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Alan Wood & Partners

August 2023

**PHASE II GEO-  
ENVIRONMENTAL  
ASSESSMENT, NETHER MILL,  
PENISTONE**

**PROJECT NO.  
JMS/SLR/SW/47495-Rp002 REV A**

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## **PHASE II GEO-ENVIRONMENTAL INVESTIGATION REPORT**

### **NETHER MILL, PENISTONE**

For

**Mulgrave Property Group Ltd**

Project Reference: JMS/SLR/SW/47495-Rp002

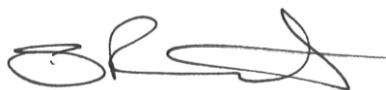
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Signed:



Date: 10<sup>th</sup> January 2023

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Signed:

Date: 10<sup>th</sup> January 2023

Issue	Revision	Revised by	Approved by	Revised Date
A	Updated Development drawing	C. Chapman	S. Roberts	4 <sup>th</sup> August 2023

For the avoidance of doubt, the parties confirm that these conditions of engagement shall not and the parties do not intend that these conditions of engagement shall confer on any party any rights to enforce any term of this Agreement pursuant of the Contracts (Rights of third Parties) Act 1999.

The Appointment of Alan Wood & Partners shall be governed by and construed in all respects in accordance with the laws of England & Wales and each party submits to the exclusive jurisdiction of the Courts of England & Wales

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## **CONTENTS**

### **EXECUTIVE SUMMARY**

<b>1</b>	<b>INTRODUCTION.....</b>	<b>7</b>
1.1	Appointment .....	7
1.2	Development Proposals .....	7
1.3	Report Status .....	7
1.4	Objectives of the Investigation.....	8
1.5	Site Works .....	8
1.6	Limitations of Study .....	8
<b>2</b>	<b>SITE DETAILS AND DESCRIPTION.....</b>	<b>11</b>
2.1	Introduction.....	11
2.2	Site Location & Description .....	11
<b>3</b>	<b>PHASE I GEO-ENVIRONMENTAL ASSESSMENT.....</b>	<b>12</b>
3.1	Anticipated Geology, Hydrogeology & Mining .....	12
3.2	Environmental Records .....	12
3.3	Historical Land Use .....	14
3.4	Anticipated Ground Conditions.....	14
3.5	Preliminary Conceptual Site Model .....	15
<b>4</b>	<b>GROUND INVESTIGATION FIELDWORK.....</b>	<b>23</b>
4.1	Introduction.....	23
4.2	Site Works .....	23
4.3	Geotechnical Investigation .....	24
4.4	Environmental Investigation .....	25
<b>5</b>	<b>RESULTS OF INVESTIGATION.....</b>	<b>26</b>
5.1	Ground Conditions Encountered .....	26
5.2	Visual & Olfactory Evidence of Contamination .....	27
5.3	In-Situ Infiltration tests.....	27
5.4	Geotechnical Testing & Material Properties .....	27
5.5	Contamination and Performance of Building Materials (Cementitious Products) .....	28
5.6	Chemical Testing.....	28
<b>6</b>	<b>GEOTECHNICAL ASSESSMENT.....</b>	<b>35</b>
6.1	Mining Risk.....	35
6.2	Foundations.....	35
6.3	Floor Slabs .....	35
6.4	Precautions Near Trees.....	35
6.5	Drainage and Soakaways.....	36
6.6	Roads and Car Parks .....	36
6.7	Ground Stability .....	36
6.8	Excavations.....	37
6.9	Sulphate attack and aggressive ground conditions .....	37

<b>7</b>	<b>ENVIRONMENTAL ASSESSMENT</b>	<b>38</b>
7.1	Guidance for Analytical Results - Assessment Criteria	38
7.2	Human Health Receptors	40
7.3	Controlled Waters Receptors	41
7.4	Ecological Receptors	41
7.5	Utilities	41
7.6	Potable Water Supplies	41
7.7	Refined Conceptual Site Model	42
7.8	Summary of Identified Contaminant Linkages	44
<b>8</b>	<b>CONCLUSIONS AND RECOMMENDATIONS</b>	<b>46</b>
8.1	General	46
8.2	Soil Contamination - Risk Evaluation	46
8.3	Hazardous Ground Gases	46
8.4	Outline Remediation Requirements	46
8.5	Disposal of Soils	47
8.6	Further Work	47
<b>9</b>	<b>REGULATORY APPROVAL</b>	<b>48</b>
<b>10</b>	<b>INFORMATION SOURCES</b>	<b>49</b>

## TABLES

Table 3.1 - Geological Information	12
Table 3.2 - Environmental Data	13
Table 3.5 - Summary of Potential Contaminant Sources	16
Table 3.6 - Summary of Potential Receptors	17
Table 3.7 - Summary of Plausible Pathways	17
Table 3.8 - Risk Categories	19
Table 3.9 - Summary of Phase I Conceptual Site Model & Risk Assessment	21
Table 5.1 - Summary of Ground Conditions	266
Table 5.2 - Plasticity Index Test Results	27
Table 5.3 - Summary of Chemical Test Results (PAH) (Made Ground TP1)	29
Table 5.4 - Summary of Chemical Test Results (TPH) (Made Ground TP1)	29
Table 5.5 - Summary of Chemical Test Results (PAH) (Made Ground TP8)	30
Table 5.6 - Summary of Chemical Test Results (TPH) (Made Ground TP8)	30
Table 5.7 - Summary of Chemical Test Results (PAH) (Made Ground TP9)	31
Table 5.8 - Summary of Chemical Test Results (TPH) (Made Ground TP9)	31
Table 5.9 - Summary of Chemical Test Results (PAH) (Made Ground mound)	32
Table 5.10 - Summary of Chemical Test Results (TPH) (Made Ground mound)	32
Table 5.11 - Summary of Chemical Test Results (PAH) (Made Ground Natural Strata)	33
Table 5.12 - Summary of Chemical Test Results (TPH) (Made Ground Natural Strata)	33
Table 7.1 - Summary of Revised Conceptual Site Model & Risk Assessment	45

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## **FIGURES**

### **DEVELOPMENT LAYOUT PLAN**

- 47495/001      SITE LOCATION PLAN**
- 47495/002      GROUND INVESTIGATION LOCATION PLAN**

## **APPENDICES**

- APPENDIX A:    GROUND INVESTIGATION LOGS**
- APPENDIX B:    LABORATORY TEST RESULTS: GEOTECHNICAL**
- APPENDIX C:    LABORATORY TEST RESULTS: CHEMICAL**
- APPENDIX D:    AWP GENERIC ASSESSMENT CRITERIA**

## EXECUTIVE SUMMARY

<b>Site Location &amp; Description</b>	The site is located to the north of the A628, approximately 600m north of Penistone and approximately 10km west of Barnsley and is centred at National Grid Reference (NGR) 424392mE 403848mN.
<b>Historical Land Use</b>	From the earliest maps examined, the site has only been developed with Mill Race which went through the south-eastern edge of the site. This was no longer shown on the 1978 map and the site is then shown as an open field. There has been development in all directions around the site.
<b>Geology</b>	<p>Superficial: Mixture of sand and gravel (River Terrace Deposits) on the southern half of the site.</p> <p>Solid geology: Mudstone and siltstone of the Pennine Lower Coal Measures Formation and sandstone of the Penistone Flags through the southern half of the site.</p>
<b>Hydrogeology</b>	<p><b>Aquifer within Superficial Deposits:</b> Secondary A</p> <p><b>Aquifer within Bedrock:</b> Secondary A</p> <p><b>Source Protection Zones:</b> There are no source protection zones within 500m of the site.</p>
<b>Mining Assessment</b>	On the basis of available information, risk associated with shallow coal mining subsidence is considered to be negligible.
<b>Geotechnical Assessment</b>	The calculated modified plasticity index (NHBC Chapter 4.2) was found to be between 22% and 37%, which is equivalent to a medium volume change potential, according to the NHBC guidelines.
<b>Foundations</b>	<p>Due to the varying ground conditions on the site, it is recommended that a plot specific foundation design is undertaken. For plots 1-3, 7 and 8, it is recommended that traditional strip or trench foundations are used. For plots 4-6 and 9-11, piled foundations may be required however further investigation is recommended to identify depth to competent strata and finalise foundation design for these plots.</p> <p>It is recommended that a plot specific ground investigation is undertaken to the north to confirm foundation depths when development levels are known.</p>
<b>Ground Slabs</b>	Given the sloping nature of the site, it is recommended that suspended floor slabs be used for the proposed development. Protective measures may be required where foundations lie within the heave zone of trees as defined by NHBC Standards (Chapter 4.2), or where seasonally desiccated soils are present at the time of construction.
<b>Precautions near Trees</b>	There are some trees along the northern boundary of the site, so precautions are likely to be required where structures lie within influencing distance given the underlying (clay) ground conditions that prevail at the site; this will be subject to a tree survey and plot specific foundation schedule. In addition, precautions may be required where trees are to be removed or where new planting is proposed. All foundations should be constructed in accordance with current guidelines (e.g. NHBC Standards, Chapter 4.2). If foundations are built off competent bedrock, no precautions are likely to be required.
<b>Drainage</b>	It is considered unlikely that soakaways would work at the site, however testing was unable to be conducted due to shallow groundwater on the western side of the site and made ground in the east. In addition, due to the sloped nature of the site, the northern part of the site is elevated and as such would be unsuitable for soakaways.
<b>Obstruction &amp; Excavations</b>	Obstructions to excavations are unlikely, however other currently unforeseen obstructions may also be present.

<b>Sulphate</b>	A Design Sulphate classification of DS-1 may be adopted along with an ACEC class of AC-1. However, it is recommended that where made ground be encountered DS-2 sulphate precautions should be adopted in foundation construction.
<b>Roads</b>	A preliminary CBR value of <2.5% is currently considered for road and pavement design. It is recommended that CBR testing is carried out when final development levels are known.
<b>Environmental Assessment</b>	<p>A total of four made ground soil samples were analysed for inorganic and organic contaminants. Assessment of the soils data indicates that there are elevated concentrations of potential contaminants of concern that exceed relevant GAC criteria.</p> <p>A total of seven natural soil samples were also analysed which indicated there are no elevated concentrations of potential contaminants of concern that exceed relevant GAC criteria.</p>
<b>Potable Water Supplies</b>	Risk to potable water supply pipes is considered to be moderate. On the basis of available test results, it is likely that protective measures will be required.
<b>Remediation requirements</b>	On the basis of available information, it is considered that remediation will be required on the site due to the made ground to the south of the site.
<b>Gas Protection Measures</b>	It is considered unlikely that elevated concentrations of CO <sub>2</sub> and CH <sub>4</sub> may be present due to a lack of potential sources within the vicinity of the site.
<b>Further Works</b>	<ul style="list-style-type: none"> <li>• Additional sampling and analysis of existing topsoil on site to confirm its suitability for re-use within garden areas to the proposed development in accordance with local authority requirements;</li> <li>• Assessment of the influence of trees in relation to foundations and floor slabs where clays are present at founding depth;</li> <li>• Additional site investigation, windowless sampler boreholes or cable percussive boreholes to confirm the base of the soft clay on the northern edge of the site and through the made ground towards the centre of the site to confirm the depth to competent strata and resolve foundation recommendations in this area;</li> <li>• CBR testing when final development levels are known.</li> </ul>
<p><b>NB.</b> The Executive Summary presented above is an overview of the key findings and conclusions of the report. There may be other information contained within the body of the report which puts into context the findings of the Executive Summary. No reliance should therefore be placed on the Executive Summary until the report as a whole has been read in full.</p>	

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## 1 INTRODUCTION

### 1.1 Appointment

1.1.1 Alan Wood & Partners were appointed by the Mulgrave Property Group Ltd (the 'Client') to undertake a Phase II Geo-Environmental Assessment.

1.1.2 This report provides geotechnical and environmental information in relation to the proposed redevelopment of the site for a residential end use, assuming that the site is to be redeveloped with residential end-use and that ground levels will remain similar to present. Interpretation and recommendations should not be assumed valid for adjacent areas of land, or for alternative land uses. Should the proposed site usage change, the recommendations and conclusions presented in this report may need to be re-assessed.

### 1.2 Development Proposals

1.2.1 It is understood that the site is to be redeveloped for a residential end use. A proposed preliminary development layout was provided to Alan Wood and Partners, which is appended to this report.

### 1.3 Report Status

1.3.1 The geoenvironmental investigation of the site has been carried out in two phases. A Phase I preliminary assessment (desk based study) has previously been completed by Alan Wood & Partners (Ref: JMS/SLR/SW/47495-Rp-001, dated 10<sup>th</sup> January 2023). A subsequent Phase II (intrusive) investigation has been completed on the basis of the findings of the previous report. The results of the recent intrusive investigation are presented in this report.

1.3.2 The contents of the Phase I report are not reproduced herein. Salient points have been summarised which form the basis of the phase 2 work. For full detail, reference should be made to the Phase 1 report referenced above.

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## 1.4 Objectives of the Investigation

1.4.1 The scope of works undertaken as part of this appraisal was to:

- Investigate the ground conditions present on-site and identify their geotechnical properties in relation to the site's proposed end use;
- Investigate the hydrogeological regime beneath the site wherever possible;
- Identify the nature and concentration of any contamination within the on-site soils and undertake a tiered risk assessment to establish likely risks to sensitive receptors. Defining a Conceptual Site Model of potential contaminant linkages relevant to the proposed redevelopment of the site;
- Carry out *in-situ* permeability tests to assess the potential for soakaway use at the site;
- Provide preliminary advice in relation to any environmental or geotechnical issues associated with the site including foundation recommendations and other recommendations needed to facilitate the proposed redevelopment, including, where necessary, identifying any additional phases of work or remediation that need to be carried out.

## 1.5 Site Works

1.5.1 The findings and recommendations given in this report are based on fieldwork undertaken on the 10<sup>th</sup> and 15<sup>th</sup> of November 2022, comprising the completion of nine mechanically excavated trial holes.

## 1.6 Limitations of Study

1.6.1 This report presents factual and interpretative geotechnical and environmental information, along with provisional construction proposals and recommendations relevant to the objectives of the investigation for the site end-use given above. The report has been prepared for the titled project and Alan Wood and Partners can accept no responsibility or liability for the consequences of the use of this document, wholly or in part, for any other purpose than that for which it was commissioned.

1.6.2 For the purposes of this report and thus defining risk to the proposed development from an environmental point of view, a residential end use has been adopted. Interpretation and recommendations should not be assumed valid for alternate land

- 
- uses. Where the proposed site usage changes, the findings of this report should be re-assessed to accommodate the change in proposed end-use.
- 1.6.3 The conclusions and recommendations presented in this report are based on site-specific information obtained during the desk study, ground conditions encountered and laboratory analysis and are considered reasonable on the basis of available information at the time the assessment was carried out. They should not necessarily be relied upon to represent site conditions at a substantially later date.
- 1.6.4 The findings and opinions provided in this report are given in good faith and are subject to the limitations and constraints imposed by the methods and information sources described. Factual information has been obtained from a variety of sources. Alan Wood and Partners assumes that third party data is reliable, but has not independently confirmed this. The validity and accuracy of this information is therefore outside the control of Alan Wood and Partners. Professional judgement and experience is however used to ensure that uncertainties are reduced to a level appropriate to the site conditions, the purpose of the investigation and the resources devoted to it by the Client.
- 1.6.5 Whilst every effort has been made to carry out an assessment that enables a realistic characterisation of the geotechnical and environmental parameters at the site, the possibility of significant spatial variation in actual ground, groundwater and environmental (gas and contamination) conditions existing between or beyond exploratory hole locations cannot be discounted. Where information or opinion is given this is for guidance only. Further information, ground investigation, construction activities, change of site use or the passage of time may reveal conditions that were not indicated in the data and therefore could not have been considered in the preparation of this report. Where such information might impact upon stated opinions, Alan Wood and Partners cannot accept responsibility for conditions not encountered and reserves the right to modify or retract the opinions expressed in this report. Where opinions expressed are based on current available guidelines and legislation, no liability can be accepted by AWP for the effects of any future changes to such guidelines and legislation. New information of improved practices and changes in legislation may require reinterpretation of the report as a whole, or in part.
- 1.6.6 This report does not constitute an archaeological or ecological assessment, nor does it constitute an asbestos inspection. A suitably qualified consultant should be consulted where these aspects of work are required.

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- 1.6.7 A flood risk assessment in accordance with Planning Policy Statement 25, *Development and Flood Risk* (2010) has not been undertaken as part of this commission.
- 1.6.8 All ground investigation works and soil descriptions were undertaken in general accordance with BS EN ISO 14688-1 'Geotechnical Investigation and Testing – Identification and Classification of Soil' (2002), BS10175 (2011), BS 5930 (2010) and/or BS EN 1997-1:2004 (Part 1, General Rules) and BS EN 1997-2:2007 (Part 2, Ground Investigation and Testing).

