

Site Investigation

STONEWELL HOUSE, SHEFFIELD ROAD, BIRDWELL

STEPHEN HINCHCLIFFE

23 OCTOBER 2023

**GEOTECHNICAL AND GEO-ENVIRONMENTAL
SITE INVESTIGATION**

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SHEFFIELD ROAD, BIRDWELL**

**FOR
STEPHEN HINCHCLIFFE**



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23 OCTOBER 2023

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Exploratory Hole Location Plan

Trial pit logs

Chemical test results

1.0 EXECUTIVE SUMMARY

1. This report presents the findings of a Geotechnical and Geo-environmental Site Investigation carried out by Eastwood and Partners (Consulting Engineers) Limited trading as Eastwood Consulting Engineers (ECE) for Stephen Hinchcliffe under the instructions of KSL Design.
2. The 0.56-hectare site is irregular in shape and located to the east of Sheffield Road (A61) and south of Balk Farm Court in the north of Birdwell. The site is indicated to be in use as a residential dwelling comprising a rectangular building in the east of the site with a smaller square building to the south of this. An area of hardstanding is located to the east of the buildings with the remainder of the site comprising landscaped gardens mainly laid to lawn.
3. Historical maps indicate the site to have remained as agricultural land until 1993 when a building is shown to have been constructed to the east of the centre of the site. An additional building is shown to the south of this in 2023.
4. The bedrock geology in the centre, south and east of the site to be the Pennine Middle Coal Measures Formation comprising sandstone while the bedrock geology across the north and south west of the site to be mudstone, siltstone and sandstone the Pennine Middle Coal Measures Formation. No superficial deposits are recorded to present at the site.
5. A fault striking northeast, south west with a downthrow to the south east to cross the site slightly to the west of the centre.
6. The underlying bedrock is classified as a Secondary A Aquifer.
7. A seam of coal was expected to underlie the site at shallow depth. A borehole investigation has therefore been undertaken. This encountered intact coal only with no evidence of workings.
8. A trial pit investigation encountered topsoil across most of the site, locally underlain by made ground. Firm to stiff clay was then present, with mudstone bedrock below.
9. Soakaway drainage is not viable.
10. No significant contamination was encountered on the site and no remediation is considered necessary.
11. Traditional strip/trench fill footings are considered suitable at a likely minimum depth of 900 mm, and deepened near to trees.

12. Sulphate precautions are not considered to be required.
13. This report should be considered as preliminary, pending receipt of further laboratory testing and formal borehole logs from the drilling contractor.

2.0 INTRODUCTION

2.1 Terms of Reference

This report presents the findings of a Geotechnical and Geo-environmental Site Investigation carried out by Eastwood Consulting Engineers for Stephen Hinchcliffe under the instruction of KSL Design. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

2.2 Context

Previous investigation of the site, in the form of a Coal Mining Risk Assessment, was undertaken by Design-It Structural Solutions Limited in March 2019. This report, reference Dit/18/142 has therefore been referred to, where appropriate, and should be read in conjunction with this report.

No intrusive investigations are known to have taken place on the site previously.

2.3 Aims and Objectives

The aims and objectives of this additional investigation were as follows;

2.4 Scope of Investigation

This document is split into two sections. These constitute the findings of the Phase 1 and Phase 2 investigations, consecutively.

2.4.1 Phase 1

The Phase 1 investigation involved a review of information extracted from published documentation as well as that obtained from a site reconnaissance. Information regarding the current and former land uses both on and surrounding the site, as well as the environmental sensitivity of the site location as determined by factors including geology, hydrogeology and hydrology have been examined.

Information analysed in this section of the report has been obtained from a variety of sources and included the following:

- Envirocheck Report
- Coal Authority Report
- Geological Maps and Associated Geological Memoirs; and

- A site walkover.

2.4.2 Phase 2

This part of the investigation consisted of intrusive works and laboratory analysis. The findings were used to test the conceptual model and produce a final risk assessment. The intrusive works comprised trial pits and rotary boreholes which were undertaken to enable:

- Examination of the shallow ground conditions;
- In situ description of soils, enabling any localised lateral and vertical changes in soil conditions to be logged;
- Assessment of any contamination identified using visual and olfactory methods;
- Collection of soil samples for chemical and Geotechnical testing; and
- An assessment of the presence of coal seams and/or historical mining below the site at shallow depth.

2.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with residential properties, each with private gardens and areas of hardstanding. The dwellings will be of conventional construction and will be three storeys or less in height, and it is assumed that existing ground levels will not alter significantly. If this is not the case, then the advice given in this report may not be appropriate.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, on the results of laboratory testing carried out as part of the investigation and information gained from a geological and historical desk study. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata and water conditions between or below investigation points. It should be noted that groundwater levels vary due to seasonal or other effects, and may at times differ from those measured during the investigation.

