REPORT N^{O} 70024625

TOPSOIL ASSESSMENT
BICESTER KME
BICESTER, OXFORDSHIRE

BOVIS HOMES LIMITED

CONFIDENTIAL

AUGUST 2016

WSP | PARSONS BRINCKERHOFF

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Project no: 70024625
Date: August 2016

WSP | Parsons Brinckerhoff
Mountbatten House
Basing View
Basingstoke
RG21 4HJ

www.wsp-pb.com

WSP | PARSONS BRINCKERHOFF

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Signature	[redacted]			
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1 INTRODUCTION

1.1.1 WSP | Parsons Brinckerhoff was instructed by Bovis Homes Limited to undertake an assessment of topsoil quality and determine the potential for re-use on site within the Bicester KME land parcel, Phase 1 Development Area, Bicester, Oxfordshire (the Site). The works were commissioned in response to WSP | Parsons Brinckerhoff proposal dated 14 July 2016.

1.1.2 The site is approximately 5.5 hectares in area, is situated to the south west of Bicester and has historically been used as agricultural land. The Bicester KME land parcel forms part of the broader Phase 1 development site and is situated in the central portion of the development site, bound by as yet undeveloped land parcels to the north, east and west. The southern boundary is formed by the access road 'Whitelands Way'.. The site is to be redeveloped for a residential end-use, which is understood to comprise two-storey properties with private gardens.

1.1.3 No significant industrial or contaminative land uses are known to have been historically undertaken at the site, however, a previous WSP Phase II Geo-Environmental and Geotechnical Assessment (ref: 00020861/002 dated November 2011) identified arsenic at concentrations above generic assessment criteria in near surface soils. As a consequence further shallow soil sampling and assessment of the potential risks to human health was recommended prior to site redevelopment.

1.2 OBJECTIVES

1.2.1 The objective of this assessment is to further characterise the potential human health risks associated with elevated concentrations of arsenic within topsoil present at the site. This is to support a due diligence assessment of the Site by Bovis Homes Limited.

1.2.2 For the purposes of this assessment we have assumed that topsoil will comprise the top 500 mm of material across the site and that this materials will be stripped and stockpiled for possible re-use within the proposed residential redevelopment..

1.3 SCOPE OF WORKS

1.3.1 The following scope of works has been undertaken in order to support the objective outlined above:

- → Prepare a Health and Safety Plan;
- → Additional ground investigation comprising the excavation of 24 No. hand pits to maximum depth 0.5 m bgl;
- → Full time supervision of the ground investigation works on site by WSP | Parsons Brinckerhoff;
- → Collection and laboratory analysis of representative soil samples for arsenic and bio-accessibility testing for arsenic;
- → Completion of a detailed quantitative risk assessment (DQRA) for human health with respect to arsenic using CLEA v1.071; and
- → Preparation of an interpretative report detailing the additional ground investigation works, the findings of the human health risk assessment and with recommendations for the suitability of topsoil for re-use at the site under a residential end use scenario.

1.4 SOURCES OF INFORMATION

1.4.1 The following existing sources of information have been used in the production of the report:

- WSP *Phase II Geo-Environmental and Geotechnical Assessment Central Land Parcels (KM13 to 20 and Local Centre) Whitelands Farm, Southwest Bicester, Oxfordshire* (Ref:00020861/002) dated November 2011 (WSP Phase II report);
- EA 'What's In Your Backyard?' website accessed on 23 August 2016;
- BGS 'Geology of Britain' online viewer accessed on 23 August 2016;
- BGS 'Contaminant distribution in soil' online viewer accessed on 23 August 2016; and
- NHBC, EA and CIEH 'Guidance for the Safe Development of Housing on Land Affected by Contamination' R&D66. Appendix 3. 2008.

1.5 LIMITATIONS

1.5.1 This report is addressed to and may be relied upon by Bovis Homes Limited. It may not be relied upon or transferred to any other parties without the express written agreement of WSP | Parsons Brinckerhoff. The report should be read and used in full. No responsibly will be accepted where this report is used, ether in its entirety or in part, by any other party. WSP | Parsons Brinckerhoff cannot be held liable for third party information.

1.5.2 General limitations of the site investigation are provided as **Appendix A**.

2 SITE DETAILS

2.1 SITE DESCRIPTION

2.1.1 A site location plan is provided as **Figure 1** and the site boundary is shown as **Figure 2**.

2.1.2 **Table 2.1** provides a summary of the site details obtained from a review of Ordnance Survey (OS) mapping, online aerial photography, the WSP Phase II report and key observation made during the site works.

Table 2.1: Site Information

DETAILS	DESCRIPTION
Name and address of site	Bicester KME land parcel, land off Whitelands Way, Bicester, Oxfordshire, OX26
Approximate Grid Reference	457365, 222038
Site Description and current use	The site is un-used, but was historically agriculture land use. Land boundary covers approximately 5.5 hectares in area
Site surrounding area and topography	North: as yet undeveloped formerly agricultural land South: Whitelands Way and beyond as yet undeveloped of formerly agricultural land into primary and secondary schools East: as yet undeveloped formerly agricultural land West: as yet undeveloped formerly agricultural land
Ground cover	Generally flat and level grassed covered field

2.2 ENVIRONMENTAL SETTING

GEOLOGY AND HYDROGEOLOGY

2.2.1 British Geological Survey *BGS) 1:50,000 Map Sheet 219 Buckingham (Solid and Drift) records the site to be underlain by the following geological sequence, summarised in **Table 2.2**.

Table 2.2 Published Geology

GEOLOGICAL UNIT	DESCRIPTION	AQUIFER STATUS
Cornbrash Formation	Rubbly grey to brown limestone	Secondary A

2.2.2 The site is not located in a groundwater source protection zone.

2.2.3 Reference to the BGS contaminant distribution viewer shows that the site falls within land that is classified in the upper 75th to 94.9th percentiles of arsenic concentrations i.e. typically 18.9 mg/kg to 33.4 mg/kg. The normal background concentration of arsenic in the principal soil domain is 32 mg/kg.

HYDROLOGY

2.2.4 Several land drains reported to be located within close proximity to the north and south of the site. The closest named surface water features include, Pringle Brook approximately 140 m north of the site and Langford Brook approximately 400 m south of the site.

3 CONCEPTUAL SITE MODEL

3.1.1 The following is a summary of the potential human health risks as detailed within the revised conceptual site model included in the WSP Phase II report.

3.2 CONTAMINANT SOURCES

3.2.1 Slightly elevated concentrations of arsenic with respect to generic assessment criteria in several natural soil samples. The findings of the WSP Phase II report are consistent with published BGS information that puts the site in an area of naturally occurring elevated arsenic concentrations in soils.

3.3 ACTIVE MIGRATION PATHWAYS

- Dermal contact with soil; and,
- Ingestion of soil and dust

3.4 ACTIVE RECEPTORS

- Future site users; and,
- Construction workers.

3.5 PLAUSIBLE POLLUTANT LINKAGES

3.5.1 The WSP Phase II report concluded that elevated concentrations of arsenic in areas of soft standing and residential garden areas will require re-appraisal once final development layout plans are determined.

3.5.2 In areas of hardstand cover (roads/building footprints) or raised areas by more than 0.5 m the pathway linkages are not active.

3.5.3 The risk to construction workers was assessed as being mitigated by use of appropriate PPE and health and safety procedures during construction phase.

4 GROUND INVESTIGATION

4.1 RATIONALE

4.1.1 The purpose of the additional ground investigation was to collect shallow soil samples for arsenic analysis at a UKAS accredited laboratory. These works were to supplement the data contained within the WSP Phase II report and enable a suitable dataset upon which a robust Detailed Quantitative Risk Assessment (DQRA) could be carried out. The risk assessment required a statistical appraisal of laboratory results based on an 'averaging area' of the top 0.5 m of soil across the site footprint to enable suitability of materials for re-use to be assessed.

4.2 INVESTIGATION DESIGN

4.2.1 The ground investigation works comprised the excavation of 24 trial pits by hand across the site in a non-targeted spatial sampling strategy approximately equivalent to a 47 m grid spacing. Trial pits were excavated to a maximum depth of 0.5 m and a single soil sample was collected per exploratory hole equivalent to one sample per 1,000 cu.m soil.

4.2.2 The ground investigation was undertaken in general accordance with techniques outlined in BS5930: 2015 (+A2:2010) Code of Practice for Site Investigations and BS10175:2011 (+A1:2013) Investigation of Potentially Contaminated Sites – Code of Practice.

4.3 WORKS UNDERTAKEN

4.3.1 The intrusive works were undertaken on 02 August 2016 by Geocore Site Investigations Limited under full time supervision by a competent WSP | Parsons Brinckerhoff consultant. An exploratory hole location plan is provided as **Figure 3** and exploratory hole logs are presented as **Appendix B**.

4.3.2 Works involved the excavation of 25 hand pits to maximum depth of 0.5 m (this is a variation to the initial proposed number of exploratory holes). Grassed topsoil was encountered in all locations. Discoloured or malodorous material was not encountered in the locations investigated. Made Ground was not encountered in the locations investigated.

CHEMICAL LABORATORY TESTING

4.3.3 The following laboratory analysis was undertaken on topsoil samples obtained from the hand excavated trial pits:

- → 25 soil samples were submitted for total arsenic analysis at Alcontrol Laboratories; and,
- → 4 topsoil samples were analysed for bioaccessibility using the unified BARGE method (UBM) at Alcontrol Laboratories.

4.3.4 In addition, 2 soil samples were also subjected to asbestos quantification, as the analytical laboratory suspected asbestos to be present in the samples.

5 HUMAN HEALTH RISK ASSESSMENT

5.1 LABORATORY RESULTS

5.1.1 Laboratory analysis certificates are presented in **Appendix C**. Arsenic concentrations ranged from 7.9 mg/kg to 62.1 mg/kg, with a mean average concentration of 28.6 mg/kg. Higher arsenic concentrations appear to be from soil sample locations in the central and western portions of the site.

5.1.2 *In vitro* bioaccessibilty tests indicated that arsenic in the soils analysed was between 14% to 27% bioaccessible in the stomach / intestines.

5.2 QUANTITATIVE RISK ASSESSMENT METHODOLOGY

5.2.1 Our approach to the assessment of risk to human health is to undertake a tiered assessment, commencing with a generic quantitative risk assessment (GQRA) to screen laboratory data prior to undertaking a more detailed quantitative assessment. A more detailed approach to our risk assessment is provided as **Appendix D**.

GENERIC ASSESSMENT

5.2.2 In selecting relevant generic assessment criteria (GAC) for the GQRA a number of values have been adopted to inform a 'lines of evidence' approach to the assessment. Selected GAC against which the laboratory results have been screened are:

- WSP | Parsons Brinckerhoff derived GACs;
- CL:AIRE Category Four Screening Levels for Assessment of Land (C4SL) Affected by Contamination SP1010 September 2014; and,
- British Geological Survey – Normal Background Concentrations (NBC) SP1008.

5.2.3 Although three GACs are listed, the lowest generic assessment criteria value selected from the WSP | Parsons Brinckerhoff GACs / C4SL / NBC is used as the 'adopted' GAC (as highlighted in **Table 5.2**, below) for the screening assessment in the GQRA. The higher GACs are used to help inform the GQRA evaluation process if exceedance of the adopted GAC is recorded. It is noted that DEFRA and the Welsh Government have confirmed that C4SLs provide a simple test for deciding when land is suitable for use and definitely not contaminated in the context of Part2A of the Environmental Protection Act 1990.

