S	22-22.45	10	10	10	11	11	12	44							
D	23.0														
U	23.5-23.95	140													
										⊢					
D	25.0														
										⊩					
	Sampl	ing Co	de: U	- Undi	sturb	ed B -	Large	Distu	rbed		D - Small Disturbe	d W - Water	(U*) Non recovery	of Sample	
												Stockley Park, UB11			
1					1	T: 018	95 77	2187	E: info@joma	sass	ociates.com W: www	v.jomasassociates.co	n		

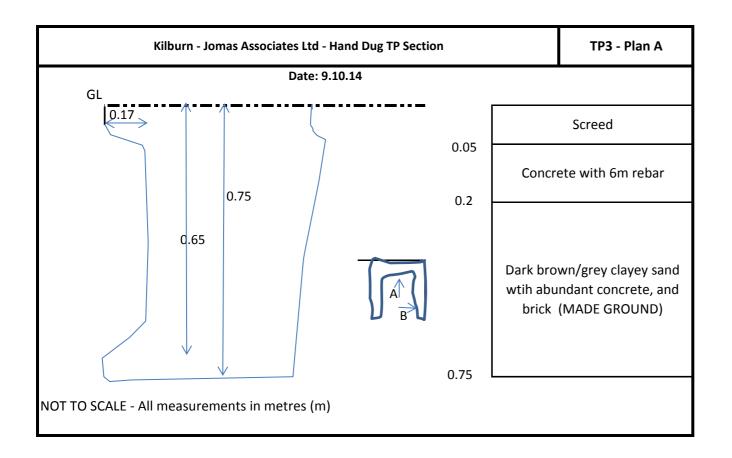
	Specia	alists	in the		stigati	ion &	reclar	matio	5 n of brownfield	sites	Exploratory Ho	ole No	BH2		
Site A	ddress								Kilburn Hig	Road	Project No		P8591J338		
Clien	t								254 Kilburn		Ground Level				
Site P	ersonne	I							SK BD		Commenced		15/10/2014		
	<u> </u>										Completed		16/10/2014		
	d diame evels rec									DANDO 1	1/5				
Date		orue	uuu	iiig		ig, iii									
Hole De	pth														
Casing [
	evel on s evel afte														
Remark		er 20	mins												
1.		ring v	well i	nstal	led t	o 20ı	mbgl	. Plai	in with bent	nite surround to 1	mbgl, slotted to 2	0m with gravel s	urround		
2.		-					-				-	-			
3.															
4		Sami	oles d	or Te	sts					Strata					
					lesul	te						Strata Descriptio	20		
Туре	Depth								Depth (m)	Legend		Strata Descriptio			
	(m)	75	75	75	75	75	75	N	CONCRETE						
									0.30		CONCRETE				
											Sand, Gravel of brick	(MADE GROUND)			
	Sand, Gravel of brick (MADE GROUND)														
_															
S	1.5-1.95	2	3	2	2	3	2	9							
D	2-2.2								2.00						
											Firm brown grey CLA	Y			
U	2.5-2.95	20													
Ŭ	2.5-2.55	30													
S	3.5-3.95	2	2	2	3	3	3	11							
D	4.2									-					
_															
U	4.5-4.95	35													
										_					
s	5.5-5.95	3	3	3	3	4	4	14							
	5.5-5.85	5	ľ	_ ا	⁻	¯	1	-4							
D	6.5														
I		45													
U	7-7.45	45									becoming stiff				
										_					
, I	0 5 0 05	,	6	6	6	6	_	<u>-</u> -		_					
S	8.5-8.95	4	6	6	6	6	7	25							
D	9.5														
U	10-10.45	45													
	Sampli	ng Co	de: U	- Undi	sturb	ed B -	Large	Distu	rbed	D - Small Disturbe	ed W - Water	(U*) Non recovery	of Sample		
	1	5								se, 1 Furzeground Way,			-		
					١	Г: 018	95 77	2187	E: info@jomas	issociates.com W: www	v.jomasassociates.cor	n			

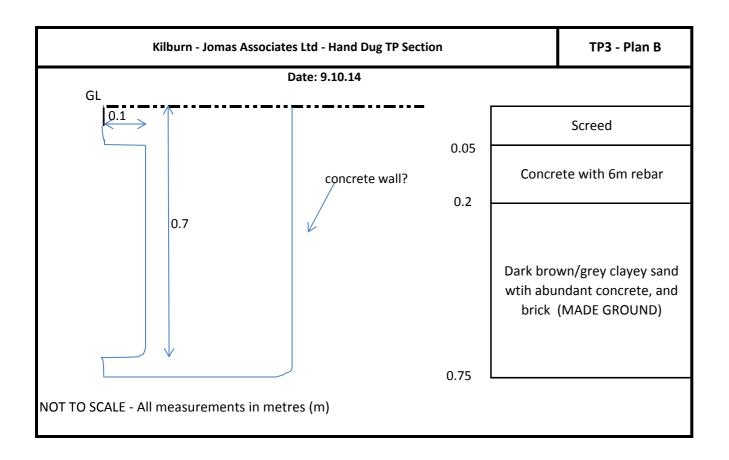
	Specia	alists	in the) inve	stigati	ion &	reclar	natio	5 n of brownfiel	Exploratory H	ole No	BH2			
Site 4	ddress	_					_		Kilburn Hi			Project No		P8591J338	
Clien									254 Kilbur			Ground Level		10001000	
Site F	ersonne	1							SK BD			Commenced		15/10/2014	
												Completed		16/10/2014	
Type an	d diame	ter c	of eq	uipm	ent:						DANDO 1			· · ·	
Water I	evels rec	orde	ed du	iring	borir	ng, m	1								
Date															
Hole De															
Casing I	Depth .evel on s		_												
	evel offs evel afte														
Remark					<u> </u>										
1.	-														
2.															
3.															
4		C			-	_	_	_		C 1					
		Sam	ples	or re	sts					50	ata	-			
Туре	Depth			R	lesul	ts			Depth				Strata Descriptio	on	
71	(m)	75	75	75	75	75	75	N							
									Continued from prev	rious sheet					
					_	_	_								
S	11.5-11.95	4	6	6	7	7	7	27							
									11.90						
									11.90	╢┤		Very stiff blue grey C	LAY		
D	125														
U	13-13.45														
0	13-13.45	65								\mathbb{H}					
										⊢					
S	14.50-14.5	4	5	8	7	7	8	30							
										\mathbb{H}					
D	15.5														
U	16-16.45	65								Щ					
										\parallel					
										Ш					
										\parallel					
s	17.5-17.95	7	10	10	10	10	11	41		\parallel					
D	18.5									\parallel					
Ī															
U	19-19.45	80													
										⊢∣					
										\parallel					
S	20.5-20.95	8	10	11	11	12	12	46							
	Sampli	ng Co	de: U	- Undi							D - Small Disturbe		(U*) Non recovery	of Sample	
												, Stockley Park, UB11 v.jomasassociates.coi			
						010	11	07							

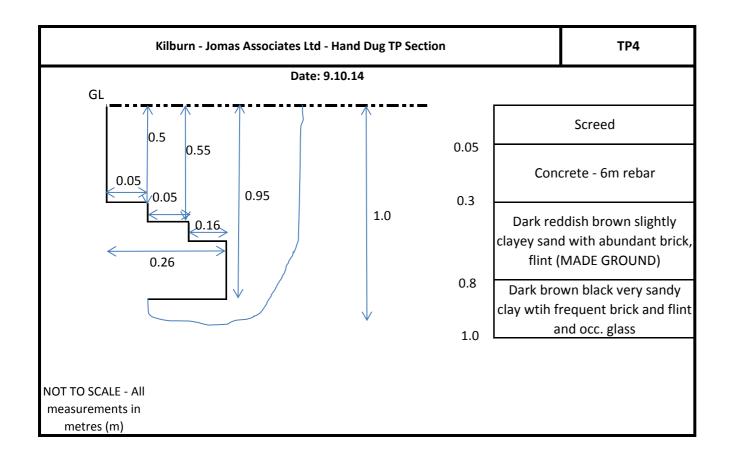
									5			Exploratory H	ole No	BH2
- C''		alists	in the	inve:	stigati	ion &	reclar	natio						DOFOLICE
	ddress								Kilburn Hi			Project No		P8591J338
Client									254 Kilbur	n H	RLLP	Ground Level		
Site P	Personne	el 👘							SK BD			Commenced		15/10/2014
_												Completed		16/10/2014
	d diame										DANDO 1	.75		
	evels rec	corde	ed du	iring	borii	ng, m	1							
Date														
Hole De														
Casing [Water]	evel on s	ctrike	2											
	evel afte													
Remark														
1.														
2.														
3.														
4		-												
		Sam	ples	or Te	sts					S	trata	-		
Turne	Depth			R	lesul	ts			Strata Descriptio	on				
Туре	(m)	75	75	75	75	75	75							
	(11)	/3	/3	/5	/3	/5	/5	continued from prev	ious page					
D	21.5													
U	22-22.45	85												
S	23.5-23.95	11	12	12	13		12							
						(59mr	n I						
										⊢				
D	25.0								25.00					
										⊩				
										⊩				
	Sampli	ing Co	de: U	- Undi	sturb	ed B -	Large	Distu	rbed		D - Small Disturbe	d W - Water	(U*) Non recovery	of Sample
										ouse,		Stockley Park, UB11		-
												v.jomasassociates.co		

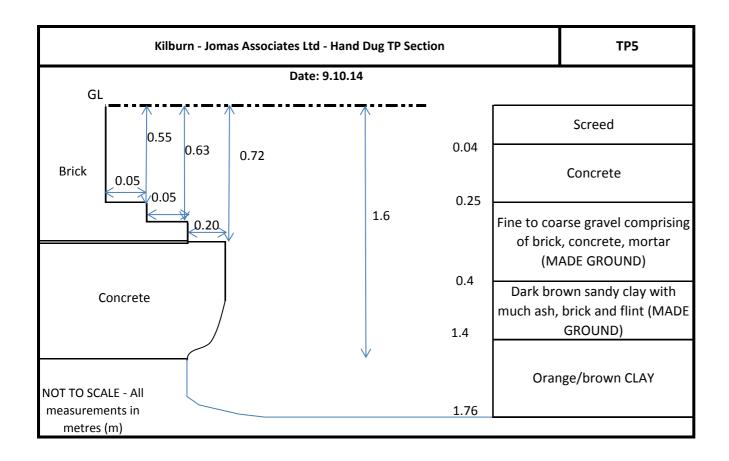


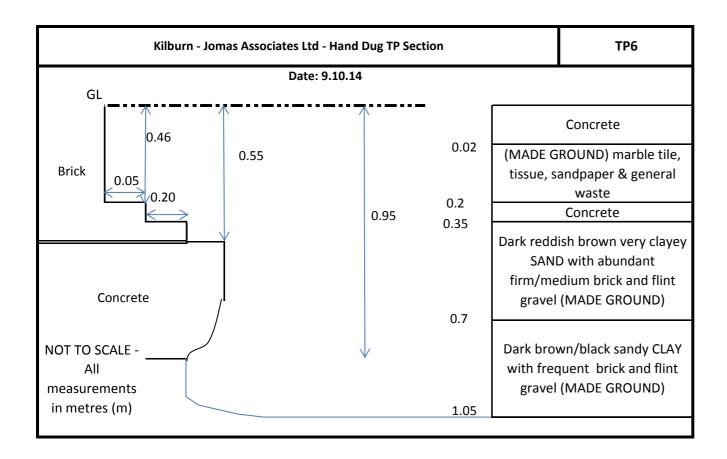


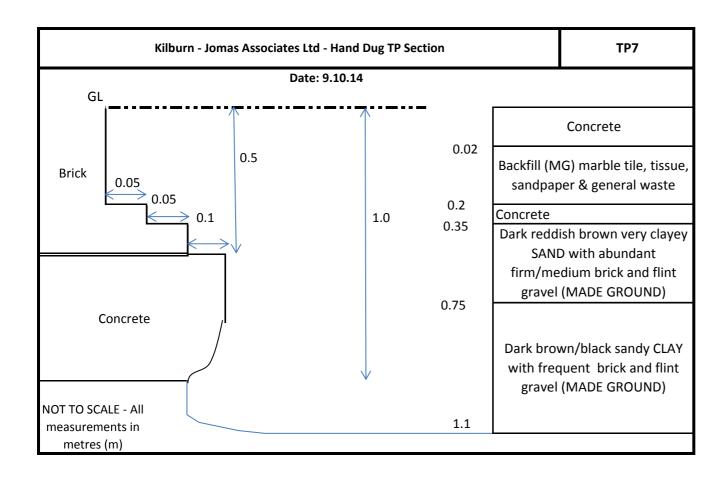














APPENDIX 3 – CHEMICAL LABORATORY TEST RESULTS



Unit A2 Windmill Road Ponswood Industrial Estate St Leonards on Sea East Sussex TN38 9BY Telephone: (01424) 718618 Facsimile: (01424) 729911 <u>info@elab-uk.co.uk</u>

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	14-01039
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- Issue:
- **Date of Issue:** 03/11/2014
- Contact: Roni Savage
- Customer Details: Jomas Associates Limited Lakeside House 1 Furzeground Way

1

- Quotation No: Q14-00127
- **Order No:** P8592
- Customer Reference: J338-08
- **Date Received:** 23/10/2014
- **Date Approved:** 03/11/2014
 - Kilbum High Road

Approved by:

Details:

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683



Sample Summary

Report No.: 14-01039

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
7108	WS1 P 0.50	13/10/2014	24/10/2014	Sandy silty loam	cfg
7109	WS1 P 1.00	13/10/2014	24/10/2014	Silty loam	cfg
7110	WS2 P 1.00	13/10/2014	24/10/2014	Silty clayey loam	cfg
7111	WS2 D 1.50	13/10/2014	24/10/2014	Silty clayey loam	cfg
7112	WS3 P 0.50	13/10/2014	24/10/2014	Stone/ Concrete	cfg
7113	WS3 P 1.00	13/10/2014	24/10/2014	Sandy silty loam	cfg
7114	WS3 P 1.50	13/10/2014	24/10/2014	Silty loam	cfg
7115	WS3 D 3.00	13/10/2014	24/10/2014	Clayey loam	cfg
7116	WS4 P 0.50	13/10/2014	24/10/2014	Silty loam	cfg
7117	WS4 P 1.00	13/10/2014	24/10/2014	Silty loam	cfg
7118	WS5 P 0.30	13/10/2014	24/10/2014	Silty loam	cfg
7119	WS5 P 1.00	13/10/2014	24/10/2014	Silty loam	cfg
7120	BH1 D6 5.20	13/10/2014	24/10/2014	Clay	
7121	BH1 D9 8.00	13/10/2014	24/10/2014	Clayey loam	
7122	BH1 D15 14.00	13/10/2014	24/10/2014	Clayey loam	
7123	BH1 D18 17.00	13/10/2014	24/10/2014	Clay	
7124	BH2 D2 2.20	13/10/2014	24/10/2014	Silty clayey loam	
7125	BH2 D5 4.20	13/10/2014	24/10/2014	Clayey loam	
7126	BH2 D14 12.50	13/10/2014	24/10/2014	Clay	
7127	BH2 D26 25.00	13/10/2014	24/10/2014	Clayey loam	
7128	WS1 1.50	13/10/2014	24/10/2014		
7129	WS1 2.00	13/10/2014	24/10/2014		
7130	WS1 3.00	13/10/2014	24/10/2014		
7131	WS1 4.00	13/10/2014	24/10/2014		
7132	WS2 0.40	13/10/2014	24/10/2014		
7133	WS2 2.00	13/10/2014	24/10/2014		
7134	WS2 3.00	13/10/2014	24/10/2014		
7135	WS2 4.00	13/10/2014	24/10/2014		
7136	WS3 0.20	13/10/2014	24/10/2014		
7137	WS3 2.00	13/10/2014	24/10/2014		
7138	WS3 2.50	13/10/2014	24/10/2014		
7139	WS3 4.00	13/10/2014	24/10/2014		
7140	WS4 1.50	13/10/2014	24/10/2014		
7141	WS4 2.00	13/10/2014	24/10/2014		
7142	WS4 3.00	13/10/2014	24/10/2014		
7143	WS4 4.00	13/10/2014	24/10/2014		
7144	WS5 0.50	13/10/2014	24/10/2014		
7145	WS5 1.50	13/10/2014	24/10/2014		
7146	WS5 2.00	13/10/2014	24/10/2014		
7147	WS5 3.00	13/10/2014	24/10/2014		
7148	WS5 4.00	13/10/2014	24/10/2014		