This report considers the ground and groundwater and does not cover any buildings or their fabric or the constituents of any existing hardstanding materials. Generally, testing has only been carried

out for contaminants identified as potentially present with no assessment made of biological contamination. Risks to ecological receptors, such as bats, have not been considered.

3.0 THE SITE

3.1 Description

The 0.56-hectare site is irregular in shape and located to the east of Sheffield Road (A61) and south of Balk Farm Court in the north of Birdwell. The site is centred on grid reference 434410, 402090 and accessed from the north via Balk Farm Court.

The site is currently occupied by a single residential dwelling comprising a rectangular building in the east of the site with a detached garage adjacent. An area of hardstanding is located to the east of the buildings with the remainder of the site comprising landscaped gardens mainly laid to lawn. A mature hedgerow separates the northern third of the gardens from the southern two thirds with further hedgerows bordering the entire site.

Sheffield Road follows the sites western boarder with mature woodland located beyond. Residential areas are located to the north, east and south of the site.

The site gently slopes up to the south and east at between 118 and 123 m above ordinance (AOD).

3.2 History

Historical Ordnance Survey maps obtained as part of the Envirocheck Report have been studied to assess the previous use of the site. Copies of the maps are presented in Appendix 2.

3.2.1 The Site

The earliest map viewed, dated 1855, shows the site to comprise agricultural land, divided into several fields, with a well located in the east of the site and a footpath running from east to west across the northern tip of the site.

No further significant changes were observed at the site until 1993 when a building is shown to have been constructed to the east of the centre of the site. An additional building (garage) is shown to the south of this in 2023.

3.2.2 The Surrounding Area

The earliest viewed map, dated 1855, shows an unnamed road to follow the sites western border and a collection of buildings, assumed to be agricultural related, located immediately to the north of the site. Quarry hill is located approximately 200 m north of the site, and is indicated to be an old sandstone quarry. A second old sandstone quarry is shown approximately 200 m south west of the

site. The area surrounding the site is generally shown to comprise agricultural land and woodland at this time.

Disused Rockley Colliery is shown 600 m north west of the site in 1893.

A row of residential dwellings are constructed 100 m to the east of the sites eastern corner by 1931. The area immediately to the south and east of the site, up to 400 m east and over 1 km south of the site continued to undergo gradual residential development between 1938 and 1978 resulting in a dense residential area to the east and south of the site. The M1 motorway has also been constructed 500 m west of the site by this date.

No further significant developments have been observed in the area surrounding the site, which remains mainly agricultural in nature to the present day.

3.3 Geology

Reference to the online BGS Geology Viewer and map sheet 87 of Geological Survey of England and Wales 1:63,360/1:50,000 geological map series, New Series show the bedrock geology in the centre, south and east of the site to be the Pennine Middle Coal Measures Formation comprising sandstone and the bedrock geology across the north and south west of the site to be mudstone, siltstone and sandstone the Pennine Middle Coal Measures Formation. No superficial deposits are recorded to present at the site.

Map sheet SE30SW agrees with the above and indicates a fault striking northeast, south west with a downthrow to the south east to cross the site slightly to the west of the centre.

According to the Envirocheck ground stability hazards are recorded to be 'no hazard' to 'low' with the exception of potential for compressible ground which has been recorded as moderate.

3.4 Hydrogeology

3.4.1 Groundwater Vulnerability

The underlying bedrock is classified as a Secondary A Aquifer comprising permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

No superficial aquifer is indicated to be present.

3.4.2 Groundwater Abstractions

There are no groundwater abstractions within 500 m of the site boundary.

3.5 Hydrology

The Envirocheck records the nearest surface water feature, an unnamed stream, to lie around 70 m to the west of the site.

Information within the Envirocheck states that the site does not lie within a groundwater Source Protection Zone.

3.6 Extractive Industries

3.6.1 Coal Mining

A coal mining risk assessment was previously completed for the site by Design It Structural Solutions Limited, report reference Dit/18/142-Rev0, the pertinent points of which are summarised below;

- The Swallow Wood Coal Seam is indicated to outcrop approximately 25 m south west of the site and is estimated by Design It Structural Solutions Limited to be within approximately 5 m below ground level in the north of the site and between 5 to 10 m bgl towards the sites north eastern boundary. Locally the BGS record the seam to be between 0.2 and 3.7 m thick with several dirt partings. Nearby historic records record a total exploitable thickness of 1.7 m. It has therefore been calculated that there is insufficient competent cover above the Swallow Wood Seam across the northern area of the site.
- The Coal Authority (CA) record a number of former mine entries, both shaft and adits, to the north of the site along the Swallow Wood Coal outcrop.
- According to the CA, three coal seams are recorded to have been worked beneath the site, these were between 135 and 286 m depth and were last worked in 1967. Design It Structural Solutions Limited have reported that worked seams are at a depth where there is sufficient competent cover and *“there is considered to be no adverse effect upon the surface stability of the site”*
- According to the CA, there are no spine roadways recorded beneath the site at shallow depth and there are no mine entries within 100 m of the site. However, the presence of unrecorded mine entries within or in the immediate vicinity of the site cannot be discounted.