5.2.4 The data set also included six relevant soil analytical results for arsenic from the previous WSP Phase II report.

5.2.5 A statistical assessment of the dataset is also undertaken using the approach defined in the report entitled 'Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, May 2008)' and using the ESI Contaminated Land Statistical Calculator v2.0. Where results are reported at less than analytical limit of detection (LoD), WSP have taken the LoD as the soil concentration for use in the statistical analysis. Although it is noted that if more that 15% of the sample set are recorded at less than LoD the results of the statistical assessment are invalid.

5.2.6 Site specific assessment criteria have been derived for arsenic in soils using the CLEA v1.071 workbook released by the Environment Agency in 2015 and is summarised in **Table 5.1**, below. The single change to the workbook was the use of a site derived soil bioacessible/bioavailable value for arsenic. The highest recorded bioaccessible fraction (above limit of detection) was used in the derivation of the SSAC, as a means of conservatism. The relative bioavailability (RBA) fraction for airborne dust was not changed, as this was not sampled and analysed. A summary of the CLEA v1.071 worksheets is provided as **Appendix E**.

Table 5.1 Site Specific Assessment Criteria

CONTAMINANT	SSAC (MG/KG)
Arsenic (Bioaccessible Fraction ^= 27%)	80

^ with respect to arsenic bioaccessible fraction is approximately equivalent to relevant bioavailable fraction

5.3 GQRA AND DQRA FINDINGS

5.3.1 A summary of the initial GQRA screening assessment is presented in **Table 5.2** and a summary of the statistical assessment is presented in **Table 5.3**. Full screening tables are presented in **Appendix F** and detailed summary of the statistical assessment is presented as **Appendix G**.

Table 5.2: Exceedances of Soil Assessment Criteria for a Residential without Home-grown Produce Land Use 0.0 to 0.5 m bgl

ANALYTE	NO SAMPLES TESTED	ASSESSMENT CRITERIA				SAMPLES EXCEEDING ASSESSMENT CRITERIA				MAX CONC. (MG/KG) AND LOCATION
		WSP GAC MG/KG	NBC MG/KG	C4SL MG/KG	SSAC MG/KG	NO. > WSP GAC	NO. > NBC	NO. > C4SL	NO.> SSAC	
Arsenic	31	32	32	37	80	13	13	6	0	62.1 HD07 at 0.5 m bgl

Values in highlighted in **grey** are the adopted GAC; values highlighted in **orange** exceed the adopted GAC

Table 5.3 Summary Statistical Analysis 0.0 to 0.5 m bgl

ANALYTE	NO SAMPLES TESTED	MIN MG/KG	MAX MG/KG	ARITHMETIC MEAN MG/KG	STANDARD DEVIATION MG/KG	95%ILE UPPER CONFIDENCE LIMIT MG/KG	DISTRIBUTION AND OUTLIERS
Arsenic	31	7.9	62.1	28.6	11.5	32.1	Normal distribution. Outlier test not applicable

5.3.2 The statistical analysis records a 95th percentile upper confidence limit (UCL) of the mean at 32.1 mg/kg this is equivalent to the WSP Parsons Brinckerhoff GAC of 32 mg/kg and the BGS normal background concentration for arsenic in the principal soil domain. The statistical assessment found that there was insufficient evidence to reject the null hypothesis.

5.3.3 The UCL is, however, less than the C4SL value of 37 mg/kg, a value at which the land would definitely not be classified as contaminated land under the principals of Part 2A of the Environmental Protection Act 1990.

5.3.4 A site specific assessment criterion based on the bioaccessibility testing was derived to provide an additional line of evidence that the top 0.5 m of soils can be re-used in the proposed residential development.

5.3.5 No soil sample collected from 0.0 to 0.5 m depth range was found to contain arsenic concentrations above the SSAC of 80 mg/kg.

5.3.6 There is sufficient evidence to reject the null hypothesis when the C4SL and SSAC are used as the critical concentrations for the statistical assessment.

5.3.7 Asbestos was not identified in the soil samples tested.

5.4 RISK EVALUATION

5.4.1 The historical land use at the Bicester KME land parcel was agricultural land use. Previous site investigations identified concentrations of arsenic in soil samples collected from natural geological units. The WSP Phase II report recommended that arsenic concentrations in soil are further appraised with respect to residential back gardens that may be used for home grown produce.

5.4.2 The statistical analysis did not reject or confirm the null hypothesis when comparing the UCL of the sample population dataset against the WSP | Parsons Brinckerhoff GAC and published NBC for arsenic. This was due to the UCL and the GAC / NBC being approximately equal.

5.4.3 Comparing UCL of the sample population dataset with the C4SL value of 37 mg/kg and the SSAC value of 80 mg/kg provides additional lines of evidence that there is sufficient evidence to reject the null hypothesis (for a planning scenario).

5.4.4 On the basis of the laboratory analysis including bioaccessibility testing and statistical assessment presented above it is unlikely that the soils collected from 0.0 to 0.5 m depths within the Bicester KME land parcel pose a significant risk of harm to future end users in a residential with homegrown produce scenario.

5.4.5 Bovis Homes Limited may reasonably consider as part of their due diligence assessment that the top 0.0 to 0.5 m depth of soil (based on existing site levels) within the Bicester KME land parcel is suitable for re-use on the site.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY AND CONCLUSIONS

6.1.1 Bovis Homes Limited commissioned WSP | Parsons Brinckerhoff to investigate the suitability for re-use of a topsoil strip of 0.5 m in a residential with homegrown produce end use at the Bicester KME land parcel. This was to support Bovis Homes Limited due diligence assessment and that historical site investigations previously undertaken by WSP identified arsenic at elevated concentrations with respect to generic assessment criteria (GAC) in soils collected from natural strata.

6.1.2 The recent works included the excavation of shallow exploratory holes (to maximum depth 0.5 m) across the Bicester KME land parcel and the collection of soil samples for laboratory analysis for total arsenic concentration and included a limited number of soil samples for arsenic bioaccessibility analysis.

6.1.3 The laboratory results of 25 soil samples collected from this phase of the site investigation and six arsenic results from the WSP Phase II Report were screened against four assessment criteria to provide a lines of evidence approach to the suitability for reuse of the material.

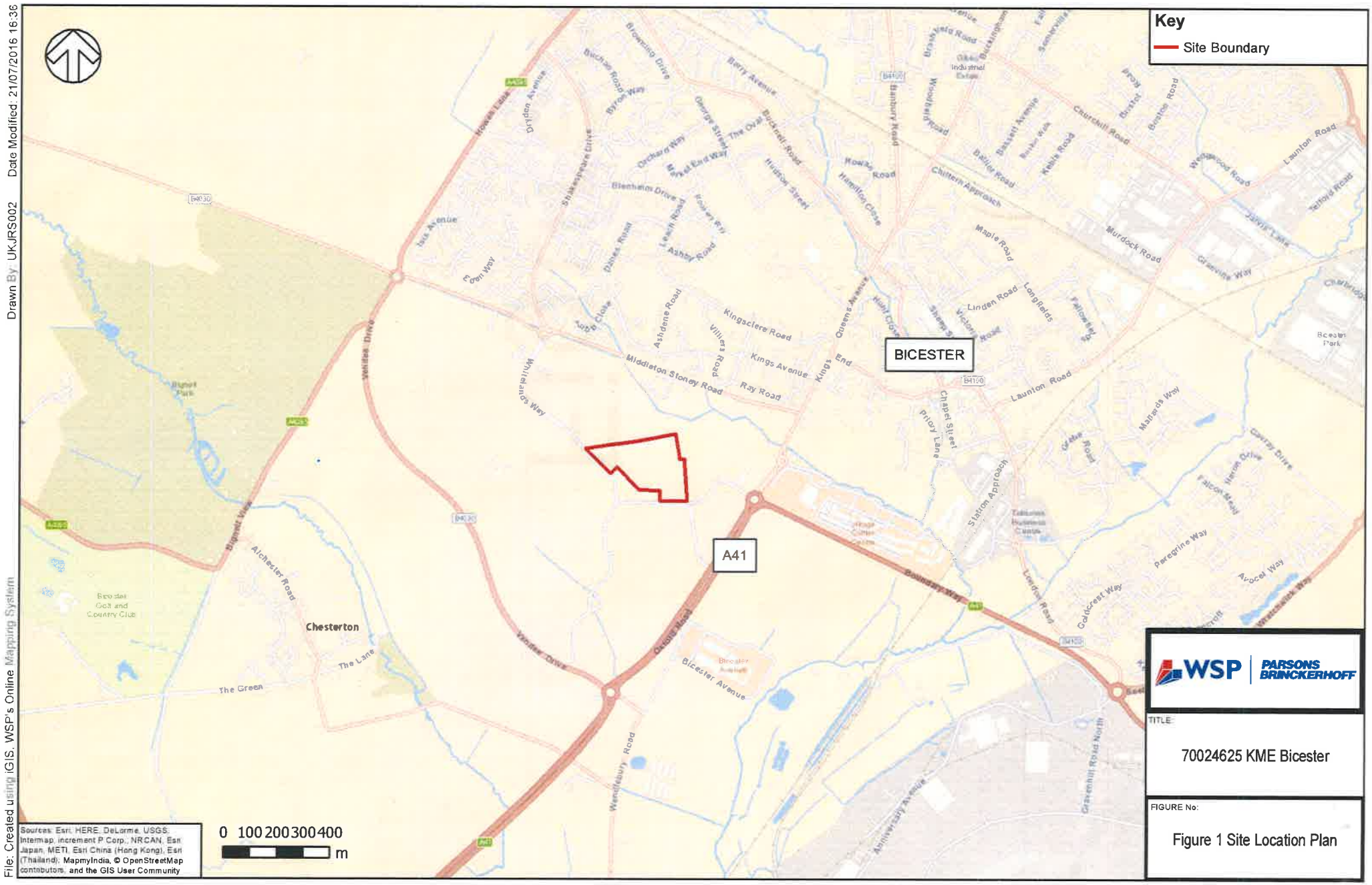
6.1.4 Arsenic concentrations in soil samples collected from 0.0 to 0.5 m depths ranged from 7.9 mg/kg to 62.1 mg/kg, with a mean average concentration of 28.6 mg/kg. A number of soil samples were found to contain arsenic concentrations above the WSP | Parsons Brinckerhoff derived GAC, but arsenic concentrations were less than a WSP | Parsons Brinckerhoff derived SSAC.

6.1.5 The statistical assessment of the data found that the null hypothesis (for a planning scenario) could be rejected when the upper confidence level of the sample dataset was assessed against the C4SL arsenic value of 37 mg/kg or the SSAC of 80 mg/kg. It is noted that DEFRA and the Welsh Government have confirmed that C4SLs provide a simple test for deciding when land is suitable for use and definitely not contaminated in the context of Part2A of the Environmental Protection Act 1990.

6.1.6 On the basis of the laboratory analysis including bioaccessibility testing and statistical assessment presented above, as part of their due diligence assessment Bovis Homes Limited may reasonably consider that the top 0.0 to 0.5 m depth of soil (based on existing site levels) within the Bicester KME land parcel is suitable for re-use on the site.

6.1.7 WSP | Parsons Brinckerhoff also note that it is best practice that when re-using site won stockpiled material in private residential gardens to undertake validation check sampling prior to or following placement of material. This may also be a requirement of the Local Planning Authority as a planning condition to the development.