Results Summary Report No.: 14-01039

		ELAB	Reference	7108	7109	7110	7111	7112	7113
	Cu	ustomer	Reference	Р	Р	Р	D	Р	Р
			Sample ID						
			mple Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			e Location	WS1	WS1	WS2	WS2	WS3	WS3
		•	Depth (m)	0.50	1.00	1.00	1.50	0.50	1.00
		Sam	pling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	13.8	17.5	17.4	14.3	^ 10.6	n/t
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	^ < 0.5	n/t
Chromium	M	mg/kg	5	15.9	27.8	26.9	36.3	^ 18.6	n/t
Copper	M	mg/kg	5	204	52.2	50.1	21.2	^ 57.9	n/t
Lead	M	mg/kg	5	190	351	478	38.4	^ 110	n/t
Mercury	M	mg/kg	0.5	< 0.5	0.7	1.7	< 0.5	^ < 0.5	n/t
Nickel	M	mg/kg	5	33.7	19.7	17.2	15.7	^ 36.0	n/t
Selenium	M	mg/kg	1	1.4	< 1.0	1.3	< 1.0	^ < 1.0	n/t
Zinc	M	mg/kg	45	94.0	88.1	69.8	54.5	^ 67.6	n/t
Anions									
Water Soluble Sulphate	M	g/l	0.01	0.23	0.06	0.04	0.02	^ 0.04	n/t
Inorganics									
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	n/t
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	^ < 1.0	n/t
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.22	0.09	0.06	0.04	0.84	n/t
Water Soluble Boron	N	mg/kg	0.5	1.6	2.5	2.1	1.7	1.4	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	< 0.1
Loss Of Ignition (450°C)	N	%	0.01	n/t	n/t	n/t	n/t	n/t	1.4
pH	M	units	0.1	9.6	7.6	7.1	7.4	^ 11.1	8.7
Total Organic Carbon	N	%	0.01	n/t	1.8	n/t	0.39	5.2	3.0



Results Summary Report No.: 14-01039

Report No.: 14-01039									
		ELAB	Reference	7108	7109	7110	7111	7112	7113
	Cu	ustomer	Reference	Р	Р	Р	D	Р	Р
			Sample ID						
		Sa	mple Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			e Location	WS1	WS1	WS2	WS2	WS3	WS3
		•	Depth (m)	0.50	1.00	1.00	1.50	0.50	1.00
				13/10/2014					
	0.1	1	-	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	Codes	Units	LOD						
Organics									
>C8-C10 BCB	N	mg/kg	1	cfg < 1.0	cfg 8.1	cfg < 1.0	cfg < 1.0	cfg < 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	cfg < 1.0	cfg 55.6	cfg < 1.0	cfg < 1.0	cfg < 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	cfg < 1.0	cfg 135	cfg < 1.0	cfg < 1.0	cfg < 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	cfg < 1.0	cfg 77.8	cfg < 1.0	cfg < 1.0	cfg < 1.0	n/t
>C21-C35 BCB	N	mg/kg	1	cfg 4.5	cfg 32.8	cfg 2.1	cfg 2.2	cfg 4.7	n/t
>C35-C40 BCB	N	mg/kg	1	cfg < 1.0	cfg 4.5	cfg < 1.0	cfg < 1.0	cfg < 1.0	n/t
Total (>C8-C40) BCB	N	mg/kg	1	cfg 4.5	cfg 314	cfg 2.1	cfg 2.2	cfg 4.7	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	c < 5	c < 5	c < 5	c < 5	c < 5	n/t
Polyaromatic hydrocarbor	าร								
Naphthalene	М	mg/kg	0.5	c < 0.5	c 10.7	c < 0.5	c < 0.5	c^ < 0.5	n/t
Acenaphthylene	M	mg/kg	0.5	c < 0.5	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Acenaphthene	M	mg/kg	0.5	c < 0.5	c 1.9	c < 0.5	c < 0.5	c^ < 0.5	n/t
Fluorene	М	mg/kg	0.5	c < 0.5	c 0.6	c < 0.5	c < 0.5	c^ < 0.5	n/t
Phenanthrene	М	mg/kg	0.5	c 0.9	c 2.2	c < 0.5	c < 0.5	c^ < 0.5	n/t
Anthracene	М	mg/kg	0.5	c < 0.5	c 1.6	c < 0.5	c < 0.5	c^ < 0.5	n/t
Fluoranthene	М	mg/kg	0.5	c 1.6	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Pyrene	M	mg/kg	0.5	c 1.3	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (a) anthracene	M	mg/kg	0.5	c 0.9	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Chrysene	М	mg/kg	0.5	c 1.3	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (b) fluoranthene	М	mg/kg	0.5	c 0.9	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (k) fluoranthene	М	mg/kg	0.5	c 0.8	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo (a) pyrene	М	mg/kg	0.5	c 0.7	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Indeno (1,2,3-cd) pyrene	М	mg/kg	0.5	c 0.6	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Dibenzo(a,h)anthracene	М	mg/kg	0.5	c < 0.5	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Benzo(ghi)perylene	M	mg/kg	0.5	c 0.6	c < 0.5	c < 0.5	c < 0.5	c^ < 0.5	n/t
Total PAH(16) Speciated	M	mg/kg	2	c 11	c 18	c < 2	c < 2	c^ < 2	n/t
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	n/t	n/t	n/t	n/t	c < 2
BTEX									
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	cfg < 0.01
Total Petroleum Hydrocar	bons								
Mineral Oil	U	mg/kg	5	n/t	n/t	n/t	n/t	n/t	cfg < 5
PCB (ICES 7 congeners)	-	5.9	-						<u> </u>
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	c < 0.03
- (



Results Summary Report No.: 14-01039

		ELAB	Reference	7114	7115	7116	7117	7118	7119
	Cu	ustomer	Reference	Р	D	Р	Р	Р	Р
			Sample ID						
			mple Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			e Location	WS3	WS3	WS4	WS4	WS5	WS5
						-	-		
		•	Depth (m)		3.00	0.50	1.00	0.30	1.00
		Sam	pling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	24.4	n/t	23.3	33.7	21.1	22.4
Cadmium	M	mg/kg	0.5	0.7	n/t	< 0.5	0.8	< 0.5	1.3
Chromium	M	mg/kg	5	27.7	n/t	32.0	34.4	48.4	31.1
Copper	M	mg/kg	5	82.0	n/t	91.2	111	63.2	90.9
Lead	M	mg/kg	5	848	n/t	1900	2530	585	555
Mercury	M	mg/kg	0.5	2.3	n/t	1.3	1.4	1.0	1.6
Nickel	M	mg/kg	5	26.7	n/t	28.4	33.6	34.7	28.1
Selenium	M	mg/kg	1	1.8	n/t	1.1	2.2	< 1.0	1.1
Zinc	M	mg/kg	45	837	n/t	413	593	277	119
Anions									
Water Soluble Sulphate	M	g/l	0.01	0.10	n/t	0.22	0.12	0.59	0.20
Inorganics									
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	n/t	< 0.8	< 0.8	< 0.8	< 0.8
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.16	n/t	0.22	0.16	0.20	0.33
Water Soluble Boron	N	mg/kg	0.5	3.9	n/t	5.1	4.7	3.6	2.9
Miscellaneous		· · · · ·							
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	< 0.1	n/t	n/t	n/t	n/t
Loss Of Ignition (450°C)	N	%	0.01	n/t	1.2	n/t	n/t	n/t	n/t
pH	M	units	0.1	7.5	8.1	7.2	7.2	8.0	7.5
Total Organic Carbon	N	%	0.01	n/t	0.26	n/t	n/t	1.9	n/t



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Report No.: 14-01039			1						
		ELAB	Reference	7114	7115	7116	7117	7118	7119
	Cu	ustomer	Reference	Р	D	Р	Р	Р	Р
		:	Sample ID						
		Sa	mple Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			e Location	WS3	WS3	WS4	WS4	WS5	WS5
		•	Depth (m)	1.50	3.00	0.50	1.00	0.30	1.00
		•	• • • •	13/10/2014	13/10/2014		13/10/2014		
	0.1			13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	Codes	Units	LOD						
Organics									
>C8-C10 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C10-C12 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C12-C16 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C16-C21 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
>C21-C35 BCB	N	mg/kg	1	cfg 2.4	n/t	cfg 4.1	cfg 4.1	cfg 5.0	cfg 2.5
>C35-C40 BCB	N	mg/kg	1	cfg < 1.0	n/t	cfg < 1.0	cfg < 1.0	cfg < 1.0	cfg < 1.0
Total (>C8-C40) BCB	N	mg/kg	1	cfg 2.4	n/t	cfg 4.1	cfg 4.1	cfg 5.0	cfg 2.5
Phenols									
Total Monohydric Phenols	N	mg/kg	5	c < 5	n/t	c < 5	c < 5	c < 5	c < 5
Polyaromatic hydrocarbon	S								
Naphthalene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Acenaphthylene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Acenaphthene	М	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Fluorene	М	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Phenanthrene	М	mg/kg	0.5	c < 0.5	n/t	c 0.5	c 0.5	c < 0.5	c < 0.5
Anthracene	М	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Fluoranthene	М	mg/kg	0.5	c < 0.5	n/t	c 1.5	c 2.5	c < 0.5	c < 0.5
Pyrene	М	mg/kg	0.5	c < 0.5	n/t	c 1.4	c 2.2	c < 0.5	c < 0.5
Benzo (a) anthracene	M	mg/kg	0.5	c < 0.5	n/t	c 1.0	c 1.7	c < 0.5	c < 0.5
Chrysene	М	mg/kg	0.5	c < 0.5	n/t	c 1.2	c 1.9	c < 0.5	c < 0.5
Benzo (b) fluoranthene	М	mg/kg	0.5	c < 0.5	n/t	c 0.7	c 1.1	c < 0.5	c < 0.5
Benzo (k) fluoranthene	М	mg/kg	0.5	c < 0.5	n/t	c 1.1	c 1.8	c < 0.5	c < 0.5
Benzo (a) pyrene	М	mg/kg	0.5	c < 0.5	n/t	c 1.0	c 1.7	c < 0.5	c < 0.5
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.5	c < 0.5	n/t	c 0.5	c 0.9	c < 0.5	c < 0.5
Dibenzo(a,h)anthracene	M	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5	c < 0.5	c < 0.5
Benzo(ghi)perylene	M	mg/kg	0.5	c < 0.5	n/t	c 0.5	c 0.8	c < 0.5	c < 0.5
Total PAH(16) Speciated	М	mg/kg	2	c < 2	n/t	c 10	c 16	c < 2	c < 2
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	c < 2	n/t	n/t	n/t	n/t
BTEX									
Total BTEX	M	mg/kg	0.01	n/t	cfg < 0.01	n/t	n/t	n/t	n/t
Total Petroleum Hydrocark	ons								
Mineral Oil		mg/kg	5	n/t	cfg < 5	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)		J	-						
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	c < 0.03	n/t	n/t	n/t	n/t
	101	ing/itg	0.00	14/1	0 0.00	11/ L	14/1	171	· // t



Results Summary Report No.: 14-01039

Report No.: 14-01035									
		ELAB	Reference	7120	7121	7122	7123	7124	7125
	Cu	stomer	Reference	D6	D9	D15	D18	D2	D5
		:	Sample ID						
			mple Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			e Location	BH1	BH1	BH1	BH1	BH2	BH2
		•	Depth (m)		8.00	14.00	17.00	2.20	4.20
		Sam	pling Date	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Cadmium	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Chromium	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Copper	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Lead	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Nickel	M	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Selenium	M	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Zinc	M	mg/kg	45	n/t	n/t	n/t	n/t	n/t	n/t
Anions									
Water Soluble Sulphate	M	g/l	0.01	0.17	0.98	0.33	0.25	0.07	0.03
Inorganics									
Hexavalent Chromium	N	mg/kg	0.8	n/t	n/t	n/t	n/t	n/t	n/t
Total Cyanide	M	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss Of Ignition (450°C)	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
pH	M	units	0.1	8.1	7.8	8.2	8.3	7.8	8.3
Total Organic Carbon	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t



Results Summary Report No.: 14-01039

Report No.: 14-01039								1	
		ELAB	Reference	7120	7121	7122	7123	7124	7125
	Cu	ustomer	Reference	D6	D9	D15	D18	D2	D5
			Sample ID						
		Sa	mple Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			e Location	BH1	BH1	BH1	BH1	BH2	BH2
		•	Depth (m)	5.20	8.00	14.00	17.00	2.20	4.20
		•	pling Date		13/10/2014	13/10/2014			13/10/2014
Determinand	Codes	1		13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014	13/10/2014
	Codes	Units	LOD						
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C21-C35 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C35-C40 BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Total (>C8-C40) BCB	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
Polyaromatic hydrocarbon	S								
Naphthalene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Acenaphthylene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Acenaphthene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Fluorene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Phenanthrene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Anthracene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Fluoranthene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Pyrene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (a) anthracene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Chrysene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (b) fluoranthene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (k) fluoranthene	M	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo (a) pyrene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Indeno (1,2,3-cd) pyrene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Dibenzo(a,h)anthracene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Benzo(ghi)perylene	М	mg/kg	0.5	n/t	n/t	n/t	n/t	n/t	n/t
Total PAH(16) Speciated	M	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
Total PAH (Including Coronene)	N	mg/kg	2.1	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Total BTEX	М	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Total Petroleum Hydrocark	ons								
Mineral Oil		mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)									
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t
			0.00	140	140	140			



Results Summary Report No.: 14-01039

Report No.: 14-01039					
		ELAB	Reference	7126	7127
	Cu	stomer	Reference	D14	D26
		:	Sample ID		
			mple Type	SOIL	SOIL
			e Location	BH2	BH2
		•	Depth (m)	12.50	25.00
		•	• • • •		13/10/2014
				13/10/2014	13/10/2014
Determinand	Codes	Units	LOD		
Metals					
Arsenic	M	mg/kg	1	n/t	n/t
Cadmium	M	mg/kg	0.5	n/t	n/t
Chromium	M	mg/kg	5	n/t	n/t
Copper	M	mg/kg	5	n/t	n/t
Lead	M	mg/kg	5	n/t	n/t
Mercury	M	mg/kg	0.5	n/t	n/t
Nickel	M	mg/kg	5	n/t	n/t
Selenium	M	mg/kg	1	n/t	n/t
Zinc	M	mg/kg	45	n/t	n/t
Anions					
Water Soluble Sulphate	M	g/l	0.01	0.25	0.20
Inorganics					
Hexavalent Chromium	N	mg/kg	0.8	n/t	n/t
Total Cyanide	M	mg/kg	1	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	n/t	n/t
Miscellaneous					
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t
Loss Of Ignition (450°C)	N	%	0.01	n/t	n/t
рН	M	units	0.1	8.3	8.4
Total Organic Carbon	N	%	0.01	n/t	n/t