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## 2 SITE DETAILS AND DESCRIPTION

### 2.1 Introduction

2.1.1 Published environmental, geological and historical data relating to the site area has been reviewed, in conjunction with a walkover survey undertaken on the 10<sup>th</sup> of November 2022, the findings of which are presented below. The principal considerations of immediate relevance are presented in the following sections.

### 2.2 Site Location & Description

2.2.1 The site is located to the north of the A628, approximately 600m north of Penistone and approximately 10km west of Barnsley. The site is centred at National Grid Reference (NGR) 424392mE 403848mN. A site location plan is presented as Figure 47495/001.

2.2.2 The site contains a spoil mound with an abundance of anthropogenic fragments including piles of paving blocks, concrete, UVPC, tiles, brick and reworked topsoil.

2.2.3 The site has a sloped bank to the north with the highest elevation at the northern boundary.

2.2.4 There are trees around the site boundary with hedges to mark the site boundary.

2.2.5 Invasive plant species, including Japanese Knotweed and Giant Hogweed were not observed during the site walkover.

### 3 PHASE I GEO-ENVIRONMENTAL ASSESSMENT

#### 3.1 Anticipated Geology, Hydrogeology & Mining

3.1.1 Full details of the information reviewed is presented in the Phase 1 report for the site. Salient points are summarised below in relation to the sites geological and hydrogeological setting.

**Table 3.1 - Geological Information**

<i>Made Ground and Surface Ground Workings</i>	<p>Information presented in the Groundsure report indicates that there are no areas of artificial/made ground within 500m of the site.</p> <p>There are numerous entries in the Groundsure report that refer to historical surface ground working features within 250m of the site. The nearest lies 5m south of the site and relates to a pond. Other surface features beyond this refers to unspecified pits, unspecified ground workings and a sandstone quarry.</p>
<i>Geology</i>	<p>Superficial soils are reported to be present on site compromising of River Terrace Deposits of sand and gravel.</p> <p>The solid geology underlying the site area is recorded as mudstone and siltstone of the Pennine Lower Coal Measures Formation and sandstone of the Penistone Flags.</p> <p>There is one localised BGS borehole to 224m east of the site, records of which have been reviewed. These indicate that bedrock is present at around 6m bgl.</p>
<i>Discontinuities</i>	<p>Information presented in the Groundsure report indicates that the nearest normal geological (inferred) fault lies 431m to the east of the site.</p>
<i>Hydrogeology</i>	<p><b><u>Aquifer within Superficial Deposits:</u></b> Secondary A</p> <p><b><u>Aquifer within Bedrock:</u></b> Secondary A</p> <p><b><u>Source Protection Zones:</u></b> There are no source protection zones within 500m of the site.</p>
	<p><b><u>Source Protection Zones within Confined Aquifer:</u></b> There are no source protection zones within 500m of the site.</p> <p><b><u>Vulnerability &amp; Leaching Potential:</u></b> The groundwater vulnerability and soil leaching potential for the site is indicated to be secondary aquifer/low leaching potential.</p>
<i>Hydrology</i>	<p>There are eight reported surface water features within 250m of the site. The nearest is 41m southeast of the site and refers to the River Don which is an inland river.</p>
<i>Mining &amp; Ground Stability</i>	<p><b><u>Historic Underground Working Features</u></b></p> <p>Information presented in the Groundsure report indicates that the nearest historical underground working feature lies 670m north of the site. This is associated with a tunnel which dates back to 1891.</p>

	<p><b><u>Coal Mining</u></b></p> <p>Information presented on the Coal Authority website (<a href="http://www.coal.decc.gov.uk">www.coal.decc.gov.uk</a>) indicates that the site does not lie within a Development High Risk area but it does lie within a Coal Mining Reporting area.</p> <p>On the basis of available information risk associated with shallow coal mining subsidence is considered to <b>negligible</b>.</p>
<i>Non-coal Mining</i>	Historical information indicates that there are no non-coal mining areas within 1km of the site.
<i>Natural Cavities</i>	The GroundSure data indicates that there are no natural cavities recorded within 1km of the study site.
<i>Radon, Landfill and Mine Gas</i>	The site lies within an area where radon protective measures are not required in construction.

### 3.2 Environmental Records

3.2.1 A summary of the available environmental information is presented in Table 3.2.

**Table 3.2 - Environmental Data**

<i>Potentially Harmful Discharges (Red List) to Controlled Waters</i>	There are no records of red list discharge consents reported to be within 500m of the site.
<i>Licensed Discharge Consents</i>	There are 15 records of licensed discharge consents reported to be within 500m of the site. The nearest active licensed discharge is 90m south of the site and refers to a sewer storm overflow (dating back to 2007).
<i>EA Recorded Pollution Incidents to Controlled Waters</i>	There are eleven EA recorded pollution incident within 500m of the site. The nearest is 63m southeast and relates to a crude sewage material. There was no impact recorded to land or air but there was a minor impact to water.
<i>Landfill and Other Waste Sites</i>	There are four Environment Agency historic landfill sites and one BGS/DoE non-operational landfill sites within 500m. There are also two records of two Local Authority landfill sites within 500m of the site.  There is one licensed waste site within 500m of the site. This lies 381m northeast and dates back to 2012 (clinical waste transfer station).
<i>Flooding</i>	The Groundsure report indicates that the site lies within 50m of a Environment Agency Zone 2 floodplain (updated as of 3rd November 2014).  The Groundsure report indicates that there is a low risk of groundwater flooding on site.
<i>Abstractions</i>	There are six groundwater abstractions located within 2km of the site, while the nearest surface water abstraction lies 1065m south-east of the site, this being for general use relating to secondary category (medium loss). There are no potable water abstractions within 2km of the site.
<i>Invasive Plant Species</i>	Japanese Knotweed was not observed during the site walkover. It would be prudent however to undertake an invasive plant species survey to confirm this prior to redevelopment.
<i>Public Register of Contaminated Land: Part 2A (EPA 1990)</i>	There are no sites designated as contaminated land under, Section 78R of the EPA 1990, within 500m of the site.

<i>Dangerous or Hazardous Sites</i>	<p>There are no NIHHS or COMAH sites or high-pressure underground pipelines within 500m of the site.</p> <p>The nearest active petrol or fuel site lies 88m to the southwest, this being located at Texaco, Barnsley Road.</p>
<i>Potentially Contaminative Current Land Uses</i>	<p>There are a number of potentially contaminative industrial sites located within 250m of the site, although these are unlikely to have affected the site or its intended redevelopment. These include, for example:</p> <p>Petrol filling station, vehicle parts and accessories, published goods, fireplaces and mantelpieces.</p>

### 3.3 Historical Land Use

- 3.3.1 A full record of the historical period reviewed is presented in the desk study report. A summary of significant findings is presented below.
- 3.3.2 From the earliest map examined, Mill Race runs through the southeast boundary of the site with a small footpath. The footpath is no longer shown in the 1960 map and Mill Race is no longer shown in the 1978 1:2500 map. The site is then shown as an open field.
- 3.3.3 There has been both commercial and residential development in all directions around the site.

### 3.4 Anticipated Ground Conditions

#### 3.4.1 Made Ground

- 3.4.2 As the site has previously been developed with Mill Race, there may be some localised made ground on the south-eastern boundary of the site. There has also been development to the immediate south of the site so there may be some localised made ground present on the southern boundary of the site.
- 3.4.3 The presence, type and extent of any on-site made ground soils will need to be established through ground investigation.

#### 3.4.4 Natural Strata

- 3.4.5 The site is shown to be underlain by superficial River Terrace Deposits comprising of a mixture of sand and gravel on the southern half of the site.

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3.4.6 The solid geology underlying the site is recorded as being the Pennine Lower Coal Measures Formation and sandstone of the Penistone Flags through the southern half of the site.

3.4.7 Groundwater

3.4.8 Localised perched lenses of groundwater may be present within the superficial deposits where granular material is present.

3.4.9 It is anticipated that true groundwater will be present at depth within the mudstone, siltstone and sandstone bedrock.

### 3.5 Preliminary Conceptual Site Model

3.5.1 Introduction

3.5.1.1 The following section summarises the Preliminary Phase I Conceptual Site Model (CSM), which has been produced following the review of available pertinent desk study and third-party information. The CSM summarises the understanding of surface and sub-surface features, the potential sources of contamination, pathways and receptors in order to support the identification and assessment of plausible contaminated linkages.

3.5.2 Initial Conceptual Site Model & Risk Assessment

3.5.2.1 The risk assessment has been carried out to assess the likelihood of risk to human health and the wider environment, on the basis of information reviewed. The risk assessment is a qualitative source-pathway-receptor assessment and its function is to assess the likelihood that each possible linkage exists and to decide whether they pose potentially unacceptable risks to identified receptors (i.e. people, structures, water bodies or ecosystems) that may be harmed.

3.5.2.2 Risk can be defined as the combination of the consequence of a harmful effect and the probability of its occurrence. The existence of a contaminant linkage is dependent on site use, as well as environmental conditions: **if no contaminant linkage(s) can be proven, then the risk(s) may be discounted.**

### 3.5.3 Site Summary & Environmental Sensitivity

3.5.3.1 A review of available desk study information indicates that the proposed development area was historically crossed by a Mill Race and this is no longer shown from the 1978 map, the site then remained as an open field.

3.5.3.2 As the site has historically been crossed by a Mill Race, there may be some localised made ground on the south-east boundary of the site. There has also been development to the immediate south of the site so there may be some localised made ground present on the southern boundary, although its presence will need to be discounted through ground investigation.

3.5.3.3 The underlying geology is indicated to comprise is indicated to comprise of river terrace deposit (sand and gravel) on the southern half of the site and Pennine Lower Coal Measures to the north.

3.5.3.4 The potential leaching of mobile contaminants of concern to the underlying aquifer is considered to be low given the absence of significant sources and reported low leaching potential of soils within the vicinity to the site.

3.5.3.5 In summary, given the site history, the anticipated contaminant load within the on-site soils, its underlying geology, gassing potential and the nature of controlled waters receptors, sensitivity of the site is considered, at this stage, to be **low**. The nature and concentration of any contamination will need to be confirmed through testing.

### 3.5.4 Potential Sources

3.5.4.1 A potential source is defined as 'a contaminant which is in, or under the land and has the potential to cause harm to human health or to cause pollution of controlled waters'.

3.5.4.2 The following potential contaminants that may be associated with the site are summarised in Table 3.3.

**Table 3.3 - Summary of Potential Contaminant Sources**

Potential Sources	Associated Potential Contaminants ( <i>not limited to</i> )	
	<i>Metals, inorganics and other contaminants</i>	<i>Organics</i>
Contaminated near surface soils originating from nearby former railway.	Heavy metals/metalloids, sulphate, asbestos	PAH, Pesticides

\* Invasive plant species to be assessed separately if encountered.

### 3.5.5 Potential Receptors

3.5.5.1 A receptor is the potential target of the source contaminant, to which either significant harm or deterioration in quality may be caused.

3.5.5.2 The potential sensitive receptors with respect to the potential contamination hazards identified above are considered in Table 3.4.

**Table 3.4 - Summary of Potential Receptors**

Potential Receptor	Comment
Human Health	Site end-users Site operatives (during construction phase only)
Construction	Potable water supply pipes Foundations
Underlying natural strata	Near surface soils and/or any perched groundwater

### 3.5.6 Plausible Pathways

3.5.6.1 Migration pathways are routes by which contaminant sources may come into contact with receptors. Potential pathways for different types of contaminants vary depending on the properties of the contaminant, the mechanism of its release and the nature of the receptor. The principal potential pollution pathways by which receptors might become exposed to potential contamination at the site are summarised as follows in Table 3.7.

**Table 3.5 - Summary of Plausible Pathways**

Potential Source	Pathway
Potentially contaminated made ground soils, underlying natural strata / perched groundwater	Direct ingestion, dermal contact, dust and/or vapour inhalation
	Direct ingestion and/or dermal contact with liquid contaminants
	Leaching and direct contact with foundations and potable water supply pipes. Lateral migration of contaminants through preferential pathways
	Inhalation of asbestos fibres

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### 3.5.7 Risk Assessment

3.5.7.1 The potential contaminant linkages listed above are based on available data and the features noted during the 'walkover'. Therefore, the linkages identified are tentative in nature and are subject to the following uncertainties (to be followed up through ground investigation):

- Presence of made ground at the site although considered unlikely;
- Nature of the underlying natural strata at the site;
- The actual distribution of contaminants within the near surface soils and underlying natural soils;
- The hydrogeological regime beneath the site.

3.5.7.2 The assessment presented herein assumes that the site end-use is to be residential with gardens. The assessment is not valid for other land uses. Should the proposed end-use of the site change, the assessment contained herein would need to be revised to accommodate this.

3.5.7.3 The identified potential contaminants and receptors have been considered in relation to the pathways that may link them. The risk classification has been estimated in accordance with those methods prescribed in CIRIA publication C552 'Contaminated Land Risk Assessment: A Guide to Good Practice', 2001.

3.5.7.4 Risk is regarded as a combination of the likelihood of an 'event' occurring and its severity: both elements must be taken into account when assessing risk. The method for risk assessment, or evaluation, is purely qualitative. As defined in CIRIA C552:2001, the magnitude of the potential 'severity' of risk occurring may be assessed against:

- **Severe:** short term risk to human health likely to result in significant harm as defined under EPA 1990, Part 2A. Short term risk of pollution to sensitive water receptor;
- **Medium:** significant harm to human health, pollution of sensitive water resource or significant change to an ecosystem or specific organism;
- **Mild:** pollution of non-sensitive water resource but significant damage to crops, buildings, structures and services or the environment;
- **Minor:** harm, which may result in financial loss, or expenditure to resolve. Non-permanent effects to human health. Easily repairable effects of damage to buildings, structures and services.

3.5.7.5 Similarly, the classification of the magnitude of the 'probability' of the risk occurring may be assessed against:

- **High Likelihood:** a contaminant linkage exists and an event appears very likely in the short term, or almost inevitable in the long term, or pollution is causing harm at the receptor;
- **Likely:** a contaminant linkage exists and it is probable that an event will occur. An event may not occur, but it is possible in the short term and likely over the long term;
- **Low Likelihood:** a contaminant linkage exists and it is possible that an event will occur. It is not certain that an event will occur over time but it is less likely in the short term;
- **Unlikely:** a contaminant linkage exists but it is not possible to say if an event will occur even over a very long time.

3.5.7.6 Following completion of the severity and probability assessment, classifications can be compared to indicate the actual risk each contaminant linkage presents: this can only be undertaken where there is a possibility of there being an active contaminant linkage.

3.5.7.7 The risk categories which can be assigned are presented in Table 3.8 and range between 'very high risk' to 'very low risk'. NB - it is not possible to classify an identified risk as 'no-risk'.

**Table 3.6 - Risk Categories**

		Consequence			
		Severe	Medium	Mild	Minor
Probability	Highly Likely	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low Likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

Reproduced from Table 6.5, CIRIA C552/2001.

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- **Very High** – severe harm could arise to a designated receptor or that severe harm is occurring. Urgent investigation and remediation is likely to be required;
  - **High** – harm could occur to a designated receptor and that urgent investigation and remediation may be needed in the short term, but are likely over the longer term;
  - **Moderate** – harm could occur. It is unlikely to be severe, most probably relatively mild. Investigation is normally required to clarify the risk with some remedial works being required in the longer term;
  - **Low** – possible that harm could occur, but if it did, at worst it would be mild;
  - **Very Low** – low possibility of harm arising, and that if it does it is not likely to be severe.

3.5.7.8 The identified potential contaminants and receptors have been considered in relation to the pathways that may link them. The resulting contaminant linkages are presented in Table 3.7.

**Table 3.7 - Summary of Phase I Conceptual Site Model & Risk Assessment**

Potential Source	Potential Receptor	Plausible Pathway	Probability	Severity	Initial Risk Rating	Solution
Localised potentially contaminated near surface natural strata / perched groundwater	<u>Human Health</u> Site end-users, inc. maintenance and site workers (short term risk during construction)	Direct ingestion or dermal contact with soil, dust and/or vapour inhalation	Low likelihood	Medium	<b>Moderate/Low</b>	Soil capping or removal of contaminated soils where necessary
		Direct ingestion and/or dermal contact with liquid contaminants	Unlikely	Mild	<b>Very Low</b>	
		Inhalation of asbestos fibres	Unlikely	Severe	<b>Moderate</b>	Soil capping or removal of contaminated soils where necessary
	<u>Construction (Potable Water Supply Pipes)</u>	Direct contact/leaching (tainting)	Low likelihood	Mild	<b>Low</b>	Upgraded water pipes/clean backfill material where necessary
	<u>Construction (Foundations)</u>	Direct contact/leaching	Low likelihood	Mild	<b>Low</b>	Appropriate concrete specification
	<u>Controlled Waters</u>	Surface run-off / lateral migration	Unlikely	Mild	<b>Very Low</b>	No risk anticipated

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3.5.7.9 The preliminary conceptual site model (CSM) presented above has indicated that a small number of contaminant linkages may exist on-site.