- According to the CA, there are no records of mine gas emissions requiring actions within 500 m of the site.
- The CA interactive viewer indicate the north of the site to lie within an area of probable past shallow coal mining. Design It Structural Solutions Limited have therefore considered the site to be within a Development High Risk Area.
- Information provided by the Coal Authority indicates that the site is not affected by past, present or future opencast workings. Former opencast coal workings are recorded to be present 200 m south west of the site.

Design It Structural Solutions Limited determined that there is a *“high risk to surface stability from shallow mine works that may be present within the Swallow Wood Coal seam. Additionally, there is a potential moderate risk to surface stability by way of unrecorded shallow mine entries and a low to moderate risk exists for the site to be affected by potential mine gas emissions”*

It has been recommended in the report previously completed, Dit/18/142-Rev0, that drilling should be completed to at least 30 m deep across the site to determine the depth to rock head and depth to/nature of the underlying coal seam.

The presence of unrecorded mine entries should be confirmed through vigilance during enabling works. If mine entries are identified on the site these will require treatment by grouting and capping or alternative methods as appropriate. Development over or within influencing distance of mine entries should be avoided.

Design It Structural Solutions Limited consider gas protection measures are likely to be required and that a gas monitoring program is required.

ECE agree with the above risk assessment and recommendations. Should shallow mine works be encountered as a result of the drilling investigation an appropriate ground improvement program including grouting should be undertaken to stabilise the ground.

3.6.2 Quarrying

The Envirocheck records two BGS recorded mineral sites within 250 m of the site. These are located 155 m south west and 172 m north of the site. These are both recorded to have been mined for sandstone by opencast methods. The workings are not shown to extend near to the site, and therefore the risk of quarry workings being present on site is low.

3.7 Ground Gas

The site is indicated to be in a low to intermediate probability radon area meaning that a proportion of the site is in an area where less than 1% of homes are at or above the action level and a portion of the site is in an area where 1 to 3% of homes are at or above the action level for Radon. Radon precautions are therefore not required at the site.

The site is located within an area of probable past shallow mining, and three coal seams are recorded to have previously been mined beneath the site (last mined in 1967) and it is considered possible that unrecorded mine entries are located within the vicinity of the site.

Opencast sandstone quarries are recorded 155 m south west and 172 m north, however these are usually infilled with inert spoil sourced from the quarry excavation and are therefore not considered to be a significant ground gas source.

According to the Envirocheck potentially infilled areas of land are located 152 m south west of the site and 178 m north of the site, these are considered likely to be the sandstone quarries discussed above.

Based on the known site history, significant depths of made ground are not expected at the site.

There are no historic landfill sites or local authority landfill site recorded within 1 km of the site.

Given the above there is a risk of ground gas generation and migration at the site, a gas monitoring program is therefore required.

3.8 Pollution Incidents to Controlled Waters

The Envirocheck does not list any pollution incidents within 250 m of the site.

3.9 Local Authority Pollution Prevention and Controls

The Envirocheck does not list any controls within 250 m of the site. However, there is an authorised petrol filling station, 'Hill Top Services' located 260 m south of the site.

3.10 Discharge Consents

The Envirocheck does not record any discharge consents within 250 m of the site.

3.11 Flooding

According to the Envirocheck the site is not at risk of flooding from rivers or the sea. The majority of the site is not indicated to be at risk of surface water flooding, however, a small area along the northwestern boundary is indicated to be at a low risk of surface water flooding (1 in 1000 years). It should also be noted that Sheffield Road to the west of the site is also at a low risk of surface water flooding and Balk Farm Court to the north of the site is at a low to medium risk of surface water flooding (1000 to 100 year return).

3.12 Soil Geochemistry

The Envirocheck estimates the following concentrations of arsenic, cadmium, chromium, nickel and lead to be present in the natural soil at the site. These have been compared to the appropriate assessment value protective of residential human health receptors with homegrown produce.

Contaminant	Estimated Concentration (mg/kg)	Assessment Value (mg/kg)
Arsenic	15 to 35	37
Cadmium	<1.8	11
Chromium	60 to 90	910
Lead	<100	200
Nickel	15 to 30	180

Given the above, no naturally elevated concentrations of metals/metalloids are anticipated.

3.13 Contemporary Trade Directory Entries and Fuel Station Entries

There are no active contemporary trade directory entries recorded within 250 m of the site. There is one inactive entry located 209 m south of the site under garage services.

In in active petrol filling station is recorded 260 m south of the site.