Results Summary Report No.: 14-01039

Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene Phenothrene	N N N N N N N N N M M	stomer Sample Sample Sam Units mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	Reference Reference Sample ID mple Type e Location Depth (m) pling Date LOD 1 1 1 1 1 1 1 1 5 5	7126 D14 SOIL BH2 12.50 13/10/2014 n/t n/t n/t n/t n/t n/t n/t	7127 D26 SOIL BH2 25.00 13/10/2014 n/t n/t n/t n/t n/t n/t n/t n/t n/t
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene Phenothrene	N N N N N N N N N M M	Sample Sample Sample Sam Units mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	Sample ID mple Type e Location Depth (m) pling Date LOD 1 1 1 1 1 1 1 5	SOIL BH2 12.50 13/10/2014 n/t n/t n/t n/t n/t n/t n/t n/t	SOIL BH2 25.00 13/10/2014
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene Phenothrene	N N N N N N N N N M M M	Sample Sample Sample Sam Units Mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	mple Type e Location Depth (m) pling Date LOD 1 1 1 1 1 1 1 5	BH2 12.50 13/10/2014 n/t n/t n/t n/t n/t n/t n/t	BH2 25.00 13/10/2014 n/t n/t n/t n/t n/t n/t
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene Phenothrene	N N N N N N N N N M M M	Sample Sample Sam Units Mg/kg Mg/kg Mg/kg Mg/kg Mg/kg Mg/kg Mg/kg	e Location Depth (m) pling Date LOD 1 1 1 1 1 1 1 5	BH2 12.50 13/10/2014 n/t n/t n/t n/t n/t n/t n/t	BH2 25.00 13/10/2014 n/t n/t n/t n/t n/t n/t
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene Phenothrene	N N N N N N N N N M M M	Sample Sample Sam Units Mg/kg Mg/kg Mg/kg Mg/kg Mg/kg Mg/kg Mg/kg	e Location Depth (m) pling Date LOD 1 1 1 1 1 1 1 5	12.50 13/10/2014 n/t n/t n/t n/t n/t n/t	25.00 13/10/2014 n/t n/t n/t n/t n/t n/t n/t
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene Phenothrene	N N N N N N N N N M M M	Sample Sam Units Mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	Depth (m) pling Date LOD 1 1 1 1 1 1 1 5	12.50 13/10/2014 n/t n/t n/t n/t n/t n/t n/t	25.00 13/10/2014 n/t n/t n/t n/t n/t n/t n/t
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene	N N N N N N N N N M M M	Sam Units mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	pling Date LOD 1 1 1 1 1 1 1 5	13/10/2014 	13/10/2014
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene	N N N N N N N M M	Units mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	LOD 1 1 1 1 1 1 1 1 5	n/t n/t n/t n/t n/t n/t	n/t n/t n/t n/t n/t n/t
Organics >C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenothrene Fluorene Phenothrene Phenothrene	N N N N N N N M M	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	1 1 1 1 1 1 1 5	n/t n/t n/t n/t n/t	n/t n/t n/t n/t n/t
>C8-C10 BCB >C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Fluoranthene Fluoranthene Pluoranthene	N N N N N N M M	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	1 1 1 1 1 1 5	n/t n/t n/t n/t n/t	n/t n/t n/t n/t n/t
>C10-C12 BCB >C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Fluoranthene Fluoranthene Pluoranthene	N N N N N N M M	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	1 1 1 1 1 1 5	n/t n/t n/t n/t n/t	n/t n/t n/t n/t n/t
>C12-C16 BCB >C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Fluoranthene Fluoranthene Pyrene	N N N N N M M	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg	1 1 1 1 1 5	n/t n/t n/t n/t n/t	n/t n/t n/t n/t n/t
>C16-C21 BCB >C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Fluoranthene Fluoranthene Pyrene	N N N N M M	mg/kg mg/kg mg/kg mg/kg mg/kg	1 1 1 5	n/t n/t n/t n/t	n/t n/t n/t n/t
>C21-C35 BCB >C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene	N N N N M M	mg/kg mg/kg mg/kg mg/kg mg/kg	1 1 1 5	n/t n/t n/t	n/t n/t n/t
>C35-C40 BCB Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthylene Fluorene Phenanthrene Fluorene Fluoranthene Fluoranthene	N N M M	mg/kg mg/kg mg/kg mg/kg	1 1 5	n/t n/t	n/t n/t
Total (>C8-C40) BCB Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene	N N M M	mg/kg mg/kg mg/kg	1 5	n/t	n/t
Phenols Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene	N M M	mg/kg mg/kg	5		
Total Monohydric Phenols Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene	M M	mg/kg		n/t	n/t
Polyaromatic hydrocarbons Naphthalene Acenaphthylene Acenaphthylene Fluorene Phenanthrene Phenanthrene Anthracene Fluoranthene Pluoranthene Phenanthrene	M M	mg/kg		n/t	n/t
Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene	М		0.5		
Naphthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene	М		0.5		
Acenaphthene Fluorene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Pyrene			0.0	n/t	n/t
Fluorene Phenanthrene Anthracene Fluoranthene Pyrene		mg/kg	0.5	n/t	n/t
Phenanthrene Anthracene Fluoranthene Pyrene	M	mg/kg	0.5	n/t	n/t
Anthracene Fluoranthene Pyrene	М	mg/kg	0.5	n/t	n/t
Fluoranthene Pyrene	М	mg/kg	0.5	n/t	n/t
Pyrene	М	mg/kg	0.5	n/t	n/t
· ·	М	mg/kg	0.5	n/t	n/t
Benzo (a) anthracene	М	mg/kg	0.5	n/t	n/t
	М	mg/kg	0.5	n/t	n/t
Chrysene	М	mg/kg	0.5	n/t	n/t
Benzo (b) fluoranthene	М	mg/kg	0.5	n/t	n/t
Benzo (k) fluoranthene	М	mg/kg	0.5	n/t	n/t
	М	mg/kg	0.5	n/t	n/t
Indeno (1,2,3-cd) pyrene	М	mg/kg	0.5	n/t	n/t
Dibenzo(a,h)anthracene	М	mg/kg	0.5	n/t	n/t
	M	mg/kg	0.5	n/t	n/t
	М	mg/kg	2	n/t	n/t
· · · · · · · · · · · · · · · · · · ·	N	mg/kg	2.1	n/t	n/t
BTEX					
	M	mg/kg	0.01	n/t	n/t
Total Petroleum Hydrocarbor	าร				
Mineral Oil	U	mg/kg	5	n/t	n/t
PCB (ICES 7 congeners)					
PCB (Total of 7 Congeners)		mg/kg	0.03	n/t	n/t



MCERTS

Results Summary Report No.: 14-01039

Elab Ref:	7115						I Waste Ac Criteria Lim	•
Sample Date:	13/10/201	4					Stable Non-	
Sample ID:	WS3 D						reactive	
Depth:	3					Inert	Hazardous	Hazardous
Site:	-		Kilbum High	Road		Waste	waste in	Waste
			0			Landfill	non- hazardous	Landfill
Determinand		Code	Units				Landfill	
Total Organic Carbon		N	%		0.3	3	5	6
Loss on Ignition		М	%		1.2			10
Total BTEX		М	mg/kg		< 0.01	6		
Total PCBs (7 congeners)		М	mg/kg		< 0.03	1		
TPH Total WAC		М	mg/kg		< 5	500		
Total (of 17) PAHs		Ν	mg/kg		< 2	100		
pH		М	5.5		8.1		>6	
Acid Neutralisation Capacity		N	mol/kg		< 0.1		To evaluate	To evaluate
Eluate Analysis			2:1	8:1	10:1	Limit	values for cor	
Liuale Analysis				-			est using BS I	
			mg/l	mg/l	mg/kg	-	L/S 10 l/kg	
Arsenic		Ν	< 0.005	< 0.005	< 0.05	0.5	2	25
Barium		Ν	< 0.005	< 0.005	< 0.05	20	100	300
Cadmium		Ν	< 0.001	< 0.001	< 0.01	0.04	1	5
Chromium		Ν	< 0.005	< 0.005	< 0.05	0.5	10	70
Copper		Ν	< 0.005	< 0.005	< 0.05	2	50	100
Mercury		Ν	< 0.005	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		Ν	< 0.005	< 0.005	< 0.05	0.5	10	30
Nickel		Ν	< 0.001	< 0.001	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.001	< 0.05	0.5	10	50
Antimony		Ν	< 0.005	< 0.005	< 0.05	0.06	0.7	5
Selenium		Ν	< 0.005	< 0.005	< 0.05	0.1	0.5	7
Zinc		Ν	< 0.005	< 0.005	< 0.05	4	50	200
Chloride		Ν	28.000	8.000	104.00	800	15000	25000
Fluoride		Ν	< 1	< 1	< 10	10	150	500
Sulphate		N	98.000	8.000	183.00	1000	20000	50000
Total Dissolved Solids		N	290.000	140.000	1570.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	15.300	9.430	101.00	500	800	1000
Leach Test Informatio	n							
Eluent Volume (ml)		N	195	1400				
pH		N	7.9	7.6				
Conductivity (uS/cm)		N	500	149				
Temperature (°C)		N	18	19				
Solid Information			-					
Dry mass of test portion (g)			175					
Moisture (%)			30					

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation



MCERTS

Results Summary Report No.: 14-01039

WAC Analysis Elab Ref:	7113						I Waste Ac Criteria Lim	•
Sample Date:	13/10/201	4					Stable Non-	
Sample ID:	WS3 P						reactive	
Depth:	1					Inert	Hazardous	Hazardous
Site:			Kilbum High l	Road		Waste	waste in	Waste
			5			Landfill	non- hazardous	Landfill
Determinand		Code	Units				Landfill	
Total Organic Carbon		N	%		3.0	3	5	6
Loss on Ignition		M	%		1.4			10
Total BTEX		М	mg/kg		< 0.01	6		
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1		
TPH Total WAC		M	mg/kg		< 5	500		
Total (of 17) PAHs		N	mg/kg		< 2	100		
pH		M			8.7		>6	
Acid Neutralisation Capacity		N	mol/kg		< 0.1		To evaluate	To evaluate
. ,		IN	-	0.4				
Eluate Analysis			2:1	8:1	10:1		values for cor est using BS I	
			mg/l	mg/l	mg/kg	louoning t	L/S 10 l/kg	
Arsenic		N	< 0.005	< 0.005	< 0.05	0.5	2	25
Barium		N	0.027	0.008	0.10	20	100	300
Cadmium		N	< 0.001	< 0.001	< 0.01	0.04	1	5
Chromium		N	< 0.005	< 0.005	< 0.05	0.5	10	70
Copper		N	< 0.005	< 0.005	< 0.05	2	50	100
Mercury		N	< 0.005	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		N	0.029	0.007	0.10	0.5	10	30
Nickel		N	0.001	< 0.001	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.001	< 0.05	0.5	10	50
Antimony		N	< 0.005	< 0.005	< 0.05	0.06	0.7	5
Selenium		N	< 0.005	< 0.005	< 0.05	0.1	0.5	7
Zinc		N	0.006	< 0.005	< 0.05	4	50	200
Chloride		N	16.000	7.000	80.00	800	15000	25000
Fluoride		N	< 1	< 1	< 10	10	150	500
Sulphate		N	637.000	63.000	1450.00	1000	20000	50000
Total Dissolved Solids		N	1110.000	170.000	3040.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	11.400	6.120	69.00	500	800	1000
Leach Test Informatio	n							
Eluent Volume (ml)		N	250	1400				
pH		N	7.5	7.7				
Conductivity (uS/cm)		N	1350	250				
Temperature (°C)		N	18	19				
Solid Information			-					
Dry mass of test portion (g)			176					
Moisture (%)			22.7					

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation



Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonards on Sea, East Sussex, TN38 9BY Tel: +44 (0)1424 718618, Email: info@elab-uk.co.uk, Web: www.elab-uk.co.uk

Results Summary

Report No.: 14-01039

Asbestos Qualitative Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Result
7108	0.50	WS1 P	Sandy silty loam	No asbestos detected
7112	0.50	WS3 P	Stone/ Concrete	No asbestos detected
7114	1.50	WS3 P	Silty loam	No asbestos detected
7116	0.50	WS4 P	Silty loam	No asbestos detected



Method Summary Report No.: 14-01039

Parameter	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil				
Hexavalent chromium	As submitted sample	28/10/2014	110	Colorimetry
Acid Soluble Sulphate	Air dried sample	03/11/2014	115	Ion Chromatography
Aqua regia extractable metals	Air dried sample	29/10/2014	118	ICPMS
Phenols in solids	As submitted sample	28/10/2014	121	HPLC
Polyaromatic hydrocarbons (GC-FID)	As submitted sample	28/10/2014	133	GC-FID
Water soluble anions	Air dried sample	29/10/2014	172	Ion Chromatography
Water soluble boron	Air dried sample	29/10/2014	202	Colorimetry
Total cyanide	As submitted sample	30/10/2014	204	Colorimetry
Basic carbon banding in soil	As submitted sample	28/10/2014	218	GC-FID
Asbestos identification	As submitted sample	29/10/2014	PMAN	Microscopy
Leachate				
Arsenic*		29/10/2014	101	ICPMS
Cadmium*		29/10/2014	101	ICPMS
Chromium*		29/10/2014	101	ICPMS
Lead*		29/10/2014	101	ICPMS
Nickel*		29/10/2014	101	ICPMS
Copper*		29/10/2014	101	ICPMS
Zinc*		29/10/2014	101	ICPMS
Mercury*		29/10/2014	101	ICPMS
Selenium*		29/10/2014	101	ICPMS
Antimony		29/10/2014	101	ICPMS
Barium*		29/10/2014	101	ICPMS
Molybdenum*		29/10/2014	101	ICPMS
pH Value*		29/10/2014	113	Electrometric
Electrical Conductivity*		29/10/2014	136	Probe
Dissolved Organic Carbon		29/10/2014	102	TOC analyser
Chloride*		29/10/2014	131	Ion Chromatography
Fluoride*		29/10/2014	131	Ion Chromatography
Sulphate*		29/10/2014	131	Ion Chromatography
Total Dissolved Solids		29/10/2014	144	Gravimetric
Phenol index		29/10/2014	121	HPLC
WAC Solids analysis				
pH Value**	Air dried sample	29/10/2014	113	Electrometric
Total Organic Carbon	Air dried sample	29/10/2014	210	IR
Loss on Ignition**	Air dried sample	29/10/2014	129	Gravimetric
Acid Neutralization Capacity to pH 7	Air dried sample	29/10/2014	NEN 737	Electrometric
Total BTEX**	As submitted sample	29/10/2014	181	GCMS
Mineral Oil**	As submitted sample	29/10/2014	117	GCFID
Total PCBs (7 congeners)	Air dried sample	29/10/2014	120	GCMS
Total PAH (17)**	As submitted sample	29/10/2014	133	GCFID



Report Information

Report No.: 14-01039

Key

Ney	
U	hold UKAS accreditation
М	hold MCERTS and UKAS accreditation
Ν	do not currently hold UKAS accreditation
Λ	MCERTS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"
	Comments or interpretations are beyond the scope of UKAS accreditation
	The results relate only to the items tested
	Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

- a No date of sampling supplied
- b No time of sampling supplied (Waters Only)
- c Sample not received in appropriate containers
- d Sample not received in cooled condition
- e The container has been incorrectly filled
- f Sample age exceeds stability time (sampling to receipt)
- g Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month All water samples will be retained for 7 days following the date of the test report Charges may apply to extended sample storage



APPENDIX 4 – GEOTECHNICAL LABORATORY TEST RESULTS



LABORATORY REPORT



4043

Contract Number: PSL14/5410

Client's Reference:

Report Date: 31 October 2014

Client Name: Jomas Associates Ltd Associates Ltd Associates Ltd 1 Furzeground Way Lakeside House Stockley Park UB11 1BD

For the attention of: Roni Savage

Contract Title: Kilburn High Road

 Date Received:
 22/10/2014

 Date Commenced:
 22/10/2014

 Date Completed:
 31/10/2014

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

Mburs

M Beastall (Laboratory Manager)

Page 1 of

D Lambe (Senior Technician)

R Gunson

(Director)

S Royle

(Senior Technician)

A Watkins

(Director)

5 – 7 Hexthorpe Road, Hexthorpe, Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642 e-mail: rgunson@prosoils.co.uk awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH1	1	U	1.50	Firm grey mottled brown slightly gravelly slightly sandy CLAY.
BH1	7	U	5.50	Firm brown mottled grey slightly sandy CLAY.
BH1	10	U	8.50	Stiff brown slightly sandy CLAY.
BH1	13	U	11.50	Very stiff brown slightly sandy CLAY.
BH1	19	U	17.50	Stiff brown slightly sandy CLAY.
BH1	25	U	23.50	Very stiff brown slightly sandy CLAY.
BH2	3	U	2.50	Firm brown slightly sandy CLAY.
BH2	6	U	4.50	Firm brown mottled grey slightly sandy CLAY.
BH2	9	U	7.00	Stiff brown slightly sandy CLAY.
BH2	15	U	13.00	Very stiff brown slightly sandy CLAY.
BH2	21	U	19.00	Very stiff brown slightly sandy CLAY.

	Compiled by	Date	Checked by	Date	Approved by	Date
e pe	$\mathcal{O}\mathcal{O}\mathcal{O}$	31/10/14	M.S.	31/10/14	M.S.	31/10/14
Professional Soils Laboratory	V	ILBURN H	Contract No:	PSL14/5410		
	ĸ			Client Ref:	P8592J338-07	

SUMMARY OF SOIL CLASSIFICATION TESTS

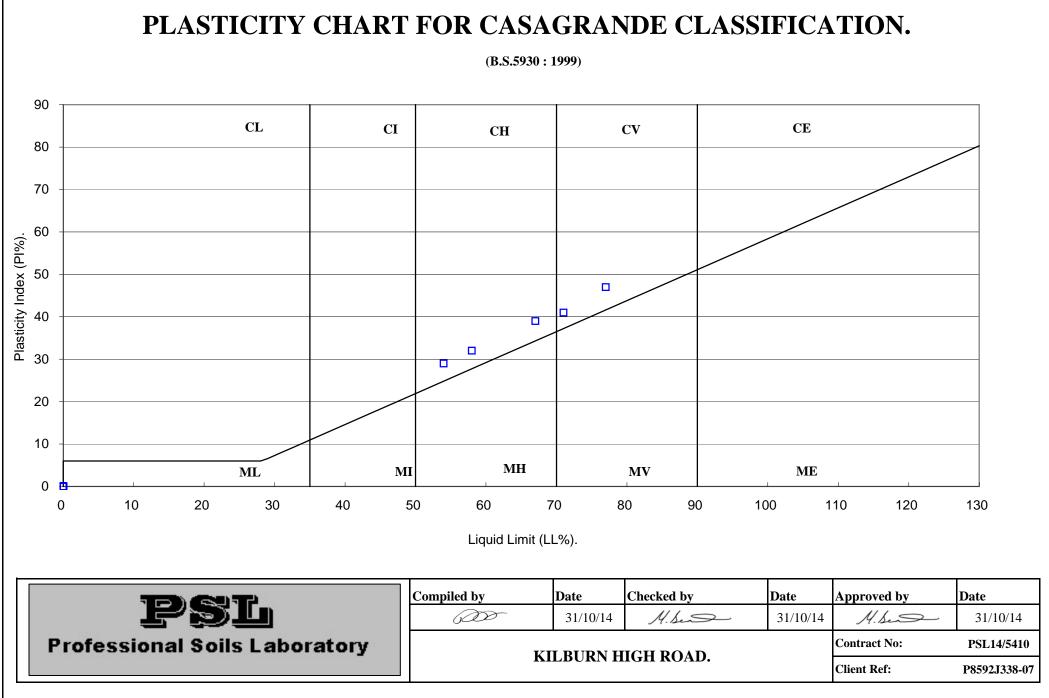
(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content %	Bulk Density Mg/m ³	Dry Density Mg/m ³	Particle Density Mg/m ³	Liquid Limit %	Plastic Limit %	Plasticity Index %	% Passing .425mm	Remarks
				Clause 3.2	Clause 7.2	Clause 7.2	Clause 8.2	Clause 4.3/4.4	Clause 5.3	Clause 5.4		
BH1	1	U	1.50	30				58	26	32	100	High plasticity CH.
BH1	13	U	11.50	30				77	30	47	100	Very high plasticity CV.
BH2	6	U	4.50	31				67	28	39	100	High plasticity CH.
BH2	9	U	7.00	29				71	30	41	100	Very high plasticity CV.
BH2	21	U	19.00	26				54	25	29	100	High plasticity CH.

