

**PHASE 2 GEOTECHNICAL AND
GEO-ENVIRONMENTAL SITE INVESTIGATION REPORT**

**LAND AT UPPER HOYLAND ROAD,
BARNSELY**

FOR

LOW FARM PROPERTIES



41677-001

29 September 2017

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FOR

LOW FARM PROPERTIES

ISSUE 1

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Assessment Values

1.0 EXECUTIVE SUMMARY

1. The site has an area of approximately 0.61 hectares and is located north of Upper Hoyland Road in Hoyland, Barnsley. It is centred on grid reference 436080, 401420. It is proposed to develop the site for residential use.
2. The site currently comprises four connected fields, with the boundaries separated by hedgerow mainly comprising Hawthorne. It is understood the site has been used as pasture land until recently, with grass and sparse shrubs present across the site at the time of investigation. An overhead electricity cable also crosses the south western corner of the site.
3. The site is covered by topsoil to between 0.3 and 0.4 m depth, with localised made ground present at the site entrance only. Beneath the topsoil, natural ground comprising friable slightly sandy clay was encountered, overlying stiff friable clay. Weak weathered sandstone was present from depths of between 1.4 m and 2.8 m bgl, with the strength of the sandstone increasing slightly with depth. Evidence of coal workings was not found beneath the site. Shallow groundwater was not encountered.
4. A borehole investigation has been undertaken and two seams of coal were encountered. Neither seam was found to have been worked. Precautions against the effects of shallow coal mining are therefore not considered necessary.
5. It is considered that traditional unreinforced strip or trench fill footings, taken onto the stiff clay below should be appropriate. The clay has been assessed as medium volume change potential and footings would need to be founded at a minimum depth of 900 mm below original or finished ground level whichever is the lower. Heave precautions will be required where foundations are within the influencing distance of existing or proposed trees.
6. A ground bearing slab may be considered, provided that is less than 600 mm of made ground is present and that the footing depth due to trees is less than 1500 mm. Otherwise a reinforced suspended or precast concrete floor with 250 mm high ventilated void beneath will be required.
7. Radon or ground gas precautions are not required.
8. None of the samples of topsoil or natural ground recorded concentrations of any contaminants that exceeded the assessment criteria for human health or phytotoxicity to plants. Therefore no remediation is required and the existing topsoil may be re-used.

9. DS-1 AC-1 precautions are required where concrete is in contact with the natural ground. It is recommended the chemical test results are forwarded to the water company to advise on the types of water supply pipes that need to be installed at the site.
10. The conclusions made in this report are subject to agreement by the approving bodies, such as the Local Authority and your warranty provider.

1.0 INTRODUCTION

1.1 Terms of Reference

This report presents the findings of a Phase 2 intrusive geotechnical and geo-environmental site investigation carried out by Eastwood & Partners (Consulting Engineers) Ltd for, and on the behalf of, Low Farm Properties. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

1.2 Context

A Phase 1 Site Investigation report was prepared by Ecus Ltd in May 2016, referenced RZ/7918/160418/P1. Any relevant information will be referenced in this report. The Phase 1 report should be read in conjunction with this site investigation report.

1.3 Aims and Objectives

The aims and objectives of this investigation were as follows:

- To detail the ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed office development;
- To undertake chemical testing enabling refinement and subsequent further testing of the conceptual model;
- To carry out tiered risk assessment to establish the likely risks to future receptors, involving the use of generic assessment criteria and where unacceptable risks are identified, site specific assessment criteria within a detailed quantitative risk assessment;
- To identify feasible remediation options if unacceptable risks are highlighted; and
- To develop an appropriate remediation strategy where remediation is required;

1.4 Scope of Investigation

The Phase 2 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 the completion of trial pits and soakaway testing to enable:

- Examination of the upper few metres of ground;
- 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 and;
- Collection of soil samples for geotechnical and chemical testing.

1.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with 14 low rise residential properties of conventional construction, each with private gardens and areas of soft landscaping, and that existing ground levels will not alter significantly. If this is not the case, further advice may be needed.

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, environmental 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 and gas levels vary due to seasonal or other effects, and may at times differ from those measured during the investigation.

This report only considers the ground and groundwater. It does not cover any existing 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.

2.0 SUMMARY OF PHASE 1 REPORT

Ecus Limited undertook a Phase 1 site investigation in May 2016. A copy of their report, reference RZ/7918/160418/P1, was made available to Eastwood & Partners by the client, in order to allow the design of the Phase 2 works. The phase 1 report should be read in conjunction with this report.

2.1 The Site

The site has an area of approximately 0.61 hectares and is located to the north of Upper Hoyland Road in Hoyland Common, near Barnsley, South Yorkshire. It is centred on grid reference 436080, 401420.

The site currently comprises four connected fields, with the boundaries separated by hedgerow mainly comprising Hawthorne. It is understood the site has been used as pasture land until recently, with grass and sparse shrubs present across the site at the time of investigation. An overhead electricity cable also crosses the south western corner of the site.

The site is bounded by a wooded embankment and Dearne Valley Parkway to the north, wooded embankment to the east, and hedgerow and Upper Hoyland Road to the south and west, with housing present further south.

The topography of the site slopes down towards the north west, sloping gently from a level of around 148 m in the south east to 140 m AOD in the north, resulting in an average gradient of around 1 in 11.

2.2 Site History

The earliest historical map, shows the site to comprise four connected fields bounded by hedgerow, as today. No further significant changes are understood to have taken place on site since this time.

Several collieries and associated pits and shafts, including High Royd Colliery, Rockingham Colliery and Hoyland Silkstone Collieries have historically been present in the surrounding area, the closest of which 400 m north west of the site. Numerous quarries have also been present in the surrounding area; the closest located around 200 m west of the site and shown as disused by the 1970's. A brick works and associated clay pits are also shown approximately 400 m north west and 350 m west of the site.