Figures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70024625 KME Bicester
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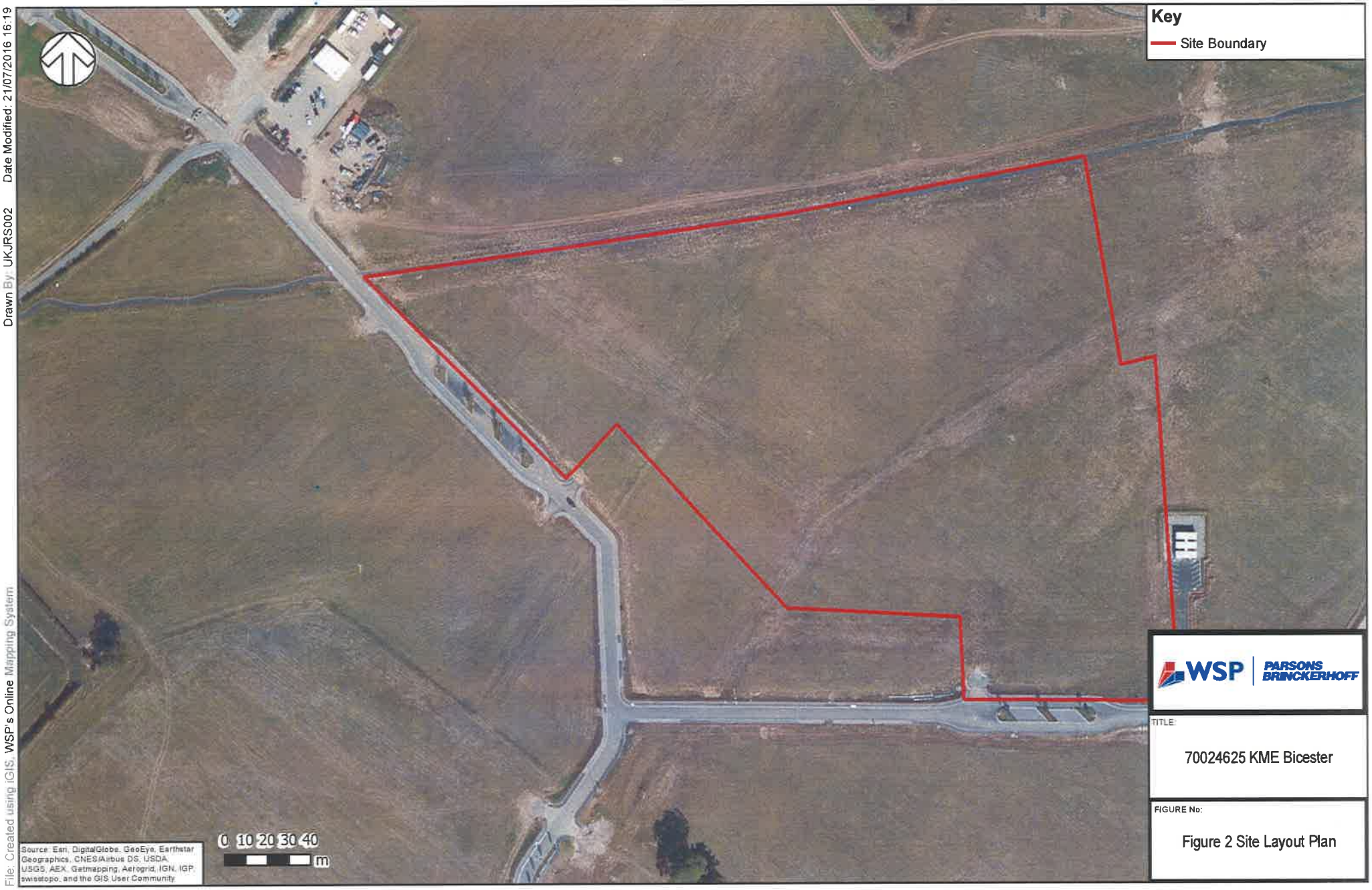
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WSP | PARSONS BRINCKERHOFF
TITLE:
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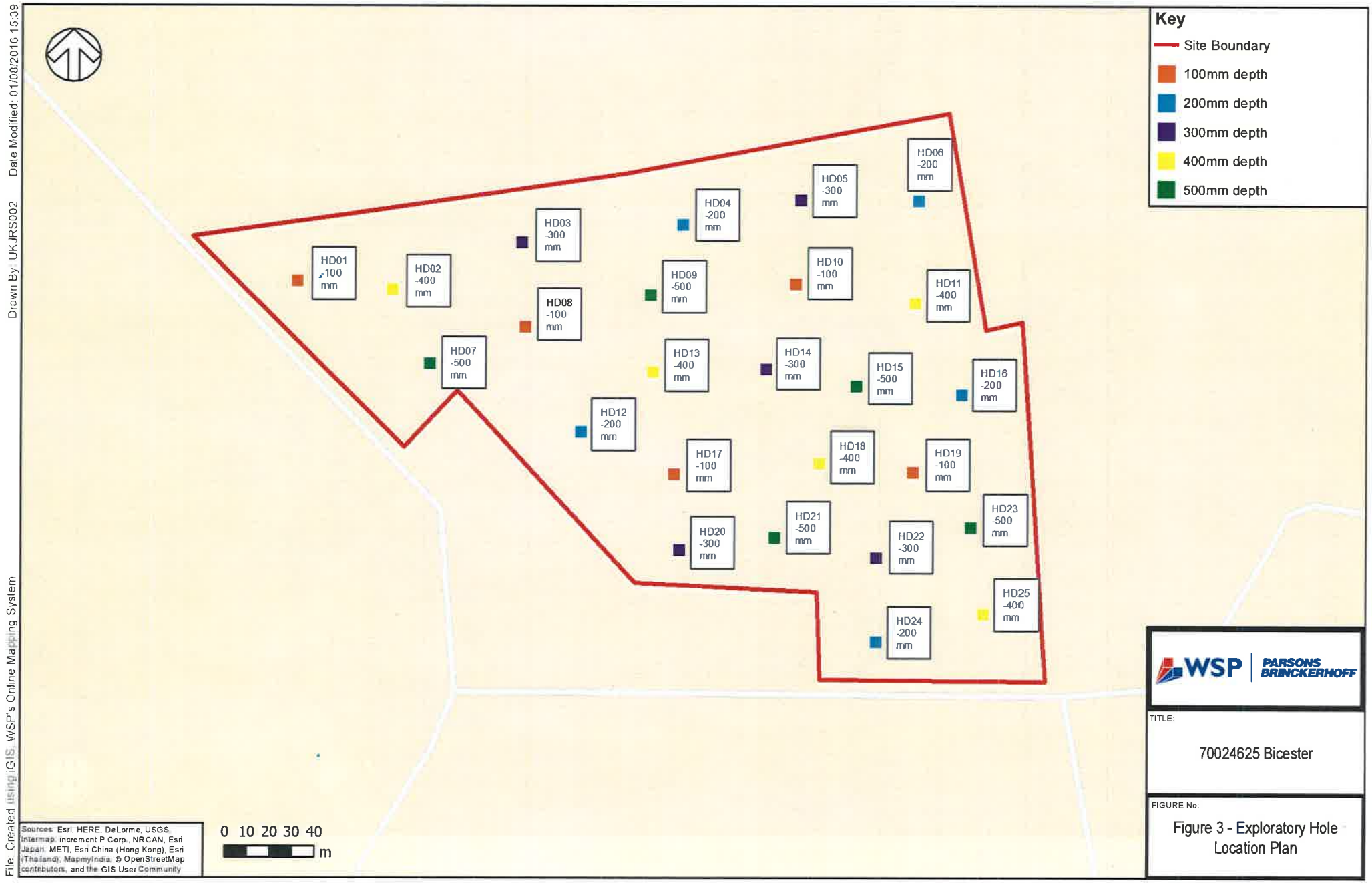
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Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
WSP
PARSONS BRINCKERHOFF
TITLE:
70024625 Bicester
FIGURE No:
Figure 3 - Exploratory Hole Location Plan
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File: Created using iGIS, WSP's Online Mapping System

Appendix A

GENERAL LIMITATIONS

LIMITATIONS FOR GROUND RISK AND REMEDIATION DIVISION

General

WSP has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report. Unless explicitly agreed otherwise, in writing, this report has been prepared under WSP Standard Terms and Conditions, as included within our proposal to the Client.

Project specific appointment documents may be agreed on a project by project basis, at our discretion. A charge may be levied for both the time to review and finalise appointments documents and also for associated changes to the appointment terms. WSP reserve the right to amend the fee should any changes to the appointment terms create an increase risk to WSP.

The report needs to be considered in the light of the WSP proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report. The report is only valid for its originally intended purpose as set out in either our report or the proposal.

Phase 1 Geo Environmental Preliminary Risk Assessments

The works undertaken to prepare this report comprise a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. It is not standard, due to the timescales, to visit archives and local libraries as part of these works. WSP cannot be held responsible for any disclosures that are provided post production of our report and will not automatically update our report.

The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, WSP reserves the right to review such information and, if warranted, to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the Site.

WSP does not warrant work / data undertaken / provided by others.

This section covers reports with the following titles or combination of titles: Phase 1; Desk Top Study; Geo-Environmental Assessment; Development Appraisal; Preliminary Environmental Risk Assessment; Constraints Report; Due Diligence Report; Geotechnical Development Review; Environmental Statement; Environmental Chapter; Geotechnical Development Risk Register or Baseline Environmental Assessment. These limitations associated with preliminary works also apply when they are reported within an intrusive investigation report.

Intrusive Investigation Reports

The investigation has been undertaken to provide information concerning the type and degree of contamination present at the Site in order to allow a generic risk assessment to be undertaken or identification of the soil properties to allow for geotechnical development constraints to be identified.

The objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters. For geotechnical investigations the purpose is to broadly identify the development constraints associated with the physical property of the soils underlying the site.

The amount of exploratory work, soil property and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report. For example these include spatial variations in soil properties; the varying thickness and physical nature of the strata identified and changes in groundwater levels or flow rates.

The inspection; testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. WSP has interpreted between these points based upon assumptions to develop our interpretation and conclusions. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation.

On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.

In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. A GDR can strictly only be prepared following confirmation of all structural loads and serviceability requirements. The design process requires close co-operation between the geotechnical engineer and the structural engineer and is iterative. Where a GDR is prepared using preliminary or assumed loadings and/or serviceability limits it should only be considered as an interim report and should not be relied upon for the procurement or construction of the works it describes. A GDR will be a standalone specifically entitled report.

During any build programme WSP should be consulted if alternative ground conditions are encountered. It assumes during any site works that the contractor will use their best endeavours to manage and control groundwater and other unforeseen ground conditions. WSP will not be liable for actions taken prior to consultation.

The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.

The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with the WSP risk assessment process have been outlined within the body or associated appendix of the report.

Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.

If costs have been included in relation to additional site works, and / or site remediation works these must be considered as indicative only and must, be confirmed by a qualified quantity surveyor.

The following report titles (or combination) may cover this category of work: geo environmental site investigation; geotechnical assessment; GIR (Ground Investigation reports); preliminary environmental and geotechnical risk assessment; geotechnical risk register.

Detailed Quantitative Risk Assessments and Remedial Strategy Reports

These reports either use primary data or build upon previous report versions and associated notes. The scope of the investigation; further testing and monitoring and associated risk assessments were selected on the basis of the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.

The outputs of the Detailed Quantitative Risk Assessments are based upon WSP manipulation of standard risk assessment models. Models are simulations based on the available data set and should not be used as predictions.

Where a remediation strategy is proposed, this is based on our interpretation of the risk assessment criteria and is specific to a particular location and a particular intended land use and configuration / layout. Prior to adoption they will need discussing and agreeing with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of WSP. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.

Monitoring (including Remediation Monitoring reports)

These reports are factual in nature and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of an earthworks or remedial works.

The data is presented and will be compared with assessment criteria.