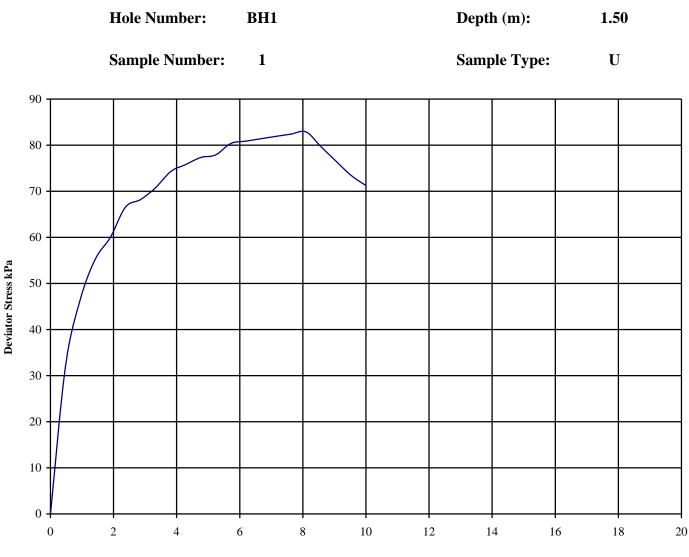
SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

	Compiled by	Date	Checked by	Date	Approved by	Date
Pol	$\mathcal{O}\mathcal{D}\mathcal{D}$	31/10/14	M. Sent	31/10/14	M. Sun	31/10/14
Professional Soils Laboratory	V	LBURN H		Contract No:	PSL14/5410	
	K		Client Ref:	P8592J338-07		



without measurement of Pore Pressure B.S. 1377 : Part7 : Clause 8 : 1990



Axial Strain %

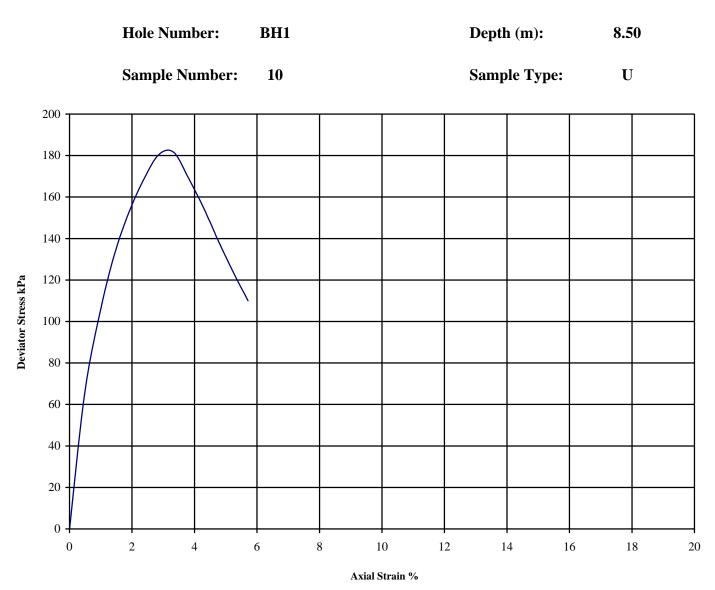
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 n	nm Single	Stage.	Undistu	bed		
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Remarks			
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	Sample taken from top of tube			
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of stra	ain = 1.9 %	%/min		
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm t	hickness,	
	$\theta_3 \qquad (\theta_1 - \theta_3)_f \qquad \frac{1}{2}(\theta_1 - \theta_3)_f \qquad \text{Correction applied} \qquad 0$							0.36	kPa				
А	30	1.81	1.40	30	83	41	8.1	Brittle	See summary of soil descriptions.				
									Checked	Date	Approved	Date	
									N.b.S	31/10/14	M.b.S	31/10/14	
Profes	P S ssional S	SL ioils Labo	oratory				act No: 4/5410						

without measurement of Pore Pressure B.S. 1377 : Part7 : Clause 8 : 1990



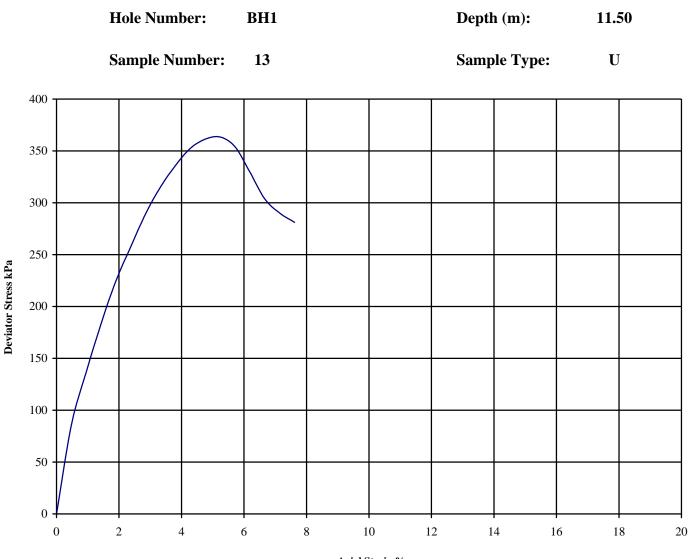
Axial Strain %

Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 n	nm Single	Stage.	Undistu	bed		
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Remarks			
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ten from t	op of tube		
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of stra	ain = 1.9 %	%/min		
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm t	hickness,	
$\theta_3 \qquad (\theta_1 - \theta_3)_f \frac{1}{2}(\theta_1 - \theta_3)_f$								Correction	applied	0.36	kPa		
A 32 1.90 1.44 110 134 67 5.2 Bri							Brittle	See summary of soil descriptions.					
									Checked	Date	Approved	Date	
									M.b.D	31/10/14	M.b.D	31/10/14	
Profes		SL oils Labo	pratory	KILBURN HIGH ROAD.					Contract No: PSL14/5410				



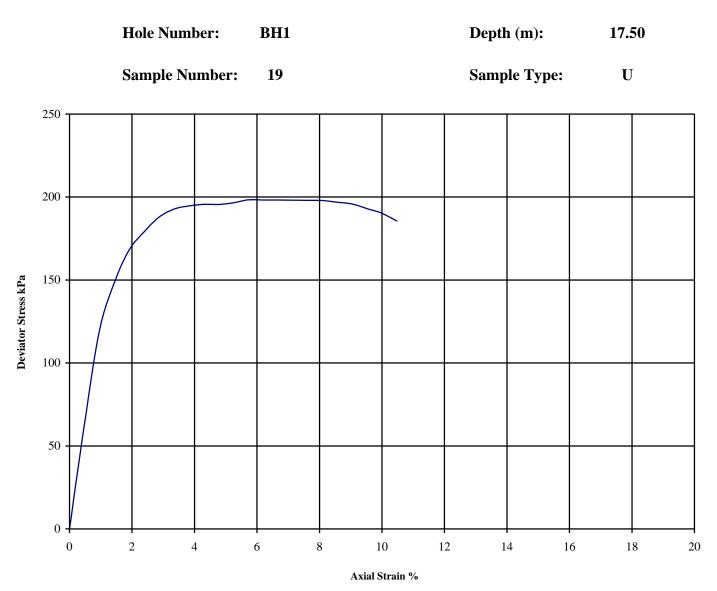
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	nm Single	Stage.	Undistu	rbed			
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode	Remarks					
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ken from t	op of tube			
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of str	ain = 1.9 9	%/min			
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm t	hickness,		
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.37 kPa					
А	31	1.94	1.48	170	182	91	3.3	Brittle	See summary of soil descriptions.					
									Checked	Date	Approved	Date		
									M.b.D	31/10/14	M.b.D	31/10/14		
Profes	P ssional S	SL ioils Labo	oratory	KILBURN HIGH ROAD.					Contract No: PSL14/5410					

without measurement of Pore Pressure B.S. 1377 : Part7 : Clause 8 : 1990

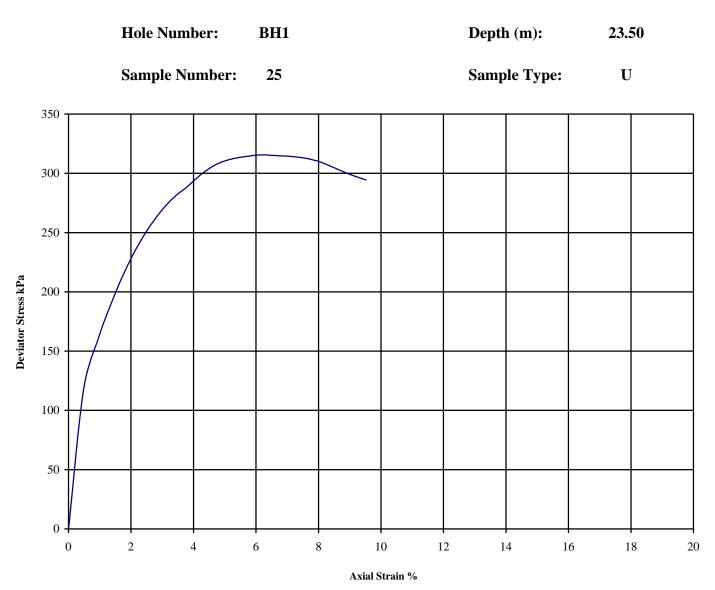


Axial Strain %

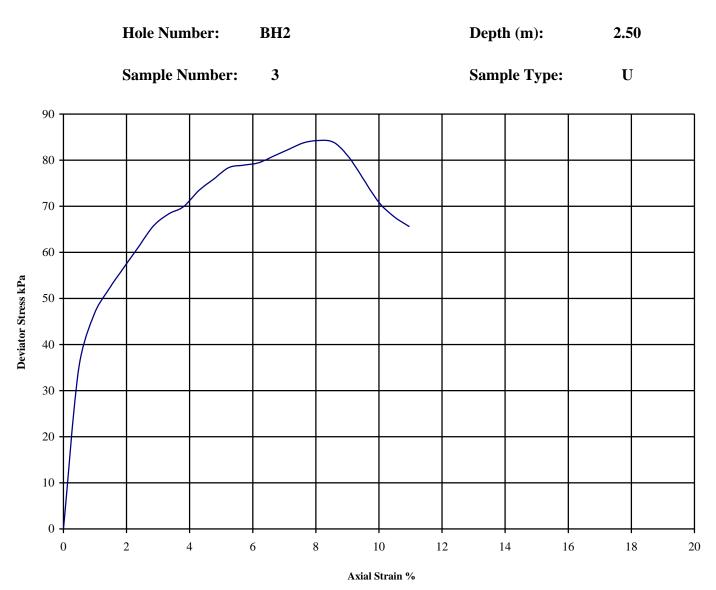
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 n	nm Single	Stage.	Undistur	rbed		
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode	Remarks				
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ten from to	op of tube		
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of str	ain = 1.9 %	%/min		
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm ti	hickness,	
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.36 k				
А	30	1.96	1.51	230	363	182	5.2	Brittle	See summary of soil descriptions.				
									Checked	Date	Approved	Date	
									M.b.S	31/10/14	M.b.D	31/10/14	
Profes	P ssional S	SL ioils Labo	pratory	KILBURN HIGH ROAD.							act No: 4/5410		



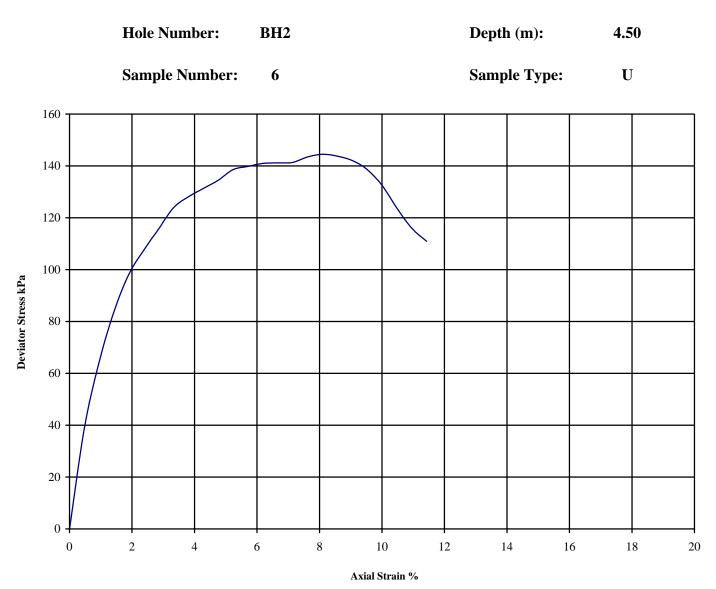
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	m Single	Stage.	Undistur	bed		
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Remarks			
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ten from to	op of tube		
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of str	ain = 1.9 %	%/min		
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm ti	hickness,	
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.36 kPa				
А	28	1.96	1.54	350	198	99	5.7	Brittle	See summary of soil descriptions.				
									Checked	Date	Approved	Date	
									M.b.D	31/10/14	M.b.D	31/10/14	
Profes		SL ioils Labo	oratory		KILBUF	RN HIGH	I ROAD).			act No: 4/5410		



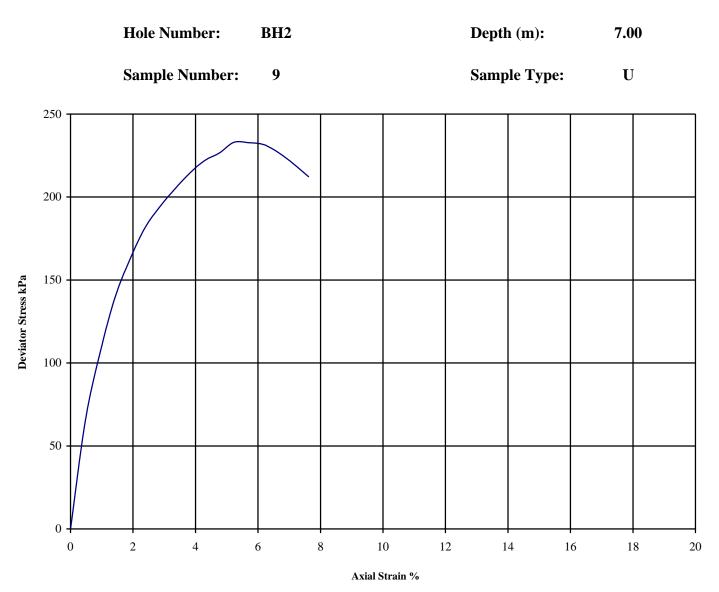
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	nm Single	Stage.	Undistur	bed	
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Ren	narks	
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ten from to	op of tube	
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of stra	ain = 1.9 %	%/min	
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm ti	hickness,
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction	applied	0.36	kPa
А	30	1.95	1.50	470	316	158	6.2	Brittle	See summa	ary of soil	description	s.
									Checked	Date	Approved	Date
									M.b.D	31/10/14	M.b.D	31/10/14
Profes	P S ssional S	SL oils Labo	oratory		KILBUF	RN HIGH	I ROAD).	FF			