A large spoil tip associated with Rockingham Colliery is present 450 m west by the 1960's, expanding to around 150 m west of the site by the late 1970's.

Dearne Valley Parkway has been constructed immediately north of the site by 2002, and Shortwood Business Park around 200 m west of the site by 2010.

There are no further significant changes shown in the surrounding area until the present day.

2.3 Anticipated Ground Conditions

The ground conditions are expected to comprise a layer of topsoil overlying natural clay and mudstone, siltstone or sandstone across the majority of the site, with sandstone expected to be present beneath the north western corner of the site.

Made ground is expected to be present at the site entrance, as a layer of burnt shale was noted as a 'landing area' for farm traffic to ease access. A significant thickness is not expected. Made ground is not expected elsewhere across the site.

2.4 Groundwater

Groundwater is not expected at shallow depth beneath the site.

According to the Groundsure report, the underlying bedrock strata are classified as a Secondary A Aquifer.

The site does not lie within a Groundwater Source Protection Zone.

2.5 Coal Mining

A Coal Mining Risk Assessment was undertaken by Ecus, which identified the site as potentially at risk of unrecorded shallow coal workings and coal mine gas emissions from shallow workings. An intrusive investigation was recommended to determine whether shallow coal workings were present.

The shallowest seam expected beneath the site is the Kents Thin Coal. According to the geological map for the area, this outcrops approximately 40 m north west of the site, and is expected at a depth of between 7 m and 20 m beneath the surface. The seam may be up to 1.9 m in thickness, although is considered unlikely to be worked in this area.

Due to the risk of shallow coal workings beneath the site, precautions against the effects of shallow coal mining may be required.

2.6 Ground Gas

Radon precautions are not required for new dwellings on this site.

There are no recorded active or historical landfills within 250 m of the site.

Shallow coal workings may be present.

2.7 Flooding

The site lies within a Flood Zone 1.

2.8 Outline Conceptual Model

The following table details the possible sources and associated contaminants of concern, pathways and receptors, potentially present.

Source	Potential Contaminants	Potential Pathways	Potential Receptors
Shallow mine workings	Ground gas	Inhalation	- Future residents and visitors to the site - Site construction workers - Buildings

3.0 GROUND INVESTIGATION

3.1 Site Works

The site works were undertaken on 04 September 2017. Ten trial pits, referenced TP1 to TP10, were excavated in order to determine the ground conditions below the site. The trial pits reached depths of between 1.3 m and 3.4 m bgl.

A borehole investigation was also undertaken between 4 and 5 September 2017. Eight rotary boreholes, referenced BH1 to BH8, were drilled to depths of up to 25 m bgl using a rotary drilling rig in order to determine the depth and condition of the expected coal seams beneath the site. Prior to commencing the drilling works, a suitable permit was obtained from the Coal Authority.

The trial pits and boreholes were positioned in order to give good site coverage. Copies of the trial pit and borehole logs are presented in Appendix 2 and their locations are shown on the Exploratory Hole Location Plan, Drawing number 41677/001 in Appendix 1.

3.2 Laboratory Testing

Three natural clay samples were sent for plasticity testing to Professional Soils Laboratory in Doncaster. The results are discussed in Section 5.0 and included in Appendix 3.

Five samples of the topsoil and six samples of natural ground were despatched for chemical testing. Soil samples were taken in 500 g plastic tubs and 250 ml amber glass jars and analysed at Chemtech Environmental Limited, using MCERTs accredited methodologies where available. The chemical test results are presented in Appendix 4 and discussed further in Section 6.

4.0 GROUND CONDITIONS

4.1 Topsoil

Topsoil was encountered in all of the trial pits. The topsoil comprised dark brown slightly silty clay with roots, encountered to depths of between 0.3 and 0.4 m depth. Occasional brick and burnt shale fragments were noted within the topsoil in TP9 close to the site entrance.

4.2 Made Ground

Made ground was not encountered during the site investigation.

A small quantity brick fragments and burnt shale was found to be present in the site entrance. This has been placed above the topsoil and used to create a more level site access. The placement of this material was extremely localised around the entrance gate. Although a trial pit was not excavated through this material, it is clear that the fragments will not extend to any significant depth.

4.3 Natural Ground

The natural ground was encountered beneath the topsoil in all trial pits. It was found to comprise friable slightly sandy clay beneath the topsoil, encountered to depths of between 1.0 m and 1.4 m bgl. This was generally underlain by stiff friable clay, becoming weak weathered sandstone from depths of between 1.4 m and 2.8 m bgl. The strength of the sandstone often increased to moderately weak with depth.

Stiff dark grey/black carbonaceous clay was encountered above the weak sandstone and stiff friable clay in TP4 and TP8, at depths of between 1.5 m to 2.0 m and 1.3 m to 1.6 m respectively. In TP4 this black material was recorded as containing fine coal fragments and coal dust/powder.

Two coal seams were found in all eight of the boreholes, with the exception of BH1 in which only a shallower coal seam was encountered. The upper coal seam, believed to be the Kents Thin Coal was encountered from depths of between 4.3 m and 9.2 m bgl in all boreholes, with a thickness of between 0.7 m and 1.4 m. This seam was not found to be intact in all of the boreholes, with no loss of flush or other indication of any prior disturbance.

The second seam was encountered from depths of between 13.5 m and 18.6 m bgl in all boreholes except BH1. A thickness of between 0.3 m and 0.5 m was recorded, and this seam was also found not to have been worked. This seam is most likely to be the Kents Thick Coal. The two seams were separated by mudstone and sandstone beds.

4.4 Groundwater

Groundwater was not encountered in any of trial pits or boreholes across the site.

4.5 Evidence of Contamination

No visual or olfactory evidence of possible significant contamination was identified in any of the exploratory holes.