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## 4 GROUND INVESTIGATION FIELDWORK

### 4.1 Introduction

- 4.1.1 The investigation requirements at the site were twofold: to undertake a geotechnical investigation and an environmental investigation. A ground investigation was carried out to identify geotechnical and environmental liabilities in relation to the proposed development work at the site.
- 4.1.2 The positions of the exploratory locations are limited to areas of the site, within the site boundary, that were accessible during the works.
- 4.1.3 Alan Wood and Partners scoped the intrusive investigation on the basis of information submitted in the desk study report and in general accordance with guidance given in BS5930:1999+A2:2010, BS10175:2011+A1:2013 and BS EN 1997:2004 and 2013.

### 4.2 Site Works

- 4.2.1 The findings and recommendations given in this report are based on fieldwork undertaken on the 10<sup>th</sup> and 15<sup>th</sup> of November 2022 and comprised of nine mechanically excavated trial pits.
- 4.2.2 The infiltration tests were carried out by SOCOTEC Ltd.
- 4.2.3 The positions of the exploratory holes are shown on the appended ground investigation plan, Figure 47495/002. They were positioned on the basis of the findings of the site conceptual model and distributed in general accordance with the requirements of BS10175:2011+A1:2013 and the working site conditions at the time each phase of investigation was completed.
- 4.2.4 No specific areas of interest were targeted from either a geotechnical or environmental point of view.
- 4.2.5 Samples of topsoil, subsoil and made ground were collected in sterile containers appropriate to the nature of potential contaminants present for subsequent laboratory chemical and geotechnical testing.

4.2.6 Representative samples of the on-site soils were therefore recovered from the exploratory holes. Sampling was undertaken in accordance with those guidelines prescribed in BS 10175:2011. All environmental samples were collected in 500ml plastic tubs with sealable lids, 250ml glass amber jars or vials (subject to analytical requirements). Care was taken to minimise cross contamination (i.e. wiping of equipment) between sampling. Environmental samples were packed into cool boxes with ice packs and transported by courier to Chemtech Environmental, an MCERTS and UKAS accredited laboratory for analysis and subsequent storage.

4.2.7 No groundwater samples were taken from the trial pits excavated.

### 4.3 Geotechnical Investigation

4.3.1 A geotechnical investigation was carried out to identify constraints in relation to the proposed construction works at the site and aid the design of appropriate foundation solutions. The following objectives of the ground investigation were therefore to:

- Confirm the lateral and vertical extent of any made ground soils, the nature of the underlying natural ground and the depth to bedrock at selected positions across the area under investigation;
- Determine the depth to groundwater and the stability of excavation;
- Recover bulk samples for geotechnical testing where necessary;
- Assess the potential for soakaway use as a means of surface water disposal through *in situ* permeability testing.

4.3.2 Standard strata descriptions of the soils encountered are in general compliance with BS EN 1997:2004, BS EN 1997:2007, BS EN ISO 14688:2002, BS EN ISO 14688:2004 and BS EN ISO 14689:2003. The individual strata depths recorded on each hand pit or borehole log are those from existing ground levels.

4.3.3 Geotechnical laboratory testing was undertaken on a selection of soil samples in accordance with those techniques outlined in BS 1377:1990 'Methods of Test for Soils for Civil Engineering Purposes' at the laboratory of Professional Soils Laboratory in Doncaster. This laboratory is a fully UKAS compliant laboratory.

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## 4.4 Environmental Investigation

4.4.1 The environmental investigation was designed so that site-specific data could be obtained with respect to any potential soil and groundwater contamination associated with the site so that risks could be quantified in relation to the *source-pathway-receptor* scenarios and plausible contaminant linkages postulated in the initial Conceptual Site Model summarised above.

4.4.2 Given the potentially historic contaminative nature of the on-site soils, it was considered possible that, when considered within the context of proposed end-use, the on-site soils may present an (albeit low) unacceptable risk to human health and/or the wider environment.

4.4.3 The scope of works undertaken, were therefore to:

- Inspect and identify the general soil conditions that prevail across the site;
- Assess the potential for soil contamination within any made ground, the underlying natural strata or groundwater;
- Recover soil samples to test for heavy metals, metalloids, non-metal inorganics, organics and asbestos fibres.

4.4.4 The analytical strategy adopted for the environmental investigation was designed to provide an overall assessment of potential contaminants thought to likely be present within the on-site soils. Whilst no specific contaminants of concern were anticipated in significant concentrations, the soil testing undertaken was for a suite of contaminants in general accordance with NHBC Standards Chapter 4.1 'Land Quality – Managing Ground Conditions' and CLR 8 'Potential Contaminants for the Assessment of Land' (withdrawn but used for reference purposes where applicable). The testing of the following analytes was scheduled on selected samples:

- Heavy metals suite (including As, Cd, Cr, Cu, Hg, Pb, Ni, Zn);
- Speciated Polycyclic Aromatic Hydrocarbons;
- Cyanide (free and total) and Thiocyanate;
- Phenol (total);
- Sulphates (Total and Water Soluble);
- Asbestos fibres;
- Sulphide; and
- pH.

## 5 RESULTS OF INVESTIGATION

### 5.1 Ground Conditions Encountered

5.1.1 The ground conditions encountered are summarised in Table 5.1, while discussion about each one is given in the following paragraphs.

5.1.2 A copy of the ground investigation logs are presented in Appendix A.

**Table 5.1 - Summary of Ground Conditions**

Lithology	Exploration Location	Approximate proven depth (m) to base from existing ground level	Approximate Thickness (m)	Approximate allowable bearing capa
Topsoil	TP2, TP3, TP4, TP5, TP6, TP7	0.2 – 0.4	0.2 – 0.4	Nil
Made Ground	TP1, TP8, TP9	0.4-1.0	0.4-1.0	Nil
Grey mottled orange clay	All locations	0.6 - 1.8	0.1 – 1.5	75
Light grey clay	TP4	Base not proven		75
Gravel	TP1, TP2, TP3, TP5, TP6, TP7, TP8	Base not proven		80-100
Clay	TP1	Base not proven		150
Groundwater	Perched water was encountered in TP1, TP2 and TP3			

5.1.3 Made Ground: Made ground was encountered in TP1, TP8 and TP9. Made ground in TP1 consisted of 0.10m of tarmac overlaying a silty gravelly sand with coarse brick inclusions. TP8 consisted of a reworked topsoil overlaying 0.70m of a sandy gravel with inclusions of concrete, brick, tar and sandstone. TP9 consisted of a reworked topsoil with abundant anthropogenic material inclusions such as brick, plastic, UVPC, tiles, woven bags and concrete.

5.1.4 Natural Strata: Topsoil was encountered in TP2, TP3, TP4, TP5, TP6 and TP7 The underlying ground conditions comprised of a dark brown silty clay with frequent rootlets.

5.1.5 In accordance with Table 8 of BS EN ISO 14688-2:2004+A1:2018 the consistency index (IC) of the underlying cohesive soils may be described as soft to stiff.

5.1.6 **Groundwater:** Groundwater was encountered in TP1, TP2 and TP3.

## 5.2 Visual & Olfactory Evidence of Contamination

5.2.1 Visual or olfactory evidence of gross contamination, such as hydrocarbons, was recorded during the ground investigation as a tar odour was encountered in a black tarry material in TP8.

## 5.3 In-Situ Infiltration tests

5.3.1 Due to unfavourable conditions at the site, in situ permeability testing was unable to be conducted. This is due to shallow groundwater on the western side of the site and made ground in the east. In addition, due to the slopy nature of the site, the northern part of the site is elevated and as such would be unsuitable for soakaways.

## 5.4 Geotechnical Testing & Material Properties

### *Atterbergs, Moisture Content & Volume Change Potential*

5.4.1 The geotechnical laboratory testing was carried out on five samples of cohesive soil by Professional Soils LTD. A copy of the test results are presented in Appendix B but are summarised in Table 5.3.

**Table 5.2 - Plasticity Index Test Results**

Borehole Number	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Volume Change Potential*
TP1	0.60	43	21	22	100	22
TP2	0.40	54	24	30	100	30
TP5	1.10	51	25	26	100	26
TP8	1.10	64	27	37	100	37
TP9	1.10	59	26	33	91	30

\* VCP: 10-19% = Low, 20-39% = Medium, 40% and greater = High (after NHBC:2018).

5.4.2 The Plasticity Index (Ip) of a soil is a measure of its Volume Change Potential (VCP) and is determined by Atterberg Limits tests, the results of which are given in the above table. All tests to determine the liquid limit ( $w_L$ ) and plastic limit ( $w_p$ ) were also performed by PSL LTD. A Modified Plasticity Index (I<sub>p</sub>) has been calculated for the samples tested, which is defined as the Plasticity Index multiplied by the percentage of particles less than 425µm. The conversion factor applied is presented in NHBC Standards (2019), Chapter 4.2.

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5.4.3 The calculated modified plasticity index (NHBC Chapter 4.2) was found to be between 22% and 37%, which is equivalent to a **medium** volume change potential, according to the NHBC guidelines.

## 5.5 Contamination and Performance of Building Materials (Cementitious Products)

5.5.1 Eleven soil samples were analysed for a suite of contaminants consistent with BRE Special Digest 1 'Concrete in Aggressive Ground' (2005). A copy of the individual test results is given in the appended laboratory certificates in Appendix C.

5.5.2 The pH values recorded for the soil samples ranged between 6.1 and 8.9 (pH units) with an average of 7.3, indicating neutral conditions prevail within the on-site soils.

5.5.3 Water soluble sulphate analysis of the soils yielded concentrations between <0.01g/l (<10mg/l) and 0.377g/l (377mg/l) in the samples (0.129g/l on average).

## 5.6 Chemical Testing

5.6.1 Eleven representative samples of soil from within the near surface and at depth were analysed for the suite of contaminants outlined in Section 4.4.5. This was in order to assess the general degree and nature of contamination within the on-site soils in relation to the site's proposed redevelopment.

5.6.2 A summary of the test results is given in the following tables, whilst a copy of the individual test results is presented in full in Appendix C.

**Table 5.3 - Summary of Total Soil Concentrations (Made Ground TP1)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
<b>Metals</b>						
Arsenic (inorganic)	37*	13		1	0	Pass
Cadmium	22*	<0.2		1	0	Pass
Chromium	21*	<1		1	0	Pass
Copper	2400**	40		1	0	Pass
Mercury (inorganic)	40**	<0.5		1	0	Pass
Nickel	130**	34		1	0	Pass
Lead	200*	29		1	0	Pass
Selenium	250**	1.3		1	0	Pass
Zinc	3700**	52		1	0	Pass

\* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

\*\* LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

**Table 5.4 - Summary of Chemical Test Results (PAH) (Made Ground TP1)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	2.3	0.28		1	0	Pass
Acenaphthylene	400	0.29		1	0	Pass
Acenaphthene	490	1.45		1	0	Pass
Fluorene	390	1.33		1	0	Pass
Phenanthrene	220	14.44		1	0	Pass
Anthracene	5400	5.7		1	0	Pass
Fluoranthene	560	29.8		1	0	Pass
Pyrene	620	22.75		1	0	Pass
Benzo(a)anthracene	11	12.58		1	1	Fail
Chrysene	22	12.32		1	0	Pass
Benzo(b)fluoranthene	3.3	17.26		1	1	Fail
Benzo(k)fluoranthene	77	6.32		1	0	Pass
Benzo(a)pyrene	2.7	14.07		1	1	Fail
Dibenzo(a,h)anthracene	0.28	1.91		1	1	Fail
Indeno(1,2,3-cd)pyrene	36	12.09		1	0	Pass
Benzo(g,h,i)perylene	340	9.76		1	0	Pass

\* [CLEA/LQM/CIEH, 2015] Calculated for residential end-use scenario, with plant uptake in CLEA v1.071. GAC range for 2.5% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

**Table 5.5 - Summary of Total Soil Concentrations (Made Ground TP8)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
<b>Metals</b>						
Arsenic (inorganic)	37*	6.4		1	0	Pass
Cadmium	22*	<0.2		1	0	Pass
Chromium	21*	<1		1	0	Pass
Copper	2400**	13		1	0	Pass
Mercury (inorganic)	40**	<0.5		1	0	Pass
Nickel	130**	22		1	0	Pass
Lead	200*	16		1	0	Pass
Selenium	250**	4.8		1	0	Pass
Zinc	3700**	34		1	0	Pass

\* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

\*\* LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

**Table 5.6 - Summary of Chemical Test Results (PAH) (Made Ground TP8)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	2.3	1.48		1	0	Pass
Acenaphthylene	400	<0.02		1	0	Pass
Acenaphthene	490	34.41		1	0	Pass
Fluorene	390	25.35		1	0	Pass
Phenanthrene	220	178.8		1	0	Pass
Anthracene	5400	51.19		1	0	Pass
Fluoranthene	560	239.65		1	0	Pass
Pyrene	620	210.43		1	0	Pass
Benzo(a)anthracene	11	107.57		1	1	Fail
Chrysene	22	105.12		1	1	Fail
Benzo(b)fluoranthene	3.3	111.20		1	1	Fail
Benzo(k)fluoranthene	77	47.47		1	0	Pass
Benzo(a)pyrene	2.7	75.89		1	1	Fail
Dibenzo(a,h)anthracene	0.28	11		1	1	Fail
Indeno(1,2,3-cd)pyrene	36	58.22		1	1	Fail
Benzo(g,h,i)perylene	340	42.18		1	0	Pass

\* [CLEA/LQM/CIEH, 2015] Calculated for residential end-use scenario, with plant uptake in CLEA v1.071. GAC range for 2.5% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

**Table 5.7 - Summary of Total Soil Concentrations (Made Ground TP9)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
<b>Metals</b>						
Arsenic (inorganic)	37*	11		1	0	Pass
Cadmium	22*	0.3		1	0	Pass
Chromium	21*	46		1	1	Fail
Copper	2400**	23		1	0	Pass
Mercury (inorganic)	40**	<0.5		1	0	Pass
Nickel	130**	24		1	0	Pass
Lead	200*	45		1	0	Pass
Selenium	250**	1.3		1	0	Pass
Zinc	3700**	93		1	0	Pass

\* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

\*\* LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

**Table 5.8 - Summary of Chemical Test Results (PAH) (Made Ground TP9)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	2.3	0.09		1	0	Pass
Acenaphthylene	400	0.10		1	0	Pass
Acenaphthene	490	0.19		1	0	Pass
Fluorene	390	0.20		1	0	Pass
Phenanthrene	220	2.14		1	0	Pass
Anthracene	5400	0.79		1	0	Pass
Fluoranthene	560	5.83		1	0	Pass
Pyrene	620	5.19		1	0	Pass
Benzo(a)anthracene	11	3.25		1	0	Pass
Chrysene	22	2.65		1	0	Pass
Benzo(b)fluoranthene	3.3	4.28		1	1	Fail
Benzo(k)fluoranthene	77	1.82		1	0	Pass
Benzo(a)pyrene	2.7	3.66		1	1	Fail
Dibenzo(a,h)anthracene	0.28	0.53		1	1	Fail
Indeno(1,2,3-cd)pyrene	36	2.83		1	0	Pass
Benzo(g,h,i)perylene	340	2.24		1	0	Pass

\* [CLEA/LQM/CIEH, 2015] Calculated for residential end-use scenario, with plant uptake in CLEA v1.071. GAC range for 2.5% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

**Table 5.9 - Summary of Total Soil Concentrations (Made Ground mound)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
<b>Metals</b>						
Arsenic (inorganic)	37*	6.4		1	0	Pass
Cadmium	22*	<0.02		1	0	Pass
Chromium	21*	27		1	1	Fail
Copper	2400**	19		1	0	Pass
Mercury (inorganic)	40**	<0.5		1	0	Pass
Nickel	130**	25		1	0	Pass
Lead	200*	19		1	0	Pass
Selenium	250**	0.9		1	0	Pass
Zinc	3700**	53		1	0	Pass

\* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

\*\* LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

**Table 5.10 - Summary of Chemical Test Results (PAH) (Made Ground mound)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	1	<0.02		1	0	Pass
Acenaphthylene	170	<0.02		1	0	Pass
Acenaphthene	200	<0.02		1	0	Pass
Fluorene	165	<0.02		1	0	Pass
Phenanthrene	95	<0.02		1	0	Pass
Anthracene	2300	<0.02		1	0	Pass
Fluoranthene	280	<0.02		1	0	Pass
Pyrene	620	<0.02		1	0	Pass
Benzo(a)anthracene	7.5	<0.02		1	0	Pass
Chrysene	15	<0.03		1	0	Pass
Benzo(b)fluoranthene	2.6	<0.02		1	0	Pass
Benzo(k)fluoranthene	77	<0.03		1	0	Pass
Benzo(a)pyrene	2.2	<0.02		1	0	Pass
Dibenzo(a,h)anthracene	0.24	<0.02		1	0	Pass
Indeno(1,2,3-cd)pyrene	27	<0.02		1	0	Pass
Benzo(g,h,i)perylene	315	<0.02		1	0	Pass

\* [CLEA/LQM/CIEH, 2015] Calculated for residential end-use scenario, with plant uptake in CLEA v1.071. GAC range for 1.0% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

**Table 5.11 - Summary of Total Soil Concentrations (Natural Strata)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
<b>Metals</b>						
Arsenic (inorganic)	37*	6.7	17	7	0	Pass
Cadmium	22*	<0.2	0.4	7	0	Pass
Chromium	21*	<1		7	0	Pass
Copper	2400**	15	29	7	0	Pass
Mercury (inorganic)	40**	<0.5		7	0	Pass
Nickel	130**	15	38	7	0	Pass
Lead	200*	17	78	7	0	Pass
Selenium	250**	0.9	1.7	7	0	Pass
Zinc	3700**	71	101	7	0	Pass

\* DEFRA (2014). Development of Category 4 Screening Levels (SP1010)

\*\* LQM/CIEH (2015). S4UL for Human Health Risk Assessment.