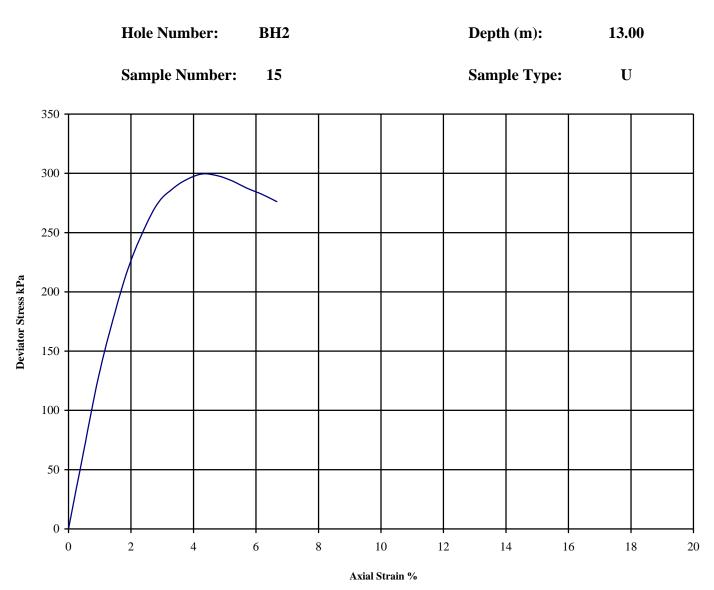
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 n	nm Single	Stage.	Undistur	bed	
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Ren	narks	
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ken from to	op of tube	
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of stra	ain = 1.9 %	6/min	
					(kPa)	(kPa)			Latex Men	nbrane use	d 0.2 mm t	hickness,
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.36 kl			kPa
A 30 1.96 1.51				50	84	42	8.1	Brittle	See summa	ary of soil	description	s.
									Checked	Date	Approved	Date
									M.b.S.	31/10/14	M.b.S	31/10/14
PSL Professional Soils Laboratory					KILBUF	RN HIGH	I ROAI).			act No: 4/5410	



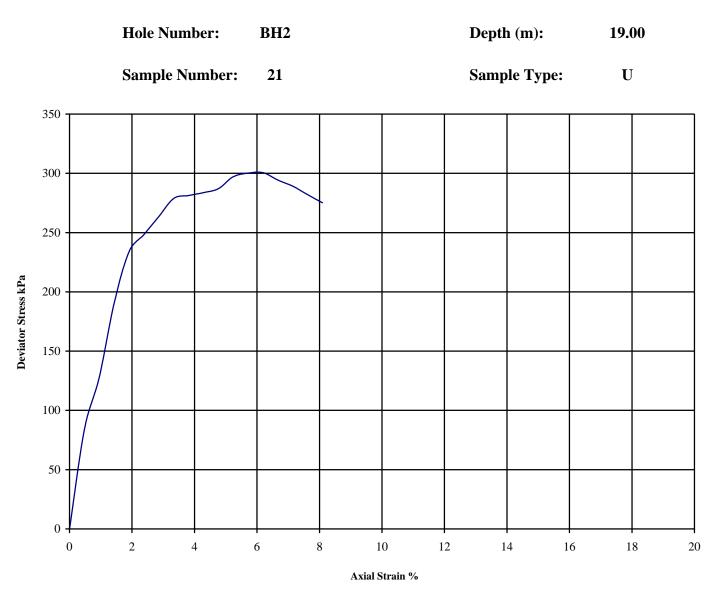
Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	nm Single	Stage. Undisturbed				
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Ren	narks		
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ten from t	op of tube		
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of str	ain = 1.9 %	%/min		
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm t	hickness,	
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction	applied	0.36	kPa	
А	31	1.93	1.48	90	145	72	8.1	Brittle	See summa	ary of soil	description	IS.	
									Checked	Date	Approved	Date	
									M.b.D	31/10/14	M.b.S.	31/10/14	
Profes	P ssional S	SL ioils Labo	oratory		KILBUF	RN HIGH	I ROAD).	Contract No: PSL14/5410				



Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	m Single	Stage.	Undistur	bed	
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode	Remarks			
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tak	ten from to	op of tube	
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of stra	ain = 1.9 %	%/min	
					(kPa)	(kPa)			Latex Men	nbrane use	ed 0.2 mm t	hickness,
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.36 kPa			kPa
А	29	1.76	1.36	140	233	116	5.2	Brittle	See summa	ary of soil	description	s.
								Checked Date Approved				Date
									M.b.S	31/10/14	M.b.S	31/10/14
Profes	P ssional S	SL ioils Labo	oratory		KILBUF	RN HIGH	I ROAD).	Contract No: PSL14/5410			



Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	nm Single	Stage. Undisturbed			
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Ren	narks	
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tal	ten from t	op of tube	
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of str	ain = 1.9 %	%/min	
					(kPa)	(kPa)			Latex Mer	nbrane use	ed 0.2 mm t	hickness,
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.36 kPa			kPa
А	28	1.99	1.56	260	300	150	4.3	Brittle	See summ	ary of soil	description	s.
									Checked	Date	Approved	Date
									M.b.D	31/10/14	M.b.D	31/10/14
Profes	P ssional S	SL ioils Labo	oratory		KILBUF	RN HIGH	I ROAD).	Contract No: PSL14/5410			



Diamete	er (mm):	102.0	Height (mm):	210.0	Test:	100 m	nm Single	Stage. Undisturbed				
Specimen	Moisture	Bulk	Dry	Cell	Corr. Max.	Shear	Failure	Mode		Ren	narks		
	Content	Density	Density	Pressure	Deviator	Strength	Strain	of	Sample tal	ten from t	op of tube		
	(%)	(Mg/m3)	(Mg/m3)	(kPa)	Stress	Cu	(%)	Failure	Rate of str	ain = 1.9 %	%/min		
					(kPa)	(kPa)			Latex Mer	nbrane use	ed 0.2 mm t	hickness,	
				θ_3	$(\theta_1 - \theta_3)_f$	$^{1}/_{2}(\theta_{1}-\theta_{3})_{f}$			Correction applied 0.36 kPa			kPa	
А	26	2.02	1.60	380	301	150	6.2	Brittle	See summ	ary of soil	description	s.	
									Checked	Date	Approved	Date	
									M.b.S.	31/10/14	M.b.S	31/10/14	
Profes	P ssional S	SL oils Labo	oratory		KILBUF	RN HIGH	I ROAD).	Contract No: PSL14/5410				



APPENDIX 5 – STATISTICAL ANALYSIS RESULTS

	ervations	10							
3 From File WorkSheet.wst 4 Full Precision OFF 5 Confidence Coefficient 95% 6 Number of Bootstrap Operations 2000 7 2000 7 Arsenic 10 General Statistics 11 General Statistics 12 Number of Valid Observations 10 13 Interview Log-transformed Statistics 14 Raw Statistics Log-transformed Statistics 15 Minimum 10.6 16 Maximum 33.7 17 Mean of	ervations	10							
4 Full Precision OFF 5 Confidence Coefficient 95% 6 Number of Bootstrap Operations 2000 7 2000 7 Arsenic 9 Arsenic 10 General Statistics 11 General Statistics 12 Number of Valid Observations 10 13 It 14 Raw Statistics 15 Minimum 10.6 16 Maximum 33.7 17 Mean of	ervations	10							
5 Confidence Coefficient 95% 6 Number of Bootstrap Operations 2000 7 2000 8 2000 9 Arsenic 10 General Statistics 11 General Statistics 12 Number of Valid Observations 10 13 Number of Distinct Obs 14 Raw Statistics Log-transformed Statistics 15 Minimum 10.6 Minimum of 16 Maximum 33.7 Maximum of 17 Mean of 19.85 Mean of	ervations	10							
6 Number of Bootstrap Operations 2000 7	ervations	10							
7	ervations	10							
8 9 Arsenic 10 Image: General Statistics 11 General Statistics 12 Number of Valid Observations 13 Image: General Statistics 14 Raw Statistics 15 Minimum 16 Maximum 17 Mean of	ervations	10							
9 Arsenic 10 Image: Ceneral Statistics 11 General Statistics 12 Number of Valid Observations 13 Image: Ceneral Statistics 14 Raw Statistics 15 Minimum 16 Maximum 17 Mean of	ervations	10							
ID General Statistics I1 General Statistics I2 Number of Valid Observations I0 Number of Distinct Obs I3 Image: Statistics I4 Raw Statistics I5 Minimum 10.6 Minimum of I6 Mean of I7 Mean of	ervations	10							
Interference General Statistics 12 Number of Valid Observations 10 Number of Distinct Obs 13 Interference Interference Interference 14 Raw Statistics Log-transformed Statistics 15 Minimum 10.6 Minimum of 16 Maximum 33.7 Maximum of 17 Mean 19.85 Mean of	ervations	10							
12Number of Valid Observations10Number of Distinct Obs131414Raw Statistics15161717	ervations	10							
I3 Log-transformed Statistics 14 Raw Statistics 15 Minimum 10.6 16 Maximum 33.7 17 Mean 01									
14Raw StatisticsLog-transformed Statistics15Minimum10.6Minimum of16Maximum33.7Maximum of17Mean19.85Mean of									
15Minimum10.6Minimum of16Maximum33.7Maximum of17Mean19.85Mean of									
16 Maximum 33.7 Maximum of 17 Mean 19.85 Mean of	Log Data	2.361							
17 Mean 19.85 Mean of	Log Data	3.517							
	f log Data	2.938							
	f log Data								
19 Median 19.3									
20 SD 6.641									
21 Std. Error of Mean 2.1									
22 Coefficient of Variation 0.335									
23 Skewness 0.758									
24									
25 Relevant UCL Statistics									
26 Normal Distribution Test Lognormal Distribution Test									
27 Shapiro Wilk Test Statistic 0.951 Shapiro Wilk Test	t Statistic	0.98							
28 Shapiro Wilk Critical Value 0.842 Shapiro Wilk Critical Value	cal Value	0.842							
29 Data appear Normal at 5% Significance Level Data appear Lognormal at 5% Significance	ce Level								
30									
31 Assuming Normal Distribution Assuming Lognormal Distribution	n								
	95% H-UCL 25.01								
33 95% UCLs (Adjusted for Skewness) 95% Chebyshev (MV	UE) UCL	29.1							
34 95% Adjusted-CLT UCL (Chen-1995) 23.84 97.5% Chebyshev (MV	UE) UCL	33.1							
35 95% Modified-t UCL (Johnson-1978) 23.78 99% Chebyshev (MV	UE) UCL	40.95							
36		1							
37 Gamma Distribution Test Data Distribution									
38 k star (bias corrected) 7.199 Data appear Normal at 5% Significance	a Level								
39 Theta Star 2.757									
40 MLE of Mean 19.85									
41 MLE of Standard Deviation 7.398									
42 nu star 144									
43 Approximate Chi Square Value (.05) 117.3 Nonparametric Statistics									
44 Adjusted Level of Significance 0.0267 95%	CLT UCL								
45 Adjusted Chi Square Value 113.1 95% Jackk	nife UCL	23.7							
46 95% Standard Boots	trap UCL	23.19							
47 Anderson-Darling Test Statistic 0.198 95% Bootstr	ap-t UCL	24.57							
48 Anderson-Darling 5% Critical Value 0.725 95% Hall's Boots	trap UCL	24.99							
49 Kolmogorov-Smirnov Test Statistic 0.118 95% Percentile Boots	trap UCL	23.16							
50 Kolmogorov-Smirnov 5% Critical Value 0.267 95% BCA Boots	•								
51Data appear Gamma Distributed at 5% Significance Level95% Chebyshev(Mean,	,								
52 97.5% Chebyshev(Mean,	,								
53Assuming Gamma Distribution99% Chebyshev(Mean,	Sd) UCL	40.75							
54 95% Approximate Gamma UCL (Use when n >= 40) 24.38									
55 95% Adjusted Gamma UCL (Use when n < 40) 25.28									

	А	В	С	D	E	F	G	Н	I	J	K	L	
56													
57			Potential U	JCL to Use				dent's-t UCL	23.7				
58													
59	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.												
60	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and laci (2002)												
61	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.												
62													

	A	В	С	D	E	F	G	Н	J	K	L
1					Outlier Test	ts for Selecte	d Variables				
2			User Selec	ted Options					 		
3				From File	WorkSheet	.wst			 		
4				Il Precision	OFF				 		
5			Outliers with		1						
6	Test for S	Suspected C	Outliers with F	Rosner test	1						
7											
8											
9		Dixon's C	Dutlier Test fo	or Arsenic							
10											
11	Number of a	data = 10									
12	10% critical	value: 0.409	9								
13	5% critical v	value: 0.477									
14	1% critical v	alue: 0.597									
15											
16	1. Data Val	ue 33.7 is a	Potential Out	tlier (Upper T	'ail)?						
17											
18	Test Statisti	c: 0.467									
19											
20	For 10% sig	inificance lev	vel, 33.7 is ar	n outlier.							
21	For 5% sign	ificance leve	el, 33.7 is not	an outlier.							
22	For 1% sign	ificance leve	el, 33.7 is not	an outlier.							
23											
24	2. Data Valu	ue 10.6 is a l	Potential Out	lier (Lower T	ail)?						
25											
26	Test Statisti	c: 0.232									
27											
28	For 10% sig	Inificance lev	vel, 10.6 is no	ot an outlier.							
29	For 5% sign	ificance leve	el, 10.6 is not	an outlier.							
30	For 1% sign	ificance leve	el, 10.6 is not	an outlier.							
31											