5.0 GEOTECHNICAL APPRAISAL

5.1 General

The site is covered by topsoil to between 0.3 and 0.4 m depth, with localised made ground present at the site entrance only. Beneath the topsoil, natural ground comprising friable slightly sandy clay was encountered, overlying stiff friable clay. Weak weathered sandstone was present from depths of between 1.4 m and 2.8 m bgl, with the strength of the sandstone increasing slightly with depth. No evidence of coal mine workings was found beneath the site. Shallow groundwater was not encountered.

The natural clay is considered to provide an allowable bearing capacity of at least 125 kN/m² in the upper layers, increasing to in excess of 150 kN/m² below approximately 1.2 m bgl.

Three samples of the natural clay were sent for plasticity testing. The results are included in Appendix 3 (PSL17/4342). Modified plasticity indices of between 15.98% and 29.76% were recorded, which equates to a low to medium change potential of the natural clay. Based on these results, it would be prudent to allow for medium volume change potential across the site.

The site slopes at present, and therefore some re-grading will be necessary to provide level plateaus for the proposed plots. Some retaining structures may be required locally.

5.2 Foundations

It is considered that traditional unreinforced strip or trench fill footings should be appropriate for low rise dwellings. The footings should be constructed within the natural stiff clay at a minimum depth of 900 mm below original or finished ground level, whichever is the lower.

Wherever trees are within influencing distance of the foundations, the footing depth will need to be deepened in accordance with NHBC Chapter 4.2 guidance. Precautions against lateral soil heave will be required in footings in clay with a calculated founding depth greater than 1500 mm due to the influence of past or existing trees.

5.3 Ground Slabs

A ground bearing slab can be considered, providing there is less than 600 mm of made ground is present and that the footing depth due to trees is less than 1500 mm. Otherwise a reinforced suspended or precast concrete floor with 250 mm high ventilated void beneath will be required.

5.4 Superstructure Precautions

No superstructure precautions are considered necessary due to the ground conditions encountered on the site.

5.5 Excavation Problems

The sides of excavations may be unstable, particularly where made ground or shallow groundwater is present.

Temporary support will 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.

5.6 Obstructions

No significant obstructions were encountered during the intrusive investigation. However an overhead electricity cable crosses the south western corner of the site. Suitable easements will need to be maintained around this feature, unless it is to be diverted.

5.7 Surface Water Drainage

Due to the presence of cohesive soils on site, soakaway drainage is not expected to be viable. An alternative method of surface water drainage, such as a connection to existing sewage network, will be required.

6.0 CONTAMINATION APPRAISAL

6.1 Source Characterisation

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

6.2 Ground Conditions

The site is covered by topsoil to between 0.3 and 0.4 m depth, with localised made ground present at the site entrance only. No other made ground was encountered on the site. Beneath the topsoil, natural ground comprising friable slightly sandy clay was encountered, overlying stiff friable clay. Weak weathered sandstone was present from depths of between 1.4 m and 2.8 m bgl, with the strength of the sandstone increasing slightly with depth. Evidence of coal workings was not found beneath the site. Shallow groundwater was not encountered.

There is no reason to suspect that natural ground encountered on site will contain any elevated concentrations of contaminants, however naturally elevated contaminants such as arsenic are occasionally encountered. In addition, atmospheric fallout of contaminants such as benzo(a)pyrene can sometimes lead to elevated levels within near surface soils.

The chemical analysis undertaken for these materials are discussed in section 6.5.

6.3 Gas Precautions

No radon precautions are required for new dwellings on this site.

There are no landfills within 250 m of the site.

Shallow coal workings were not encountered, and therefore mine gas is not expected to pose a significant risk to the site.

No gas precautions are considered necessary.

6.4 Unexpected Contamination

No visual or olfactory observations of unexpected potential contamination were noted.

6.5 Chemical Testing

Five samples of the topsoil and six samples of natural ground were sent for chemical testing. Each of the samples were analysed for the suite of contaminants listed below:

Contaminant Type	Actual Contaminants
Metals/Metalloids	Arsenic, cadmium, chromium (III and VI), lead, mercury, nickel, selenium, copper and zinc
pH	pH
PAHs	Speciated Polycyclic Aromatic Hydrocarbons
Sulphates*	Acid soluble sulphate, water soluble sulphate and sulphur.
Asbestos**	Asbestos fibres in soil

*Natural ground samples only

**Topsoil samples only

Testing was undertaken by Chemtech Environmental Limited, using MCERTs accredited methodologies, where available.

6.6 Assessment Criteria

The proposed development of the site is to be residential with private gardens and public open space. Therefore the assessment criteria relating to residential with home grown produce have been used. Tables detailing the relevant assessment concentrations used are included in Appendix 4.

6.7 Chemical Test Results

A copy of the test results (Chemtech Report no. 67085) is presented in Appendix 4.

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

6.7.1 Topsoil

None of the samples of topsoil were found contain elevated concentrations of metals/metalloids or PAHs above the assessment criteria for human health.

None of the samples of topsoil were found to be above the assessment criteria for phytotoxicity to plants.

6.7.2 Natural ground

None of the samples of natural ground were found contain elevated concentrations of metals/metalloids or PAHs above the assessment criteria for human health.

None of the samples of natural ground were found to be above the assessment criteria for phytotoxicity to plants.

6.7.3 Sulphates

The results from the samples of natural ground indicate that the water soluble sulphate concentrations are between 20 mg/l and 159 mg/l, with a characteristic value of 85 mg/l calculated, compared with the upper limit of Design Sulphate Class 1 of 500 mg/l. The concentrations of total potential sulphate calculated are <0.03% and 0.24%, with a characteristic value of 0.21% calculated, compared with an upper design limit of 0.24% for class DS-1. The pH of the natural ground samples ranged between 5.1 and 7.5, with a characteristic pH value of 7.4.

Based on these results, the natural ground would be assigned a Design Sulphate Class of DS-1 and Aggressive Chemical Environment for Concrete (ACEC) Class of AC-1.