**Table 5.12 - Summary of Chemical Test Results (PAH) (Natural Strata)**

Contaminant of Concern	GAC* (mg/kg)	Contaminant Concentrations (mg/kg)		No. of Samples Tested	No. of Samples >GAC	Pass/Fail Tier 1 GAC Screen
		Min	Max			
Naphthalene	1	<0.02	0.05	7	0	Pass
Acenaphthylene	170	<0.02	0.05	7	0	Pass
Acenaphthene	200	<0.02	0.06	7	0	Pass
Fluorene	165	<0.02	0.04	7	0	Pass
Phenanthrene	95	<0.02	0.92	7	0	Pass
Anthracene	2300	<0.02	0.36	7	0	Pass
Fluoranthene	280	<0.02	4.70	7	0	Pass
Pyrene	620	<0.02	4.66	7	0	Pass
Benzo(a)anthracene	7.5	<0.02	3.11	7	0	Pass
Chrysene	15	<0.03	3.16	7	0	Pass
Benzo(b)fluoranthene	2.6	<0.02	4.56	7	0	Pass
Benzo(k)fluoranthene	77	<0.03	1.68	7	0	Pass
Benzo(a)pyrene	2.2	<0.02	3.50	7	0	Pass
Dibenzo(a,h)anthracene	0.24	<0.02	0.59	7	0	Pass
Indeno(1,2,3-cd)pyrene	27	<0.02	2.97	7	0	Pass
Benzo(g,h,i)perylene	315	<0.02	2.35	7	0	Pass

\* [CLEA/LQM/CIEH, 2015] Calculated for residential end-use scenario, with plant uptake in CLEA v1.071. GAC range for 1.0% SOM used unless stated otherwise. Values will be more conservative for cohesive soils.

- 
- 5.6.3 Four samples were taken in made ground soils, the analysis of these has revealed elevated concentrations of chromium, chrysene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene and ideno(1,2,3-cd)pyrene.
- 5.6.3 Two soil samples were sent for analysis for pesticides. Analysis showed no detectable pesticides in any of the samples.

---

## **6 GEOTECHNICAL ASSESSMENT**

### **6.1 Mining Risk**

6.1.1 On the basis of the available information, the potential for there to be shallow mine workings beneath the site is considered to be negligible.

### **6.2 Foundations**

6.2.1 For plots 1-3, 7 and 8, it is recommended that traditional strip or trench foundations are used.

6.2.2 For plots 4-6 and 9-11, piled foundations may be required however further investigation is recommended to identify depth to competent strata and finalise foundation design for these plots.

6.2.3 It is recommended that a plot specific ground investigation is undertaken to the north to confirm foundation depths when development levels are known.

### **6.3 Floor Slabs**

6.3.1 Given the sloping nature of the site, it is recommended that suspended floor slabs be used for the proposed development. Protective measures may be required where foundations lie within the heave zone of trees as defined by NHBC Standards (Chapter 4.2), or where seasonally desiccated soils are present at the time of construction.

6.3.2 Where ground bearing slabs are implemented in excess of 600mm of unsuitable land, care must be taken to ensure that shallow strata do not become heavily disturbed by site clearance/construction activities (especially during inclement weather). Where this occurs, this could result in an increased requirement for suspended floor slabs.

### **6.4 Precautions Near Trees**

6.4.1 There are some trees around the boundaries to the site, so precautions are likely to be required where structures lie within influencing distance given the underlying (clay) ground conditions that prevail at the site; this will be subject to a tree survey and plot specific foundation schedule.

6.4.2 In addition, precautions may be required where trees are to be removed or where new planting is proposed. All foundations should be constructed in accordance with current guidelines (e.g. NHBC Standards, Chapter 4.2). If foundations are built off competent bedrock, no precautions are likely to be required.

## 6.5 Drainage and Soakaways

6.5.1 *In situ* permeability testing was unable to be carried out due to unfavourable conditions on the site at the time the investigation was carried out.

## 6.6 Roads and Car Parks

6.6.1 No *in situ* CBR testing has been carried out to date as the final development levels at the site are unknown.

6.6.2 On the basis of visual observation, it is considered that the near surface soils are likely to have a minimum CBR value of around 2.0%, perhaps higher, but this should be confirmed.

6.6.3 Highways Agency document HD25 Interim Advice Note 73/06 Revision 1 (2009) states that where a subgrade has a CBR lower than 2.5%, it is considered unsuitable support for a pavement foundation since it would tend to deform under construction traffic and must be improved. All road design should be discussed with the local authority if highways are to be subject to a Section 38 agreement.

## 6.7 Ground Stability

6.7.1 Excavations are unstable below groundwater level where granular deposits are encountered. Instability should be anticipated where weak strata is encountered and where excavations are left open over prolonged periods of time and where excavations are left open during prolonged periods of wet weather (e.g. in service trenches). Allowance for instability of the near surface granular deposits should be made where necessary.

6.7.2 An adequate drainage system for surface water may need to be installed by a competent contractor in order to prevent surface water ponding or collection, both during and post construction, as this may lead to deterioration and weakening of the founding stratum.

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6.7.3 Where excavations are proposed close to site boundaries and there is the possibility of weak/unstable ground passing across that boundary and beneath adjacent structures, a risk assessment of the integrity/stability should be undertaken prior to such works being carried out. Designed and engineered temporary/permanent measures should be adopted to ensure their continued stability where necessary.

## **6.8 Excavations**

6.8.1 Localised obstructions to excavations or shallow hard rock are not anticipated given the geology and lack of previous development.

6.8.2 No man entry into unsupported excavations should be allowed without an appropriate risk assessment. Reference to CIRIA report 97 (1983) should be made to establish suitable means of support or battering of excavation sides.

## **6.9 Sulphate attack and aggressive ground conditions**

6.9.1 An assessment of the data was carried out in accordance with Section C4 'Site Investigation for Aggressive Ground Conditions' and the procedure prescribed in Section C5 'Classification of Site Locations for Chemicals Aggressive to Concrete' of BRE SD1 (2005) to assess whether ground conditions at the site are potentially aggressive to buried concrete products.

6.9.2 The results of the assessment indicate that a Design Sulphate classification of DS-1 may be adopted along with an ACEC class of AC-1. However, it is recommended that where made ground is retained in contact with buried structures DS2 sulphate precautions should be adopted in foundation construction.

6.9.3 Static groundwater conditions have been assumed in this assessment.

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## 7 ENVIRONMENTAL ASSESSMENT

### 7.1 Guidance for Analytical Results - Assessment Criteria

#### *Soil*

- 7.1.1 With reference to the proposed end use of the site, the results of the chemical testing were assessed as part of an environmental risk assessment against a number of potential receptors, considering risks to human health, environmental quality and the built environment. Such risk assessment comprises the initial comparison of the measured soil concentrations with Generic Assessment Criteria (GAC), which in this instance are considered protective of a residential end use, with plant uptake.
- 7.1.2 In line with current best practice in the UK, initial screening of contaminant concentrations is carried out against appropriate published generic assessment criteria. Currently the authoritative generic assessment criteria are considered to be DEFRA's SGVs, DEFRA's Category 4 Screening Levels (2014) and the LQM/CIEH Suitable 4 Use Levels (2015). The assessment criteria have been derived on the basis of currently widely accepted assumptions relating to the modelling of human exposure to soil contaminants for the standard land uses: residential (with and without home-grown produce), allotments, commercial and public open spaces (close to residential properties and parks).
- 7.1.3 The general consensus between contaminated land practitioners is that the C4SL values, which are based on the low level of toxicological concern (LLTC), are less cautious than the GAC values published by LQM/CIEH and may not, therefore, be wholly applicable for use outside the context of Part 2A Statutory Guidance. Although both publications in no way undermine the validity of existing Environment Agency guidance presented in, for example, SR2, SR3 and the existing CLEA software, we are of the mind that the LQM/CIEH S4UL values, which are based on Health Criteria that represents minimal or tolerable levels of risks to health (as described in the Environment Agency's SR2 guidance) but incorporates the current exposure assumptions presented in DEFRA's C4SL guidance, provide a better starting point from which to generate determine assessment criteria that can be applied to brownfield development sites and are 'suitable for use' under the planning system.
- 7.1.4 It should be noted that all approaches are based on sandy loam soil with 6% soil organic matter (SOM). Whilst this does not affect metal contaminants, as they are not dependent on soil type or SOM, the algorithms used to model plant uptake and

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volatilisation for organic contaminants do take account of SOM content in the soil. The GAC values for metals in the standard land uses may therefore be directly applied, whether these are SGVs, C4SL or S4UL derived, whilst independent GAC values for organics (e.g. PAH, TPH) have been generated using CLEA Version 1.071 and the toxicological updates presented in the aforementioned documents. These have also been adjusted for soil type and are calculated for SOM contents at 1%, 2.5% and 6% for a sandy soil.

#### *Soil Leachate and Groundwater*

- 7.1.5 Where the desk study and fieldwork do not reveal a potential source of contamination or sensitive receptor no leachate or groundwater testing is usually performed. Where a potential source and a sensitive receptor within influencing distance has been identified the testing will comprise leachate testing on the material considered most likely to pose a risk. Groundwater testing is usually undertaken if water is present at shallow depth.
- 7.1.6 For the assessment of test results, the Groundwater Threshold Values or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate or groundwater test results. These are presented in full in The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. When the most sensitive receptor is considered to be the aquifer (i.e. groundwater) the Groundwater Threshold Values will be adopted as the Tier 1 screening values, whilst where the receptor is a surface water feature (e.g. stream, drain or river) the EQS values will be used to define the Tier I Screening values.
- 7.1.7 A summary of the generic assessment criteria values is presented in Appendix D.

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## 7.2 Human Health Receptors

7.2.1 In order to assess the significance of the recorded concentrations of potential contaminants of concern in relation to human health laboratory analysis was compared with the adopted generic assessment criteria.

### *Metals, Metalloids and Other Inorganic Analytes*

7.2.2 A total of eleven soil samples were analysed. Assessment of the soils data indicates that there are four areas of made ground where elevated chromium is present within made ground which exceeds relevant GAC criteria.

7.2.3 There is considered to be a potential risk to human health in a residential site end use scenario with plant uptake, with respect to metals, metalloids and non-metal inorganics.

### *Organics (PAH and MTBE)*

7.2.4 A total of eleven soil samples were analysed for PAH contaminants.

7.2.5 Four of the samples analysed for PAH returned concentrations above relevant GAC's.

7.2.6 There is considered to be a potential risk to human health in a residential site end use scenario with plant uptake, with respect to organic contaminants (PAHs in the made ground material).

### *Asbestos*

7.2.7 A total of eleven soil samples were analysed. No asbestos fibres were detected in the samples tested.

7.2.8 There is considered to be no significant risk associated with asbestos containing materials within soils at the site.

### *Pesticides*

7.2.9 A total of two soil samples were analysed. No pesticides were detected in the samples tested.

7.2.10 There is considered to be no significant risk associated with pesticides within soils at the site.

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## *Topsoil*

7.2.11 Environmental analysis has been completed on three samples of topsoil. Concentrations of all potential contaminants of concern were below the adopted GAC value for a residential site end-use, with plant uptake. The existing topsoil is considered likely to be suitable for continued use at the site. However, additional testing should be undertaken in accordance with the requirements of YALPAG guidance to confirm suitability.

### **7.3 Controlled Waters Receptors**

7.3.1 No sources of potentially significant contamination have been identified which could present a risk to controlled water receptors.

### **7.4 Ecological Receptors**

7.4.1 There are no known ecological receptors at the site.

### **7.5 Utilities**

7.5.1 It is recommended that the results of the chemical testing and details of the proposed redevelopment of the site are provided to the appropriate utility companies to determine the necessity for service protection.

### **7.6 Potable Water Supplies**

7.6.1 There is considered to be a moderate risk locally to potable water supply pipes where made ground exists due to the elevated concentrations of PAH contaminants. This can be mitigated by upgrading the pipes or removing the made ground. On the basis of available test results, it is likely that protective measures will be required. This is subject to the requirement of the local water supply company and proposed locations of the supply that protective measures will be required where pipes are placed in residual made ground. Consultation should however be undertaken with the local water authority with respect to any precautions they may require, prior to construction.

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## 7.7 Refined Conceptual Site Model

### 7.7.1 Introduction

7.7.1.1 The preliminary CSM given above presented our initial understanding of the site, being based on available geological information, site location, likely contamination status and the overall risk it presented to the identified receptors through various pollution pathways.

7.7.1.2 This section revises the initial CSM in light of the ground investigation findings and chemical analysis results presented above.

7.7.1.3 The revised conceptual site model has been developed for the proposed future residential site end-use, with plant uptake. This summarises our understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors assuming that no remediation has been undertaken at the site.

### 7.7.2 Ground Conditions - Summary

7.7.2.1 Made Ground: There are four areas where made ground was identified, including tarmac hard core and reworked topsoil containing anthropogenic material.

7.7.2.2 A total of four made ground soil samples were analysed for inorganic and organic contaminants. Assessment of the soils data indicates that there are elevated concentrations of potential contaminants of concern that exceed relevant GAC criteria (PAHs and chromium).

7.7.2.3 Natural Strata: The site is underlain by a layer soft clay above a gravel material with a layer of firm clay to the south and east of the site.

7.7.2.4 A total of seven natural soil samples were analysed for inorganic and organic contaminants. Assessment of the soils data indicates that there are no elevated concentrations of potential contaminants of concern that exceed relevant GAC criteria.

7.7.2.5 A total of eleven soil samples were analysed for asbestos. No asbestos fibres were detected in the samples tested.

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7.7.2.6 A total of two soil samples were analysed for pesticides. No pesticides were detected in the samples tested.

### 7.7.3 Qualitative Contaminated Land Risk Assessment

7.7.3.1 Current UK legislation on contaminated land is principally contained in Sections 78(A) to (YC) in Part 2A of the Environmental Protection Act 1990, which was retrospectively inserted by Section 57 of the Environment Act 1995. The Contaminated Land Regulations 2000 were amended in 2005. The Environmental Protection Act 1990: Part 2A Contaminated Land, Statutory Guidance, Edition 2, 2006, promulgates the revised statutory guidance with respect to the operation of the Contaminated Land Regime following the implementation of the Contaminated Land Regulations, 2005.

7.7.3.2 The definition of contaminated land is central to the operation of Part 2A. Legislation adopts the principle of a 'suitable for use' approach for the assessment of contaminated land, the rationale reflected in the site-specific risk assessment and determination of remedial strategy. Action is only required if unacceptable risks are posed to human health or to the environment, taking into account the current land use and geo-environmental setting.

7.7.3.3 The legislation places a responsibility on the Local Authority to determine whether the land under its jurisdiction is contaminated by consideration of whether:

- Significant harm is being caused;
- There is a significant possibility of significant harm being caused;
- Significant pollution of controlled waters is being caused or is likely to be caused.

### 7.7.4 Assessment Framework

7.7.4.1 The statutory guidance describes a risk assessment methodology in terms of 'significant contaminants' and 'contaminant linkages', using 'source-pathway-receptor' scenarios for the site. Contaminant linkages are formed when there is a linkage between a contaminant source and a receptor by means of a pathway. Each element has to be present, or no linkage can be formed.

7.7.4.2 Risk assessment and the procedure of identifying sources, pathways and receptors is recognised as an approach to determine the extent and significance of contamination either within the context of Part 2A (when assessing current site status or when considering the acquisition of an existing development) or the planning process (for

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the redevelopment of an existing site, or when considering the acquisition of a site for redevelopment purposes). Either way, the 'suitable for use' approach is adopted when assessing risk and the source-pathway-receptor assessment defines the conceptual model for the site.

7.7.4.3 Within the context of this report therefore, the revised risk assessment has been undertaken on the basis that the 'suitable for use' approach remains aligned with the site being redeveloped for the end use given above.

## **7.8 Summary of Identified Contaminant Linkages**

7.8.1.1 On the basis of the ground investigation and laboratory test results, on-site soils have been found to contain elevated concentrations of inorganic and/or organic contaminants in excess of the adopted GACs.

7.8.1.2 There is considered to be a potential risk to human health, the development or the wider environment, with respect to the identified levels of contaminants within localised on-site soils (made ground).