4	A	В	С	D General UCL S	E tatistics f	F Full Data	G Sets	Н	I	J		K	L
1		User Selec	ted Options										
2			From File	WorkSheet.wst									
4		Ful	II Precision	OFF									
5	(Confidence	Coefficient	95%									
6	Number of	Bootstrap	Operations	2000									
7													
8													
	Benzo(a)pyre	ene											
10													
11							I Statistics						
12			Num	per of Valid Obse	ervations	10			Numb	er of Disti	nct Obse	rvations	4
13													
14			Raw St	tatistics				L	_og-transfo				
15					Minimum						mum of L	-	
16				Ν	laximum						mum of L	-	
17					Mean						Mean of I	-	
18				Geomet	ric Mean						SD of I	og Data	0.419
19					Median								
20				0.1 -		0.39							
21				Std. Error									
22				Coefficient of									
23				S	kewness	2.309							
24													
25				Warni	na: Ther	e are only 4	1 Distinct Valu	es in this dat	ta				
26			There a		-	-	1 Distinct Valu			ethods			
26 27			There a	re insufficient Di	stinct Va	lues to perfo	orm some GO	F tests and b	ootstrap m	ethods.			
26 27 28			There a	re insufficient Di	stinct Va	lues to perfo		F tests and b	ootstrap m	ethods.			
26 27 28 29				re insufficient Dia Those met	stinct Val	lues to perfo	orm some GO /A' value on yo	F tests and t our output di	pootstrap m splay!				
26 27 28 29 30			lt is	re insufficient Dia Those met necessary to ha	stinct Val thods will ave 4 or r	lues to perfo l return a 'N/ more Distinc	orm some GO /A' value on yo ct Values to co	F tests and to our output dia ompute boots	pootstrap m splay! strap metho	ds.			
26 27 28 29 30 31		lt	lt is	re insufficient Dia Those met	stinct Val thods will ave 4 or r s obtaine	lues to perfo l return a 'N/ more Distinc d using 4 to	orm some GO /A' value on yo ct Values to cc o 9 distinct valu	F tests and b our output dia ompute boots ues may not	bootstrap m splay! strap metho be reliable.	ds.	sults.		
26 27 28 29 30 31 32		lt	lt is	re insufficient Di Those met necessary to ha However, results	stinct Val thods will ave 4 or r s obtaine	lues to perfo l return a 'N/ more Distinc d using 4 to	orm some GO /A' value on yo ct Values to cc o 9 distinct valu	F tests and b our output dia ompute boots ues may not	bootstrap m splay! strap metho be reliable.	ds.	sults.		
26 27 28 29 30 31 32 33		lt	lt is	re insufficient Di Those met necessary to ha However, results	stinct Val thods will ave 4 or r s obtaine	lues to perfo l return a 'N/ more Distinc d using 4 to pre observat	orm some GO /A' value on yo ct Values to cc o 9 distinct valu	F tests and b our output dia ompute boots ues may not	bootstrap m splay! strap metho be reliable.	ds.	sults.		
26 27 28 29 30 31 32 33 34		lt	It is is recommer	re insufficient Di Those met necessary to ha However, results	stinct Val thods will ave 4 or r s obtaine	lues to perfo l return a 'N/ more Distinc d using 4 to pre observat	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and t our output dis ompute boots ues may not ate and mea	bootstrap m splay! strap metho be reliable.	ds. tstrap res			
26 27 28 29 30 31 32 33 34 35		It	It is is recommer Normal Dist	re insufficient Di Those met necessary to ha However, results nded to have 10-	stinct Val thods will ave 4 or r s obtaine 15 or mo	lues to perfo I return a 'N/ more Distinc d using 4 to pre observat Relevant U	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and t our output dis ompute boots ues may not ate and mea	pootstrap m splay! strap metho be reliable. ningful boo ognormal D	ds. tstrap res Distributio		Statistic	0.635
26 27 28 29 30 31 32 33 34 35 36		It	It is is recommer Normal Dist	re insufficient Di Those met a necessary to ha However, results Inded to have 10- ribution Test	stinct Val thods will ave 4 or r s obtaine 15 or mo	lues to perfo I return a 'N/ more Distinc d using 4 to ore observat Relevant U	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and t our output dis ompute boots ues may not ate and mea	oootstrap m splay! strap metho be reliable. ningful boo ognormal D	ids. tstrap res Distributio Shapiro V	n Test		
26 27 28 29 30 31 32 33 34 35			It is is recommer Normal Dist	re insufficient Dia Those met necessary to ha However, results nded to have 10- ribution Test hapiro Wilk Test	stinct Val thods will ave 4 or r s obtaine 15 or mo	lues to perfo I return a 'N/ more Distinc d using 4 to ore observat Relevant U	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and b our output dis ompute boots ues may not ate and mea	oootstrap m splay! strap metho be reliable. ningful boo ognormal D	ids. Itstrap res Distributio Shapiro V Shapiro V	n Test Vilk Test Vilk Critica	al Value	
26 27 28 29 30 31 32 33 34 35 36 37			It is is recommer Normal Dist	re insufficient Di Those met e necessary to ha However, results nded to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic	stinct Val thods will ave 4 or r s obtaine 15 or mo	lues to perfo I return a 'N/ more Distinc d using 4 to ore observat Relevant U	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and b our output dis ompute boots ues may not ate and mea	pootstrap m splay! strap metho be reliable. ningful boo ognormal D	ids. Itstrap res Distributio Shapiro V Shapiro V	n Test Vilk Test Vilk Critica	al Value	
26 27 28 29 30 31 32 33 34 35 36 37 38		Data not	It is is recommer Normal Dist Si Normal at 5	re insufficient Di Those met e necessary to ha However, results nded to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic	stinct Val thods will ave 4 or r s obtaine 15 or mo	lues to perfo I return a 'N/ more Distinc d using 4 to ore observat Relevant U	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	pootstrap m splay! strap metho be reliable. ningful boo ognormal D	ods. Itstrap res Distributio Shapiro V Shapiro V Shapiro V at 5% Sig	n Test Vilk Test Vilk Critica nificance stribution	al Value Level	0.842
26 27 28 29 30 31 32 33 34 35 36 37 38 39		Data not	It is is recommer Normal Dist Si Normal at 5 esuming Norr	re insufficient Di Those met necessary to ha However, results need to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL	lues to perfo return a 'N/ more Distinc d using 4 to ore observat Relevant U 0.586 0.842	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	oootstrap m splay! strap metho be reliable. ningful boo ognormal D	ods. Itstrap res Distributio Shapiro V Shapiro V Shapiro V at 5% Sig	n Test Vilk Test Vilk Critica nificance stribution	al Value	0.842
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40		Data not As 95%	It is is recommer Normal Dist S S Normal at 5 ssuming Norr UCLs (Adjus	re insufficient Di Those met necessary to ha However, results added to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L mal Distribution 95% Studen	stinct Val thods will ave 4 or r s obtaine 15 or mo Statistic cal Value .evel t's-t UCL ss)	lues to perfo return a 'N/ more Distinc d using 4 to ore observat Relevant U 0.586 0.842	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95%	ods. Itstrap res Distributio Shapiro V Shapiro V It 5% Sign Itormal Dis G Chebys	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL	al Value Level	0.842
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41		Data not As 95%	It is is recommer Normal Dist Si Normal at 5 ssuming Norr UCLs (Adjust 95% Adjuste	re insufficient Di Those met necessary to ha However, results aded to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Che	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value t's-t UCL ss) en-1995)	lues to perfo return a 'N/ more Distinc d using 4 to re observat Relevant U 0.586 0.842 0.916 0.992	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	bootstrap m splay! strap metho be reliable. ningful boo ognormal c	ids. itstrap res Distributio Shapiro V Shapiro V Shapiro V it 5% Sign iormal Dis G Chebys	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL	al Value Level 6 H-UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42		Data not As 95%	It is is recommer Normal Dist Si Normal at 5 ssuming Norr UCLs (Adjust 95% Adjuste	re insufficient Di Those met necessary to ha However, results added to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L mal Distribution 95% Studen	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value t's-t UCL ss) en-1995)	lues to perfo return a 'N/ more Distinc d using 4 to re observat Relevant U 0.586 0.842 0.916 0.992	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	bootstrap m splay! strap metho be reliable. ningful boo ognormal c	ids. itstrap res Distributio Shapiro V Shapiro V Shapiro V it 5% Sign iormal Dis G Chebys	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL	al Value Level 6 H-UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43		Data not As 95%	It is is recommer Normal Dist S Normal at 5 suming Norr UCLs (Adjust 95% Adjuste 95% Modifie	re insufficient Di Those met necessary to ha However, results added to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Chreat ed-t UCL (Johnson	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value t's-t UCL ss) en-1995)	lues to perfo return a 'N/ more Distinc d using 4 to re observat Relevant U 0.586 0.842 0.916 0.992	orm some GO /A' value on yo ct Values to cc o 9 distinct valu tions for accur	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	bootstrap m splay! strap metho be reliable. iningful boo ognormal D ognormal a uming Logr 95% 97.5% 99%	ds. Itstrap res Distributio Shapiro V Shapiro V Shapiro V It 5% Sign iormal Dis Chebys Chebys Chebys	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level 6 H-UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44		Data not As 95%	It is is recommer Normal Dist S Normal at 5 suming Norr UCLs (Adjust 95% Adjuste 95% Modifie	re insufficient Di Those met necessary to ha However, results need to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Che ed-t UCL (Johnson ribution Test	stinct Val thods will ave 4 or r s obtaine 15 or mo Statistic cal Value evel t's-t UCL ss) en-1995) on-1978)	lues to performed a local second seco	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and b our output dis ompute boots ues may not ate and mea L Data not L Assu	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D	itstrap res Distributio Shapiro V Shapiro V Shapiro V tormal Dis Chebys Chebys Chebys	n Test Wilk Test & Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246 1.584
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45		Data not As 95%	It is is recommer Normal Dist S Normal at 5 suming Norr UCLs (Adjust 95% Adjuste 95% Modifie	re insufficient Dis Those met a necessary to ha However, results added to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Chast ed-t UCL (Johnson ribution Test k star (bias co	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value t's-t UCL ss) en-1995) on-1978)	lues to performed a line of the line of th	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and to our output dis ompute boots ues may not ate and mea L Data not L	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D	itstrap res Distributio Shapiro V Shapiro V Shapiro V tormal Dis Chebys Chebys Chebys	n Test Wilk Test & Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246 1.584
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46		Data not As 95%	It is is recommer Normal Dist S Normal at 5 suming Norr UCLs (Adjust 95% Adjuste 95% Modifie	re insufficient Di Those met necessary to ha However, results need to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes ed-CLT UCL (Chu ed-t UCL (Johnson ribution Test k star (bias co	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL ss) en-1995) on-1978) on-1978)	Iues to perform I return a 'N/ more Distinct d using 4 to ore observat Relevant U 0.586 0.842 0.916 0.992 0.931 3.797 0.182	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and b our output dis ompute boots ues may not ate and mea L Data not L Assu	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D	itstrap res Distributio Shapiro V Shapiro V Shapiro V tormal Dis Chebys Chebys Chebys	n Test Wilk Test & Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246 1.584
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49		Data not As 95%	It is is recommer Normal Dist S Normal at 5 ssuming Norr UCLs (Adjus 95% Adjuste 95% Adjuste 95% Modifie	re insufficient Di Those met necessary to ha However, results added to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Chast ed-t UCL (Johnson k star (bias co Th k star (bias co	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value t's-t UCL ss) en-1995) on-1978) on-1978) orrected) neta Star of Mean	lues to perfo return a 'N/ more Distinc d using 4 to ore observat 0.586 0.842 0.916 0.992 0.931 3.797 0.182 0.69	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and b our output dis ompute boots ues may not ate and mea L Data not L Assu	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D	itstrap res Distributio Shapiro V Shapiro V Shapiro V tormal Dis Chebys Chebys Chebys	n Test Wilk Test & Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246 1.584
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48		Data not As 95%	It is is recommer Normal Dist S Normal at 5 ssuming Norr UCLs (Adjus 95% Adjuste 95% Adjuste 95% Modifie	re insufficient Di Those met necessary to ha However, results need to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes ed-CLT UCL (Chu ed-t UCL (Johnson ribution Test k star (bias co	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL ss) en-1995) on-1978) on-1978) orrected) neta Star of Mean Deviation	Iues to perform I return a 'N/ more Distinct d using 4 to ore observat Relevant U 0.586 0.842 0.916 0.992 0.931 3.797 0.182 0.69 0.354	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and b our output dis ompute boots ues may not ate and mea L Data not L Assu	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D	itstrap res Distributio Shapiro V Shapiro V Shapiro V tormal Dis Chebys Chebys Chebys	n Test Wilk Test & Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246 1.584
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49		Data not As 95%	It is is recommer Normal Dist S Normal at 5 Suming Norr UCLs (Adjus 95% Adjuste 95% Modifie Gamma Dist	re insufficient Dia Those met necessary to ha However, results need to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Che ed-t UCL (Johnse d-CLT UCL (Johnse d-CLT UCL (Johnse d-CLT UCL (Johnse d-CLT UCL (Johnse d-CLT UCL (Joh	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL ss) en-1995) on-1978) on-1978) on-1978) on-1978) on-1978) orrected) heta Star of Mean Deviation nu star	Iues to perform return a 'N/ more Distinct d using 4 to ore observat Relevant U 0.586 0.842 0.916 0.992 0.931 3.797 0.182 0.69 0.354 75.94	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and to pur output dis perpute boots les may not ate and mea L Data not L Assu Data do not fo	bootstrap m splay! strap metho be reliable. iningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D bollow a Diso	ods. Itstrap res Distributio Shapiro V Shapiro V Shapiro V It 5% Sign istribution Chebysi Chebysi Schebysi Schebysi Schebysi Schebysi Schebysi	n Test Vilk Test i Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL	0.842 0.919 1.075 1.246 1.584
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 51 52		Data not As 95%	It is is recommer Normal Dist S Normal Dist S Normal at 5 S Suming Norr UCLs (Adjus 95% Adjuste 95% Adjuste 95% Modifie Gamma Dist	re insufficient Di Those met a necessary to ha However, results inded to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Chr ed-t UCL (Johnson ribution Test k star (bias co Th MLE LE of Standard I e Chi Square Va	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL ss) en-1995) on-1978) on-1978) on-1978) orrected) neta Star of Mean Deviation nu star	Iues to perform I return a 'N/ more Distinct d using 4 to ore observat Relevant U 0.586 0.842 0.916 0.992 0.931 3.797 0.182 0.69 0.354 75.94 56.87	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and to pur output dis permute boots les may not ate and mea L Data not L Assu Data do not fo	bootstrap m splay! strap metho be reliable. ningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D	ods. Itstrap res Distributio Shapiro V Shapiro V Shapiro V It 5% Sign istribution Chebysi Chebysi Schebysi Schebysi Schebysi Schebysi Schebysi	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL hev (MVL hev (MVL	al Value Level 5 H-UCL JE) UCL JE) UCL JE) UCL Don (0.05)	0.842
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53		Data not As 95%	It is is recommer Normal Dist S Normal Dist Suming Norr UCLs (Adjus 95% Adjuste 95% Adjuste 95% Modifie Gamma Dist Gamma Dist Adjus	re insufficient Di Those met a necessary to ha However, results inded to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L mal Distribution 95% Studen sted for Skewnes d-CLT UCL (Cha ed-t UCL (Johnson sted for Skewnes d-CLT UCL (Johnson sted for Sk	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL ss) en-1995) on-1978)	Iues to perform return a 'N/ more Distinct d using 4 to ore observat Relevant U 0.586 0.842 0.916 0.992 0.931 3.797 0.182 0.69 0.354 75.94 56.87 0.0267	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and to pur output dis permute boots les may not ate and mea L Data not L Assu Data do not fo	bootstrap m splay! strap metho be reliable. iningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D bollow a Diso	ods. Itstrap res Distributio Shapiro V Shapiro V Shapiro V It 5% Sign Itstribution Chebysi Chebysi Chebysi Schebysi	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL hev (MVL hev (MVL hev (MVL hev (MVL	al Value Level H-UCL JE) UCL JE) UCL JE) UCL Don (0.05) CLT UCL	0.842
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52		Data not As 95%	It is is recommer Normal Dist S Normal Dist Suming Norr UCLs (Adjus 95% Adjuste 95% Adjuste 95% Modifie Gamma Dist Gamma Dist Adjus	re insufficient Di Those met a necessary to ha However, results inded to have 10- ribution Test hapiro Wilk Test hapiro Wilk Critic % Significance L nal Distribution 95% Studen sted for Skewnes d-CLT UCL (Chr ed-t UCL (Johnson ribution Test k star (bias co Th MLE LE of Standard I e Chi Square Va	stinct Val thods will ave 4 or r s obtaine 15 or mo : Statistic cal Value .evel t's-t UCL ss) en-1995) on-1978)	Iues to perform return a 'N/ more Distinct d using 4 to ore observat Relevant U 0.586 0.842 0.916 0.992 0.931 3.797 0.182 0.69 0.354 75.94 56.87 0.0267	orm some GO /A' value on yout ct Values to cco 9 distinct value JCL Statistics	F tests and to pur output dis permute boots les may not ate and mea L Data not L Assu Data do not fo	bootstrap m splay! strap metho be reliable. iningful boo ognormal D ognormal a uming Logr 95% 97.5% 99% Data D bollow a Disc Dlow a Disc	ds. tstrap res Distributio Shapiro V Shapiro V t 5% Sigu tormal Dis Chebys Chebys Chebys Sch	n Test Vilk Test Vilk Critica nificance stribution 95% hev (MVL hev (MVL hev (MVL hev (MVL hev (MVL	al Value Level JE) UCL JE) UCL JE) UCL JE) UCL Son (0.05)	0.842

	А	В	С	D	E	F	G	Н		J	K	L
56			Anders	son-Darling T	est Statistic	1.838				95% Boo	otstrap-t UCL	1.384
57			Anderson-	Darling 5% C	ritical Value	0.729			ç	5% Hall's Bo	ootstrap UCL	1.534
58			Kolmogor	ov-Smirnov T	est Statistic	0.411			95% I	Percentile Bo	ootstrap UCL	0.91
59		K	olmogorov-S	Smirnov 5% C	ritical Value	0.267				95% BCA Bo	ootstrap UCL	0.96
60	Da	ata not Gamr	na Distribute	ed at 5% Sign	ificance Leve	el			95% Ch	ebyshev(Me	an, Sd) UCL	1.228
61									97.5% Ch	ebyshev(Me	an, Sd) UCL	1.46
62		As	suming Gam	nma Distributi	on				99% Ch	ebyshev(Me	an, Sd) UCL	1.917
63	95	5% Approxim	ate Gamma	UCL (Use wi	nen n >= 40)	0.921						
64		95% Adju	isted Gamma	a UCL (Use v	vhen n < 40)	0.97						
65												
66			Potential U	JCL to Use					ι	Jse 95% Stu	ident's-t UCL	0.916
67									7	or 95% Mo	odified-t UCL	0.931
68												
69	No	ote: Suggesti	ons regardin	g the selection	on of a 95% l	UCL are pro	ovided to help	the user to s	select the mo	st appropria	te 95% UCL.	
70		These recon	nmendations	are based u	pon the resu	Its of the sin	nulation studio	es summariz	zed in Singh,	Singh, and	laci (2002)	
71			and Singh	and Singh (2	003). For a	dditional ins	sight, the user	may want to	o consult a si	atistician.		
72												

	A	В	С	D	Е	F	G	Н	J	K	L
1					Outlier Test	s for Selecte	d Variables				
2			User Selec	ted Options							
3				From File	WorkSheet	wst			 		
4				Il Precision	OFF				 		
5			Outliers with		1						
6	Test for	Suspected C	Outliers with F	Rosner test	1						
7											
8											
9	C)ixon's Outlie	er Test for Be	enzo(a)pyrene	e						
10											
11	Number of a	data = 10									
12	10% critical	value: 0.409)								
13	5% critical v	value: 0.477									
14	1% critical v	alue: 0.597									
15											
16	1. Data Val	ue 1.7 is a P	otential Outli	ier (Upper Ta	ail)?						
17											
18	Test Statisti	c: 0.583									
19											
20	For 10% sig	inificance lev	vel, 1.7 is an	outlier.							
21	For 5% sigr	ificance leve	el, 1.7 is an o	utlier.							
22	For 1% sigr	ificance leve	el, 1.7 is not a	an outlier.							
23											
24	2. Data Valı	ue 0.5 is a Po	otential Outlie	er (Lower Ta	il)?						
25											
26	Test Statisti	c: 0.000									
27											
28	For 10% sig	Inificance lev	vel, 0.5 is not	an outlier.							
29	For 5% sigr	ificance leve	el, 0.5 is not a	an outlier.							
30	For 1% sigr	ificance leve	el, 0.5 is not a	an outlier.							
31											