Asbestos in soils

Unless explicitly included for in our proposal, our investigation does not include for a formal asbestos assessment and the inspection for asbestos, either as asbestos containing materials (ACMs) lying on the surface or as ACMs and/or as loose asbestos fibres within made ground/stockpiles is excluded. Our report will include only the factual reporting of any laboratory asbestos soil screening results, if completed. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the site.

Where we indicate in our proposal that we will consider asbestos we will undertake screening of representative soil samples for the presences / absence of loose asbestos fibres. If these are found a further and more detailed specific investigation into asbestos in soils will need to be undertaken, which will include asbestos quantification testing. These investigations are associated with more rigorous monitoring of asbestos and health and safety provisions.

Appendix B

EXPLORATORY HOLE LOGS

WSP PARSONS BRINCKERHOFF
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One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

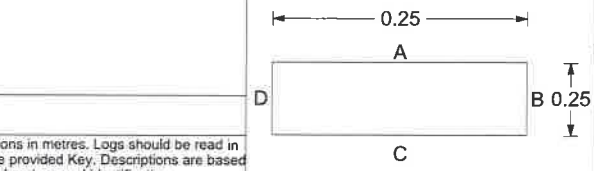
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.10)	Stiff dark yellow brown slightly gravelly sandy CLAY. (TOPSOIL)		TS	
0.10-0.10	ES					73.19	0.10				

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1
Width 0.25m	**Ground Level (m AOD)** 73.294	**Co-Ordinates (NGR)** E 457172 N 222087	**Date** 02-08-16 02-08-16
Orientation degrees from north	**Method/Plant Used** Hand digging	**Contractor** Geocore	**Scale** 1:6.7

Trial Hole No.

HD01

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

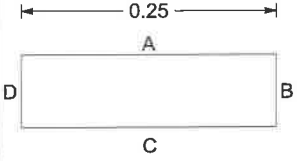
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
						73.10	(0.15) 0.15	Firm dark yellow brown slightly gravelly sandy CLAY. (TOPSOIL)		TS	
						72.90	(0.20) 0.35	Light brown slightly clayey very gravelly SAND. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		CB	
0.40-0.40	ES					72.85	0.40	Very weak cream LIMESTONE. Excavated as slightly gravelly fine to coarse sand. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		CB	

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1
Width 0.25m	**Ground Level (m AOD)** 73.248	**Co-Ordinates (NGR)** E 457214 N 222084	**Date** 02-08-16 02-08-16
Orientation degrees from north	**Method/Plant Used** Hand digging	**Contractor** Geocore	**Scale** 1:6.7

Trial Hole No.

HD02

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

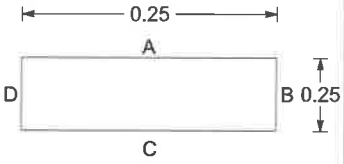
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm brown slightly gravelly sandy CLAY. Gravel is fine subangular limestone. (TOPSOIL)		TS	
0.20-0.20	ES										
						73.03	0.30	0.25 m bgl Gravel becoming fine to coarse.			

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length: 0.25m	Logged By: JS	Client: Bovis Homes		Sheet: 1 of 1
Width: 0.25m	Ground Level (m AOD): 73.327	Co-Ordinates (NGR): E 457270 N 222098	Date: 02-08-16 02-08-16	Trial Hole No. HD03
Orientation: degrees from north	Method/Plant Used: Hand digging	Contractor: Geocore	Scale: 1:6.7	

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One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.20)	Firm dark brown gravelly sandy CLAY. Gravel is fine to medium subrounded to subangular limestone. (TOPSOIL)		TS	
0.20-0.20	ES					72.81	0.20				

General Remarks	Length 0.25m	Logged By JS	Client Bovis Homes	Sheet 1 of 1
Shoring/Support: Stability:	Width 0.25m	Ground Level (m AOD) 73.008	Co-Ordinates (NGR) E 457343 N 222114	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.	Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

A 0.25 | D | B 0.25 | C

Trial Hole No.

HD04

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular limestone. (TOPSOIL)		TS	
0.30-0.30	ES					72.18	0.30				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, D, B 0.25, C	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.477	Co-Ordinates (NGR) E 457395 N 222125	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD05

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.20)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular limestone. (TOPSOIL)		TS	
0.20-0.20	ES					71.86	0.20				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, D, B 0.25, C	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.058	Co-Ordinates (NGR) E 457448 N 222125	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD06

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

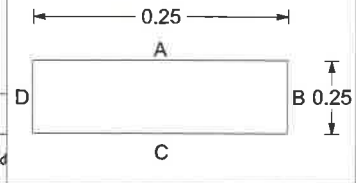
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to subangular limestone. (TOPSOIL)		TS	
						73.01	0.30				
							(0.10)	Light brown slighty clayey very gravelly fine to coarse SAND. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		CB	
						72.91	0.40				
							(0.10)	Yellow brown slightly gravelly fine to coarse SAND. Gravel is fine to medium subrounded to subangular limestone. (CORNBRASH FORMATION)		CB	
0.50-0.50	ES					72.81	0.50				

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1

Width	Ground Level (m AOD)	Co-Ordinates (NGR)	Date	Trial Hole No.
0.25m	73.306	E 457231 N 222050	02-08-16 02-08-16	HD07

Orientation	Method/Plant Used	Contractor	Scale
degrees from north	Hand digging	Geocore	1:6.7

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
0.10-0.10	ES					73.58	(0.10) 0.10	Firm dark yellow brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular limestone. (TOPSOIL)		TS	

General Remarks		Length	Logged By	Client	Sheet
		0.25m	JS	Bovis Homes	1 of 1
Shoring/Support:		Width	Ground Level (m AOD)	Co-Ordinates (NGR) / Date	Trial Hole No.
Stability:		0.25m	73.675	E 457273 N 222067 — 02-08-16 / 02-08-16	HD08
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation	Method/Plant Used	Contractor / Scale	
		degrees from north	Hand digging	Geocore — 1:6.7	

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TRIAL PIT LOG

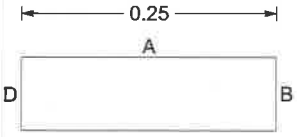
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm dark yellow brown gravelly sandy CLAY. Gravel is fine to coarse subrounded to subangular limestone. (TOPSOIL)		TS	
						72.88	0.30				
							(0.10)	Cream slightly gravelly fine to coarse SAND. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		CB	
						72.78	0.40				
							(0.10)	Very weak cream LIMESTONE. Excavated as slightly gravelly fine to coarse sand. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		CB	
0.50-0.50	ES					72.68	0.50				

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1
Width 0.25m	**Ground Level (m AOD)** 73.184	**Co-Ordinates (NGR)** E 457329 N 222082	**Date** 02-08-16 02-08-16
Orientation degrees from north	**Method/Plant Used** Hand digging	**Contractor** Geocore	**Scale** 1:6.7

Trial Hole No.

HD09

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1 03.GDT 4/8/16

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B5 4PJ
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TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.10)	Dark brown gravelly sandy CLAY. Gravel is fine to coarse subrounded to subangular limestone. (TOPSOIL)		TS	
0.10-0.10	ES					72.58	0.10				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, D, B 0.25, C	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.684	Co-Ordinates (NGR) E 457394 N 222088	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD10

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

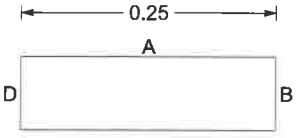
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.40)	Stiff dark brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular limestone. (TOPSOIL)		TS	
0.40-0.40	ES					72.16	0.40	0.35 m bgl Gravel becoming fine to coarse.			

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1

Width	Ground Level (m AOD)	Co-Ordinates (NGR)	Date	Trial Hole No.
0.25m	72.564	E 457447 N 222080	02-08-16 02-08-16	HD11

Orientation	Method/Plant Used	Contractor	Scale
degrees from north	Hand digging	Geocore	1:6.7

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

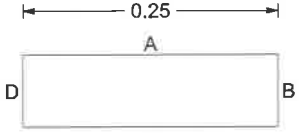
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.20)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular limestone. (TOPSOIL)		TS	
0.20-0.20	ES					73.12	0.20				

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1

Width	Ground Level (m AOD)	Co-Ordinates (NGR)	Date	Trial Hole No.
0.25m	73.323	E 457299 N 222021	02-08-16 02-08-16	HD12

Orientation	Method/Plant Used	Contractor	Scale
degrees from north	Hand digging	Geocore	1:6.7

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

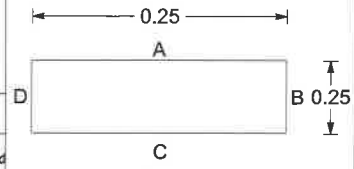
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.20)	Firm brown gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded limestone. (TOPSOIL)		NODATA	
						72.85	0.20				
							(0.15)	Light brown slightly clayey very gravelly SAND. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		NODATA	
						72.70	0.35				
0.40-0.40	ES					72.65	0.40	Very weak cream LIMESTONE. Excavated as slightly gravelly fine to coarse sand. Gravel is fine to medium subangular limestone. (CORNBRASH FORMATION)		NODATA	

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1
Width 0.25m	**Ground Level (m AOD)** 73.053	**Co-Ordinates (NGR)** E 457331 N 222047	**Date** 02-08-16 02-08-16
Orientation degrees from north	**Method/Plant Used** Hand digging	**Contractor** Geocore	**Scale** 1:6.7

Trial Hole No.

HD13

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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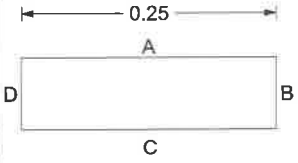
TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular limestone. (TOPSOIL)		TS	
0.30-0.30	ES					72.61	0.30				

General Remarks	Length	Logged By	Client	Sheet
	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:	Width 0.25m	Ground Level (m AOD) 72.912	Co-Ordinates (NGR) E 457381 N 222049	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.	Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7



Trial Hole No.

HD14

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

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TRIAL PIT LOG

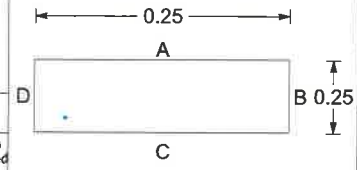
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
						72.25	(0.18) 0.18	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine subangular to subrounded limestone with rare coarse limestone gravel. (TOPSOIL)		TS	
						71.93	(0.32) 0.50	Light red brown fine to medium SAND. (KELLAWAYS)		KLB	
0.50-0.50	ES										

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1
Width 0.25m	**Ground Level (m AOD)** 72.425	**Co-Ordinates (NGR)** E 457422 N 222042	**Date** 02-08-16 02-08-16
Orientation degrees from north	**Method/Plant Used** Hand digging	**Contractor** Geocore	**Scale** 1:6.7

Trial Hole No.

HD15

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.20)	Firm dark brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium subrounded limestone. (TOPSOIL)		TS	
0.20-0.20	ES					72.52	0.20				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, B 0.25, C, D	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.718	Co-Ordinates (NGR) E 457468 N 222039	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD16

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thickness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.10)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine subangular to subrounded limestone. (TOPSOIL)		TS	
0.10-0.10	ES					73.13	0.10				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, B 0.25, C, D	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 73.228	Co-Ordinates (NGR) E 457340 N 222002	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD17

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
BS 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.35)	Stiff dark brown slightly gravelly sandy CLAY. Gravel is fine subangular limestone. (TOPSOIL)		TS	
0.40-0.40	ES					72.15	0.35				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, D, B 0.25, C	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.498	Co-Ordinates (NGR) E 457405 N 222008	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD18

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

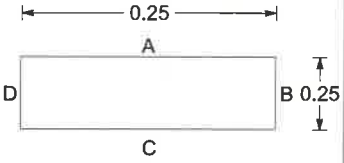
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.10)	Stiff dark brown slightly gravelly sandy CLAY. Gravel is fine to medium subangular limestone. (TOPSOIL)		TS	
0.10-0.10	ES					72.46	0.10				

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length: 0.25m	Logged By: JS	Client: Bovis Homes	Sheet: 1 of 1
Width: 0.25m	Ground Level (m AOD): 72.560	Co-Ordinates (NGR): E 457479 N 222004	Date: 02-08-16 02-08-16
Orientation: degrees from north	Method/Plant Used: Hand digging	Contractor: Geocore	Scale: 1:6.7

Trial Hole No.