7.8.1.3 A summary of the revised risk assessment is given in Table 7.1.

**Table 7.1 - Summary of Revised Conceptual Site Model & Risk Assessment**

Potential Source	Potential Receptor	Plausible Pathway	Initial Risk Rating	Probability	Severity	Revised Risk Rating	Solution
Localised potentially contaminated made ground, near surface natural strata / perched groundwater	<u>Human Health</u> Site end-users, inc. maintenance and site workers (short term risk during construction)	Direct ingestion or dermal contact with soil, dust and/or vapour inhalation	<b>Moderate/Low</b>	Likely	Medium	<b>Moderate</b>	Localised risk anticipated due to elevated concentrations of inorganic and/or organic contaminants in excess of the adopted GACs.
		Direct ingestion and/or dermal contact with liquid contaminants	<b>Very Low</b>	Unlikely	Mild	<b>Very Low</b>	No risk anticipated
		Inhalation of Asbestos fibres	<b>Moderate/Low</b>	Unlikely	Severe	<b>Moderate / Low</b>	No risk anticipated <b>Risk rating cannot be downgraded due to severity</b>
	<u>Construction (Potable Water Supply Pipes)</u>	Direct contact/leaching (tainting)	<b>Low</b>	Likely	Medium	<b>Moderate</b>	Localised risk anticipated due to elevated concentrations of inorganic and/or organic contaminants in excess of the adopted GACs
	<u>Construction (Foundations)</u>	Direct contact/leaching	<b>Low</b>	Unlikely	Mild	<b>Very Low</b>	No risk anticipated. Appropriate concrete specification
	Controlled Waters	Surface run-off / lateral migration	<b>Very Low</b>	Unlikely	Mild	<b>Very Low</b>	No risk anticipated

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## **8 CONCLUSIONS AND RECOMMENDATIONS**

### **8.1 General**

8.1.1 This geo-environmental appraisal has been carried out in relation to the redevelopment of land off the A628 near Nether Mill, Penistone.

8.1.2 It has been assumed in the production of this report that the site is to be redeveloped for a residential site end use, with plant uptake.

### **8.2 Soil Contamination - Risk Evaluation**

8.2.1 The revised Conceptual Site Model confirms that there are potential contaminant linkages exist at the site in relation to existing on-site soils.

8.2.2 There is considered to be potential risk to sensitive receptors (end site users) from soil contamination locally at the site.

8.2.3 Potential risk to construction worker is considered to be low to moderate.

8.2.4 Contaminant levels are not considered unlikely to be potentially mobile and no significant sources of liquid contaminants have been identified. Controlled water receptors are not considered to be at risk from soil contamination at the site.

### **8.3 Hazardous Ground Gases**

8.3.1 No significant potential sources of ground gases have been identified within influencing distance of the site. No ground gas monitoring was warranted and no protection measures will be required in proposed development.

8.3.2 No radon protection measures will be required.

### **8.4 Outline Remediation Requirements**

8.4.1 On the basis of available information, it is considered that remediation will be required locally at the site due to the elevated contaminants in the made ground material. Made ground should not be retained within 600mm of final ground level. Where residual made ground remains, a clean soil cover system 600mm thick should be provided to garden areas including a minimum of 100mm of topsoil. Where no made ground exists or necessary reductions in site levels to achieve development levels is carried out

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which removes the made ground, no remedial measures will be necessary and garden areas should have final levels reinstated with provided subsoil and topsoil. Should site won material is likely to be available.

8.4.2 Confirmation of the chemical condition of any materials brought to site should be confirmed prior to importation.

## **8.5 Disposal of Soils**

8.5.1 Should brightly coloured or odorous soil be encountered during the proposed construction works, Alan Wood and Partners should be notified immediately. An experienced geo-environmental engineer will visit site for further sampling, analysis and risk assessment, where required.

8.5.2 Any materials removed from site should be undertaken in accordance with the Duty of Care Regulations 1991 and the Hazardous Waste Regulations 2005. There will also be a requirement to classify the waste in accordance with the European Waste Catalogue. The waste should also be subject to Waste Acceptance Criteria (WAC) testing.

## **8.6 Further Work**

8.6.1 Additional sampling and analysis of existing topsoil on site to confirm its suitability for re-use within garden areas to the proposed development in accordance with local authority requirements.

8.6.2 Assessment of the influence of trees in relation to foundations and floor slabs where clays are present at founding depth.

8.6.3 Additional site investigation, windowless sampler boreholes or cable percussive boreholes to confirm the base of the soft clay on the northern edge of the site and through the made ground towards the centre of the site to confirm the depth to competent strata and resolve foundation recommendations in this area;

8.6.4 CBR testing when final development levels are known.

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## 9 REGULATORY APPROVAL

- 9.1.1 The conclusions and recommendations presented in this report are considered reasonable on the basis of available information and the assessment of the site as carried out by Alan Wood and Partners.
- 9.1.2 It should be noted however that the works undertaken cannot be guaranteed to gain approval by the Regulatory Authorities and your Warranty Provider, so copies of this report should be made available to the relevant organisations (as appropriate) for their comment and approval, prior to undertaking any irrecoverable works associated with the site.

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## 10 INFORMATION SOURCES

In addition to the specific references cited in the text, the following references have been referred to in the production of this report, where relevant to the defined project objectives.

- 1 BRE BR211 (2007) *Radon: guidance on protective measures for new dwellings*;
- 2 BRE GBG 75 (2009), '*Radon Protection For New Large Buildings*';
- 3 BS5930 (1999), *Code of practice for site investigations*;
- 4 BS:8576 (2013), *Guidance on Investigations for Ground Gas - Permanent Gases and Volatile Organic Compounds (VOCs)*;
- 5 BSEN 1997-1 (2004), *Geotechnical Design Part 1 – General Rules*;
- 6 BSEN 1997-2 (2007), *Geotechnical Design Part 2 – Ground investigation and testing*;
- 7 Chartered Institute of Environmental Health (CIEH): *Professional Practice Note: Reviewing human health risk assessment reports invoking contaminant oral bioavailability measurements or estimates* (2009);
- 8 CIRIA C552 (2001), *Contaminated Land Risk Assessment, A Guide to Good Practice*;
- 9 CIRIA C665 (2007), *Assessing risks posed by hazardous ground gases to buildings*;
- 10 CL:AIRE / EIC / AGS: *Soil Generic Assessment Criteria for Human Health Risk Assessment* (updated January 2010 version);
- 11 Coal Authority, [www.coal.decc.gov.uk](http://www.coal.decc.gov.uk);
- 12 DEFRA SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Policy Companion Document*, December 2014;
- 13 DETR Circular 02/2000 (2000). *Environmental Protection Act 1990 Part 2A. Contaminated Land*. Department of the Environment, Transport and the Regions, Circular 02/2000, Dated 20<sup>th</sup> March 2000;
- 14 Land Contamination Risk Management Guidance – Environment Agency. Gov.uk website 2022;
- 15 NHBC Chapter 4.2 (2022), *Building near trees*, NHBC Publication, 2022;
- 16 Environment Agency, [www.environment-agency.org.uk](http://www.environment-agency.org.uk);
- 17 Environment Agency (2009). *Human Health Toxicological Assessment of Contaminants in Soil*, Science Report SC050021/SR2;
- 18 Environment Agency (2009). *Updated Technical Background to the CLEA Model*, Science Report SC050021/SR3;
- 19 Land Quality Management / CIEH: *The LQM/CIEH S4UL's for Human Health Risk Assessment*, Land Quality Press, Nottingham, 2015. Publication Number S4UL3286;

## FIGURES

# Land off Watermill Gardens, Penistone, South Yorkshire



### Electric car charging Point.

Mode 3 electric vehicle charging point with a type 2 outlet socket.

- External wall of dwelling or garage.

- Bollard.

### Enclosures

1.8m high masonry wall.

1.8m board fence.

1.2m post & rail fence.

1.2m estate railings.

### External Materials.

Facing material - Artificial Stone.

Facing material - Render.

Roof tile - Natural Slate.

### Soft Landscaping

Proposed tree planting.

Proposed hedging.

Proposed shrub planting.

Mown Grass.

For detailed landscape design refer to Landscape Architects drawings and specification.

# Proposed Site Layout



### Schedule of Accommodation

#### House Types

H4	2 b 2 St	781	04	03,124
Newton	3 B 2 St	1006	05	05,030
Farnham	4 B 2 St	1191	03	03,573
Chatsworth	4 B 2 St	1554	01	01,554
Brompton	3 B 2 St	1665	02	03,330
Kirby	6 B 2 St	2758	02	05,516

**Site Total** 17 22,127

Gross Site Area = 0.74 Ha (1.82 Acres)  
 Nett Site Area = 0.66 Ha (1.63 Acres)

13,574 SqFt Per Acre

25.75 DPH

Rev	By	Note	Date

Status	Planning



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 E:mail@pra-architecture.com W: www.pra-architecture.com

PROJECT Land off Watermill Gardens, Penistone, S Yorkshire

TITLE Proposed Site Layout

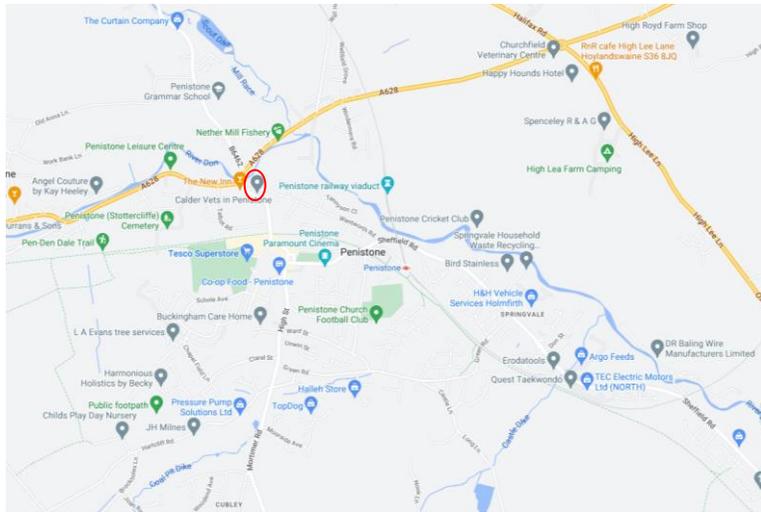
CLIENT Mulgrave Developments Ltd

DATE 26.07.23 SCALE 1:500@A2

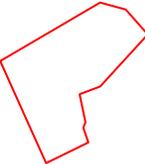
DRAWING 1286.04 REVISION 0

DRAWN JD CHECKED JD

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### Key

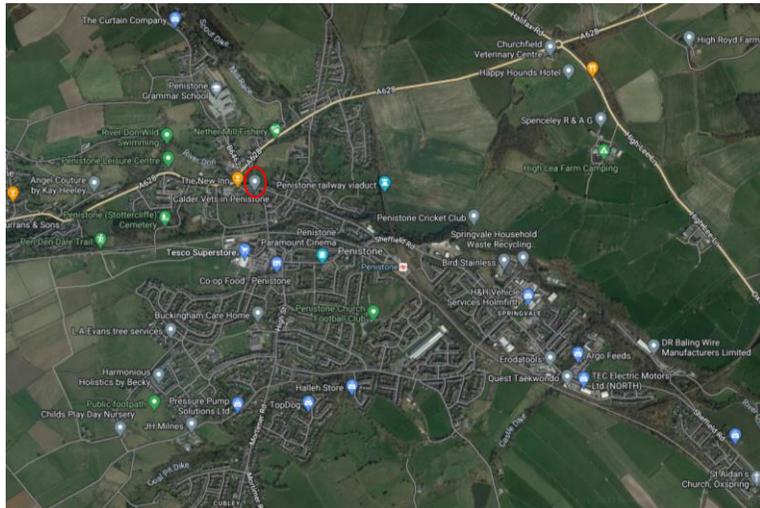
 Site Location  
 Approximate Red Line Boundary

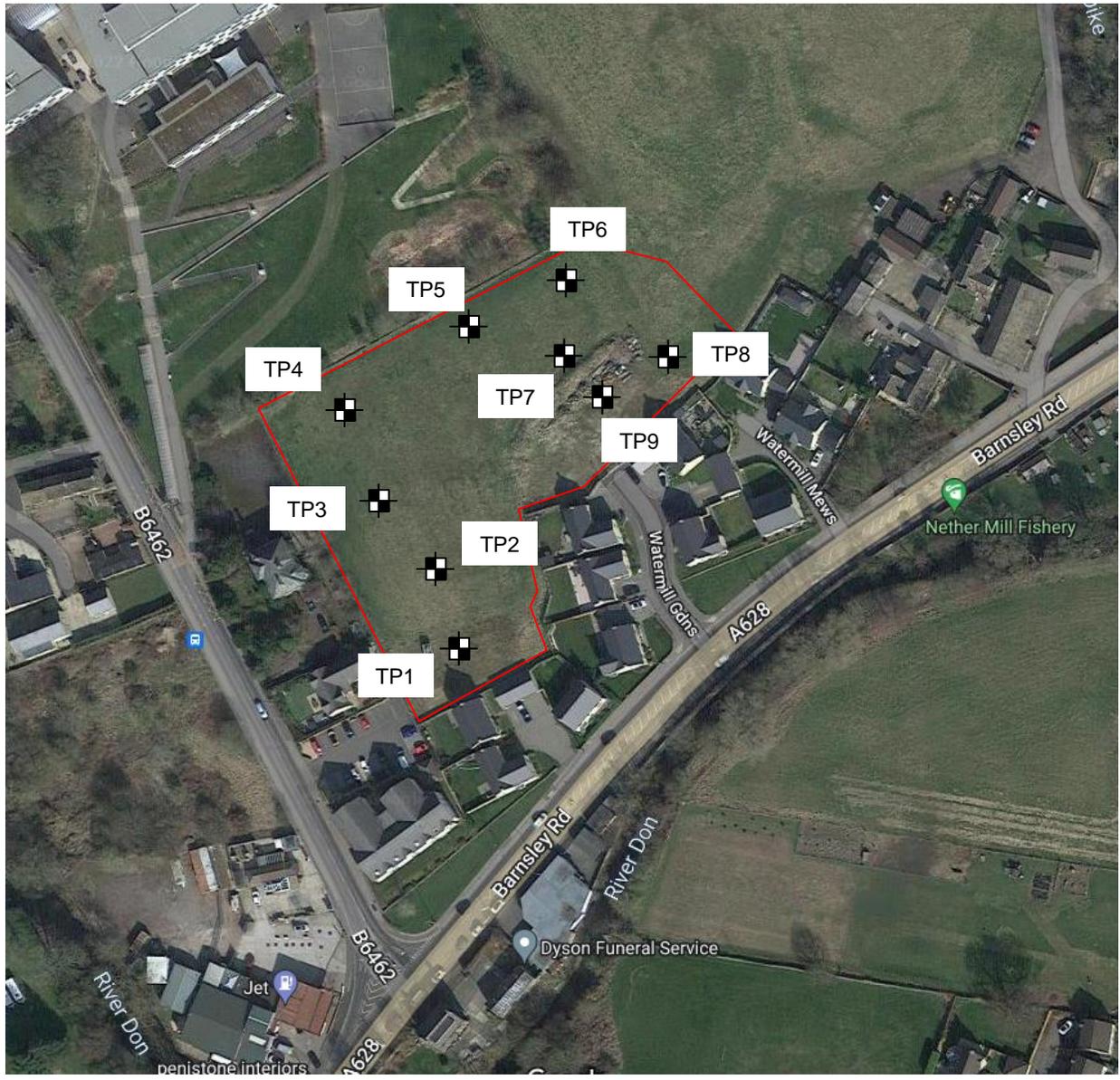
DO NOT SCALE

Alan Wood & Partners

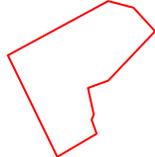


Client. <b>Mulgrave Property Group Ltd</b>		
Project. <b>Nether Mill, Penistone</b>		
Drawing. <b>Site Location Plan</b>		
Date. <b>31.10.22</b>	Scale. <b>NTS</b>	
Drawn by. <b>SW</b>	Check by. <b>SLR</b>	Approved by. <b>SLR</b>
Status: <b>INFO</b>		
Job no. <b>47495</b>	Fig. no. <b>001</b>	Rev.



Key

 Approximate Trial Pit Locations

 Approximate Red Line Boundary



DO NOT SCALE



Client. <b>Mulgrave Property Group Ltd</b>		
Project. <b>Nether Mill, Penistone</b>		
Drawing. <b>Exploratory Hole Location Plan</b>		
Date. <b>02.11.22</b>	Scale. <b>NTS</b>	
Drawn by. <b>SW</b>	Check by. <b>SLR</b>	Approved by. <b>SLR</b>
Status: <b>INFO</b>		
Job no. <b>47495</b>	Fig. no. <b>002</b>	Rev.