6.8 Significant Pollutant Linkages

No significant pollutant linkages have been identified.

7.0 RISK ASSESSMENT

7.1 Human Health: Future Site Users

Elevated concentrations of contaminants have not been identified within the topsoil or natural ground. Coal workings have not been identified beneath the site. A significant risk to site users is not expected, and remedial measures are therefore not considered to be necessary.

The topsoil is considered suitable for re-use on site.

The localised made ground near the site entrance will need to be removed from site. Since this comprises burnt shale which is likely to be expandable, it is not recommended to be used as fill, and will need to be exported off site. A significant volume of material will not need to be disposed of.

7.2 Human Health: During Construction

Ground workers employed during the construction phase of the development are most at risk of harm due to them having direct contact with the affected soils. Normal hygiene measures such as washing hands before eating should be adopted. A significant risk to construction workers is not expected.

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

7.3 Plants

None of the samples of topsoil or natural ground were found to be above the assessment criteria for phytotoxicity to plants. No significant risk to plant growth is expected to be present.

7.4 Controlled Waters

Elevated concentrations were not found in either the topsoil or natural ground. The risk to controlled waters from materials on site is therefore considered to be negligible.

7.6 Construction Materials

It is considered that DS-1 AC-1 sulphate precautions are suitable for concrete in contact with the ground at the site. Sulphate precautions are therefore not required.

The results of the chemical testing will need to be forwarded to the water company so that appropriate water supply pipes can be selected. No special measures are expected to be required.

7.7 Unexpected Contamination

There is the possibility that areas more significantly contaminated than identified to date may be present. Any unusual, brightly coloured, ashy or odorous material encountered during the construction phase should be brought to the attention of the site staff and investigated.

8.0 CONTAMINATION RECOMMENDATIONS AND APPROVALS

1. Across the site, none of the samples recorded elevated concentrations of contaminants which exceeded the human health assessment criteria. The topsoil is considered suitable for reuse on site.
2. Across the site, none of the samples recorded elevated concentrations of contaminants which exceeded phytotoxic levels for plants. Plant growth will not be affected.
3. Radon and gas precautions are not required.
4. DS-1 AC-1 sulphate precautions, i.e. none, should be used on site for concrete in contact with the natural ground.
5. There is the possibility that, as with any site, areas of more significant contamination are encountered during construction works. If any unusual, brightly coloured, ashy or particularly odorous material are encountered it should be brought to the attention of the site staff and investigated.
6. The conclusions made in this report are subject to agreement by the approving bodies, such as the Local Authority and your warranty provider.

Appendix 1

Exploratory Hole Location Plan – Drawing 41677/001A



INFORMATION WITHIN THIS DRAWING IS NOT NECESSARILY PRODUCED TO SCALE.
ALWAYS USE FIGURED DIMENSIONS AND CO-ORDINATES - IF IN DOUBT, ASK.

KEY:

-  Approximate location of Borehole excavated by Eastwood and Partners between 04.09.17 and 05.09.17.
-  Approximate location of Trial Pit excavated by Eastwood and Partners on 04.09.17.
-  Approximate position of overhead electricity cable crossing the site.
-  Existing field boundaries marked by hedgerows.

A	First Issue.			
REV	DESCRIPTION	SIG	CHK	DATE

LOW FARM PROPERTIES

UPPER HOYLAND ROAD

EXPLORATORY HOLE LOCATION
PLAN

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SCALE WHEN PLOTTED AT A3 1:500			DRAWING STATUS INFORMATION	
DRAWN JRB	CHECKED SAE	DATE 08.09.17	DRAWING NUMBER 41677-001	REV A

Appendix 2

Trial Pit Logs – TP1 to TP10

Borehole logs – BH1 to BH8

Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 3.10m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
0.50	D					Brown friable slightly sandy CLAY.	
1.40 1.40 1.40 1.40	IPP 1 IPP 2 IPP 3 D	450 450 450	1.30			Stiff friable grey mottled brown CLAY.	
			2.80			Grey brown weak to moderately weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	3
			3.10			Trialpit Complete at 3.10 m	4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 2.20m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
						Brown friable slightly sandy CLAY.	
0.70	D		1.20				1
						Stiff friable grey mottled brown CLAY.	
1.30	D		1.60				
						Grey brown weak to moderately weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	
			2.20			Trialpit Complete at 2.20 m	2
							3
							4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 3.40m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.20	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
0.60	D					Brown friable slightly sandy CLAY.	
1.30	IPP 1	450	1.10			Stiff friable grey mottled brown CLAY.	1
1.30	IPP 2	450					
1.30	IPP 3	450					
1.30	D		2.70			Grey brown weak to moderately weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	2
			3.40			Trialpit Complete at 3.40 m	3
							4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 3.00m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
						Brown friable slightly sandy CLAY.	
0.90	D		1.00			Stiff grey mottled brown CLAY.	1
1.10	D						
1.10	D		1.50			Stiff dark grey/black CLAY with fine coal fragments and dust.	
			2.00			Grey brown weak to moderately weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	2
			3.00			Trialpit Complete at 3.00 m	3
							4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 2.70m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.20	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
0.90	D		1.30			Brown friable slightly sandy CLAY.	1
1.40	D		1.50			Stiff friable grey mottled brown CLAY.	
			2.70			Grey brown weak to moderately weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	2
						Trialpit Complete at 2.70 m	3
							4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 3.10m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	1
0.80	D					Brown friable slightly sandy CLAY.	
1.60	IPP 1	350	1.40			Stiff friable grey mottled brown CLAY.	2
1.60	IPP 2	300					
1.60	IPP 3	325					
1.60	IPP 4	400					
1.60	D		2.60			Brown to dark brown/black weak to moderately weak SANDSTONE, recovered as gravel to cobble sized pieces. Strength increases slightly with depth.	3
1.60							
			3.10			Trialpit Complete at 3.10 m	4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 2.90m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
1.00	D		1.20			Brown friable slightly sandy slightly gravelly CLAY. Gravel is medium angular to subangular of sandstone.	1
1.50 1.50 1.50 1.50	IPP 1 IPP 2 IPP 3 D	350 300 350	1.80			Stiff friable grey mottled brown CLAY.	
			2.90			Grey brown weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	2
						Trialpit Complete at 2.90 m	3
							4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