4.0 OUTLINE CONCEPTUAL MODEL

4.1 Potential Sources of Contamination

According to available historic maps the site remained in use as agricultural land until 1993 when a residential building was constructed in the east of the site, an additional building was constructed to the south of this by 2023.

Due to the sites history as agricultural land elevated concentrations of PAHs, heavy metals or pesticides may be present. Any made ground potentially preset at the site may contain elevated concentrations of contaminants such as heavy metals/metalloids and polycyclic aromatic hydrocarbons (PAHs).

4.2 Ground Gas

Radon precautions are not required.

Given the history of mining in the vicinity of the site it is considered that there is a risk of ground gas generation and migration at the site and a gas monitoring program is required if workings are encountered below the site. At this stage it is recommended that the requirement of ground gas precautions be considered likely.

4.3 Potential Pollutant Linkages

The following table details the possible sources and associated contaminants of concern, pathways and receptors, highlighted by the Phase 1 as potentially present.

Source	Potential Contaminants	Potential Pathways	Potential Receptors
Made ground	Heavy metals/metalloids Asbestos PAHs TPH VOCs/SVOCs Asbestos	Ingestion Inhalation Direct contact Biological uptake Migration through ground	Site residents and visitors to the site Site construction workers Secondary A Aquifer Plants Water supply pipes
Made or natural ground	Sulphates Low pH	Direct contact	Below ground concrete
Potential shallow coal workings Radon	Ground gas and mine gas	Migration through ground	Site residents and visitors Construction workers Buildings

5.0 GROUND INVESTIGATION

5.1 Site Works

We visited site on 4 October 2023 and excavated six trial pits, TP01 to TP06 in order to determine the underlying ground conditions. These reached depths of up to 3.2 m below ground level.

A return visit was undertaken on 18 October when six rotary boreholes were drilled to 30 m bgl to investigate the potential presence of shallow coal seams beneath the site.

Copies of the trial pit and borehole logs are presented in Appendix 4, and their locations are plotted on the Exploratory Hole Location Plan, Drawing number 48448/001 revision A in Appendix 1.

5.2 Laboratory Testing

Six samples of topsoil, two made ground and two of natural ground were despatched for chemical testing. Soil samples were taken in 1 kg plastic tubs and 250 ml amber glass jars and analysed at i2 analytical, using MCERTs accredited methodologies where available. Laboratory testing results are presented in Appendix 5 and discussed further in Section 8.0.

Three samples of natural clay and two samples of natural gravel were sent for plasticity testing to Professional Soils Laboratory in Doncaster. Laboratory testing results are presented in Appendix 5 and discussed further in Section 6.0.

6.0 GROUND CONDITIONS

6.1 Surface Covering

Topsoil was encountered in all of the trial pits at surface. This was typically between 200 mm and 300 mm thick, but was 1.0 m thick in TP01.

6.2 Made Ground

Made ground was encountered at 2 trial pits (TP01 and TP06) and comprised dark brown gravelly clayey sand in TP01 and gravelly sandy clay in TP06. A pocket of macadam was also recovered in TP06.

6.3 Natural Ground

Natural ground was encountered at all trial pits and generally comprised brown, mottled orange and grey, slightly gravelly, slightly sandy to sandy clay, often with ironstone nodules and paleo roots within.

Mudstone bedrock was present from between 2.1 m and 2.6 m bgl.

6.4 Coal

A seam of coal was recorded in the boreholes drilled across the site. This was intact in all locations with no sign of workings. Further details will be provided when the drillers formal logs are received.

6.5 Obstructions

No obstructions were observed.

6.6 Groundwater

Groundwater was encountered at the base of trial pits TP01, TP02, TP03. Additionally, perched groundwater was encountered in TP06 at a depth of 0.8-1.3m.

6.7 Evidence of Contamination

Visual or olfactory evidence of possible contamination was not identified in any of the exploratory holes.

7.0 GEOTECHNICAL APPRAISAL

The site is underlain by a limited amount of made ground, with stiff clay below and mudstone bedrock at fairly shallow depth.

Geotechnical test results are awaited to confirm the shrinkability of the cohesive materials. Shallow mining was not recorded beneath the site.

A bearing capacity of at least 100 kN/m² appears suitable for the competent natural clay.

7.1 Foundations

Traditional strip or trench fill footings are expected to be appropriate for the proposed dwellings.

A minimum founding depth of 900 mm is likely to be needed, with footings being deepened near to trees.

7.2 Ground Floors

Where less than 600 mm of made ground is present, ground bearing slabs will be appropriate. Elsewhere, reinforced suspended slabs or precast concrete floors with a minimum 150 mm high ventilated void should be used.

If the footings require heave precautions due to trees, a precast concrete floor with a ventilated void will be required. This void should be a minimum of 250 mm high (to be confirmed on receipt of the geotechnical test results).