## APPENDIX A

### GROUND INVESTIGATION LOGS



Alan Wood & Partners

# Trial Pit Log

Trialpit No

**TP1**

Sheet 1 of 1

Project Name: Nether Mill, Penistone

Project No. 47495

Co-ords: 424404.83 - 403804.05  
Level: 196.34

Date 10/11/2022

Location: Penistone

Dimensions (m):

Scale 1:25

Client: Mulgrave Property Group Ltd

Depth 2.60

Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.25	D		0.10	196.24		MADE GROUND: Tarmac hardcore
				0.40	195.94		MADE GROUND: Dark pinkish grey silty, gravelly SAND. Gravel of fine and medium, subrounded and rounded sandstone and angular coarse brick.
				1.10	195.24		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				2.50	193.84		Wet dark blackish grey silty, sandy GRAVEL. Gravel of fine to coarse, subrounded and rounded siltstone, sandstone and mudstone with infrequent cobbles. Cobbles of rounded sandstone.
				2.60	193.74		
						Firm greyish brown silty, sandy CLAY	

End of pit at 2.60 m

Remarks: Groundwater encountered at 1.9m

Stability: Stable in clay, slightly unstable in gravel





# Trial Pit Log

Trialpit No  
**TP2**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone

Project No.  
47495

Co-ords: 424392.81 - 403817.44  
Level: 196.44

Date  
10/11/2022

Location: Penistone

Dimensions (m):  
Depth 2.50



Scale  
1:25  
Logged  
SW

Client: Mulgrave Property Group Ltd

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.10	D		0.30	196.14		TOPSOIL: Dark brown silty CLAY with frequent rootlets.
	0.40	D					1.10
	0.50	D		2.50	193.94	Dark brown silty, sandy GRAVEL. Gravel of fine to coarse, subrounded and rounded sandstone and fine to coarse, subrounded and rounded siltstone with infrequent cobbles and boulders. Cobbles and boulders of rounded sandstone.	
						End of pit at 2.50 m	



Remarks: Groundwater encountered at 1.6m

Stability: Stable in clay, slightly unstable in gravel





# Trial Pit Log

Trialpit No  
**TP3**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone      Project No. 47495      Co-ords: 424372.12 - 403841.38      Date 10/11/2022  
Level: 196.80

Location: Penistone      Dimensions (m):       Scale 1:25  
Client: Mulgrave Property Group Ltd      Depth 2.40      Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.20	D		0.40	196.40		TOPSOIL: Dark brown silty CLAY with frequent rootlets.
				1.30	195.50		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				2.40	194.40		Wet dark grey silty, sandy GRAVEL. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone with infrequent cobbles. Cobbles of rounded sandstone.
							----- End of pit at 2.40 m -----

Remarks: Groundwater encountered at 1.6m

Stability: Stable in clay, slightly unstable in gravel





# Trial Pit Log

Trialpit No  
**TP4**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone      Project No. 47495      Co-ords: 424374.69 - 403874.04      Date 10/11/2022  
Level: 199.22

Location: Penistone      Dimensions (m):       Scale 1:25  
Client: Mulgrave Property Group Ltd      Depth 2.60      Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	D		0.20	199.02		TOPSOIL: Dark brown silty CLAY with frequent rootlets.
				1.00	198.22		Soft dark grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine and medium, subrounded and rounded sandstone and siltstone.
				2.60	196.62		Soft light grey silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone with infrequent cobbles. Cobbles of rounded sandstone.
							End of pit at 2.60 m

Remarks: No groundwater encountered

Stability: Stable





# Trial Pit Log

Trialpit No  
**TP5**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone

Project No.  
47495

Co-ords: 424403.18 - 403890.13  
Level: 199.50

Date  
15/11/2022

Location: Penistone

Dimensions (m):

Scale  
1:25

Client: Mulgrave Property Group Ltd

Depth  
2.70

Logged  
SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	D		0.35	199.15		TOPSOIL: Dark brown silty CLAY with frequent rootlets.
	1.10	D		1.20	198.30		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				2.70	196.80		Dark grey silty, sandy GRAVEL. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone with infrequent cobbles. Cobbles of rounded sandstone.
							End of pit at 2.70 m

Remarks: No groundwater encountered

Stability: Stable in clay, slightly unstable in gravel





# Trial Pit Log

Trialpit No  
**TP6**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone      Project No. 47495      Co-ords: 424431.33 - 403907.27      Date 15/11/2022  
Level: 199.27

Location: Penistone      Dimensions (m):       Scale 1:25  
Client: Mulgrave Property Group Ltd      Depth 3.00      Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	198.97		TOPSOIL: Dark brown silty CLAY with frequent rootlets.
	0.60	D		1.80	197.47		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				3.00	196.27		Dark grey silty, sandy GRAVEL. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
							----- End of pit at 3.00 m

Remarks: No groundwater encountered

Stability: Stable in clay, slightly unstable in gravel





# Trial Pit Log

Trialpit No  
**TP7**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone	Project No. 47495	Co-ords: 424429.58 - 403879.38 Level: 198.12	Date 15/11/2022
Location: Penistone		Dimensions (m): Depth 2.80	Scale 1:25
Client: Mulgrave Property Group Ltd			Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40	D		0.25	197.87		TOPSOIL: Dark brown silty CLAY with frequent rootlets.
				0.60	197.52		Soft light grey silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				2.00	196.12		Firm dark grey silty CLAY.
				2.60	195.52		Dark grey silty, sandy GRAVEL. Gravel of fine to coarse, subrounded and rounded sandstone, siltstone and infrequent chalk with infrequent cobbles. Cobbles of rounded sandstone.
				2.80	195.32		End of pit at 2.80 m

Remarks: No groundwater encountered

Stability: Stable in clay, slightly unstable in gravel





# Trial Pit Log

Trialpit No  
**TP8**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone      Project No. 47495      Co-ords: 424462.06 - 403881.50      Date 15/11/2022  
Level: 197.54

Location: Penistone      Dimensions (m):       Scale 1:25  
Client: Mulgrave Property Group Ltd      Depth 3.10      Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40	D		0.30	197.24		MADE GROUND: Dark brown silty CLAY with frequent rootlets (TOPSOIL).
				1.00	196.54		MADE GROUND: Light orange sandy GRAVEL. Gravel of fine to coarse, subrounded to angular concrete, brick, tar and sandstone with infrequent cobbles. Cobbles of subrounded sandstone.
	1.20	D		1.10	196.44		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine and medium, subrounded and rounded sandstone and siltstone.
				1.30	196.24		Firm dark greenish grey silty, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
							Dark grey silty, sandy GRAVEL. Gravel of fine to coarse, subrounded to rounded sandstone and siltstone with infrequent cobbles. Cobbles of rounded sandstone.
				3.10	194.44		End of pit at 3.10 m

Remarks: No groundwater encountered

Stability: Stable in clay, slightly unstable in gravel



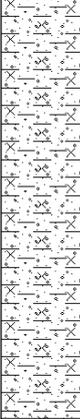
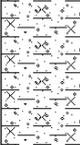


# Trial Pit Log

Trialpit No  
**TP9**  
Sheet 1 of 1

Project Name: Nether Mill, Penistone      Project No. 47495      Co-ords: 424444.14 - 403869.51      Date 15/11/2022  
Level: 197.52

Location: Penistone      Dimensions (m):       Scale 1:25  
Client: Mulgrave Property Group Ltd      Depth 2.60      Logged SW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	D					MADE GROUND: Dark brown silty CLAY (topsoil) with abundant anthropogenic fragments to include brick, plastic, woven bags, UPVC, tiles, concrete and sandstone (potential reworked topsoil).
				0.50	197.02		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				1.90	195.62		Firm dark blackish grey silty CLAY.
				2.10	195.42		Soft light grey mottled orange silty, sandy, gravelly CLAY. Gravel of fine to coarse, subrounded and rounded sandstone and siltstone.
				2.60	194.92		End of pit at 2.60 m



Remarks: No groundwater encountered

Stability: Stable



## APPENDIX B

### LABORATORY TEST RESULTS: GEOTECHNICAL



# LABORATORY REPORT



4043

**Contract Number: PSL22/7321**

Report Date: 21 November 2022

Client's Reference: 47495

Client Name: Alan Wood & Partners  
Hallamshire House  
Meadow Court  
Hayland Street  
Sheffield  
S9 1BY

**For the attention of: Sophie Williams**

Contract Title: Nether Mill, Penistone

Date Received: 14/11/2022

Date Commenced: 14/11/2022

Date Completed: 21/11/2022

**Notes: Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins  
(Director)

R Berriman  
(Quality Manager)

S Royle  
(Laboratory Manager)

L Knight  
(Assistant Laboratory Manager)

S Eyre  
(Senior Technician)

T Watkins  
(Senior Technician)

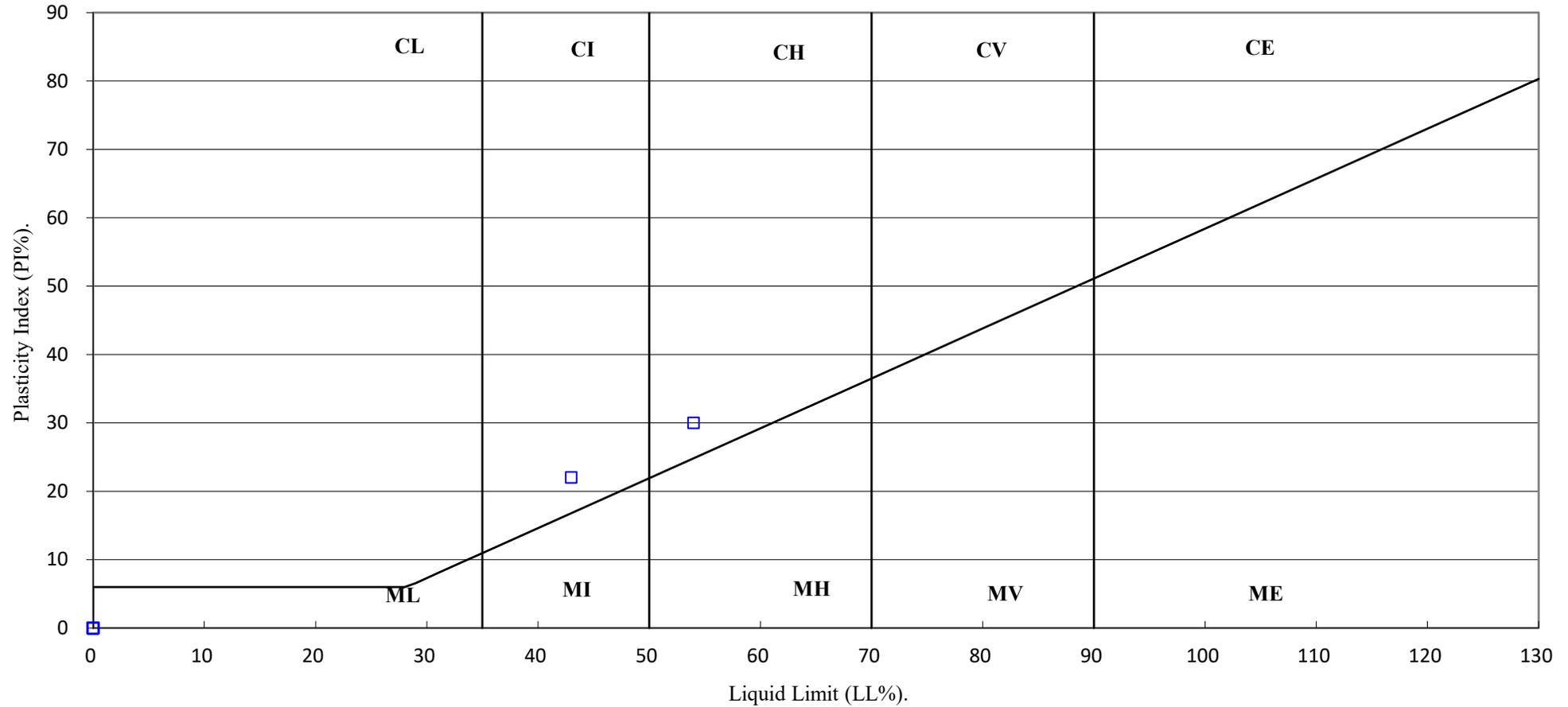
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Page 1 of





# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

# PSL

Professional Soils Laboratory

Nether Mill, Penistone

Contract No:

PSL22/7321

Client Ref:

S5060/47495



# LABORATORY REPORT



4043

**Contract Number: PSL22/8025**

Report Date: 10 January 2023  
Client's Reference: 47495  
Client Name: Alan Wood & Partners  
Hallamshire House  
Meadow Court  
Hayland Street  
Sheffield  
S9 1BY

**For the attention of: Sophie Williams**

Contract Title: Nether Mill, Penistone

Date Received: 16/11/2022  
Date Commenced: 16/12/2022  
Date Completed: 10/1/2023

**Notes: Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins  
(Director)

R Berriman  
(Quality Manager)

S Royle  
(Laboratory Manager)

L Knight  
(Assistant Laboratory Manager)

  
S Eyre  
(Senior Technician)

T Watkins  
(Senior Technician)

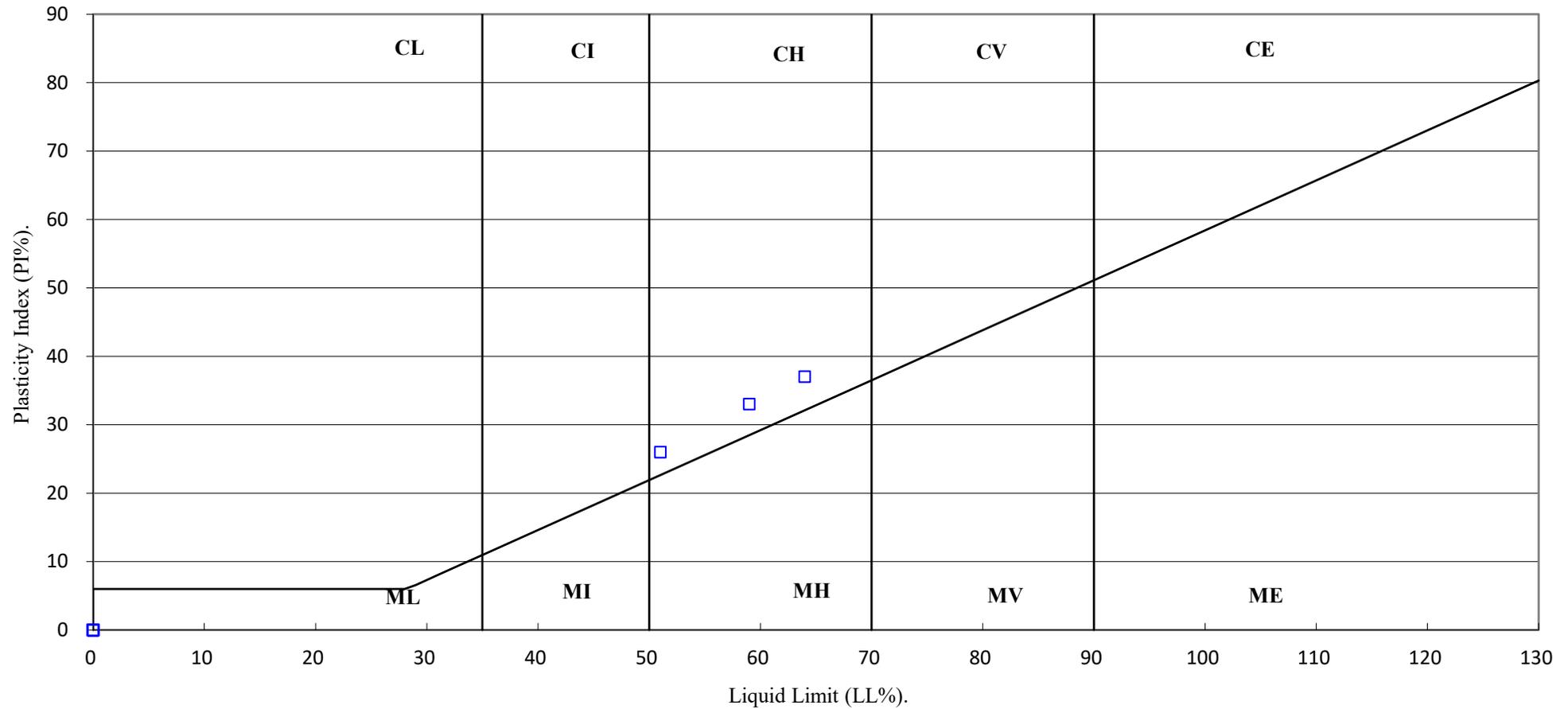
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Page 1 of





# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

# PSL

Professional Soils Laboratory

Nether Mill, Penistone

Contract No:

PSL22/8025

Client Ref:

47495

## APPENDIX C

### LABORATORY TEST RESULTS: CHEMICAL



## ANALYTICAL TEST REPORT

**Contract no:** 115715(1)

**Contract name:** Nether Mill, Penistone

**Client reference:** 47495

**Clients name:** Alan Wood & Partners

**Clients address:** Hallamshire House  
Hayland Street  
Sheffield  
S9 1BY

**Samples received:** 14 November 2022

**Analysis started:** 14 November 2022

**Analysis completed:** 29 November 2022

**Report issued:** 29 November 2022

This is a supplementary report to report number 115715 issued 21 November 2022.