HD19

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

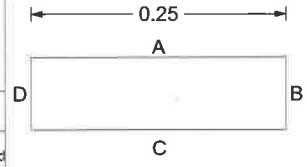
WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to subangular limestone. (TOPSOIL)		TS	
0.30-0.30	ES					72.85	0.30				

General Remarks	Length	Logged By	Client	Sheet
	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:	Width 0.25m	Ground Level (m AOD) 73.151	Co-Ordinates (NGR) E 457344 N 221968	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.	Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7



Trial Hole No.

HD20

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
						72.80	(0.25) 0.25	Stiff dark brown slightly gravely sandy CLAY. Gravel is fine subangular limestone. (TOPSOIL)		TS	
						72.55	(0.25) 0.50	Firm red brown very sandy CLAY. (KELLAWAYS)		KLB	
0.50-0.50	ES										

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, D, B 0.25, C	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 73.053	Co-Ordinates (NGR) E 457386 N 221975	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD21

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.30)	Firm dark brown slightly gravelly sandy CLAY. Gravel is fine to medium subrounded to subangular limestone. (TOPSOIL)		TS	
0.30-0.30	ES					72.47	0.30				

General Remarks		Length 0.25m	Logged By JS	Client Bovis Homes	Sheet 1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.770	Co-Ordinates (NGR) E 457446 N 221968	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

0.25 (A) × B 0.25 (D, C)

Trial Hole No.

HD22

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

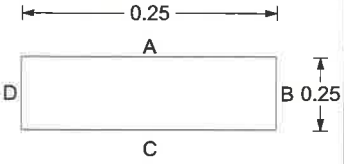
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.35)	Stiff dark brown slightly gravelly sandy CLAY. Gravel is fine subangular limestone. (TOPSOIL)		TS	
						72.83	0.35				
							(0.15)	Stiff brown sandy CLAY. (KELLAWAYS)		KLB	
0.50-0.50	ES					72.68	0.50				

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1

Width	Ground Level (m AOD)	Co-Ordinates (NGR)	Date	Trial Hole No.
0.25m	73.181	E 457473 N 221979	02-08-16 02-08-16	HD23

Orientation	Method/Plant Used	Contractor	Scale
degrees from north	Hand digging	Geocore	1:6.7

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P.Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
							(0.20)	Stiff dark brown slightly gravelly sandy CLAY. Gravel is fine subangular limestone. (TOPSOIL)		TS	
0.20-0.20	ES					72.10	0.20				

General Remarks		Length	Logged By	Client	Sheet
	0.25 A, B 0.25, C, D	0.25m	JS	Bovis Homes	1 of 1
Shoring/Support: Stability:		Width 0.25m	Ground Level (m AOD) 72.301	Co-Ordinates (NGR) E 457431 N 221929	Date 02-08-16 02-08-16
Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.		Orientation degrees from north	Method/Plant Used Hand digging	Contractor Geocore	Scale 1:6.7

Trial Hole No.

HD24

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

WSP | PARSONS BRINCKERHOFF
WSP Parsons Brinckerhoff
One Queens Drive
B5 4PJ
Telephone: 0121 352 4700

TRIAL PIT LOG

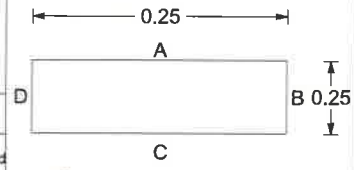
Project	Job No
KME Bicester	70024625

Depth	Type	PID (ppmV)	HSV (kN/m2)	P-Pen (kN/m2)	Water	Elev. (mAOD)	Depth (Thick-ness)	STRATA Description	Legend	Geology	Install / Backfill
						72.24	(0.35) 0.35	Stiff dark brown slightly gravelly sandy CLAY. Gravel is fine subangular limestone. (TOPSOIL)		TS	
0.40-0.40	ES					72.19	0.40	Stiff brown sandy CLAY. (KELLAWAYS)		KLB	

General Remarks

Shoring/Support:
Stability:

Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.



Length	Logged By	Client	Sheet
0.25m	JS	Bovis Homes	1 of 1

Width	Ground Level (m AOD)	Co-Ordinates (NGR)	Date	Trial Hole No.
0.25m	72.593	E 457479 N 221942	02-08-16 02-08-16	HD25

Orientation	Method/Plant Used	Contractor	Scale
degrees from north	Hand digging	Geocore	1:6.7

08 WSP TP LOG LS 2 PHOTO 70024625 BICESTER.GPJ WSPETEMPLATE1.03.GDT 4/8/16

Appendix C

LABORATORY CERTIFICATES

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

WSP PB LBH
WSP PB
4th Floor
6 Devonshire Square
London
EC2M 4YE

Attention: Joanne Szulc

CERTIFICATE OF ANALYSIS

Date:	12 August 2016
Customer:	H_WSP_LON
Sample Delivery Group (SDG):	160804-77
Your Reference:	70024625
Location:	BICESTER
Report No:	373199

We received 25 samples on Thursday August 04, 2016 and 25 of these samples were scheduled for analysis which was completed on Friday August 12, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan
Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13907334	HD01	ES	0.00 - 0.10	02/08/2016
13907367	HD02	ES	0.00 - 0.40	02/08/2016
13907386	HD03	ES	0.00 - 0.30	02/08/2016
13907389	HD04	ES	0.00 - 0.20	02/08/2016
13907393	HD05	ES	0.00 - 0.30	02/08/2016
13907397	HD06	ES	0.00 - 0.20	02/08/2016
13907404	HD07	ES	0.00 - 0.50	02/08/2016
13907408	HD08	ES	0.00 - 0.10	02/08/2016
13907412	HD09	ES	0.00 - 0.50	02/08/2016
13907336	HD10	ES	0.00 - 0.10	02/08/2016
13907339	HD11	ES	0.00 - 0.40	02/08/2016
13907342	HD12	ES	0.00 - 0.20	02/08/2016
13907346	HD13	ES	0.00 - 0.40	02/08/2016
13907348	HD14	ES	0.00 - 0.30	02/08/2016
13907350	HD15	ES	0.00 - 0.50	02/08/2016
13907352	HD16	ES	0.00 - 0.20	02/08/2016
13907354	HD17	ES	0.00 - 0.10	02/08/2016
13907358	HD18	ES	0.00 - 0.40	02/08/2016
13907362	HD19	ES	0.00 - 0.10	02/08/2016
13907372	HD20	ES	0.00 - 0.30	02/08/2016
13907374	HD21	ES	0.00 - 0.50	02/08/2016
13907376	HD22	ES	0.00 - 0.30	02/08/2016
13907378	HD23	ES	0.00 - 0.50	02/08/2016
13907382	HD24	ES	0.00 - 0.20	02/08/2016
13907384	HD25	ES	0.00 - 0.40	02/08/2016

Only received samples which have had analysis scheduled will be shown on the following pages.

ALcontrol Laboratories

CERTIFICATE OF ANALYSIS

Validated

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			13907334	HD01	ES	0.00 - 0.10	1kg TUB
			13907367	HD02	ES	0.00 - 0.40	1kg TUB
			13907386	HD03	ES	0.00 - 0.30	1kg TUB
			13907389	**HD04**	ES	0.00 - 0.20	1kg TUB
			13907393	HD05	ES	0.00 - 0.30	1kg TUB
			13907397	HD06	ES	0.00 - 0.20	1kg TUB
			13907404	**HD07**	ES	0.00 - 0.50	1kg TUB
			13907408	**HD08**	ES	0.00 - 0.10	1kg TUB
			13907412	HD09	ES	0.00 - 0.50	1kg TUB
			13907336	HD10	**ES**	0.00 - 0.10	1kg TUB
			13907339	HD11	ES	0.00 - 0.40	**1kg TUB**
			13907342	HD12	ES	0.00 - 0.20	1kg TUB
			13907345	HD13	ES	0.00 - 0.40	1kg TUB
			13907348	HD14	ES	0.00 - 0.30	1kg TUB
			13907350	HD15	ES	0.00 - 0.50	1kg TUB
			13907352	HD16	ES	0.00 - 0.20	1kg TUB
			13907354	HD17	ES	0.00 - 0.10	1kg TUB
			13907356	HD18	ES	0.00 - 0.40	1kg TUB
			13907358	HD19	ES	0.00 - 0.10	1kg TUB
			13907372	HD20	ES	0.00 - 0.30	1kg TUB
			13907374	HD21	ES	0.00 - 0.50	1kg TUB
			13907376	HD22	ES	0.00 - 0.30	1kg TUB
			13907378	HD23	ES	0.00 - 0.50	1kg TUB
			13907382	**HD24**	ES	0.00 - 0.20	1kg TUB
			13907384	**HD25**	ES	0.00 - 0.40	1kg TUB
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2					
Metals in solid samples by OES	All	NDPs: 0 Tests: 25	X	X	X	X	X
Non-Routine Work	All	NDPs: 0 Tests: 4					
Sample description	All	NDPs: 0 Tests: 23	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
13907334	HD01	0.00 - 0.10	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	Vegetation
13907367	HD02	0.00 - 0.40	Light Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
13907386	HD03	0.00 - 0.30	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	Vegetation
13907389	HD04	0.00 - 0.20	Light Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
13907393	HD05	0.00 - 0.30	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	None
13907397	HD06	0.00 - 0.20	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Vegetation	Concrete/Aggregate
13907404	HD07	0.00 - 0.50	Light Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
13907408	HD08	0.00 - 0.10	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Vegetation	Stones
13907412	HD09	0.00 - 0.50	Light Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
13907336	HD10	0.00 - 0.10	Dark Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
13907339	HD11	0.00 - 0.40	Dark Brown	Sandy Clay	0.063 - 2.00 mm	Stones	Vegetation
13907342	HD12	0.00 - 0.20	Dark Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
13907346	HD13	0.00 - 0.40	Light Brown	Sand	0.063 - 2.00 mm	Vegetation	Stones
13907348	HD14	0.00 - 0.30	Light Brown	Sandy Clay	0.063 - 2.00 mm	Stones	Vegetation
13907350	HD15	0.00 - 0.50	Light Brown	Loamy Sand	0.063 - 2.00 mm	Vegetation	Stones
13907352	HD16	0.00 - 0.20	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	Vegetation
13907354	HD17	0.00 - 0.10	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	Vegetation
13907358	HD18	0.00 - 0.40	Light Brown	Sandy Clay	0.063 - 2.00 mm	Vegetation	Stones
13907362	HD19	0.00 - 0.10	Dark Brown	Sandy Loam	0.063 - 2.00 mm	Stones	Vegetation
13907372	HD20	0.00 - 0.30	Dark Brown	Sandy Clay	0.063 - 2.00 mm	Brick	Vegetation
13907374	HD21	0.00 - 0.50	Light Brown	Loamy Sand	0.063 - 2.00 mm	None	None
13907376	HD22	0.00 - 0.30	Dark Brown	Silty Clay	0.002 - 0.063 mm	Stones	Vegetation
13907378	HD23	0.00 - 0.50	Dark Brown	Clay	<0.002 mm	Vegetation	None
13907382	HD24	0.00 - 0.20	Dark Brown	Clay Loam	0.002 - 0.063 mm	Vegetation	Stones
13907384	HD25	0.00 - 0.40	Light Brown	Clay	<0.002 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