7.3 Superstructure Precautions

A fault appears to be present below the site. Additional superstructure reinforcement and movement joints should be allowed for in dwellings over the fault or within 20 m of it.

7.4 Excavation Problems

Support will therefore be required in accordance with current Health & Safety Regulations wherever access is required to trenches deeper than 1.2 m or less where there is risk of collapse.

7.5 Obstructions

No obstructions were encountered.

Foundations will need to be deepened near to the existing retaining wall along the boundary with Sheffield Road to avoid any lateral loads from the foundations being transferred to the rear of the wall.

7.6 Roads

A CBR value of at least 2% is likely to be appropriate for road design. The ground should be assumed to be frost susceptible and a minimum construction thickness of 450 mm will therefore apply. It is recommended that CBR tests are undertaken along any proposed roads prior to construction so that more accurate CBR values can be obtained.

7.7 Surface Water Drainage

Soakaway testing was undertaken, but was unsuccessful. A piped drainage system will be required.

8.0 REFINEMENT OF OUTLINE CONCEPTUAL MODEL

8.1 Source Characterisation

An outline conceptual model, detailing the possible sources and associated contaminants of concern, potential pathways and receptors identified in the phase 1 study was detailed in section 4.0.

This section of the report documents the works undertaken to obtain information to test and refine this model enabling a risk assessment to be produced and, where significant risks are expected, remediation recommendations.

8.2 Investigation of Potential Contamination Sources

The investigation works undertaken to cover each of the sources of potential contamination outlined in Section 4, are detailed in the table below:

Source	Potential Contaminants	Targeted Exploratory Holes
Made ground/Topsoil	Heavy metals/metalloids PAHs Asbestos	Made ground was encountered in two of the exploratory holes
Sulphates and low pH in made ground or natural ground	Sulphates Low pH	Natural ground was encountered in all of the exploratory holes
On site – MG/infilled features/coal workings	Ground Gas Mine gas	None encountered.

8.3 Gas Precautions

No radon precautions are required.

Gas protective measures are not required.

8.4 Unexpected Contamination

No visual or olfactory observations of unexpected contamination were noted.

8.5 Chemical Testing

Six samples of topsoil, two made ground and two of natural ground were sent for testing. Each of the samples was analysed for the suite of contaminants listed overleaf.

Contaminant Type	Actual Contaminants
Metals/Metalloids	Arsenic, cadmium, chromium, lead, mercury, nickel, selenium, copper and zinc
pH	pH
PAHs	Speciated PAH
Sulphates*	Water soluble sulphate, acid soluble sulphate, total sulphur
Asbestos	Fibres
TOC	Total organic carbon content
TPH CWG	Aliphatic-Aromatic hydrocarbons

*made and natural ground samples only

In addition to the above testing the two samples of made ground and two samples of natural ground were analysed for water soluble sulphate, acid soluble sulphate and sulphur.

Testing was undertaken by i2 analytical, using MCERTs accredited methodologies, where available.

8.6 Assessment Criteria

The proposed development of the site is to be residential with associated gardens. Therefore the assessment criteria relating to a residential end use with homegrown produce have been used.

Tables detailing the relevant assessment concentrations used are included in Appendix 5.

8.7 Chemical Test Results

Some preliminary risk assessment is undertaken in this section of the report where determinants can be readily discounted.

8.7.1 Topsoil

Lead and Zinc were found to be elevated at TP01. However, the average concentration for these two metals in the topsoil across the site is 159mg/kg for lead and 370mg/kg for Zinc. Therefore one elevated sample is not thought to be of concern.

8.7.2 Made Ground

No elevated concentrations were observed in the made ground tested.

8.7.3 Natural Ground

No elevated concentrations were observed in the natural ground tested.

8.7.4 Sulphates

In accordance with BRE Special Digest 1, the site comes under the classification of 'brownfield' and groundwater is expected to be mobile.

The following table displays the results of the made ground and natural ground samples tested:

Made Ground	Range of Results	Characteristic Value
Water Soluble Sulphate (mg/l)	3.9-12.5	
Total Sulphur (%)	0.009-0.012	
Total Potential Sulphate (%)	0.015-0.022	
pH	6.8-7.3	
Natural Ground	Range of Results	Characteristic Value
Water Soluble Sulphate (mg/l)	3-7	
Total Sulphur (%)	0.006-0.018	
Total Potential Sulphate (%)	0.014-0.036	
pH	6.9-7.6	

8.8 Significant Pollutant Linkages

The significant pollutant linkages consequently identified are thus documented in the following table.

Source	Pathway	Receptor
Single elevated concentration of lead in the made ground.	Ingestion, inhalation, direct contact	Future residents
Sulphates in the made ground	Direct contact	Below ground concrete

9.0 RISK ASSESSMENT

9.1 Human Health: Future Site Users

Outside of TP01 there were no recorded concentrations in excess of their respective assessment values and the corrected average across the site is below these assessment values, therefore, the natural ground on site is considered suitable for reuse in the development.