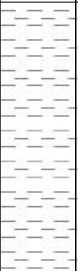
Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 3.10m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.10	D					TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
0.45	D		0.40			Brown friable slightly sandy slightly gravelly CLAY. Gravel is medium angular to subangular of sandstone.	1
			1.30			Stiff dark grey/black CLAY.	
1.50 1.50 1.50 1.50	IPP 1 IPP 2 IPP 3 D	450 450 425	1.60			Stiff friable grey mottled brown CLAY.	2
2.10	D		2.50			Grey brown weak SANDSTONE, recovered as gravel to cobble sized pieces with clay smearing. Strength increases slightly with depth.	3
			3.10			----- Trialpit Complete at 3.10 m	4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 1.60m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.30	D		0.40			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots. Occasional brick/ burnt shale fragments nearer to surface.	
1.00	D					Brown friable slightly sandy CLAY, occasionally slightly mottled grey in places.	1
1.50	IPP 1	350	1.40			Stiff grey slightly mottled orange/brown CLAY.	
1.50	IPP 2	350	1.60				
1.50	IPP 3	300					
1.60	D					Trialpit Complete at 1.60 m	2
							3
							4

Remarks:

Groundwater: None encountered.



Project Name
 Upper Hoyland Road

Project No.
 41677

Co-ords: -
 Level: -

Date
 04/09/2017

Location: Barnsley

Dimensions: -

Scale
 1:25

Client: Low Farm Properties

Depth
 1.30m

Logged By
 SAE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.20	D		0.30			TOPSOIL: Vegetation over dark brown slightly silty CLAY with roots.	
0.80	D		1.10			Brown friable slightly sandy CLAY.	
			1.30			Friable grey slightly mottled orange/brown CLAY, becoming weak sandstone by the base of the pit.	
Trialpit Complete at 1.30 m							

Remarks:

Groundwater: None encountered.



Project Name
Upper Hoyland Road

Project No.
41677

Co-ords: -

Hole Type
RO

Location: Barnsley

Level: -

Scale
1:125

Client: Low Farm Properties

Dates: 05/09/2017

Logged By
Drillers

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								SANDSTONE	1
									2
									3
									4
									5
									6
									7
									8
					9.20				9
								COAL	10
					10.10			Grey MUDSTONE	11
									12
									13
									14
									15
									16
									17
									18
									19
					19.20			Grey MUDSTONE	20
									21
									22
									23
									24
		Type	Results					End of Borehole at 25.00 m	

Remarks:



Project Name
Upper Hoyland Road

Project No.
41677

Co-ords: -

Hole Type
RO

Location: Barnsley

Level: -

Scale
1:125

Client: Low Farm Properties

Dates: 05/09/2017

Logged By
Drillers

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								SANDSTONE	1
									2
									3
									4
									5
									6
									7
									8
					8.90			COAL	9
					9.90			Grey MUDSTONE	10
									11
									12
									13
									14
									15
					15.90			COAL	16
					16.30			Grey MUDSTONE	17
									18
									19
									20
									21
									22
									23
									24
		Type	Results					End of Borehole at 25.00 m	

Remarks:



Project Name
Upper Hoyland Road

Project No.
41677

Co-ords: -

Hole Type
RO

Location: Barnsley

Level: -

Scale
1:125

Client: Low Farm Properties

Dates: 05/09/2017

Logged By
Drillers

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								SANDSTONE	1
									2
									3
									4
					5.20				5
								COAL	6
					6.10			Grey MUDSTONE	7
									8
									9
									10
									11
									12
									13
									14
									15
					15.20			COAL	16
					15.50			Grey MUDSTONE	17
									18
									19
									20
									21
									22
									23
									24
		Type	Results					End of Borehole at 25.00 m	

Remarks:



[illegible]

Remarks:

Project Name
Upper Hoyland Road

Project No.
41677

Co-ords: -

Hole Type
RO

Location: Barnsley

Level: -

Scale
1:125

Client: Low Farm Properties

Dates: 05/09/2017

Logged By
Drillers

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								SANDSTONE	1
									2
									3
									4
									5
					5.70				6
					6.60			COAL	6
								Grey MUDSTONE	7
									8
									9
									10
									11
									12
									13
									14
					15.20				15
					15.50			COAL	15
								Grey MUDSTONE	16
									17
									18
									19
									20
									21
									22
									23
									24
		Type	Results					End of Borehole at 25.00 m	

Remarks:



Project Name
Upper Hoyland Road

Project No.
41677

Co-ords: -

Hole Type
RO

Location: Barnsley

Level: -

Scale
1:125

Client: Low Farm Properties

Dates: 05/09/2017

Logged By
Drillers

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								SANDSTONE	1
									2
									3
									4
					4.30				
								COAL	5
					5.20				
								Grey MUDSTONE	6
									7
									8
									9
									10
									11
									12
									13
									14
					14.60				
					14.90			COAL	15
								Grey MUDSTONE	16
									17
									18
									19
									20
									21
									22
									23
									24
		Type	Results					End of Borehole at 25.00 m	

Remarks:



Project Name Upper Hoyland Road	Project No. 41677	Co-ords: -	Hole Type RO
Location: Barnsley		Level: -	Scale 1:125
Client: Low Farm Properties		Dates: 04/09/2017	Logged By Drillers