- 1	A	В	С	D General UC	E L Statistics f	F Full Data	G A Sets	Н	I	J	K	L
1		User Selec	ted Options									
2			From File	WorkSheet.	wst							
4		Ful	II Precision	OFF								
5	(Confidence	Coefficient	95%								
6	Number of	f Bootstrap	Operations	2000								
7												
8												
9	Lead											
10												
11							I Statistics					
12			Num	ber of Valid C	Observations	10			Numbe	r of Distinct C	bservations)	10
13												
14			Raw S	Statistics				L	og-transforr	ned Statistics		
15					Minimum						of Log Data	
16					Maximum						of Log Data	
17						758.5					n of log Data	
18				Geo	metric Mean					SE	of log Data	1.264
19					Median							
20						818.4						
21					rror of Mean							
22				Coefficient	t of Variation							
23					Skewness	1.549						
24						Delevent	IOI Chatiatian					
25			Normal Die	tribution Test		Relevant	JCL Statistics			stribution Tes		
26				Shapiro Wilk		0 707		L		Stribution Tes Shapiro Wilk T		0.067
27				Shapiro Wilk C						hapiro Wilk C		
28		Data not		5% Significan		0.042		Data annear		at 5% Signific		0.042
29		Data not							Lognorman	at 570 Olymin		
30		As	suming Nor	mal Distributi	on			Assi	imina Loanc	ormal Distribu	tion	
31		,			dent's-t UCL	1233		7,000			95% H-UCL	4401
32		95%	UCLs (Adiu	isted for Skev					95%	Chebyshev (
33				ed-CLT UCL		1320				Chebyshev (,	
34			-	ied-t UCL (Jo						Chebyshev (
35				, , , , , , , , , , , , , , , , , , ,	,					, , ,	,	
36 37			Gamma Dis	tribution Test	:				Data Dis	stribution		
38				k star (bia	s corrected)	0.756	Data	appear Gan	nma Distribu	ited at 5% Sig	gnificance Le	evel
39					Theta Star	1003						
40				N	ILE of Mean	758.5						
41			Μ	ILE of Standa	rd Deviation	872.2						
42					nu star	15.13						
43			Approxima	te Chi Square	e Value (.05)	7.35			Nonparame	tric Statistics		
44				sted Level of	•						% CLT UCL	
45			A	djusted Chi S	quare Value	6.43					ckknife UCL	
46									95%	Standard Bo		
47				rson-Darling 7							tstrap-t UCL	
48				-Darling 5% C						95% Hall's Bo	•	
49			-	rov-Smirnov						Percentile Bo	•	
50			•	Smirnov 5% C						95% BCA Bo	•	
51	Data	appear Gar	mma Distribu	uted at 5% Si	gnificance Lo	evel				ebyshev(Me	,	
52										nebyshev(Me	,	
53			-	nma Distribut		4501			99% Ch	ebyshev(Me	an, Sd) UCL	3334
54	95			UCL (Use w	,							
	1	95% Adjı	usted Gamm	na UCL (Use v	when n < 40)	1784						

	А	В	С	D	E	F	G	Н		J	K	L
56												
57			Potential U	JCL to Use					Use 95% A	pproximate (Gamma UCL	1561
58												
59	No	te: Suggesti	ons regardin	g the selection	on of a 95% I	JCL are prov	vided to help	the user to s	elect the mo	st appropriat	e 95% UCL.	
60	•	These recom	nmendations	are based u	pon the resu	Its of the sim	ulation studi	es summariz	ed in Singh,	Singh, and I	aci (2002)	
61			and Singh	and Singh (2	003). For a	dditional insi	ght, the user	r may want to	o consult a st	atistician.		
62												

	A	В	С	D	E	F	G	Н	J	K	L
1					Outlier Test	ts for Selecte	d Variables				
2			User Selec	ted Options							
3				From File	WorkSheet	.wst					
4				II Precision	OFF						
5	Test fo	r Suspected	Outliers with	Dixon test	1						
6	Test for S	Suspected C	Outliers with F	Rosner test	1						
7											
8											
9		Dixon's	Outlier Test	for Lead							
10											
11	Number of c	data = 10									
12	10% critical	value: 0.409	Э								
13	5% critical v	value: 0.477									
14	1% critical v	alue: 0.597									
15											
16	1. Data Val	ue 2530 is a	Potential Ou	utlier (Upper	Tail)?						
17											
18	Test Statisti	c: 0.260									
19											
20	For 10% sig	inificance lev	vel, 2530 is n	ot an outlier.							
21	For 5% sign	ificance leve	el, 2530 is no	t an outlier.							
22	For 1% sign	ificance leve	el, 2530 is no	t an outlier.							
23											
24	2. Data Valu	ue 38.4 is a l	Potential Out	lier (Lower T	ail)?						
25											
26	Test Statisti	c: 0.038									
27											
28	For 10% sig	inificance lev	vel, 38.4 is no	ot an outlier.							
29	For 5% sign	ificance leve	el, 38.4 is not	t an outlier.							
30	For 1% sign	ificance leve	el, 38.4 is not	t an outlier.							
31											

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46Adjusted Chi Square Value35.495% Jackknife UCL1.5074795% Standard Bootstrap UCL1.46248Anderson-Darling Test Statistic0.44195% Bootstrap-t UCL1.56449Anderson-Darling 5% Critical Value0.7395% Hall's Bootstrap UCL1.5150Kolmogorov-Smirnov Test Statistic0.19195% Percentile Bootstrap UCL1.4751Kolmogorov-Smirnov 5% Critical Value0.26895% BCA Bootstrap UCL1.4852Data appear Gamma Distributed at 5% Significance Level95% Chebyshev(Mean, Sd) UCL1.9985397.5% Chebyshev(Mean, Sd) UCL2.36554Assuming Gamma Distribution99% Chebyshev(Mean, Sd) UCL3.085				Adjus	sted Level of	Significance	0.0267				9	5% CLT UCL	1.47
4795% Standard Bootstrap UCL1.46248Anderson-Darling Test Statistic0.44195% Bootstrap-t UCL1.56449Anderson-Darling 5% Critical Value0.7395% Hall's Bootstrap UCL1.5150Kolmogorov-Smirnov Test Statistic0.19195% Percentile Bootstrap UCL1.4751Kolmogorov-Smirnov 5% Critical Value0.26895% BCA Bootstrap UCL1.4852Data appear Gamma Distributed at 5% Significance Level95% Chebyshev(Mean, Sd) UCL1.9985397.5% Chebyshev(Mean, Sd) UCL2.36554Assuming Gamma Distribution99% Chebyshev(Mean, Sd) UCL3.085				A	djusted Chi S	quare Value	35.4				95% Ja	ackknife UCL	1.507
48Anderson-Darling Test Statistic0.44195% Bootstrap-t UCL1.56449Anderson-Darling 5% Critical Value0.7395% Hall's Bootstrap UCL1.5150Kolmogorov-Smirnov Test Statistic0.19195% Percentile Bootstrap UCL1.4751Kolmogorov-Smirnov 5% Critical Value0.26895% BCA Bootstrap UCL1.4852Data appear Gamma Distributed at 5% Significance Level95% Chebyshev(Mean, Sd) UCL1.9985397.5% Chebyshev(Mean, Sd) UCL2.36554Assuming Gamma Distribution99% Chebyshev(Mean, Sd) UCL3.085										95%	6 Standard B	ootstrap UCL	1.462
49 Kolmogorov-Smirnov Test Statistic 0.191 95% Percentile Bootstrap UCL 1.47 50 Kolmogorov-Smirnov Test Statistic 0.191 95% Percentile Bootstrap UCL 1.47 51 Kolmogorov-Smirnov 5% Critical Value 0.268 95% BCA Bootstrap UCL 1.48 52 Data appear Gamma Distributed at 5% Significance Level 95% Chebyshev(Mean, Sd) UCL 1.998 53 97.5% Chebyshev(Mean, Sd) UCL 2.365 54 Assuming Gamma Distribution 99% Chebyshev(Mean, Sd) UCL 3.085	48				•							•	
50 Kolmogorov-Smirnov 5% Critical Value 0.268 95% BCA Bootstrap UCL 1.48 51 Data appear Gamma Distributed at 5% Significance Level 95% Chebyshev(Mean, Sd) UCL 1.998 53 97.5% Chebyshev(Mean, Sd) UCL 2.365 54 Assuming Gamma Distribution 99% Chebyshev(Mean, Sd) UCL 3.085	49				•								
S1 Data appear Gamma Distributed at 5% Significance Level 95% Chebyshev(Mean, Sd) UCL 1.998 53 97.5% Chebyshev(Mean, Sd) UCL 2.365 54 Assuming Gamma Distribution 99% Chebyshev(Mean, Sd) UCL 3.085	50			-						95%		•	
S2 S2 S3 97.5% Chebyshev(Mean, Sd) UCL 2.365 54 Assuming Gamma Distribution 99% Chebyshev(Mean, Sd) UCL 3.085	51			-									
53 Assuming Gamma Distribution 99% Chebyshev(Mean, Sd) UCL 3.085	52	Data	appear Gar	mma Distribu	uted at 5% Sig	gnificance Lo	evel				, (. ,	
	53											. ,	
55 95% Approximate Gamma UCL (Use when n >= 40) 1.632		-		•			1.000			99% C	hebyshev(Me	ean, Sd) UCL	3.085
	55	95	% Approxim	nate Gamma	UCL (Use wl	nen n >= 40)	1.632						

	А	В	С	D	E	F	G	Н		J	K	L
56		95% Adju	isted Gamma	a UCL (Use v	when n < 40)	1.738						
57												
58			Potential L	ICL to Use					ι	Jse 95% Stu	dent's-t UCL	1.507
59												
60	No	te: Suggesti	ons regardin	g the selection	on of a 95%	UCL are prov	ided to help	the user to s	elect the mo	st appropriat	te 95% UCL.	
61	-	These recon	nmendations	are based u	pon the resu	Its of the sim	ulation studio	es summariz	ed in Singh,	Singh, and I	aci (2002)	
62			and Singh	and Singh (2	003). For a	dditional insi	ght, the user	may want to	o consult a st	atistician.		
63												

	A	В	С	D	E	F	G	Н	I	J	K	L
1					Outlier Test	s for Selecte	d Variables					
2			User Selec	ted Options								
3				From File	WorkSheet.	wst						
4				II Precision	OFF							
5			Outliers with		1							
6	Test for S	Suspected C	Outliers with F	Rosner test	1							
7												
8												
9	L	Dixon's O	outlier Test fo	r Mercury								
10												
	Number of d											
12		value: 0.409)									
13	5% critical v											
14	1% critical v	alue: 0.597										
15												
16	1. Data Val	ue 2.3 is a P	otential Outli	ier (Upper Ta	il)?							
17	-											
18	Test Statisti	c: 0.333										
19	-											
20	-		vel, 2.3 is not									
21	-		el, 2.3 is not a									
22	For 1% sign	inficance leve	el, 2.3 is not a	an outlier.								
23												
24	2. Data Valu	ue 0.5 is a Po	stential Outlie	er (Lower Tai	1)?							
25	T											
26	Test Statisti	c: 0.000									<u> </u>	
27	E 100/										<u> </u>	
20	_		vel, 0.5 is not								<u> </u>	
29	-		el, 0.5 is not a								<u> </u>	
30	⊢or 1% sign	inficance leve	el, 0.5 is not a	an outlier.							<u> </u>	
31												

	A	B C	D E General UCL Statis		F or Full Data	G Sets	Н		J	К	L
1		User Selected Option	ns								
2		From File									
4		Full Precisio	n OFF								
5	С	onfidence Coefficier	nt 95%								
6	Number of	Bootstrap Operation	s 2000								
7											
, 8											
9	Napthalene										
10											
11					General	Statistics					
12		Nu	Imber of Valid Observa	ations	10			Numbe	er of Distinct O	bservations	2
13											I
14		Raw	/ Statistics				L	.og-transfor	med Statistics		
15				imum						of Log Data	
16				imum						of Log Data	
17				Mean						of log Data	
18			Geometric N						SD	of log Data	0.969
19			Me	edian							
20			-		3.226						
21			Std. Error of N								
22			Coefficient of Vari								
23			Skew	ness	3.162						
24											
25						D					
26		The	-		-	Distinct Value			ماه م ما ه		
27		Ther	e are insufficient Distine Those method		-			-	eurious.		
28			mose memou	12 MIII				spiay			
29											
~ ~			t is persent to have	1 or n	noro Disting	t Values to co	mnute boote	tran metho	de		
30			t is necessary to have				-	•	ds.		
31			However, results ob	otaineo	d using 4 to	9 distinct valu	ies may not	be reliable.			
31 32			-	otaineo	d using 4 to	9 distinct valu	ies may not	be reliable.			
31 32 33			However, results ob	otained or mo	d using 4 to re observati	9 distinct valu	ies may not	be reliable.			
31 32 33 34		It is recomr	However, results ob nended to have 10-15 o	otained or mo	d using 4 to re observati	9 distinct valuons for accura	ies may not ate and mea	be reliable.	strap results.	t	
31 32 33 34 35		It is recomr	However, results ob nended to have 10-15 of istribution Test	otained or mo	d using 4 to re observati Relevant U	9 distinct valuons for accura	ies may not ate and mea	be reliable. ningful boot	tstrap results. istribution Tes		0.366
31 32 33 34 35 36		It is recomr	However, results ob nended to have 10-15 o	otained or mol	d using 4 to re observati Relevant U 0.366	9 distinct valuons for accura	ies may not ate and mea	be reliable. ningful boot ognormal D	strap results.	est Statistic	
31 32 33 34 35 36 37		It is recomr Normal D	However, results ob nended to have 10-15 of Pistribution Test Shapiro Wilk Test Sta	or mo atistic Value	d using 4 to re observati Relevant U 0.366	9 distinct valuons for accura	L	ognormal D	istrap results. istribution Tes Shapiro Wilk T	est Statistic ritical Value	
31 32 33 34 35 36 37 38		It is recomr Normal D	However, results ob nended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V	or mo atistic Value	d using 4 to re observati Relevant U 0.366	9 distinct valuons for accura	L	ognormal D	istripution Tes Shapiro Wilk T	est Statistic ritical Value	
31 32 33 34 35 36 37 38 39		It is recomm Normal D Data not Normal a	However, results ob nended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V	or mo atistic Value	d using 4 to re observati Relevant U 0.366	9 distinct valuons for accura	Late and mea	ognormal D	istripution Tes Shapiro Wilk T	est Statistic ritical Value nce Level	
31 32 33 34 35 36 37 38 39 40		It is recomm Normal D Data not Normal a	However, results ob nended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve	otained or mod atistic Value al	d using 4 to re observati Relevant U 0.366 0.842	9 distinct valuons for accura	Late and mea	ognormal D	istribution Tes istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut	est Statistic ritical Value nce Level	0.842
31 32 33 34 35 36 37 38 39 40 41		It is recomm Normal D Data not Normal a Assuming N	However, results ob nended to have 10-15 of pistribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution	otained or mod atistic Value al	d using 4 to re observati Relevant U 0.366 0.842	9 distinct valuons for accura	Late and mea	be reliable. ningful boot ognormal D S ognormal a uming Logno	istribution Tes istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut	ritical Value nce Level tion 95% H-UCL	0.842
31 32 33 34 35 36 37 38 39 40 41 42		It is recomm Normal D Data not Normal a Assuming N 95% UCLs (Ad	However, results ob nended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t	atistic Value	d using 4 to re observati Relevant U 0.366 0.842 3.39	9 distinct valuons for accura	Late and mea	ognormal D s ognormal D s ognormal a uming Lognor 95%	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL	0.842 2.897 2.448
31 32 33 34 35 36 37 38 39 40 41 42 43		It is recomm Normal D Data not Normal a Assuming N 95% UCLs (Ad 95% Adju	However, results ob nended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t djusted for Skewness)	atistic Value 1995)	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288	9 distinct valuons for accura	Late and mea	ognormal D ognormal D s ognormal a uming Logn 95% 97.5%	istribution Tes istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065
31 32 33 34 35 36 37 38 39 40 41 42 43 44		It is recomm Normal D Data not Normal a Assuming N 95% UCLs (Ad 95% Adju	However, results ob nended to have 10-15 of pistribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t tjusted for Skewness) sted-CLT UCL (Chen-1	atistic Value 1995)	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288	9 distinct valuons for accura	Late and mea	ognormal D ognormal D s ognormal a uming Logn 95% 97.5%	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of pistribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t tjusted for Skewness) sted-CLT UCL (Chen-1	atistic Value 1995)	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288	9 distinct valuons for accura	Late and mea	be reliable. ningful boot ognormal D S sognormal a uming Logn 95% 97.5% 99%	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065
31 32 33 34 35 36 37 38 39 40 41 42 43 44		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of Distribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t djusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1	atistic Value 1995) 1978)	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56	9 distinct valuons for accurate the second s	Late and mea	be reliable. ningful boot ognormal D c c cognormal a uming Logno 95% 97.5% 99% Data Di	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of Distribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t Jjusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1 Distribution Test k star (bias corre	atistic /alue atistic /alue al t UCL 1995) 1978) acted)	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56	9 distinct valuons for accurate the second s	Late and mea	be reliable. ningful boot ognormal D c c cognormal a uming Logno 95% 97.5% 99% Data Di	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of Distribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t Jjusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1 Distribution Test k star (bias corre	atistic Value J UCL 1995) 1978) a Star	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56 0.587 2.587	9 distinct valuons for accurate the second s	Late and mea	be reliable. ningful boot ognormal D c c cognormal a uming Logno 95% 97.5% 99% Data Di	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48		It is recommendation in the image of the ima	However, results ob mended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t djusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1 Distribution Test k star (bias corre Theta	atistic /alue al UCL 1995) 1978) a Star Mean	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56 0.587 2.587 1.52	9 distinct valuons for accurate the second s	Late and mea	be reliable. ningful boot ognormal D c c cognormal a uming Logno 95% 97.5% 99% Data Di	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of Distribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t dijusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1 Distribution Test k star (bias corre Theta MLE of Standard Devi	atistic value atistic atistic value atistic value atistic value atistic value atistic atistic value atistic atis	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56 0.587 2.587 1.52	9 distinct valuons for accurate the second s	Late and mea	be reliable. ningful boot ognormal D c c cognormal a uming Logno 95% 97.5% 99% Data Di	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of Distribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t dijusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1 Distribution Test k star (bias corre Theta MLE of Standard Devi	atistic /alue al UCL 1995) 1978) a Star Mean iation u star	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56 0.587 2.587 1.52 1.983 11.75	9 distinct valuons for accurate the second s	Pata do not fo	be reliable. ningful boot ognormal D S ognormal a uming Logn 95% 97.5% 99% Data Di Dlow a Disc	istribution Tes Shapiro Wilk T Shapiro Wilk C t 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Chebyshev (N	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of istribution Test Shapiro Wilk Test Sta Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t djusted for Skewness) sted-CLT UCL (Chen-1 dified-t UCL (Johnson-1 Distribution Test k star (bias corre Theta MLE of N MLE of Standard Devi nut nate Chi Square Value	atistic /alue atistic /alue a UCL 1995) 1978) a Star Mean iation u star (.05) cance	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56 0.587 2.587 1.52 1.983 11.75 5.062 0.0267	9 distinct valuons for accurate the second s	Pata do not fo	be reliable. ningful boot ognormal D S ognormal a uming Logn 95% 97.5% 99% Data Di Dlow a Disc	Istribution Tes Shapiro Wilk T Shapiro Wilk C It 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Estribution ernable Distrit etric Statistics 95	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL MVUE) UCL MVUE) UCL	0.842 2.897 2.448 3.065 4.278
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52		It is recommendation in the image of the ima	However, results ob nended to have 10-15 of Distribution Test Shapiro Wilk Test Stat Shapiro Wilk Critical V t 5% Significance Leve ormal Distribution 95% Student's-t dified-t UCL (Johnson-1 Distribution Test k star (bias corre Theta MLE of N MLE of N MLE of Standard Devi nu	atistic /alue atistic /alue a UCL 1995) 1978) a Star Mean iation u star (.05) cance	d using 4 to re observati Relevant U 0.366 0.842 3.39 4.288 3.56 0.587 2.587 1.52 1.983 11.75 5.062 0.0267	9 distinct valuons for accurate the second s	Pata do not fo	be reliable. ningful boot ognormal D S ognormal a uming Logn 95% 97.5% 99% Data Di pllow a Disc	Istribution Tes Shapiro Wilk T Shapiro Wilk C It 5% Significar ormal Distribut Chebyshev (N Chebyshev (N Chebyshev (N Estribution ernable Distrit etric Statistics 95	est Statistic ritical Value nce Level tion 95% H-UCL MVUE) UCL MVUE) UCL MVUE) UCL oution (0.05)	0.842 2.897 2.448 3.065 4.278 3.198 N/A