9.2 Human Health: During Construction

Groundworkers employed during the construction phase of the development are most at risk of harm due to them having direct contact with the affected soils. However, the contact is generally of short duration, and all competent ground workers will be aware of the potential risks associated with the made ground soils. Therefore, the overall risk to the health of construction workers is considered to be low.

Normal site procedures, such as the wearing of gloves when handling soils and the washing of hands prior to eating, should be implemented at all times.

9.3 Plants

Only Zinc in TP01 was above the respective phytotoxicity level and the average across the site is below this level. Therefore the made and natural ground on site is not considered to pose a significant risk to plant growth.

9.4 Construction Materials

DS-1 AC-1 sulphate precautions are suitable for sub-surface concrete within the natural clays.

The results of the chemical testing will need to be forwarded to the water company so that appropriate water supply pipes can be selected.

9.5 Controlled Waters

No significant contamination was encountered and so no risk to controlled waters is considered to be present.

Standard good site practice during the construction phase of the development must still be adhered to in terms of surface water run-off control measures, to ensure there is no risk to controlled waters.

9.6 Unexpected Contamination

Should any unusual, brightly coloured, ashy, fibrous or odorous material or material suspected of containing asbestos be encountered during construction this should be brought to the attention of the site staff and investigated.

9.7 Disposal of Material

If material needs to be removed, it should to be taken to a suitably licensed landfill or waste treatment facility. The costs of disposal and landfill tax can be substantial. The disposal of material should therefore be seen as a last resort with options such as treatment and reuse either on-site or off-site considered where possible.

The category of landfill which can accept the waste (inert, non-hazardous or hazardous) would need to be determined and will also have a significant effect on the costs. Additional testing may be required by the landfill operator and the acceptance of material is generally at their discretion.

Appendix 1

Exploratory Hole Location Plan

Trial pit logs

Chemical test results

Eastwood CONSULTING ENGINEERS						TrialPit No TP01 Sheet 1 of 1	
Project Name Stonewell House			Project No. 48448		Co-ords: - Level:		Date 04/10/2023
Location: Birdwell					Dimensions: m		Scale 1:25
Client: Stephen Hinchcliffe					Depth: 2.90m		Logged JDO
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10 0.10	D ES	HVP=543659	1.00 1.20			TOPSOIL: Brown gravelly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone and fine sandstone.	1
0.90 0.90 1.00	D ES					MADE GROUND: Dark brown gravelly clayey SAND, Gravel is fine to coarse angular clasts of mudstone.	
1.50 1.50	D ES					Firm light brown slightly gravelly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone. Minor pockets of a grey, less firm clay within the brown clay.	
2.00		HVP=747966	2.00 2.60 2.90			Firm grey to brown slightly gravelly slightly sandy CLAY, gravel is fine to coarse angular clasts of mudstone and ironstone fragments	2
						Light grey MUDSTONE. Recovered as gravel.	
						Trialpit Complete at 2.900m	
							3
							4
Remarks:							
Stability: Stable							

Eastwood CONSULTING ENGINEERS						TrialPit No TP02 Sheet 1 of 1	
Project Name Stonewell House			Project No. 48448		Co-ords: - Level:		Date 04/10/2023
Location: Birdwell					Dimensions: m		Scale 1:25
Client: Stephen Hinchcliffe					Depth: 3.20m £		Logged JDO
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10 0.10	D ES	HVP=747779	0.30			TOPSOIL: brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone.	1
						Grey mottled orange brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone.	
0.90 0.90 1.00	D ES		1.60			Grey friable sandy clayey GRAVEL. Gravel is fine to coarse angular clasts of partially lithified clay/weak weathered mudstone. Ironstone nodule found within unit.	2
1.50	D					Grey very weak slightly silty MUDSTONE recovered as fine to coarse gravel.	
2.70	D	3.20		Trialpit Complete at 3.200m		4	
Remarks:							
Stability: Stable							

Eastwood CONSULTING ENGINEERS							TrialPit No TP03 Sheet 1 of 1	
Project Name Stonewell House			Project No. 48448		Co-ords: - Level:			Date 04/10/2023
Location: Birdwell					Dimensions: m			Scale 1:25
Client: Stephen Hinchcliffe					Depth: £ 2.70m			Logged JDO
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description		
Depth (m)	Type	Results						
0.10 0.10	D ES	HVP=507649	0.25 0.55 0.80 1.00 1.00			TOPSOIL: Brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone.	1	
						Mottled orange brown, slightly gravelly, sandy weathered CLAY. Gravel is fine to coarse angular clasts of mudstone.		
						Stiff grey slightly gravelly slightly sandy CLAY. Gravel is fine to coarse angular to subrounded clasts of Mudstone and ironstone		
						Dark grey crumbly slightly gravelly slightly sandy CLAY recovered as platy fine to coarse angular gravel.		
						Stiff light grey slightly gravelly slightly sandy CLAY with iron nodules		
1.50 1.50	D ES	HVP=648465	1.60 2.20 2.70			Grey laminated platy MUDSTONE	2	
2.00								
						Trialpit Complete at 2.700m		3
								4
								4
Remarks:								
Stability: Stable								