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								SANDSTONE	1	
									2	
									3	
									4	
									5	
							5.40		COAL	6
							6.10		Grey MUDSTONE	7
							7.30		SANDSTONE	8
										9
										10
										11
										12
										13
							13.50		COAL	14
							14.00		Weathered SANDSTONE	15
										16
										17
										18
										19
										20
										21
							22.30		Hard Strata - No returns	22
										23
							24.00		End of Borehole at 25.00 m	24
		Type	Results							

Remarks:



Appendix 3

Geotechnical Results (PSL17/4342)



LABORATORY REPORT



4043

Contract Number: PSL17/4342

Report Date: 18 September 2017
Client's Reference: 41677
Client Name: Eastwood & Partners
St Andrews House
23 Kingfield Road
Sheffield
S11 9AS

For the attention of: Stefani Ellis

Contract Title: Upper Hoyland Road
Date Received: 8/9/2017
Date Commenced: 8/9/2017
Date Completed: 18/9/2017

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:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)

S Eyre
(Senior Technician)

A Fry
(Senior Technician)

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

PSL
Professional Soils Laboratory

Upper Hoyland Road

Contract No:

PSL17/4342

Client Ref:

41677

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



PSL
Professional Soils Laboratory

Upper Hoyland Road

Contract No:

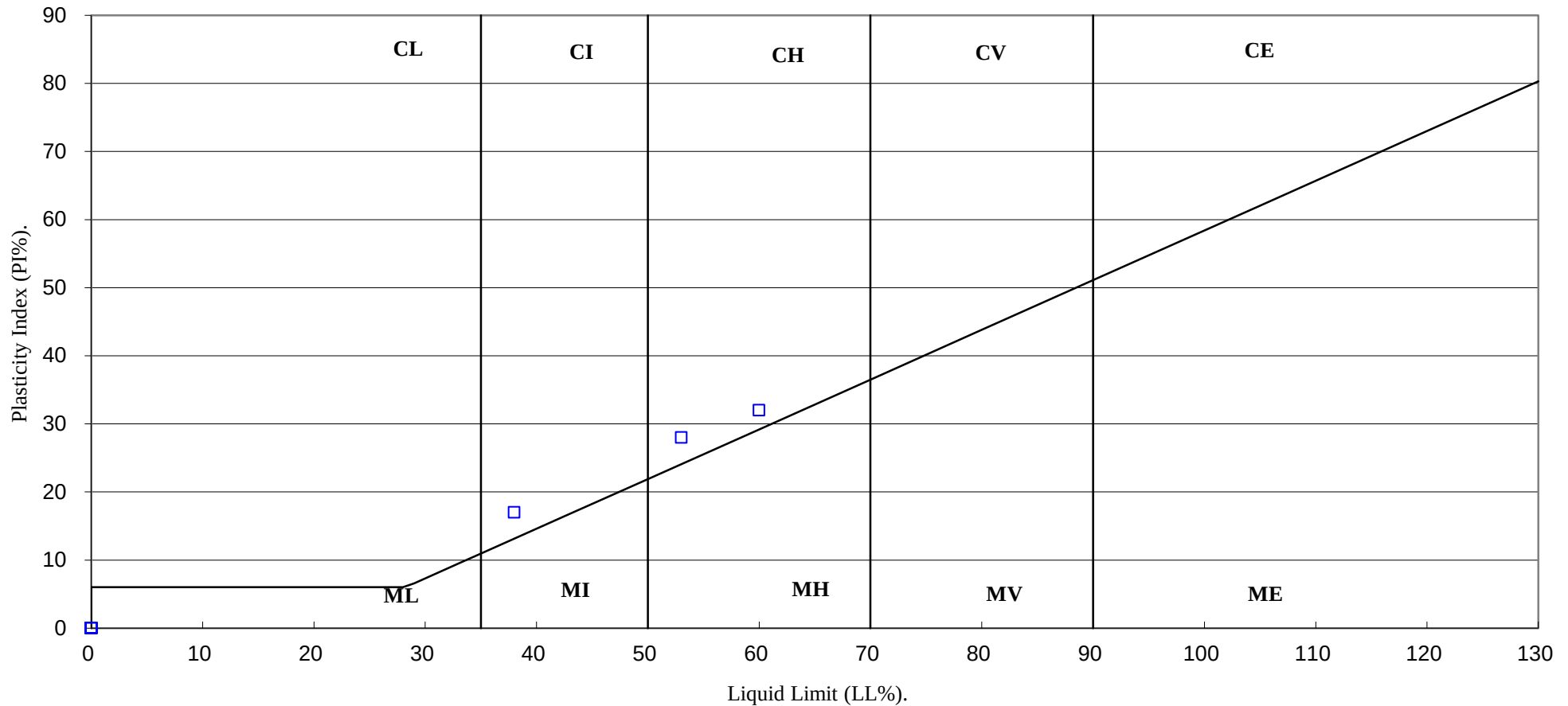
PSL17/4342

Client Ref:

41677

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



PSL
Professional Soils Laboratory

Upper Hoyland Road

Contract No:

PSL17/4342

Client Ref:

41677

Appendix 4

Chemical Test Results – Chemtech Report No. 67085

Assessment Values



2531



ANALYTICAL TEST REPORT

Contract no: 67085
Contract name: Upper Hoyland Road
Client reference: 41677
Clients name: Eastwood & Partners
Clients address: St Andrews House
23 Kingfield Road
Sheffield
S11 9AS

Samples received: 07 September 2017

Analysis started: 07 September 2017

Analysis completed 13 September 2017

Report issued: 13 September 2017

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
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 6 weeks from initial receipt unless otherwise instructed.