**Key**

- U UKAS accredited test
- M MCERTS & UKAS accredited test
- \$ Test carried out by an approved subcontractor
- I/S Insufficient sample to carry out test
- N/S Sample not suitable for testing
- NAD No Asbestos Detected

**Approved by:**

Abbie Neasham-Bourn  
Senior Reporting Administrator

# Chemtech Environmental Limited

## SAMPLE INFORMATION

### MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
115715-1	TP1 D1	0.25	Sandy Clayey Loam with Gravel	-	-	12.7
115715-2	TP2 D1	0.10	Sandy Loamy Clay with Roots	-	-	21.8
115715-3	TP3 D1	0.20	Sandy Loamy Clay with Roots	-	-	20.0
115715-4	TP4 D1	0.50	Sandy Loamy Clay with Roots	-	-	20.5

# Chemtech Environmental Limited

## SOILS

Lab number			115715-1	115715-2	115715-3	115715-4
Sample id			TP1 D1	TP2 D1	TP3 D1	TP4 D1
Depth (m)			0.25	0.10	0.20	0.50
Date sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022
Test	Method	Units				
Arsenic (total)	CE127 <sup>M</sup>	mg/kg As	13	17	14	15
Boron (water soluble)	CE063 <sup>U</sup>	mg/kg B	1.7	0.6	0.7	0.7
Cadmium (total)	CE127 <sup>M</sup>	mg/kg Cd	<0.2	0.3	0.3	0.2
Chromium (total)	CE127 <sup>M</sup>	mg/kg Cr	41	40	37	37
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1
Copper (total)	CE127 <sup>M</sup>	mg/kg Cu	40	28	23	25
Lead (total)	CE127 <sup>M</sup>	mg/kg Pb	29	51	78	59
Mercury (total)	CE127 <sup>M</sup>	mg/kg Hg	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 <sup>M</sup>	mg/kg Ni	34	20	15	21
Selenium (total)	CE127 <sup>M</sup>	mg/kg Se	1.3	1.2	1.0	1.2
Zinc (total)	CE127 <sup>M</sup>	mg/kg Zn	52	82	83	81
pH	CE004 <sup>M</sup>	units	8.9	7.0	6.1	6.8
Sulphate (2:1 water soluble)	CE061 <sup>U</sup>	mg/l SO <sub>4</sub>	343	98	30	22
Sulphate (acid extractable)	CE062 <sup>M</sup>	mg/kg SO <sub>4</sub>	1587	942	843	506
Sulphide	CE016	mg/kg S <sup>2-</sup>	129	47	27	27
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1
Thiocyanate	CE145 <sup>M</sup>	mg/kg SCN	<1	<1	<1	1.2
Phenols (total)	CE078	mg/kg PhOH	1.0	1.3	0.9	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	2.1	3.1	4.1	2.7
Estimate of OMC (calculated from TOC)	CE197	% w/w	3.6	5.3	7.0	4.6
<b>PAH</b>						
Naphthalene	CE087 <sup>M</sup>	mg/kg	0.28	<0.02	0.03	<0.02
Acenaphthylene	CE087 <sup>M</sup>	mg/kg	0.29	<0.02	<0.02	<0.02
Acenaphthene	CE087 <sup>M</sup>	mg/kg	1.45	<0.02	<0.02	<0.02
Fluorene	CE087 <sup>U</sup>	mg/kg	1.33	<0.02	<0.02	<0.02
Phenanthrene	CE087 <sup>M</sup>	mg/kg	14.44	0.10	0.18	0.06
Anthracene	CE087 <sup>U</sup>	mg/kg	5.70	<0.02	0.04	0.03
Fluoranthene	CE087 <sup>M</sup>	mg/kg	29.80	0.31	0.48	0.16
Pyrene	CE087 <sup>M</sup>	mg/kg	22.75	0.26	0.39	0.13
Benzo(a)anthracene	CE087 <sup>U</sup>	mg/kg	12.58	0.16	0.27	0.11
Chrysene	CE087 <sup>M</sup>	mg/kg	12.32	0.17	0.28	0.10
Benzo(b)fluoranthene	CE087 <sup>M</sup>	mg/kg	17.26	0.21	0.34	0.10
Benzo(k)fluoranthene	CE087 <sup>M</sup>	mg/kg	6.32	0.07	0.13	<0.03
Benzo(a)pyrene	CE087 <sup>U</sup>	mg/kg	14.07	0.15	0.23	0.07
Indeno(123cd)pyrene	CE087 <sup>M</sup>	mg/kg	12.09	0.10	0.17	0.02
Dibenz(ah)anthracene	CE087 <sup>M</sup>	mg/kg	1.91	<0.02	0.03	<0.02
Benzo(ghi)perylene	CE087 <sup>M</sup>	mg/kg	9.76	0.08	0.12	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	162	1.60	2.68	0.77
<b>Subcontracted analysis</b>						
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD
<b>Organochlorine Pesticides</b>						
aldrin	\$	mg/kg	-	-	< 0.02	-
alpha-endosulfan	\$	mg/kg	-	-	< 0.02	-
beta-endosulfan	\$	mg/kg	-	-	< 0.02	-

# Chemtech Environmental Limited

## SOILS

Lab number			115715-1	115715-2	115715-3	115715-4
Sample id			TP1 D1	TP2 D1	TP3 D1	TP4 D1
Depth (m)			0.25	0.10	0.20	0.50
Date sampled			10/11/2022	10/11/2022	10/11/2022	10/11/2022
Test	Method	Units				
cis-chlordane (alpha-chlordane)	\$	mg/kg	-	-	< 0.02	-
1,1-dichloro-2-(2-chlorophenyl)-2-(4-chloro	\$	mg/kg	-	-	< 0.02	-
1,1-dichloro-2-(2-chlorophenyl)-2-(4-chloro	\$	mg/kg	-	-	< 0.02	-
1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chl	\$	mg/kg	-	-	< 0.02	-
1,1-dichloro-2,2-bis(4-chlorophenyl)ethane	\$	mg/kg	-	-	< 0.02	-
1,1-dichloro-2,2-bis(4-chlorophenyl)ethene	\$	mg/kg	-	-	< 0.02	-
1,1,1-trichloro-2,2-bis(4-chlorophenyl)etha	\$	mg/kg	-	-	< 0.02	-
dieldrin	\$	mg/kg	-	-	< 0.02	-
endrin	\$	mg/kg	-	-	< 0.02	-
heptachlor	\$	mg/kg	-	-	< 0.02	-
heptachlor epoxide (as cis isomer B)	\$	mg/kg	-	-	< 0.02	-
hexachlorobenzene (HCB)	\$	mg/kg	-	-	< 0.02	-
alpha-hexachlorocyclohexane (a-HCH)	\$	mg/kg	-	-	< 0.02	-
beta-hexachlorocyclohexane (β-HCH)	\$	mg/kg	-	-	< 0.02	-
delta-hexachlorocyclohexane (d-HCH)	\$	mg/kg	-	-	< 0.02	-
epsilon-hexachlorocyclohexane (e-HCH)	\$	mg/kg	-	-	< 0.02	-
gamma-hexachlorocyclohexane (g-HCH, lin	\$	mg/kg	-	-	< 0.02	-
isodrin	\$	mg/kg	-	-	< 0.02	-
p,p'-methoxychlor (methoxychlor)	\$	mg/kg	-	-	< 0.02	-
trans-chlordane (gamma-chlordane)	\$	mg/kg	-	-	< 0.02	-
trifluralin	\$	mg/kg	-	-	< 0.02	-
azinphos-methyl	\$	mg/kg	-	-	< 0.10	-
chlorpyrifos-methyl	\$	mg/kg	-	-	< 0.10	-
cis-chlorfenvinphos (alpha)	\$	mg/kg	-	-	< 0.10	-
diazinon	\$	mg/kg	-	-	< 0.10	-
dichlorvos	\$	mg/kg	-	-	< 0.10	-
dimethoate	\$	mg/kg	-	-	< 1.64	-
fenitrothion	\$	mg/kg	-	-	< 0.10	-
fenthion	\$	mg/kg	-	-	< 0.10	-
malathion	\$	mg/kg	-	-	< 0.10	-
mevinphos (mixture of isomers)	\$	mg/kg	-	-	< 1.64	-
parathion-ethyl	\$	mg/kg	-	-	< 0.10	-
parathion-methyl	\$	mg/kg	-	-	< 0.10	-
phorate	\$	mg/kg	-	-	< 0.10	-
trans-chlorfenvinphos (beta)	\$	mg/kg	-	-	< 0.10	-

# Chemtech Environmental Limited

## METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO <sub>4</sub>
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	M	100	mg/kg SO <sub>4</sub>
CE016	Sulphide	Distillation, Titration	Dry		10	mg/kg S <sup>2-</sup>
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-
\$	aldrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	alpha-endosulfan	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	beta-endosulfan	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	cis-chlordane (alpha-chlordane)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDD)	Solvent extraction, GC-MS	As received		0.02	mg/kg

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## METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
\$	1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethene (o,p'-DDE)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDT)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDD)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1-dichloro-2,2-bis(4-chlorophenyl)ethene (p,p'-DDE)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDT)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	dieldrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	endrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	heptachlor	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	heptachlor epoxide (as cis isomer B)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	hexachlorobenzene (HCB)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	alpha-hexachlorocyclohexane (α-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	beta-hexachlorocyclohexane (β-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	delta-hexachlorocyclohexane (δ-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	epsilon-hexachlorocyclohexane (ε-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	gamma-hexachlorocyclohexane (γ-HCH, lindane)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	isodrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	p,p'-methoxychlor (methoxychlor)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	trans-chlordane (gamma-chlordane)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	trifluralin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	azinphos-methyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	chlorpyrifos-methyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	cis-chlorfenvinphos (alpha)	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	diazinon	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	dichlorvos	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	dimethoate	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	fenitrothion	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	fenthion	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	malathion	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	mevinphos (mixture of isomers)	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	parathion-ethyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	parathion-methyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	phorate	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	trans-chlorfenvinphos (beta)	Solvent extraction, GC-MS	As received		0.1	mg/kg

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## DEVIATING SAMPLE INFORMATION

### Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

### Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
115715-1	TP1 D1	0.25	N	
115715-2	TP2 D1	0.10	N	
115715-3	TP3 D1	0.20	N	
115715-4	TP4 D1	0.50	N	

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## ADDITIONAL INFORMATION

### Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

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

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

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## TEST REPORT REVISIONS

The table below identifies amendments that have been made to this test report for each revision.

Test Report Reference	Details of amendments to test report	Issue Date
115715	Original report issued	21 November 2022
115715(1)	Pesticides added to sample 115715-3	29 November 2022



## ANALYTICAL TEST REPORT

**Contract no:** 115889(1)

**Contract name:** Nether Mill, Penistone

**Client reference:** 47495

**Clients name:** Alan Wood & Partners

**Clients address:** Hallamshire House  
Hayland Street  
Sheffield  
S9 1BY

**Samples received:** 17 November 2022

**Analysis started:** 17 November 2022

**Analysis completed:** 06 December 2022

**Report issued:** 06 December 2022

This is a supplementary report to report number 115889 issued 24 November 2022.

**Key**

- U UKAS accredited test
- M MCERTS & UKAS accredited test
- \$ Test carried out by an approved subcontractor
- I/S Insufficient sample to carry out test
- N/S Sample not suitable for testing
- NAD No Asbestos Detected

**Approved by:**

Abbie Neasham-Bourn  
Senior Reporting Administrator

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## SAMPLE INFORMATION

### MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
115889-1	TP5 D2	0.20	Clayey Loam with Roots	-	-	21.8
115889-2	TP6 D1	0.60	Clayey Loam with Roots	-	-	27.3
115889-3	Mound 1	0.20	Sandy Clay with Gravel	-	-	<0.1
115889-4	TP7 D2	0.40	Sandy Clay with Gravel	-	-	20.0
115889-5	TP8 D1	0.40	Sandy Loam with Gravel	-	-	32.7
115889-6	TP8 D3	1.20	Clay	-	-	40.6
115889-7	TP9 D1	0.20	Sandy Loam with Gravel	-	-	17.9

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## SOILS

Lab number			115889-1	115889-2	115889-3	115889-4	115889-5	115889-6
Sample id			TP5 D2	TP6 D1	Mound 1	TP7 D2	TP8 D1	TP8 D3
Depth (m)			0.20	0.60	0.20	0.40	0.40	1.20
Date sampled			15/11/2022	15/11/2022	15/11/2022	15/11/2022	15/11/2022	15/11/2022
Test	Method	Units						
Arsenic (total)	CE127 <sup>M</sup>	mg/kg As	8.1	16	6.4	6.7	6.4	6.7
Boron (water soluble)	CE063 <sup>U</sup>	mg/kg B	0.7	0.9	<0.5	<0.5	0.8	1.5
Cadmium (total)	CE127 <sup>M</sup>	mg/kg Cd	0.2	0.3	<0.2	<0.2	<0.2	0.4
Chromium (total)	CE127 <sup>M</sup>	mg/kg Cr	47	45	27	34	106	38
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 <sup>M</sup>	mg/kg Cu	22	29	19	15	13	22
Lead (total)	CE127 <sup>M</sup>	mg/kg Pb	50	67	19	17	16	37
Mercury (total)	CE127 <sup>M</sup>	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 <sup>M</sup>	mg/kg Ni	18	21	25	24	22	38
Selenium (total)	CE127 <sup>M</sup>	mg/kg Se	1.1	1.3	0.9	0.9	4.8	1.7
Zinc (total)	CE127 <sup>M</sup>	mg/kg Zn	74	93	53	71	34	101
pH	CE004 <sup>M</sup>	units	6.8	6.6	7.1	7.1	8.3	7.6
Sulphate (2:1 water soluble)	CE061 <sup>U</sup>	mg/l SO <sub>4</sub>	41	25	<10	25	292	164
Sulphate (acid extractable)	CE062 <sup>M</sup>	mg/kg SO <sub>4</sub>	755	656	<100	157	4570	797
Sulphide	CE016	mg/kg S <sup>2-</sup>	<10	<10	<10	<10	31	151
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Thiocyanate	CE145 <sup>M</sup>	mg/kg SCN	<1	<1	<1	<1	1.1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	4.3	4.1	0.4	0.5	1.6	3.0
Estimate of OMC (calculated from TOC)	CE197	% w/w	7.5	7.0	0.7	0.9	2.8	5.2
<b>PAH</b>								
Naphthalene	CE087 <sup>M</sup>	mg/kg	0.05	<0.02	<0.02	<0.02	1.48	<0.02
Acenaphthylene	CE087 <sup>M</sup>	mg/kg	0.05	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 <sup>M</sup>	mg/kg	0.06	<0.02	<0.02	<0.02	34.41	0.06
Fluorene	CE087 <sup>U</sup>	mg/kg	0.04	<0.02	<0.02	<0.02	25.35	<0.02
Phenanthrene	CE087 <sup>M</sup>	mg/kg	0.92	0.12	<0.02	<0.02	178.80	0.05
Anthracene	CE087 <sup>U</sup>	mg/kg	0.36	0.03	<0.02	<0.02	51.19	0.02
Fluoranthene	CE087 <sup>M</sup>	mg/kg	4.70	0.31	<0.02	<0.02	239.65	0.08
Pyrene	CE087 <sup>M</sup>	mg/kg	4.66	0.27	<0.02	<0.02	210.43	0.07
Benzo(a)anthracene	CE087 <sup>U</sup>	mg/kg	3.11	0.18	<0.02	<0.02	107.57	0.04
Chrysene	CE087 <sup>M</sup>	mg/kg	3.16	0.15	<0.03	<0.03	105.12	<0.03
Benzo(b)fluoranthene	CE087 <sup>M</sup>	mg/kg	4.56	0.23	<0.02	<0.02	111.20	0.06
Benzo(k)fluoranthene	CE087 <sup>M</sup>	mg/kg	1.68	0.10	<0.03	<0.03	47.47	<0.03
Benzo(a)pyrene	CE087 <sup>U</sup>	mg/kg	3.50	0.15	<0.02	<0.02	75.89	0.04
Indeno(123cd)pyrene	CE087 <sup>M</sup>	mg/kg	2.97	0.13	<0.02	<0.02	58.22	0.03
Dibenz(ah)anthracene	CE087 <sup>M</sup>	mg/kg	0.59	<0.02	<0.02	<0.02	11.00	<0.02
Benzo(ghi)perylene	CE087 <sup>M</sup>	mg/kg	2.35	0.08	<0.02	<0.02	42.18	0.02
PAH (total of USEPA 16)	CE087	mg/kg	32.8	1.76	<0.34	<0.34	1300	0.46
<b>Subcontracted analysis</b>								
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD	NAD