ALcontrol Laboratories

CERTIFICATE OF ANALYSIS

Validated

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+&@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	HD01	HD02	HD03	HD04	HD05	HD06
			Depth (m)	0.00 - 0.10	0.00 - 0.40	0.00 - 0.30	0.00 - 0.20	0.00 - 0.30	0.00 - 0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
			Sample Time						
			Date Received	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016
			SDG Ref	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
			Lab Sample No.(s)	13907334	13907367	13907386	13907389	13907393	13907397
			AGS Reference	ES	ES	ES	ES	ES	ES
Moisture Content Ratio (% of as received sample)	%	PM024		10	4.8	10	10	9.9	10
Arsenic	<0.6 mg/kg	TM181		35.3 M	14.1 M	34.1 M	30.5 M	26.6 M	29.3 M

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CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	HD07	HD08	HD09	HD10	HD11	HD12
			Depth (m)	0.00 - 0.50	0.00 - 0.10	0.00 - 0.50	0.00 - 0.10	0.00 - 0.40	0.00 - 0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
			Sample Time						
			Date Received	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016
			SDG Ref	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
			Lab Sample No.(s)	13907404	13907408	13907412	13907336	13907339	13907342
			AGS Reference	ES	ES	ES	ES	ES	ES
Moisture Content Ratio (% of as received sample)	%	PM024		5.4	12	5	8.5	10	13
Arsenic	<0.6 mg/kg	TM181		62.1 M	40.1 M	32 M	24.9 M	27 M	36.9 M

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CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	HD13	HD14	HD15	HD16	HD17	HD18
			Depth (m)	0.00 - 0.40	0.00 - 0.30	0.00 - 0.50	0.00 - 0.20	0.00 - 0.10	0.00 - 0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
			Sample Time						
			Date Received	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016
			SDG Ref	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
			Lab Sample No.(s)	13907346	13907348	13907350	13907352	13907354	13907356
			AGS Reference	ES	ES	ES	ES	ES	ES
Moisture Content Ratio (% of as received sample)	%	PM024		5.7	12	9	12	10	12
Arsenic	<0.6 mg/kg	TM181		21.8 M	40.6 M	14.3 M	23.6 M	36.5 M	15.9 M

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CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	HD19	HD20	HD21	HD22	HD23	HD24
			Depth (m)	0.00 - 0.10	0.00 - 0.30	0.00 - 0.50	0.00 - 0.30	0.00 - 0.50	0.00 - 0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
			Sample Time						
			Date Received	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016	04/08/2016
			SDG Ref	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
			Lab Sample No.(s)	13907362	13907372	13907374	13907376	13907378	13907382
			AGS Reference	ES	ES	ES	ES	ES	ES
Moisture Content Ratio (% of as received sample)	%	PM024		12	12	9.9	14	13	10
Arsenic	<0.6 mg/kg	TM181		20.4 M	34.8 M	19.7 M	17.1 M	18.4 M	18.8 M

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SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R					
			HD25					
			Depth (m)	0.00 - 0.40				
			Sample Type	Soil/Solid				
			Date Sampled	02/08/2016				
			Sample Time					
			Date Received	04/08/2016				
			SDG Ref	160804-77				
			Lab Sample No.(s)	13907384				
			AGS Reference	ES				
Moisture Content Ratio (% of as received sample)	%	PM024	14					
Arsenic	<0.6 mg/kg	TM181	13.5 M					

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CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	HD06 ES 0.00 - 0.20 SOLID 02/08/2016 00:00:00 09/08/2016 08:30:31 160804-77 13907397 TM048	12/08/16	Lauren Sargeant	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	HD20 ES 0.00 - 0.30 SOLID 02/08/2016 00:00:00 09/08/2016 08:32:23 160804-77 13907372 TM048	12/08/16	Lauren Sargeant	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

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CERTIFICATE OF ANALYSIS

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	13907334	13907367	13907386	13907389	13907393	13907397	13907404	13907408	13907412	13907336
Customer Sample Ref.	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10
AGS Ref.	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
Depth	0.00 - 0.10	0.00 - 0.40	0.00 - 0.30	0.00 - 0.20	0.00 - 0.30	0.00 - 0.20	0.00 - 0.50	0.00 - 0.10	0.00 - 0.50	0.00 - 0.10
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples						12-Aug-2016				
Metals in solid samples by OES	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	09-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016
Non-Routine Work		11-Aug-2016								11-Aug-2016
Sample description	04-Aug-2016	04-Aug-2016	04-Aug-2016	05-Aug-2016	04-Aug-2016	04-Aug-2016	04-Aug-2016	04-Aug-2016	04-Aug-2016	05-Aug-2016

Lab Sample No(s)	13907339	13907342	13907346	13907348	13907350	13907352	13907354	13907358	13907362	13907372
Customer Sample Ref.	HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20
AGS Ref.	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
Depth	0.00 - 0.40	0.00 - 0.20	0.00 - 0.40	0.00 - 0.30	0.00 - 0.50	0.00 - 0.20	0.00 - 0.10	0.00 - 0.40	0.00 - 0.10	0.00 - 0.30
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples										12-Aug-2016
Metals in solid samples by OES	08-Aug-2016	08-Aug-2016	08-Aug-2016	09-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	11-Aug-2016	09-Aug-2016
Non-Routine Work		11-Aug-2016								
Sample description	05-Aug-2016	05-Aug-2016	05-Aug-2016	06-Aug-2016	05-Aug-2016	04-Aug-2016	04-Aug-2016	05-Aug-2016	05-Aug-2016	05-Aug-2016

Lab Sample No(s)	13907374	13907376	13907378	13907382	13907384
Customer Sample Ref.	HD21	HD22	HD23	HD24	HD25
AGS Ref.	ES	ES	ES	ES	ES
Depth	0.00 - 0.50	0.00 - 0.30	0.00 - 0.50	0.00 - 0.20	0.00 - 0.40
Type	SOLID	SOLID	SOLID	SOLID	SOLID
Metals in solid samples by OES	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016
Non-Routine Work	11-Aug-2016				
Sample description	05-Aug-2016	05-Aug-2016	04-Aug-2016	04-Aug-2016	04-Aug-2016

ALcontrol Laboratories

Units 7 - 8 Hawarden Business Park
Manor Road
Hawarden
Deeside
CH5 3US
Tel: +44 (0)1244 528700
Fax: +44 (0) 1244 528701

Contact Name Joanne Szulc
Client Address WSP PB LBH
4th Floor
Devonshire Square
London
EC2M 4YE

Non-routine Analysis Report

Date: 11th August 2016

Our References: 16-058 (SDG 160804-77)
Your Reference: 70024625
Location: BICESTER

Twenty five solid samples were received for analysis on 4th August 2016. From these four were selected for arsenic analysis by unified BARGE methodology as agreed by email.
All non-routine analysis is outside the scope of our accreditation.

We are pleased to enclose our analysis report.

Signed:

Chris Birtwistle
Laboratory Manager – Metals, Anions, Cyanides and Phenols

Contents

1.0 Approach

1.1 Sample Preparation

The solid sample was dried and crushed sufficiently so the entire sample passes a 250micron sieve. Moisture contents are available in the routine report.

0.5g portions of the sample were then weighed out in duplicate for stomach only extraction and for subsequent stomach and intestine extraction.

1.2 Sample Extraction

Four synthetic extraction fluids were made up and tested for pH as set out in the BARGE protocol.

The first extraction solution (saliva) was added to the samples and the samples were shaken vigorously. The second extraction solution (gastric) was then added and the samples were extracted with end over end rotation for an hour in an incubator at 37°C. The pHs were then measured and recorded. The pH criteria at this stage is to be <1.5. Any samples higher than this require re-extraction.

Once all of the samples were satisfactorily extracted for the first 'stomach' stage the samples were centrifuged at 3,000rpm for 5 minutes. A 0.8ml aliquot was then taken from each extraction tube and diluted with acids to matrix match the ICP-OES calibration standards.

The duodenal and bile (intestine) extraction fluids were then added to the samples. The pH of each sample extract was then adjusted if required to pH6.3+/-0.5. The samples were then extracted by rotating end over end for 4 hours in the incubator at 37°C. The pHs were then measured and recorded.

The final 'stomach and intestine' samples were then centrifuged, diluted and acidified as above.

Blank solutions were put through the system to check for contamination

1.3 ICP-OES Analysis

The instrument was calibrated at a series of applicable wavelengths with the correct matrix matched set of standards for each extract, before testing the samples against the calibration.

The most appropriate wavelength was evaluated by assessing each wavelength for interferences, sensitivity and linearity of calibration.

The mean results are reported on a dry solid basis.

2.0 Results

2.1 Table 1 – ICP-OES Analysis Results

Customer Sample ID	Lab Sample Event	As Total – from routine Test (mg/kg)	As after Stomach Only Extraction (mg/kg)	Percentage Bioaccessible As after Stomach Only Extraction (%)	As after Stomach & Intestine Extraction (mg/kg)	Percentage Bioaccessible As after Stomach & Intestine Extraction (%)
HD02 [0.00-0.40]	SE 13907367	14.1	<5	<35%	<5	<35%
HD21 [0.00-0.50]	SE 13907374	19.7	<5	<25%	5.34	27%
HD10 [0.00-0.10]	SE 13907336	24.9	<5	<20%	<5	<20%
HD12 [0.00-0.20]	SE 13907342	36.9	5.14	14%	<5	<14%

The limit of detection is 5mg/kg Arsenic for both sets of BARGE extractions.

SDG:	160804-77	**Location:**	BICESTER	**Order Number:**	70024625
Job:	H_WSP_LON-248	**Customer:**	WSP PB LBH	**Report Number:**	373199
Client Reference:	70024625	**Attention:**	Joanne Szulc	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

General

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Holding time exceeded before sample received**
5	**Samples exceeded holding time before presevation was performed**
§	**Sampled on date not provided**
•	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to sampled on date**
&	**Sample Holding Time exceeded - Late arrival of instructions.**