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:

James Spittle
Customer Services Team Leader

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.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
67085-1	TP2	0.70	Clayey Sand with Gravel	-	-	13.4
67085-2	TP3	0.20	Clay with Gravel and Roots	-	-	17.8
67085-3	TP4	0.10	Clay with Gravel and Roots	-	-	12.1
67085-4	TP4	1.10	Clay	-	-	16.7
67085-5	TP5	1.40	Clay	-	-	10.4
67085-6	TP6	0.10	Clay with Roots	-	-	21.5
67085-7	TP7	0.10	Clay with Roots	-	-	25.5
67085-8	TP8	0.45	Sandy Clay with Roots	-	-	14.4
67085-9	TP8	1.50	Clay	-	-	19.5
67085-10	TP10	0.20	Sandy Clay with Roots	-	-	21.9
67085-11	TP10	0.80	Sandy Clay with Gravel	-	-	12.4

Chemtech Environmental Limited

SOILS

Lab number			67085-1	67085-2	67085-3	67085-4	67085-5	67085-6
Sample id			TP2	TP3	TP4	TP4	TP5	TP6
Depth (m)			0.70	0.20	0.10	1.10	1.40	0.10
Date sampled			04/09/2017	04/09/2017	04/09/2017	04/09/2017	04/09/2017	04/09/2017
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	10	3.0	2.9	8.8	7.8	8.2
Cadmium (total)	CE127 ^M	mg/kg Cd	0.5	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	116	147	161	108	89	93
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	54	15	14	28	29	30
Lead (total)	CE127 ^M	mg/kg Pb	78	18	20	60	74	78
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	21	11	12	27	23	24
Selenium (total)	CE127 ^M	mg/kg Se	0.6	0.4	0.4	1.2	1.2	1.3
Zinc (total)	CE127 ^M	mg/kg Zn	97	45	47	80	98	108
pH	CE004 ^M	units	6.1	6.4	7.3	7.3	6.3	6.1
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	37	-	-	110	20	-
Sulphate (total)	CE062 ^M	mg/kg SO ₄	405	-	-	336	<100	-
Sulphur (total)	CE127	% w/w S	0.06	-	-	0.04	0.04	-
PAH								
Naphthalene	CE087 ^M	mg/kg	<0.01	0.09	0.18	0.19	<0.01	0.05
Acenaphthylene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	CE087 ^M	mg/kg	<0.01	<0.01	0.05	0.05	<0.01	<0.01
Fluorene	CE087 ^U	mg/kg	<0.01	<0.01	0.04	0.04	<0.01	<0.01
Phenanthrene	CE087 ^M	mg/kg	<0.02	0.26	0.96	1.02	<0.02	0.14
Anthracene	CE087 ^U	mg/kg	<0.02	0.09	0.29	0.31	<0.02	0.03
Fluoranthene	CE087 ^M	mg/kg	<0.02	0.28	2.08	2.20	<0.02	0.22
Pyrene	CE087 ^M	mg/kg	<0.02	0.28	1.85	1.96	<0.02	0.23
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	0.07	1.06	1.12	<0.02	<0.02
Chrysene	CE087 ^M	mg/kg	<0.01	0.18	0.91	0.96	<0.01	0.12
Benzo(b)fluoranthene	CE087 ^M	mg/kg	<0.02	<0.02	1.76	1.86	<0.02	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.02	0.05	1.15	1.22	<0.02	0.06
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	0.15	0.96	1.01	<0.02	0.12
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	0.08	0.51	0.54	<0.02	0.06
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	0.09	0.09	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	<0.02	0.09	0.49	0.51	<0.02	0.05
PAH (total of USEPA 16)	CE087	mg/kg	<0.27	1.61	12.4	13.1	<0.27	1.09
Subcontracted analysis								
Asbestos (qualitative)	\$	-	-	NAD	NAD	-	-	NAD

Chemtech Environmental Limited

SOILS

Lab number			67085-7	67085-8	67085-9	67085-10	67085-11
Sample id			TP7	TP8	TP8	TP10	TP10
Depth (m)			0.10	0.45	1.50	0.20	0.80
Date sampled			04/09/2017	04/09/2017	04/09/2017	04/09/2017	04/09/2017
Test	Method	Units					
Arsenic (total)	CE127 ^M	mg/kg As	6.3	5.8	4.8	12	7.2
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	0.2	0.3	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	86	50	54	86	45
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	20	21	54	52	15
Lead (total)	CE127 ^M	mg/kg Pb	18	50	40	98	13
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	43	18	47	27	20
Selenium (total)	CE127 ^M	mg/kg Se	1.2	0.8	1.3	1.3	0.7
Zinc (total)	CE127 ^M	mg/kg Zn	52	69	150	112	59
pH	CE004 ^M	units	6.6	7.5	5.1	6.0	6.2
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	-	44	159	-	23
Sulphate (total)	CE062 ^M	mg/kg SO ₄	-	486	444	-	204
Sulphur (total)	CE127	% w/w S	-	0.08	0.06	-	<0.01
PAH							
Naphthalene	CE087 ^M	mg/kg	0.06	0.02	<0.01	0.05	<0.01
Acenaphthylene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	CE087 ^M	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	CE087 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	CE087 ^M	mg/kg	0.18	0.07	<0.02	0.15	<0.02
Anthracene	CE087 ^U	mg/kg	0.04	<0.02	<0.02	0.04	<0.02
Fluoranthene	CE087 ^M	mg/kg	0.26	0.11	<0.02	0.22	<0.02
Pyrene	CE087 ^M	mg/kg	0.28	0.12	0.03	0.24	<0.02
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	0.09	<0.02	0.06	<0.02
Chrysene	CE087 ^M	mg/kg	0.20	0.07	<0.01	0.15	<0.01
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.11	<0.02	<0.02	<0.02	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.08	<0.02	<0.02	0.08	<0.02
Benzo(a)pyrene	CE087 ^U	mg/kg	0.18	0.06	<0.02	0.13	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.05	<0.02	<0.02	0.07	<0.02
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.07	0.04	<0.02	0.08	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	1.50	0.58	<0.27	1.27	<0.27
Subcontracted analysis							
Asbestos (qualitative)	\$	-	NAD	-	-	NAD	-

