Eastwood & Partners
CONSULTING ENGINEERS

PHASE 2 GEOTECHNICAL AND GEO-ENVIRONMENTAL SITE INVESTIGATION

NEEDLEWOOD, KERESFORTH HILL ROAD BARNSLEY

FOR

MATON HOMES LTD

ISSUE 2



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1.0 EXECUTIVE SUMMARY

1. The site is located off Keresforth Hill Road, in Barnsley. It has an area of approximately 1.2 hectares and is centred on grid reference 432840, 405030.

2. The site is currently disused with a stockpile of demolition rubble that is present in the vicinity of the former building on the site. The southern portion of the site is wooded. There is a septic tank present within the woodland. Trees also occupy the northernmost part of the site.

3. The site falls generally to the south west, becoming steeper south of the access road. The site was undeveloped until 1906, when Needlewood House was constructed. This was expected to have had a basement. Some smaller buildings were also constructed in the north east of the site, closer to Keresforth Hill Road. The smaller buildings were demolished between 1978 and 1993.

4. The site is underlain by Pennine Middle Coal Measures consisting of mudstone, sandstone and siltstone bedrock. There are two faults indicated close to the northern site boundary. The strata dip at approximately 5º to the north east.

5. The Swallow Wood, Lower Haigh Moor and Top Haigh Moor coal seams are inferred to outcrop across the site, orientated north west to south east. These have been encountered as thin intact seams within the boreholes. Precautions against the effects of shallow coal mining are not considered necessary.

6. The ground conditions generally comprise made ground of demolition rubble, reworked sandy clays with sandstone cobbles and reworked clays to depths of up to 2.0 m bgl in the vicinity of the previous buildings on the site. The natural ground comprised firm to stiff clay with intermittent thin coal seams to depths of between 1.65 and 3.7 m. Bedrock of mudstone or sandstone was encountered below.

7. Traditional unreinforced strip or trench fill foundations are considered to be appropriate for residential dwellings of up to three storeys, taken through any made or soft ground and into the natural clay at a minimum depth of 900 mm. Foundations would need to be locally deepened in the vicinity of the previous buildings, where deeper made ground is expected.

8. Footings should be deepened and constructed in accordance with NHBC Standards Chapter 4.2 where under the influence of past or present trees. Precautions against soil heave will be required for all trench fill footings with a calculated founding depth greater than 1.5 m due to past or present trees.

9. Where there is expected to be less than 600 mm of made ground below the ground floor slab, ground bearing slabs are expected to be appropriate. In the vicinity of the previous buildings more than 600 mm of made ground is expected therefore in these areas either reinforced suspended in-situ or precast concrete floors with a ventilated void will be required.

10. Infiltration tests have been undertaken and failed to drain. Soakaways are not considered to be a suitable at this site.

11. Strong bedrock was encountered in a number of holes from around 2 to 4 m depth. TPA and TP8 were terminated due to a concrete base at 1.0 and 2.0 m bgl respectively.

12. The site falls generally to the south west, becoming steeper south of the access road. Retaining walls may be required in the proposed development.

13. The demolition rubble from the old house on site contains elevated concentrations of lead, mercury and PAHs. A clean inert capping layer of 600 mm is required over this demolition rubble where it is placed below gardens and landscaped areas.

14. One elevated concentration of lead (250 mg/kg) was recorded in the topsoil/made ground sample in TP5. This topsoil was noted to be ashy, most likely remnants of a small bonfire and was only found in a localised area. Once mixed with the remaining site won topsoil, which was found to be clean, the lead concentration is expected to be 'diluted' and is therefore not considered to pose a significant risk to human health once mixed with the remaining site-won clean topsoil.

15. Where coal is present at surface level in proposed gardens, a 1 m thick non-combustible capping layer will be required.

16. A programme of gas monitoring has been undertaken. Four rounds were completed before the wells were destroyed. No radon or ground gas precautions are considered to be required on this site.

17. DS-4 AC-4 sulphate precautions are required for all sub-surface concrete in contact with the made ground. DS-1 AC-3z sulphate precautions are required for all sub-surface concrete in contact with the natural ground.

18. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies such as the Local Authority and the NHBC (if applicable).

2.0 INTRODUCTION

2.1 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 instructions of, Maton Homes Ltd. 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

A Phase 1 Geo-Environmental Report has previously been prepared by Haigh Huddleston & Associates for Respite Options. This report is referenced E07/4620/R001 and is dated June 2008. We have reviewed the Phase 1 report and incorporated relevant information into this Phase 2 report.

2.3 Aims and Objectives

The aims and objectives of this investigation were as follows.

- Detail the ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed development;
- Undertake chemical testing enabling refinement and subsequent further testing of the conceptual model;
- Carry out a 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;
- Identify feasible remediation options if unacceptable risks are highlighted; and
- Develop an appropriate remediation strategy where remediation is required.

2.4 Scope of Investigation

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, infiltration tests and rotary boreholes which were completed to enable:

- Examination of the upper few metres of ground;

- Information regarding the shallow coal seams expected beneath the site;
- In situ description of soils, enabling any localised lateral and vertical changes in soil conditions to be logged;
- Assessment of infiltration drainage in the upper few metres of ground;
- Assessment of any contamination identified using visual and olfactory methods;
- Collection of soil samples for chemical and laboratory testing.

2.5 Limitations of Investigation

This report is based on the assumption that new residential properties of conventional construction with associated hardstanding and landscaping will be built on the site. It is expected 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 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 considers the ground and groundwater and does not cover any buildings or their fabric. 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 SUMMARY OF PHASE 1 REPORT

The main findings of the Phase 1 report are summarised as follows. We have also provided supplementary information.