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix D

APPROACH TO RISK ASSESSMENT

UK APPROACH

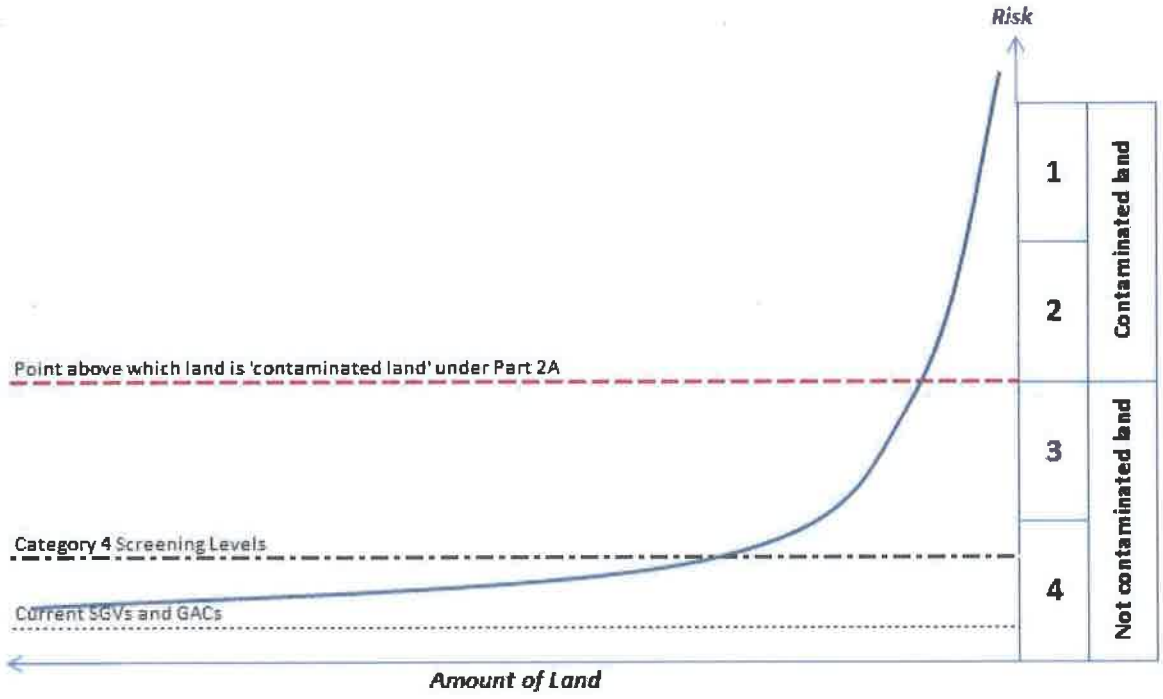
In the UK, the potential risks to human health from contamination in the ground are usually evaluated through a generic quantitative risk assessment (GQRA) approach. This allows generic and conservative exposure assumptions to be readily applied to risk assessments and can be a useful tool for rapidly screening data and to identify those contaminants or scenarios that could benefit from further investigation and/or site-specific detailed quantitative risk assessment (DQRA).

Current industry good practice is to use the approach presented in the Environment Agency (EA) publications SR2[1] and SR3[2].

This approach allows the derivation of Generic Assessment Criteria (GACs), primarily for chronic exposure. The Environment Agency's published Soil Guideline Values (SGVs) follow the same approach, but are limited to a small number of substances.

In April 2012, the Department of Environment, Food and Rural Affairs (Defra) published updated statutory guidance[3] which introduced a four category approach to determining whether land in England and Wales is contaminated or not on the grounds of significant possibility of significant harm (SPOSH). **Figure D.1** presents a graphical representation of the categories.

Figure D.1: Four Categories for Determining SPOSH



[1] Environment Agency '*Human Health Toxicological Assessment of Contaminants in Soil*', Report SC050021/SR2. January 2009.
[2] Environment Agency '*Updated Technical Background to the CLEA Model*,' Report SC050021/SR3. January 2009.
[3] Defra '*Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance*'. April 2012.

Cases classified as Category 1 are considered to be SPOSH based on actual evidence or an unacceptably high probability of harm existing. Category 4 cases are those where there is no risk or a low risk of SPOSH.

GACs and SGVs represent a minimal risk level, well within Category 4. A 2014 publication by Contaminated Land: Applicatons in Real Environments (CL:AIRE),SP1010[4] and endorsed by Defra[5] provided an approach to determine Category 4 Screening Levels (C4SLs) which are higher than the GACs whilst being "more pragmatic but still strongly precautionary". It also provided C4SLs for six contaminants of concern.

Although the C4SLs were designed to support Part 2A assessments to determine 'contaminated land' they are specifically mentioned, along with reference to the Part 2A statutory guidance, by the Department for Communities and Local Government (DCLG) for use in a planning context[6].

The SGVs were derived using the Contaminated Land Exposure Assessment (CLEA) Workbook v1.06. An updated version (v1.071) was released by the EA in September 2015 to take into account the publication of SP1010. The updates comprised: additional toxicity data for the six chemicals for which C4SLs were derived; two new public open space land use scenarios; updated exposure parameters; options to run the model using C4SL exposure assumptions; and increased functionality. There were no changes to algorithms so it is still possible to replicate the SGVs using the input parameters held within v1.071.

It should be noted that the four category approach has not been adopted in Scotland either under Part 2A or planning. The Part 2A statutory guidance applicable in Scotland (Paper SE/2006/44 dated May 2006) does not reflect the changes introduced by Defra in April 2012 which allow for the use of C4SLs within Part 2A risk assessments. Additionally, it is considered that the principal of 'minimal risk' should still apply under planning in Scotland, based on current guidance.

WSP | PB APPROACH

In the absence of a comprehensive set of SGVs it is down to individual practitioners to derive their own GACs. WSP | PB has used the approach provided within SR2, SR3, SP1010, CLEA Workbook v1.071and SR4[7] to produce a set of minimal risk GACs. The chemical-specific data within two key publications were considered during their production: CL:AIRE 2010[8] and LQM 2015[9]. Both documents provide comprehensive sets of GACs for different contaminants of concern.

The LQM Suitable For Use Levels (S4ULs) have selected exposure parameters someway between those of the SR3 land uses and the C4SL exposure scenarios. This approach was rejected by WSP | PB as not representing minimal risk. However, the LQM S4UL document was critically reviewed and the approach and chemical input parameters were utilised where considered to be appropriate.

---

[4] CL:AIRE *'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'* SP1010, Final Project Report (Revision 2). September 2014.

[5] Defra 'SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document'*. December 2014.

[6] DCLG Planning Practice Guidance *'Land Affected by Contamination'*, particularly Paragraphs 001 and 007. Ref IDs: 33-001-20140306 & 33-007-20140612.

[7] Environment Agency *'CLEA Software (Version 1.05) Handbook (and Software)'*, Report SC050021/SR4. September 2009.

[8] CL:AIRE 'The EIS/AGS/CL:AIRE *Soil Generic Assessment Criteria for Human Health Risk Assessment'*. ISBN 978-1-05046-20-1. January 2010.

[9] Nathanail et al *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*, Land Quality Press, ISBN 978-0-9931084-0-2. 2015.

With regards the current CL:AIRE 2010 GACs, a C4SL Working Group is planning to derive a larger set of C4SLs during 2016, and it is understood that this will include a critical review of the chemical input data. To avoid duplication with the S4UL document, it is anticipated that the contaminant list will be similar to that of the current CL:AIRE GACs. As such, this document was not critically reviewed by WSP | PB to the same extent as the LQM one was, for the purposes of deriving the in-house GACs.

With the exception of lead (see Chemical Specific Assumptions), WSP | PB's current approach to the assessment of risks to human health is to continue to evaluate minimal risk through the use of SGVs and in-house derived GACs, and to use the published C4SLs as a secondary tier of assessment until such time as additional suitable C4SLs are published and/or in-house values are derived.

Appendix E

CLEA V1.071 WORKSHEET FOR ARSENIC SSAC

CLEA Software Version 1.071

Report generated 23-Aug-16

Report title SSAC Arsenic 1% SOM 7pH

Created by M. WEIL at

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group						
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1																		
2	Arsenic_GAC 2016	7.99E+01	1.21E+02	NR	1.00	0.66	NR	NR	No	No	No	No	No	No	No	No	No	
3																		
4																		
5																		
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Environment Agency

	Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
	oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
21																
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28																
29																
30																

Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1																			
2	Arsenic_GAC 2016	99.9	0.1	0.0	100.0	7.99E+01	NR	4.00E+01	3.40E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-02	3.20E-02	1.84E-02	2.64E-02	1.60E-02	8.79E-02
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20																			

Environment Agency

	Soil Distribution				Media Concentrations													
	Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
	%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1																
2	Arsenic_GAC 2016	1.60E-04	4.86E-05	9.13E-05	1.32E-06	0.00E+00	0.00E+00	0.00E+00	53.34	16.21	30.45	0.00	0.00	0.00	0.00	0.00
3																
4																
5																
6																
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17																
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19																
20																

Environment Agency

	Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil Ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
21															
22															
23															
24															
25															
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27															
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29															
30															

Environment Agency

		Oral Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Inhalation Health Criteria Value ($\mu g\ kg^{-1}$ BW day^{-1})		Oral Mean Daily Intake ($\mu g\ day^{-1}$)	Inhalation Mean Daily Intake ($\mu g\ day^{-1}$)	Air-water partition coefficient (K_{aw}) ($cm^3\ cm^{-3}$)	Coefficient of Diffusion in Air ($m^2\ s^{-1}$)	Coefficient of Diffusion in Water ($m^2\ s^{-1}$)	log K_{oc} ($cm^3\ g^{-1}$)	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor ($g\ g^{-1}$ DW)	Sub-surface soil to Indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1																	
2	Arsenic_GAC 2016	ID	0.3	ID	0.002	NR	0	NR	NR	NR	NR	NR	0.03	0.5	1	**0.27**	1
3																	
4																	
5																	
6																	
7																	
8																	
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18																	
19																	
20																	

Environment Agency

	Oral Health Criteria Value (µg kg^{-1} BW day^{-1})		Inhalation Health Criteria Value (µg kg^{-1} BW day^{-1})		Oral Mean Daily Intake (µg day^{-1})	Inhalation Mean Daily Intake (µg day^{-1})	Air-water partition coefficient (K_{aw}) (cm^3 cm^{-3})	Coefficient of Diffusion in Air (m^2 s^{-1})	Coefficient of Diffusion in Water (m^2 s^{-1})	log K_{oc} (cm^3 g^{-1})	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor (g g^{-1} DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil Ingestion (unitless)	Relative bioavailability via dust Inhalation (unitless)
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																

Environment Agency

		Soil-to-water partition coefficient ($cm^3 g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1										
2	Arsenic_GAC 2016	5.00E+02	NR	1.25E+06	0.00043 fw	0.0004 fw	0.00023 fw	0.00033 fw	0.0002 fw	0.0011 fw
3										
4										
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Environment Agency

	Soil-to-water partition coefficient ($cm^3\ g^{-1}$)	Vapour pressure (Pa)	Water solubility ($mg\ L^{-1}$)	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
21									
22									
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Appendix F

SOIL SCREENING TABLES

APPENDIX F-1

GENERIC ASSESSMENT SCREENING TABLE

Component	LOD	Units	GAC	C4SL	NBC	N	Min Value	Mean Value	Max Value	UCL	Distribution	No > GAC	No > C4SL	No >NBC	1108812-132	1108812-132	1108812-132	1108812-132	1108812-132	1108812-132	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
															4095386	4095393	4095366	4095380	4095364	4095372	13907334	13907367	13907386	13907389	13907393	13907397	13907404	13907408	13907412	13907336
															WS507	WS512	WS514	WS515	WS516	WS518	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10
															0.1	0.5	0.1	0.15	0.5-1.0	0.1	0.1	0.4	0.3	0.2	0.3	0.2	0.5	0.1	0.5	0.1
															Topsoil	Topsoil	Topsoil	Cornbrash	Topsoil	topsoil	Topsoil	Cornbrash	Topsoil	Topsoil	Topsoil	Topsoil	Cornbrash	Topsoil	Cornbrash	Topsoil
															05/08/2011	05/08/2011	05/08/2016	06/08/2016	06/08/2016	06/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
Asbestos in Soil Screen / Identification Name	N/A	Type													ND	ND		ND												
Asbestos in Soil	N/A	Type	Detected			7									ND	ND		ND								ND				
Asbestos Quantification	0.001	%	0.001			7						0			ND	ND		ND								ND				
Heavy Metals / Metalloids																														
Arsenic (aqua regia extractable)	1	mg/kg	32	37	32	31	10.3	28.6	62.1	31.01	Normal	12	5	12	18.8	27.2	27.9	39.9	10.3	33.8	35.3	14.1	34.1	30.5	26.6	29.3	50.1	40.7	32	24.9