	А	В	С	D	E	F	G	Н		J	K	L
56			Anders	son-Darling T	est Statistic	3.402				95% Boo	otstrap-t UCL	N/A
57			Anderson-I	Darling 5% C	ritical Value	0.757			9	5% Hall's Bo	ootstrap UCL	N/A
58			Kolmogoro	ov-Smirnov T	est Statistic	0.555			95% F	Percentile Bo	ootstrap UCL	N/A
59		K	olmogorov-S	mirnov 5% C	ritical Value	0.276			!	95% BCA Bo	ootstrap UCL	N/A
60	Da	ata not Gamn	na Distribute	d at 5% Sign	ificance Lev	el			95% Ch	ebyshev(Me	an, Sd) UCL	5.966
61									97.5% Ch	ebyshev(Me	an, Sd) UCL	7.89
62		As	suming Gam	ma Distributi	on				99% Ch	ebyshev(Me	an, Sd) UCL	11.67
63	95	5% Approxim	ate Gamma	UCL (Use wh	nen n >= 40)	3.528						
64		95% Adju	isted Gamma	a UCL (Use v	vhen n < 40)	4.13						
65	L											
66			Potential U	ICL to Use					Use 95% Che	ebyshev (Me	an, Sd) UCL	5.966
67	L											
68	No	ote: Suggesti	ons regarding	g the selectic	on of a 95% l	UCL are prov	vided to help	the user to s	select the mo	st appropriat	e 95% UCL.	
69		These recom	mendations	are based u	pon the resu	Its of the sim	nulation studie	es summariz	zed in Singh,	Singh, and I	aci (2002)	
70			and Singh a	and Singh (2	003). For a	dditional insi	ight, the user	may want to	o consult a st	atistician.		
71												

	A	В	С	D	E	F	G	Н		J	K	L
1					Outlier Test	ts for Selecte	d Variables					
2			User Selec	ted Options								
3	From File WorkSheet.wst											
4	Full Precision OFF											
5	Test for Suspected Outliers with Dixon test 1											
6	Test for S	Suspected C	Outliers with F	Rosner test	1							
7												
8												
9		Dixon's Ou	tlier Test for	Napthalene								
10												
11	Number of c	data = 10										
12	10% critical	value: 0.409	Э									
13	5% critical v	value: 0.477										
14	1% critical v	alue: 0.597										
15												
16	1. Data Val	ue 10.7 is a	Potential Out	tlier (Upper T	Tail)?							
17												
18	Test Statisti	c: 1.000										
19												
20	For 10% sig	inificance lev	vel, 10.7 is ar	n outlier.								
21	For 5% sign	ificance leve	el, 10.7 is an	outlier.								
22	For 1% sign	ificance leve	el, 10.7 is an	outlier.								
23												
24	2. Data Valu	ue 0.5 is a Po	otential Outli	er (Lower Ta	il)?							
25												
26	Test Statisti	c: NaN										
27												
28	For 10% sig	inificance lev	vel, 0.5 is an	outlier.								
29	For 5% sign	ificance leve	el, 0.5 is an o	utlier.								
30	For 1% sign	ificance leve	el, 0.5 is an o	utlier.								
31												



APPENDIX 6 – SOIL GAS MONITORING RECORDS

	GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET									
Site: Kilburn high road	Operative(s): GG	Date: 29/10/14	Time: 12:13 pm	Time: 12:13 pm		Page: 1 of 3				
	MONITORING EQUIPMENT									
Instrument Type	Instrument Make		Serial No.		Date Last Calibrated					
Analox	GA5000									
PID	Phochecker tiger									
Dip Meter	GeoTech									
	-	MONITORING	CONDITIONS		•					
Weather Conditions: Cloud	dy, heavy rain	Ground Conditions: wet			Temperature: 16c					
Barometric Pressure (mba	ar): 1009	Barometric Pressure Trend (2	4hr): falling	r): falling Ambient Concentration: 0%CH ₄ , 0%CO ₂ , 2						

	MONITORING RESULTS												
Monitoring	Flow		Atmospheric	Methane	Methane	Carbon	Oxygen	VOC (ppm)		Hydrogen Sulphide	Carbon	Depth to	Depth to Base
Point Location	Peak	Average	Pressure (mbar)	%	% LEL	Dioxide %	%	Peak	Average	(ppm)	Monoxide (ppm)	water (bgl)	of well (bgl)
WS3	+0.2	/	1009	0.0	0	8.4	11.0	0.0	/	0	0	Dry	2.54
BH2	+0.2	/	1009	0.0	0	0.5	20.5	0.3	/	0	1	Dry	18.54

	GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET									
Site: Kilburn high road	Operative(s): GG	Date: 05/11/14	Time: 10:32 am		Round: 2	Page: 2 of 3				
	MONITORING EQUIPMENT									
Instrument Type	Instrument Make		Serial No.		Date Last Calibrated					
Analox	GA5000									
PID	Phochecker tiger									
Dip Meter	GeoTech									
	-	MONITORING CO	NDITIONS		-					
Weather Conditions: Cloud	dy, heavy rain	Ground Conditions: wet			Temperature: 12c					
Barometric Pressure (mbar): 0983 Barometric Pressure Trend (24hr): falling Ambient Concentration: 0%CH4, 0%CO2, 21.8%O2										

	MONITORING RESULTS												
Monitoring	Flow		Atmospheric	Methane	Methane	Carbon	Oxygen	VOC (ppm)		Hydrogen	Carbon	Depth to	Depth to Base
Point Location	Peak	Average	Pressure (mbar)	%	% LEL	Dioxide %	%	Peak	Average	Sulphide (ppm)	Monoxide (ppm)	water (bgl)	of well (bgl)
WS3	+0.8	/	0983	0.0	0	9.4	9.9	0.3	/	0	0	Dry	2.54
BH2	+0.2	/	0983	0.0	0	0.6	20.0	0.3	/	0	0	Dry	18.54

	GAS AND GROUNDWATER MONITORING BOREHOLE RECORD SHEET									
Site: Kilburn high road	Operative(s): GG	Date: 13/11/14	Time: 4.08 pm	Time: 4.08 pm		Page: 3 of 3				
	MONITORING EQUIPMENT									
Instrument Type	Instrument Make		Serial No.	Serial No.		ited				
Analox	GA5000									
PID	Phochecker tiger									
Dip Meter	GeoTech									
	-		ONDITIONS		-					
Weather Conditions: Cloud	dy, heavy rain	Ground Conditions: wet			Temperature: 12c					
Barometric Pressure (mba	ar): 0983	Barometric Pressure Trend (24h	r): falling	Ambient Concentration: 0%CH ₄ , 0%CO ₂ , 21.8%O ₂						

	MONITORING RESULTS												
Monitoring	Flow		Atmospheric	Methane	Methane	Carbon	Oxygen	VOC (ppm)		Hydrogen Sulphide	Carbon	Depth to	Depth to Base
Point Location	Peak	Average	Pressure (mbar)	%	% LEL	Dioxide %	%	Peak	Average	(ppm)	Monoxide (ppm)	water (bgl)	of well (bgl)
WS3	+0.2	/	0983	0.0	0	8.6	10.6	0.0	/	0	0	Dry	2.54
BH2	+0.4	/	0983	0.0	0	0.7	20.0	0.0	/	0	0	Dry	18.54



APPENDIX 7 – IN SITU CBR RESULTS

Nr Blows	S Blows	Penetration	S Pen.		
INI DIOWS	3 DIOWS	mm	mm		
0	0	50	50		
0	0	50	100		
0	0	50	150		
0	0	50	200		
3	3	50	250		
4	7	50	300		
4	11	50	350		
1	12	50	400		
2	14	50	450		
1	15	50	500		
2	17	50	550		
1	18	50	600		
1	19	50	650		
1	20	50	700		
1	21	50	750		
1	22	50	800		
1	23	50	850		
1	24	50	900		

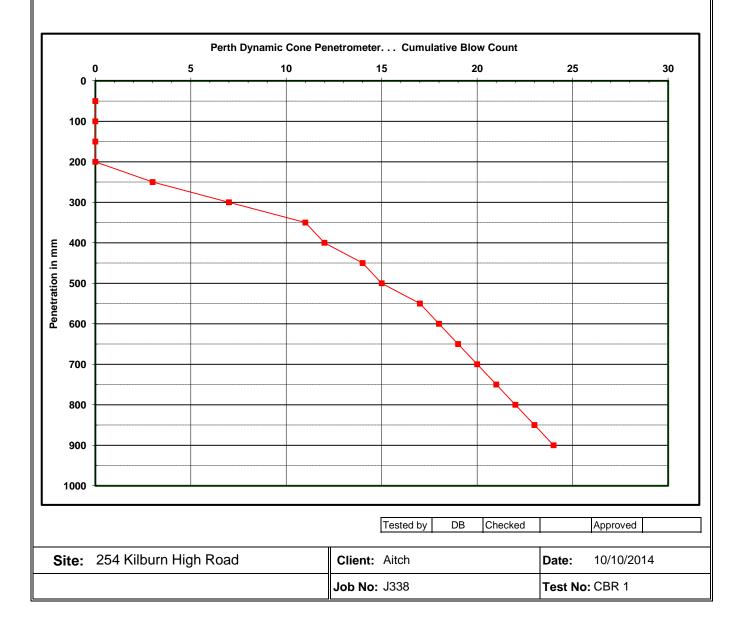
254 Kilburn High Road Test Reference: - CBR 1

Job Nr J338

Date 10-Oct-14

CBR VALUE CALCULATIONS

Initial S	Final S	Initial S	Final S	Pen/Blow	CBR	CBR	CBR
Pen mm	Pen mm	Blows	Blows	mm	TRRL	KVH	Value (%)
250	350	3	11	12.5	20.9	16.9	16.9
350	500	11	15	37.5	6.6	4.1	4.1
550	900	17	24	50.0	4.8	2.9	2.9



Nr Blows	S Blows	Penetration	S Pen.		
NI DIOWS	3 BIOWS	mm	mm		
0	0	50	50		
0	0	50	100		
0	0	50	150		
0	0	50	200		
1	1	50	250		
1	2	50	300		
2	4	50	350		
5	9	50	400		
7	16	50	450		
3	19	50	500		
2	21	50	550		
1	22	50	600		
0	22	50	650		
1	23	50	700		
0	23	50	750		
1	24	50	800		
2	26	50	850		
1	27	50	900		
1					
1					

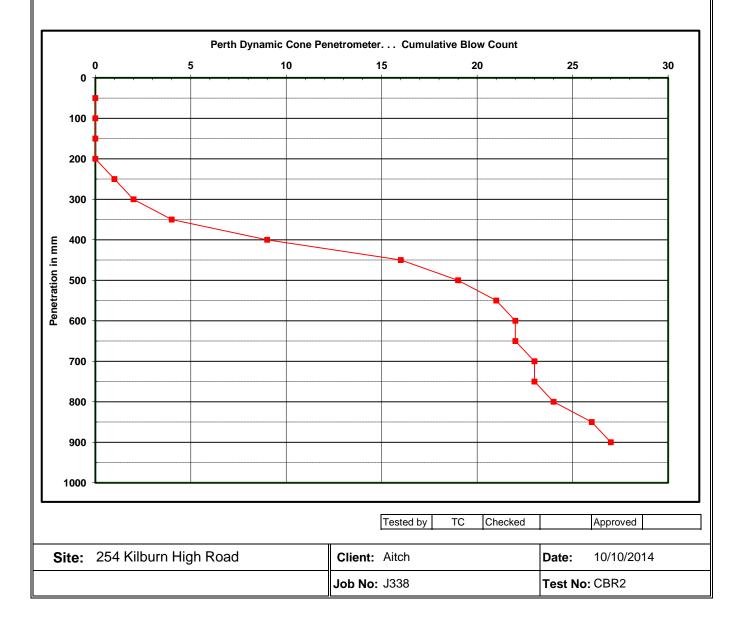
254 Kilburn High Road Test Reference: - CBR 3

Job Nr J338

Date 10-Oct-14

CBR VALUE CALCULATIONS

Initial S	Final S	Initial S	Final S	Pen/Blow	CBR	CBR	CBR
Pen mm	Pen mm	Blows	Blows	mm	TRRL	KVH	Value (%)
300	400	2	9	14.3	18.2	14.2	14.2
400	550	9	21	12.5	20.9	16.9	16.9
550	750	21	23	100.0	2.3	1.2	1.2
800	900	24	27	33.3	7.4	4.8	4.8



Nr Blows	S Blows	Penetration	S Pen.	
NI DIOWS	3 DIOWS	mm	mm	
0	0	50	50	
0	0	50	100	
0	0	50	150	
0	0	50	200	
0	0	50	250	
1	1	50	300	
7	8	50	350	
5	13	50	400	
2	15	50	450	
1	16	50	500	
1	17	50	550	
0	17	50	600	
1	18	50	650	
0	18	50	700	
1	19	50	750	
0	19	50	800	
1	20	50	850	
1	21	50	900	

254 Kilburn High Road Test Reference: - CBR 3

Job Nr J338

Date 10-Oct-14

CBR VALUE CALCULATIONS

Initial S	Final S	Initial S	Final S	Pen/Blow	CBR	CBR	CBR
Pen mm	Pen mm	Blows	Blows	mm	TRRL	KVH	Value (%)
300	400	1	13	8.3	32.1	28.4	28.4
400	550	13	17	37.5	6.6	4.1	4.1
550	750	17	19	100.0	2.3	1.2	1.2
800	900	19	21	50.0	4.8	2.9	2.9