Eastwood CONSULTING ENGINEERS						TrialPit No TP04 Sheet 1 of 1	
Project Name Stonewell House			Project No. 48448		Co-ords: - Level:		Date 04/10/2023
Location: Birdwell					Dimensions: m		Scale 1:25
Client: Stephen Hinchcliffe					Depth: 3.10m		Logged JDO
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10 0.10	D ES	HVP=505050	0.30			TOPSOIL: Grey slightly gravelly slightly sandy CLAY. Gravel is fine to coarse clasts of mudstone and shale.	1
0.50						Stiff mottled orange and brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone.	
0.80	D					Stiff grey slightly gravelly slightly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone.	
1.10	D		Grey slightly sandy clayey weathered clay GRAVEL. Gravel is fine to coarse angular clasts of mudstone and ironstone. Cobbles of ironstone nodules between 1.8 and 2.1m depth				
			2.10			Light grey and dark grey weak friable laminated slightly sandy MUDSTONE. Colour darkens with depth.	2
			3.10			Trialpit Complete at 3.100m	3
							4
Remarks:							
Stability: Stable							

Eastwood CONSULTING ENGINEERS						TrialPit No TP05 Sheet 1 of 1		
Project Name Stonewell House			Project No. 48448		Co-ords: - Level:		Date 04/10/2023	
Location: Birdwell					Dimensions: m		Scale 1:25	
Client: Stephen Hinchcliffe					Depth: 2.70m		Logged JDO	
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description		
Depth (m)	Type	Results						
0.20 0.20	D ES	HVP=452040	0.30			TOPSOIL: Brown gravelly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone	1	
						Stiff mottled orange and brown slightly gravelly slightly sandy CLAY, Gravel is fine to coarse angular clasts of mudstone		
0.60 0.60	D ES					0.70		Stiff grey slightly gravelly slightly sandy CLAY with paleo roots and ironstone nodules. Gravel is fine to coarse angular clasts of mudstone.
1.00 1.20 1.20	D ES							
1.50 1.70	D	HVP=607030	1.60			Grey slightly sandy weathered clay GRAVEL.	2	
			2.40			Grey laminated platy weak MUDSTONE with decimetre scale ironstone nodules. Recovered as gravel and cobbles. Slightly stronger at base of pit.		
			2.70			Trialpit Complete at 2.700m		3
Remarks:								
Stability: Stable								

Project Name Stonewell House			Project No. 48448		Co-ords: - Level:		Date 04/10/2023			
Location: Birdwell					Dimensions: m		Scale 1:25			
Client: Stephen Hinchcliffe					Depth: 2.75m £		Logged JDO			
Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description				
Depth (m)	Type	Results								
0.10 0.10	D ES	HVP=181019	0.20			TOPSOIL: Brown gravelly sandy CLAY. Gravel is fine to coarse angular clasts of mudstone and fine sandstone				
						MADE GROUND: Brown sandy gravelly CLAY with roots and a pocket of mercadum. Gravel is fine to coarse angular clasts of mudstone. UNSTABLE. Occasional cobbles or sandstone. Perched groundwater between 0.8 and 1.3m depth				
0.80 0.80	D ES									
1.40 1.40 1.40	D ES	HVP=181019	1.30			Soft black organic clay.				
				1.60			Grey slightly gravelly slightly sandy CLAY with paleoroots and ironstone nodules. Gravel is fine to coarse angular clasts of mudstone.			
2.00 2.10 2.10	D ES	HVP=201820	2.60 2.75			Grey laminated platy MUDSTONE				
								Trialpit Complete at 2.750m		
Remarks: Made ground collapsing from the walls as perched ground drained into the pit.										
Stability: Unstable										

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Analytical Report Number : 23-61466

Project / Site name: Stonewall House, Birdwell**Samples received on:** 09/10/2023**Your job number:** 48448**Samples instructed on/
Analysis started on:** 09/10/2023**Your order number:****Analysis completed by:** 17/10/2023**Report Issue Number:** 1**Report issued on:** 17/10/2023**Samples Analysed:** 10 soil samples**Signed:**

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-61466
Project / Site name: Stonewall House, Birdwell