														160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
														13907339	13907342	13907346	13907348	13907350	13907352	13907354	13907356	13907302	13907372	13907374	13907376	13907378	13907382	13907384
														HD11	HD12	HD13	HD14	HD15	HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25
														0.4	0.2	0.4	0.3	0.5	0.2	0.1	0.4	0.1	0.3	0.5	0.3	0.5	0.2	0.4
														Topsoil	Topsoil	Cambrush	Topsoil	Kellaway	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Kellaway	Topsoil	Kellaway	Topsoil	Kellaway
														02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
Component	LOD	Units	GAC	C4SL	NBC	N	Min Value	Mean Value	Max Value	UCL	Distribution	No > GAC	No > C4SL	No >NBC															
Asbestos in Soil Screen / Identification Name	N/A	Type																											
Asbestos in Soil	N/A	Type	Detected			7																	ND						
Asbestos Quantification	0.001	%	0.001			7						0											ND						
Heavy Metals / Metalloids																													
Arsenic (aqua regia extractable)	1	mg/kg	32	37	32	31	10.3	28.6	82.1	31.01	Normal	12	4	12	27	36.9	21.8	40.6	14.3	23.6	36.5	15.9	20.4	34.8	19.7	17.1	18.4	18.8	13.5

APPENDIX F-2

DETAILED ASSESSMENT SCREENING TABLE

Component	LOD	Units	SSAC	N	Min Value	Mean Value	Max Value	UCL	Distribution	No > SSAC	1108812-132	1108812-132	1108812-132	1108812-132	1108812-132	1108812-132	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
											4095364	4095372	4095356	4095365	4095364	4095372	13907334	13907367	13907386	13907389	13907393	13907397	13907404	13907408	13907412	13907336	13907339	13907342	13907346	13907348	13907350
											WS507	WS512	WS514	WS515	WS516	WS518	HD01	HD02	HD03	HD04	HD05	HD06	HD07	HD08	HD09	HD10	HD11	HD12	HD13	HD14	HD15
											0.1	0.5	0.1	0.15	0.0-1.0	0.1	0.1	0.4	0.3	0.2	0.3	0.2	0.5	0.1	0.5	0.1	0.4	0.2	0.4	0.3	0.5
											Topsoil	Topsoil	Topsoil	Cembrash	Topsoil	Topsoil	Topsoil	Cembrash	Topsoil	Topsoil	Topsoil	Topsoil	Cembrash	Topsoil	Cembrash	Topsoil	Topsoil	Topsoil	Cembrash	Topsoil	Kellaway
											06/08/2011	06/08/2011	06/08/2011	06/08/2011	06/08/2011	06/08/2011	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
Asbestos in Soil Screen / Identification Name	N/A	Type									ND	ND		ND								ND									
Asbestos in Soil	N/A	Type	Detected	7							ND	ND		ND								ND									
Asbestos Quantification	0.001	%	0.001	7						0	ND	ND		ND								ND									
Heavy Metals / Metalloids																															
Arsenic (assa regia extractable)	1	mg/kg	40	31	10.3	28.6	42.1	32.10	Normal	0	38.6	47.8	27.8	29.8	18.3	33.8	35.3	14.1	34.1	30.5	26.6	29.3	42.1	40.1	32	24.9	27	36.9	21.8	40.8	14.3

										160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77	160804-77
										1907362	1907364	1907368	1907362	1907372	1907374	1907376	1907378	1907382	1907384
										HD16	HD17	HD18	HD19	HD20	HD21	HD22	HD23	HD24	HD25
										0.2	0.1	0.4	0.1	0.3	0.5	0.3	0.5	0.2	0.4
										Topsoil	Topsoil	Topsoil	Topsoil	Topsoil	Kellaway	Topsoil	Kellaway	Topsoil	Kellaway
										02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016	02/08/2016
Component	**LOD**	**Units**	**SSAC**	**N**	**Min Value**	**Mean Value**	**Max Value**	**UCL**	**Distribution**	**No > SSAC**									
Asbestos in Soil Screen / Identification Name	N/A	Type													ND				
Asbestos in Soil	N/A	Type	Detected	7											ND				
Asbestos Quantification	0.001	%	0.001	7						0					ND				
Heavy Metals / Metalloids																			
Arsenic (aqua regia extractable)	1	mg/kg	40	31	10.3	26.6	62.1	32.10	Normal	0	23.6	36.5	15.9	20.4	34.8	19.7	17.1	18.4	18.8	13.5

Appendix G

STATISTICAL ASSESSMENT

Test Results

Arsenic (mg/kg)

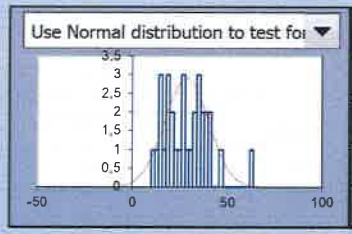
Client/client ref: Bovis Homes Li Site ref: Bicester KME

Project ref: 70024625 Data description: Topsoil assessment top 0.5 m

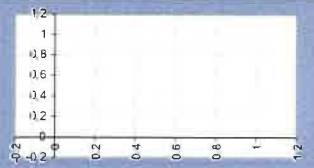
Date: 23-Aug-2016

User details:

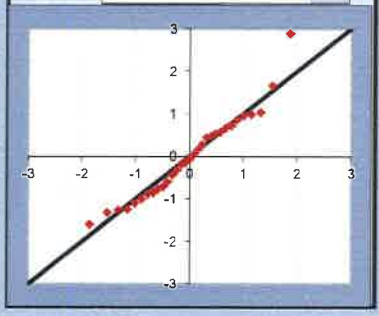
Dataset:	Arsenic (mg/kg)
Sample mean (mg/kg), $\bar{x}$	28.6
Sample standard deviation, s	11.536
Sample size, n	31
Critical concentration, Cc (mg/kg)	32



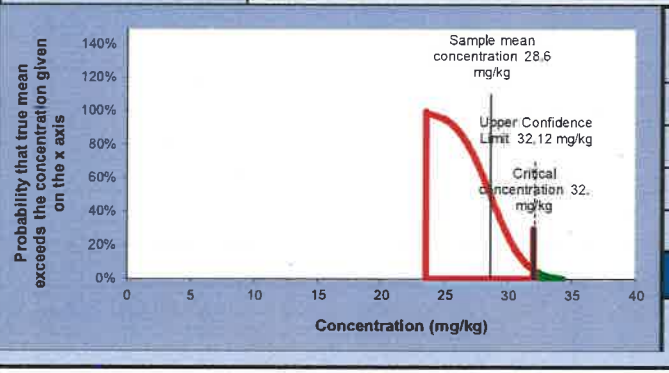
Outliers & non-detects	
Outliers present?	Yes
Significance level	5%
Outliers excluded	0
Non-detects	#NAME?



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	**94%**
Base decision on:	evidence level
Evidence level required:	**95%**
Balance of probability?	N/A
Reject Null Hypothesis?	No
Not enough evidence	

Back to data | Back to summary | Go to outlier test | Go to normality test

Test Results

Arsenic C4SL (mg/kg)

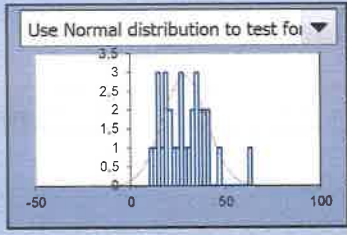
Client/client ref: Bovis Homes Li Site ref: Bicester KME

Project ref: 70024625 Data description: Topsoil assessment top 0.5 m

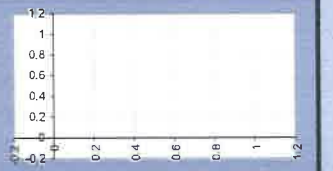
Date: 23-Aug-2016

User details:

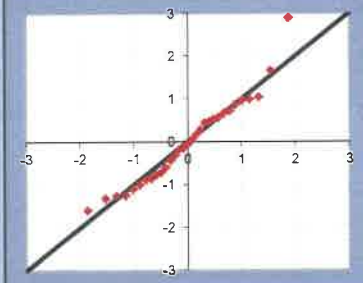
Dataset:	Arsenic C4SL (mg/kg)
Sample mean (mg/kg), $\bar{x}$	28.6
Sample standard deviation, s	11.536
Sample size, n	31
Critical concentration, Cc (mg/kg)	37



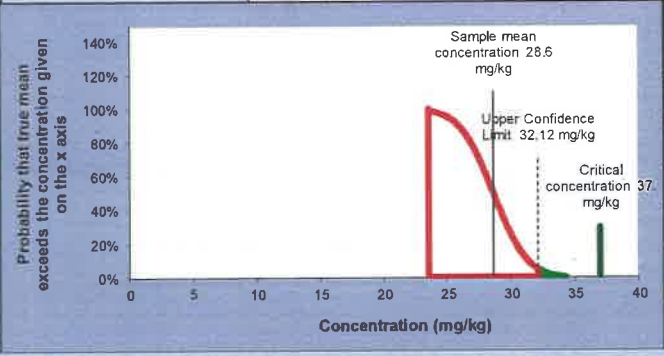
Outliers & non-detects	
Outliers present?	Yes
Significance level	5%
Outliers excluded	0
Non-detects	#NAME?



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test

Test Results

Arsenic SSAC (mg/kg)

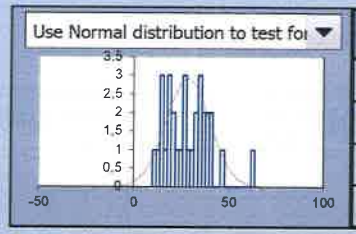
Client/client ref: Bovis Homes Li Site ref: Bicester KME

Project ref: 70024625 Data description: Topsoil assessment top 0.5 m

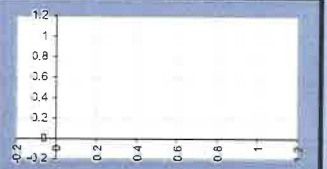
Date: 23-Aug-2016

User details:

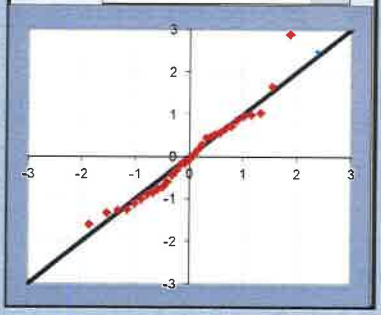
Dataset:	Arsenic SSAC (mg/kg)
Sample mean (mg/kg), $\bar{x}$	28.6
Sample standard deviation, s	11.536
Sample size, n	31
Critical concentration, Cc (mg/kg)	80



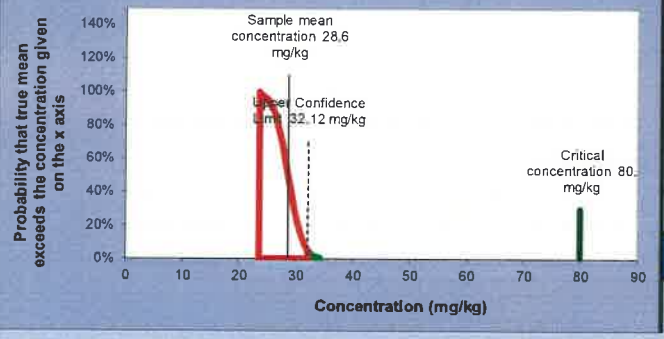
Outliers & non-detects	
Outliers present?	Yes
Significance level	5%
Outliers excluded	0
Non-detects	#NAME?



Normality test	
Significance level:	5%
Normal distribution	
Use:	Auto: One-sample t-test



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test