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## SOILS

Lab number	115889-1	115889-2	115889-3	115889-4	115889-5	115889-6
Sample id	TP5 D2	TP6 D1	Mound 1	TP7 D2	TP8 D1	TP8 D3
Depth (m)	0.20	0.60	0.20	0.40	0.40	1.20
Date sampled	15/11/2022	15/11/2022	15/11/2022	15/11/2022	15/11/2022	15/11/2022
Test	Method	Units				
<b>Organochlorine Pesticides</b>						
aldrin	\$	mg/kg	-	< 0.02	-	-
alpha-endosulfan	\$	mg/kg	-	< 0.02	-	-
beta-endosulfan	\$	mg/kg	-	< 0.02	-	-
cis-chlordane (alpha-chlordane)	\$	mg/kg	-	< 0.02	-	-
1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDD)	\$	mg/kg	-	< 0.02	-	-
1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethene (o,p'-DDE)	\$	mg/kg	-	< 0.02	-	-
1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDT)	\$	mg/kg	-	< 0.02	-	-
1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDD)	\$	mg/kg	-	< 0.02	-	-
1,1-dichloro-2,2-bis(4-chlorophenyl)ethene (p,p'-DDE)	\$	mg/kg	-	< 0.02	-	-
1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDT)	\$	mg/kg	-	< 0.02	-	-
dieldrin	\$	mg/kg	-	< 0.02	-	-
endrin	\$	mg/kg	-	< 0.02	-	-
heptachlor	\$	mg/kg	-	< 0.02	-	-
heptachlor epoxide (as cis isomer B)	\$	mg/kg	-	< 0.02	-	-
hexachlorobenzene (HCB)	\$	mg/kg	-	< 0.02	-	-
alpha-hexachlorocyclohexane (a-HCH)	\$	mg/kg	-	< 0.02	-	-
beta-hexachlorocyclohexane (β-HCH)	\$	mg/kg	-	< 0.02	-	-
delta-hexachlorocyclohexane (d-HCH)	\$	mg/kg	-	< 0.02	-	-
epsilon-hexachlorocyclohexane (e-HCH)	\$	mg/kg	-	< 0.02	-	-
gamma-hexachlorocyclohexane (g-HCH, lin	\$	mg/kg	-	< 0.02	-	-
isodrin	\$	mg/kg	-	< 0.02	-	-
p,p'-methoxychlor (methoxychlor)	\$	mg/kg	-	< 0.02	-	-
trans-chlordane (gamma-chlordane)	\$	mg/kg	-	< 0.02	-	-
trifluralin	\$	mg/kg	-	< 0.02	-	-
azinphos-methyl	\$	mg/kg	-	< 0.10	-	-
chlorpyrifos-methyl	\$	mg/kg	-	< 0.10	-	-
cis-chlorfenvinphos (alpha)	\$	mg/kg	-	< 0.10	-	-
diazinon	\$	mg/kg	-	< 0.10	-	-
dichlorvos	\$	mg/kg	-	< 0.10	-	-
dimethoate	\$	mg/kg	-	< 0.10	-	-
fenitrothion	\$	mg/kg	-	< 0.10	-	-
fenthion	\$	mg/kg	-	< 0.10	-	-
malathion	\$	mg/kg	-	< 0.10	-	-
mevinphos (mixture of isomers)	\$	mg/kg	-	< 0.10	-	-
parathion-ethyl	\$	mg/kg	-	< 0.10	-	-
parathion-methyl	\$	mg/kg	-	< 0.10	-	-
phorate	\$	mg/kg	-	< 0.10	-	-
trans-chlorfenvinphos (beta)	\$	mg/kg	-	< 0.10	-	-

# Chemtech Environmental Limited

## SOILS

<b>Lab number</b>			115889-7
<b>Sample id</b>			TP9 D1
<b>Depth (m)</b>			0.20
<b>Date sampled</b>			15/11/2022
<b>Test</b>	<b>Method</b>	<b>Units</b>	
Arsenic (total)	CE127 <sup>M</sup>	mg/kg As	11
Boron (water soluble)	CE063 <sup>U</sup>	mg/kg B	1.2
Cadmium (total)	CE127 <sup>M</sup>	mg/kg Cd	0.3
Chromium (total)	CE127 <sup>M</sup>	mg/kg Cr	46
Chromium (VI)	CE146	mg/kg CrVI	<1
Copper (total)	CE127 <sup>M</sup>	mg/kg Cu	23
Lead (total)	CE127 <sup>M</sup>	mg/kg Pb	45
Mercury (total)	CE127 <sup>M</sup>	mg/kg Hg	<0.5
Nickel (total)	CE127 <sup>M</sup>	mg/kg Ni	24
Selenium (total)	CE127 <sup>M</sup>	mg/kg Se	1.3
Zinc (total)	CE127 <sup>M</sup>	mg/kg Zn	93
pH	CE004 <sup>M</sup>	units	8.4
Sulphate (2:1 water soluble)	CE061 <sup>U</sup>	mg/l SO <sub>4</sub>	377
Sulphate (acid extractable)	CE062 <sup>M</sup>	mg/kg SO <sub>4</sub>	2326
Sulphide	CE016	mg/kg S <sup>2-</sup>	62
Cyanide (free)	CE077	mg/kg CN	<1
Cyanide (total)	CE077	mg/kg CN	<1
Thiocyanate	CE145 <sup>M</sup>	mg/kg SCN	1.7
Phenols (total)	CE078	mg/kg PhOH	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	1.7
Estimate of OMC (calculated from TOC)	CE197	% w/w	2.9
<b>PAH</b>			
Naphthalene	CE087 <sup>M</sup>	mg/kg	0.09
Acenaphthylene	CE087 <sup>M</sup>	mg/kg	0.10
Acenaphthene	CE087 <sup>M</sup>	mg/kg	0.19
Fluorene	CE087 <sup>U</sup>	mg/kg	0.20
Phenanthrene	CE087 <sup>M</sup>	mg/kg	2.14
Anthracene	CE087 <sup>U</sup>	mg/kg	0.79
Fluoranthene	CE087 <sup>M</sup>	mg/kg	5.83
Pyrene	CE087 <sup>M</sup>	mg/kg	5.19
Benzo(a)anthracene	CE087 <sup>U</sup>	mg/kg	3.25
Chrysene	CE087 <sup>M</sup>	mg/kg	2.65
Benzo(b)fluoranthene	CE087 <sup>M</sup>	mg/kg	4.28
Benzo(k)fluoranthene	CE087 <sup>M</sup>	mg/kg	1.82
Benzo(a)pyrene	CE087 <sup>U</sup>	mg/kg	3.66
Indeno(123cd)pyrene	CE087 <sup>M</sup>	mg/kg	2.83
Dibenz(ah)anthracene	CE087 <sup>M</sup>	mg/kg	0.53
Benzo(ghi)perylene	CE087 <sup>M</sup>	mg/kg	2.24
PAH (total of USEPA 16)	CE087	mg/kg	35.8
<b>Subcontracted analysis</b>			
Asbestos (qualitative)	\$	-	NAD

# Chemtech Environmental Limited

## SOILS

<b>Lab number</b>			115889-7
<b>Sample id</b>			TP9 D1
<b>Depth (m)</b>			0.20
<b>Date sampled</b>			15/11/2022
<b>Test</b>	<b>Method</b>	<b>Units</b>	
<b>Organochlorine Pesticides</b>			
aldrin	\$	mg/kg	-
alpha-endosulfan	\$	mg/kg	-
beta-endosulfan	\$	mg/kg	-
cis-chlordane (alpha-chlordane)	\$	mg/kg	-
1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDD)	\$	mg/kg	-
1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethene (o,p'-DDE)	\$	mg/kg	-
1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDT)	\$	mg/kg	-
1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDD)	\$	mg/kg	-
1,1-dichloro-2,2-bis(4-chlorophenyl)ethene (p,p'-DDE)	\$	mg/kg	-
1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDT)	\$	mg/kg	-
dieldrin	\$	mg/kg	-
endrin	\$	mg/kg	-
heptachlor	\$	mg/kg	-
heptachlor epoxide (as cis isomer B)	\$	mg/kg	-
hexachlorobenzene (HCB)	\$	mg/kg	-
alpha-hexachlorocyclohexane (α-HCH)	\$	mg/kg	-
beta-hexachlorocyclohexane (β-HCH)	\$	mg/kg	-
delta-hexachlorocyclohexane (δ-HCH)	\$	mg/kg	-
epsilon-hexachlorocyclohexane (ε-HCH)	\$	mg/kg	-
gamma-hexachlorocyclohexane (γ-HCH, lin	\$	mg/kg	-
isodrin	\$	mg/kg	-
p,p'-methoxychlor (methoxychlor)	\$	mg/kg	-
trans-chlordane (gamma-chlordane)	\$	mg/kg	-
trifluralin	\$	mg/kg	-
azinphos-methyl	\$	mg/kg	-
chlorpyrifos-methyl	\$	mg/kg	-
cis-chlorfenvinphos (alpha)	\$	mg/kg	-
diazinon	\$	mg/kg	-
dichlorvos	\$	mg/kg	-
dimethoate	\$	mg/kg	-
fenitrothion	\$	mg/kg	-
fenthion	\$	mg/kg	-
malathion	\$	mg/kg	-
mevinphos (mixture of isomers)	\$	mg/kg	-
parathion-ethyl	\$	mg/kg	-
parathion-methyl	\$	mg/kg	-
phorate	\$	mg/kg	-
trans-chlorfenvinphos (beta)	\$	mg/kg	-

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## METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO <sub>4</sub>
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	M	100	mg/kg SO <sub>4</sub>
CE016	Sulphide	Distillation, Titration	Dry		10	mg/kg S <sup>2-</sup>
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-
\$	aldrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	alpha-endosulfan	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	beta-endosulfan	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	cis-chlordane (alpha-chlordane)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDD)	Solvent extraction, GC-MS	As received		0.02	mg/kg

# Chemtech Environmental Limited

## METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
\$	1,1-dichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethene (o,p'-DDE)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl)ethane (o,p'-DDT)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDD)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1-dichloro-2,2-bis(4-chlorophenyl)ethene (p,p'-DDE)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDT)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	dieldrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	endrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	heptachlor	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	heptachlor epoxide (as cis isomer B)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	hexachlorobenzene (HCB)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	alpha-hexachlorocyclohexane (α-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	beta-hexachlorocyclohexane (β-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	delta-hexachlorocyclohexane (δ-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	epsilon-hexachlorocyclohexane (ε-HCH)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	gamma-hexachlorocyclohexane (γ-HCH, lindane)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	isodrin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	p,p'-methoxychlor (methoxychlor)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	trans-chlordane (gamma-chlordane)	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	trifluralin	Solvent extraction, GC-MS	As received		0.02	mg/kg
\$	azinphos-methyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	chlorpyrifos-methyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	cis-chlorfenvinphos (alpha)	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	diazinon	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	dichlorvos	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	dimethoate	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	fenitrothion	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	fenthion	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	malathion	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	mevinphos (mixture of isomers)	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	parathion-ethyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	parathion-methyl	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	phorate	Solvent extraction, GC-MS	As received		0.1	mg/kg
\$	trans-chlorfenvinphos (beta)	Solvent extraction, GC-MS	As received		0.1	mg/kg

# Chemtech Environmental Limited

## DEVIATING SAMPLE INFORMATION

### Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

### Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
115889-1	TP5 D2	0.20	N	
115889-2	TP6 D1	0.60	N	
115889-3	Mound 1	0.20	N	
115889-4	TP7 D2	0.40	N	
115889-5	TP8 D1	0.40	N	
115889-6	TP8 D3	1.20	N	
115889-7	TP9 D1	0.20	N	

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## ADDITIONAL INFORMATION

### Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

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

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

## APPENDIX D

### **AWP GENERIC ASSESSMENT CRITERIA**

**Alan Wood & Partners**  
**Generic Assessment Criteria for Soils**



Revision Version: V.8 - Septmeber 2018

Parameter	Residential						Commercial <sup>(i)</sup>			Allotment			Public Open Space near Residential land (POS <sub>resi</sub> )			Public Park Land (POS <sub>park</sub> )			
	With Plant Uptake			Without Plant Uptake			1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM													
<b>Organics contd./ <sup>(h)</sup></b>																			
Aromatic EC >5-7	50	110	240	155	300	630	15,000	28,000	55,000	12	25	57	56,000	56,000	56,000	76,000	84,000	92,000	CLEA/LQM/ClEH
Aromatic EC >7-8	100	240	550	370	800	1,800	33,000	68,000	130,000	21	50	117	56,000	56,000	56,000	87,000	95,000	100,000	CLEA/LQM/ClEH
Aromatic EC >8-10	20	50	110	20	53	125	2,000	5,000	120,000	8.6	21	50	5,000.0	5,000	5,000	7,200.0	8,500	9,300	CLEA/LQM/ClEH
Aromatic EC >10-12	63	150	340	120	280	650	11,000	22,000	31,000	12.5	31	74	5,000.0	5,000	5,000	9,200.0	9,700	10,000	CLEA/LQM/ClEH
Aromatic EC >12-16	140	320	660	1,100	1,900	2,300	35,000	37,000	38,000	23	57	134	5,100	5,100	5,000	10,000	10,000	10,000	CLEA/LQM/ClEH
Aromatic EC >16-21	260	540	930	1,800	1,900	1,900	28,000	28,000	28,000	47	112	260	3,800	3,800	3,800	7,600	7,700	7,800	CLEA/LQM/ClEH
Aromatic EC >21-35	1,100	1,400	1,700	1,900	1,900	1,900	28,000	28,000	28,000	370	820	1,500	3,800	3,800	3,800	7,800	7,800	7,900	CLEA/LQM/ClEH
Aromatic EC >35-44	1,100	1,400	1,700	1,900	1,900	1,900	28,000	28,000	28,000	370	820	1,500	3,800	3,800	3,800	7,800	7,800	7,900	CLEA/LQM/ClEH
Benzene	0.06	0.13	0.30	0.16	0.30	0.64	15	28	57	0.016	0.033	0.073	72	72	73	90	100	110	CLEA/LQM/ClEH
Toluene	104	240	550	370	830	1800	33,000	68,000	130,000	22	50	117	56,000	56,000	56,000	87,000	95,000	100,000	CLEA/LQM/ClEH
Ethylbenzene	30	62	150	34	81	190	3,200	7,000	16,000	16	38	91	24,000	24,000	25,000	1,700	22,000	27,000	CLEA/LQM/ClEH
o-xylene	30	70	170	40	90	200	3,700	8,000	19,000	28	67	160	41,000	42,000	43,000	17,000	24,000	33,000	CLEA/LQM/ClEH
m-xylene	30	70	160	34	80	190	3,400	8,000	18,000	30	74	170	41,000	42,000	43,000	17,000	24,000	32,000	CLEA/LQM/ClEH
p-xylene	30	70	160	33	80	180	3,200	8,000	17,000	28	69	160	41,000	42,000	43,000	17,000	23,000	31,000	CLEA/LQM/ClEH

**NOTES**

- All values are rounded to 1 or 2 significant figures. All values mg/kg unless otherwise stated.

- (a) Generic Assessment Criteria presented by DEFRA (2014) and LQM/ClEH (2015) for metals are not sensitive to Soil Organic Matter content and may be applied directly across the SOM range 1-6% for the land uses given.
- (b) Final Category 4 Screening Levels given in DEFRA SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Policy Companion Document, December 2014. Calculated for sandy loam soils with 6% SOM.
- (c) Nathaniel, C.P., McCaffrey, C., Gillett, A.C., Ogden, R.C. And Nathaniel, J.F. (2015). The LQM/ClEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Publication Number **S4UL3286**.
- (d) GAC for cadmium are calculated for soils with pH values between 6 and 8. Care should be applied when using the GAC values outside this range and particularly below 5.
- (e) Additional site specific risk assessment may be required where elevated concentrations of Chromium (VI) are measured on site.
- (f) DEFRA (2014) indicate that the BGS have derived 'normal' background lead concentrations for England & Wales. In England normal background concentrations are 180mg/kg for the principal domain, 2400mg/kg for the mineralisation domain and 820mg/kg for the urban domain (DEFRA, 2012). Calculated C4SL values to be adopted for residential, allotment and POS<sub>resi</sub> are lower therefore than the 'normal' background concentration of lead in urban areas.
- (g) BRE (2005) Special Digest 1, 3rd Edition 'Concrete in Aggressive Ground'. GAC is the upper limit for DS-1 sulphate class concrete.
- (h) Organic contaminant GAC values calculated using CLEA v1.06 for sandy soil with SOM of 1%, 2.5% and 6%. Sandy soil type is considered to be conservative for the majority of soils, including brownfield soils on (potentially contaminated) sites. Changes made to default CLEA exposure parameters as per updated information given in DEFRA (2014) (C4SL Tables 3.2 and 3.5) and LQM/ClEH (2015).
- (i) GAC derived for pre-1970 office buildings using default commercial CLEA model with adjustment to CLEA exposure parameters as per DEFRA (2014) (C4SL Tables 3.2 and 3.5).

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