Lab Sample Number				2839454	2839455	2839456	2839457	2839458
Sample Reference				TP01	TP01	TP02	TP02	TP03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.90	0.10	0.90	0.10
Date Sampled				04/10/2023	04/10/2023	04/10/2023	04/10/2023	04/10/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
Stone Content				%	0.1	NONE	< 0.1	< 0.1
Moisture Content				%	0.01	NONE	22	9.5
Total mass of sample received				kg	0.001	NONE	0.8	0.8

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PDO	PDO	PDO	N/A	PDO

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	7.3	6.4	7.6	6.2
Total Sulphate as SO ₄	%	0.005	MCERTS	-	0.015	-	0.014	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.0039	-	0.003	-
Total Sulphur	%	0.005	MCERTS	-	0.009	-	0.006	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.21	< 0.05	0.07	< 0.05	0.11
Acenaphthylene	mg/kg	0.05	MCERTS	0.11	< 0.05	< 0.05	< 0.05	0.06
Acenaphthene	mg/kg	0.05	MCERTS	0.08	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.1	< 0.05	< 0.05	< 0.05	0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.4	0.12	0.33	< 0.05	0.61
Anthracene	mg/kg	0.05	MCERTS	0.34	< 0.05	0.07	< 0.05	0.25
Fluoranthene	mg/kg	0.05	MCERTS	3	0.33	0.84	< 0.05	1.5
Pyrene	mg/kg	0.05	MCERTS	2.7	0.29	0.77	< 0.05	1.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.5	0.17	0.5	< 0.05	0.88
Chrysene	mg/kg	0.05	MCERTS	1.4	0.2	0.57	< 0.05	1
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.6	0.25	0.76	< 0.05	1.1
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.87	0.07	0.28	< 0.05	0.58
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.4	0.18	0.57	< 0.05	0.86
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.73	0.11	0.36	< 0.05	0.52
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.19	< 0.05	0.12	< 0.05	0.13
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.8	0.12	0.39	< 0.05	0.61

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	16.4	1.84	5.63	< 0.80	9.68
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	11	20	2.7	16
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.7	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	80	20	24	24	21
Copper (aqua regia extractable)	mg/kg	1	MCERTS	54	29	31	37	38
Lead (aqua regia extractable)	mg/kg	1	MCERTS	410	20	54	15	62
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	36	33	22	41	17
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	1100	100	110	110	110

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-61466
Project / Site name: Stonewall House, Birdwell

Lab Sample Number				2839459	2839460	2839461	2839462	2839463
Sample Reference				TP04	TP05	TP06	TP06	TP06
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.20	0.10	0.80	2.10
Date Sampled				04/10/2023	04/10/2023	04/10/2023	04/10/2023	04/10/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
Stone Content				%	0.1	NONE	< 0.1	< 0.1
Moisture Content				%	0.01	NONE	26	24
Total mass of sample received				kg	0.001	NONE	0.9	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	PDO	PDO	PDO	PDO	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.5	5.8	5.8	6.9	6.8
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	0.036	0.022
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	0.007	0.0125
Total Sulphur	%	0.005	MCERTS	-	-	-	0.018	0.012

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.11	0.15	0.06	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.12	0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.2	0.06	0.07	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.2	0.08	0.07	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	2	0.59	0.72	0.08	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.32	0.13	0.13	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.6	0.83	1.1	0.19	< 0.05
Pyrene	mg/kg	0.05	MCERTS	2.2	0.68	1.1	0.17	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.3	0.43	0.6	0.12	< 0.05
Chrysene	mg/kg	0.05	MCERTS	1.4	0.48	0.71	0.11	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.5	0.53	0.76	0.15	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.71	0.26	0.39	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.2	0.45	0.6	0.09	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.69	0.24	0.33	0.07	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.17	0.07	0.07	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.7	0.29	0.4	0.09	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	15.3	5.32	7.11	1.07	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	15	12	9.8	25
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.5	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	17	26	15	25
Copper (aqua regia extractable)	mg/kg	1	MCERTS	30	22	30	15	14
Lead (aqua regia extractable)	mg/kg	1	MCERTS	58	48	79	23	19
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	13	21	15	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	99	120	170	73	87

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-61466

Project / Site name: Stonewall House, Birdwell

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2839454	TP01	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2839455	TP01	None Supplied	0.9	Brown clay and sand with gravel.
2839456	TP02	None Supplied	0.1	Brown clay and sand with gravel.
2839457	TP02	None Supplied	0.9	Brown clay.
2839458	TP03	None Supplied	0.1	Brown loam and clay.
2839459	TP04	None Supplied	0.1	Brown loam and clay.
2839460	TP05	None Supplied	0.2	Brown loam and clay.
2839461	TP06	None Supplied	0.1	Brown loam and clay with vegetation.
2839462	TP06	None Supplied	0.8	Brown clay and sand.
2839463	TP06	None Supplied	2.1	Brown clay.

Analytical Report Number : 23-61466

Project / Site name: Stonewall House, Birdwell

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.



Eastwood

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