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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
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	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO ₄
CE127	Sulphur (total)	Acid extraction, ICP-MS	Dry		0.01	% w/w S
CE087	Naphthalene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	Wet	U	0.01	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	Wet		0.27	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

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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)
IT	Sample not cooled
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
67085-1	TP2	0.70	N	
67085-2	TP3	0.20	N	
67085-3	TP4	0.10	N	
67085-4	TP4	1.10	N	
67085-5	TP5	1.40	N	
67085-6	TP6	0.10	N	
67085-7	TP7	0.10	N	
67085-8	TP8	0.45	N	
67085-9	TP8	1.50	N	
67085-10	TP10	0.20	N	
67085-11	TP10	0.80	N	

Inorganic Compounds	Human Health - Residential with Homegrown Produce (mg/kg)
Arsenic	37
Cadmium	11
Chromium (III)	910
Chromium (VI)	6
Lead	200
Mercury	1.2
Nickel	180
Selenium	250
Copper	2400
Zinc	3700

Organic Compounds	Human Health - Residential with Homegrown Produce (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Naphthalene	2.3	5.6	13
Acenaphthene	210	510	1100
Acenaphthylene	170	420	920
Fluorene	170	400	860
Phenanthrene	95	220	440
Anthracene	2400	5400	11000
Fluoranthene	280	560	890
Pyrene	620	1200	2000
Benzo(a)anthracene	7.2	11	13
Chrysene	15	22	27
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(k)fluoranthene	77	93	100
Benzo(a)pyrene	2.2	2.7	3.0
Dibenz(a,h)anthracene	0.24	0.28	0.3
Indeno(1,2,3-cd)pyrene	27	36	41
Benzo(g,h,i)perylene	320	340	350
Benzene	0.087	0.17	0.37
Toluene	130	290	660
Ethylbenzene	47	110	260
o-Xylene	60	140	330
m-Xylene	59	140	320
p-Xylene	56	130	310

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 Eastwood & Partners CONSULTING ENGINEERS St Andrew's House 23 Kingfield Road Sheffield S11 9AS Tel: (0114) 255 4554 Fax: (0114) 255 4330	LOW FARM PROPERTIES UPPER HOYLAND ROAD, BARNSELY ASSESSMENT CRITERIA – RESIDENTIAL WITH HOMEGROWN PRODUCE
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Contaminant	Phytotoxicity			
	pH	pH	pH	pH
	5.0 to 5.5	5.5 to 6.0	6.0 to 6.5	>7.0
Arsenic	50			
Cadmium	3			
Chromium	400			
Lead	300			
Mercury	1			
Nickel	50	60	75	110
Copper	80	100	135	200
Zinc	200	200	200	300

The assessment concentration for lead is the Category 4 Screening Level produced by Contaminated Land: Applications in Real Environments (CL:AIRE) and outlined in Appendix H of their report SP1010. The others have been taken from Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R., and Nathanail, J., 2015, *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*, Land Quality Press, Nottingham. The metals/metalloids are based on a sandy loam soil and 6% soil organic matter. The assessment values are not intended to be applied to individual sample results where materials are similar, as the levels of contaminants will have a natural variability across the site. Instead, the modified mean value should be compared with the assessment concentration.

The assessment values for phytotoxicity are the levels at which plant growth is thought to be affected. They are taken from the maximum permissible and advisable concentrations in soil after application of soil sludge given in the *'The Code of Good Agricultural Practice for the Protection of Soil'*, MAFF, 1998.

The assessment of sulphate, water soluble sulphate, elemental sulphur and sulphide is to determine the aggressive nature of the ground with respect to concrete and consequently the results are compared with BRE Special Digest 1:2005 *'Concrete in Aggressive Ground'*.

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TPH Fraction	Intended Land Use Residential (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Aliphatic EC 5-6	42	78	160
Aliphatic EC >6-8	100	230	530
Aliphatic EC >8-10	27	65	150
Aliphatic EC >10-12	130 (48) ^{vap}	330 (118) ^{vap}	760 (283) ^{vap}
Aliphatic EC >12-16	1100 (24) ^{sol}	2400 (59) ^{sol}	4,300 (142) ^{sol}
Aliphatic EC >16-35	65,000 (8.48) ^{f, sol}	92,000 (21) ^{f, sol}	110,000 ^f
Aliphatic EC >35-44	65,000 (8.48) ^{f, sol}	92,000 (21) ^{f, sol}	110,000 ^f
Aromatic EC 5-7	70	140	300
Aromatic EC >7-8	130	290	660
Aromatic EC >8-10	34	83	190
Aromatic EC >10-12	74	180	380
Aromatic EC >12-16	140	330	660
Aromatic EC >16-21	260 ^f	540 ^f	930 ^f
Aromatic EC >21-35	1,100 ^f	1,500 ^f	1,700 ^f
Aromatic EC >35-44	1,100 ^f	1,500 ^f	1,700 ^f

^f oral, dermal, and inhalation exposure compared with oral HCV

^{sol} S4UL presented exceeds the solubility saturation limit, which is presented in brackets

^{vap} S4UL presented exceed the vapour saturation limit, which is presented in brackets

The assessment criteria for each of the petroleum hydrocarbon fractions have been taken from Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R., and Nathanail, J., 2015, *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*, Land Quality Press, Nottingham. These are also all based on a sandy loam soil.

Within the Environment Agency Science Report P5-080/TR3, Askari, K. & Pollard, S., 2005 *'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils'* it is stated that the assessment values should not be considered individually; instead the potential additive effects should be calculated. This is achieved by calculating an individual Hazard Quotient (HQ) for each fraction. The HQ is the proportion of the assessment concentration represented by the recorded concentration. The HQs are then added together to form a Hazard Index (HI) and where this exceeds unity a potential significant risk to human health may exist.

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