1. The roughly triangular approximately 1.2 hectare site is located off Keresforth Hill Road, Barnsley, around OS grid reference 432840, 405030. It was occupied by a single building named Needlewood, situated slightly north of the centre of the site. The area surrounding the building and to the east was grassed with the exception of the access road for the property. The southern portion of the site is wooded. Trees also occupy the northernmost part of the site.

2. At the time of our investigation in January 2016, Needlewood House had been demolished, with a stockpile of building rubble present in its former location. A septic tank is present in the south of the site. The site falls generally to the south west, becoming steeper south of the access road. The ground surface in south of the site was wet at the time of our visit.

3. The site was undeveloped until 1906, when Needlewood House was constructed. Some smaller buildings were also constructed in the north east of the site, closer to Keresforth Hill Road. An old shaft was shown around 220 m to the south east of the site in 1931. The smaller buildings were demolished between 1978 and 1993. It is likely that Needlewood House would have had a basement.

4. A small patch of Japanese Knotweed is present in the north of the site. We understand that this is currently being treated. This is not considered further in this report.

5. The site is underlain by Pennine Middle Coal Measures consisting of mudstone, sandstone and siltstone bedrock. There are two faults indicated offsite close to the northern site boundary. The strata dip at approximately 5º to the north east.

6. The Lower Haigh Moor, Top Haigh Moor, and Swallow Wood coal seams are shown to outcrop across the site. The Lidget coal outcrops to the south west of the site, and should also be at shallow depth below the site. Opencast mining in the Swallow Wood coal took place to the east of the site. Several adits are shown to be present in this area.

7. No radon protection measures are required. No historical or active landfills are present within 250 m of the site. A few small quarries have been present in the surrounding area at around 230 m from the site, as well as the area of opencast mining around 50 m to the south east.

8. The site does not lie within a flood zone. The site overlies a Secondary A aquifer, and is not located over a Groundwater Source Protection Zone.

4.0 OUTLINE CONCEPTUAL MODEL

Historically, the site has been developed with one main building in 1907, most recently used as a children's home before becoming derelict. The remainder of the site, aside from a couple of smaller buildings close to Keresforth Hill Road in the east of the site, has been undeveloped and mostly wooded. Historically the surrounding land has been used for agriculture and for opencast coal mining.

Deep made ground is not expected; however, there is the possibility of encountering colliery spoil from the nearby opencast coal mine on site. Made ground is also expected to be present in the footprint of the old buildings. A building the age of Needlewood house is also expected to have had a basement.

Any made ground which is present may contain some elevated concentrations of heavy metals such as arsenic, nickel, copper or zinc, as well as elevated levels of PAHs, particularly if ashy materials are present. Asbestos containing materials may also be encountered. Elevated concentrations of heavy metals and PAHs may also be anticipated in shallow soils beneath hardstanding and made ground.

The natural ground is not expected to be particularly contaminated, although some naturally elevated concentrations of metals/metalloids and sulphates may be recorded within the Coal Measures strata.

No radon precautions are required for any proposed development on the site. Mine gas may pose a risk to the site if shallow coal workings are found. Small infilled quarries and an area of infilled opencast mining were present within 250 m of the site, with the opencast mine being located on the eastern side of Keresforth Road. Although their distance from site indicates that ground gas may pose a risk to the proposed development, the underlying ground conditions are expected to comprise relatively impermeable clay and mudstone which should hinder ground gas migration. However, to confirm if gas measures are required, gas monitoring is recommended.

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

Potential Contaminants	Pathway	Receptor
Made ground with possible elevated concentrations of heavy metals, PAHs, and sulphates.	Ingestion, inhalation, direct contact. Migration through soils.	Future residents and visitors to the site. Site construction workers. Secondary A aquifer
	Direct contact.	Sub-surface concrete. Water supply pipes.
Naturally elevated concentrations of heavy metals, PAHs, and sulphates within natural ground.	Ingestion, inhalation, direct contact. Migration through soils.	Future residents and visitors to the site. Site construction workers. Secondary A aquifer.
	Direct contact.	Water supply pipes.
Asbestos in any made ground present.	Inhalation, direct contact.	Future residents and visitors to the site. Site construction workers.
Mine gas from shallow workings beneath the site, landfill gas from infilled opencast workings and small former quarries within 250 m of the site.	Migration through soils, inhalation	Future residents and visitors to the site.

5.0 GROUND INVESTIGATION

5.1 Site Works

Eastwood & Partners visited the site on 8 January 2016 and undertook ten trial pits to determine the underlying ground conditions. The trial pits, referenced TPA and TP1 to TP9, reached depths of between 1.0 and 4.55 m below ground level (bgl). The trial pit positions were chosen to give good site coverage of the area to be developed (the proposed development is to be restricted to the northern half of the site), and target any potential sources of contamination.

TP1 and TP2 were also used for soakaway tests SA1 and SA2 respectively.

Five rotary boreholes, referenced BH1 to BH5, were carried out on 29 January 2016. Four 3 m deep monitoring wells were drilled and installed with monitoring wells in the locations of BH1, BH3, BH4 and BH6.

Four rounds of gas monitoring have been undertaken. The results are included in Appendix 5.

Copies of the exploratory hole logs are presented in Appendix 2, and their locations are shown on the Exploratory Hole Location Plan, Drawing number 39353/001B in Appendix 1.

5.2 Laboratory Testing

Disturbed samples were obtained from each of the trial pits and were generally taken at each significant change of strata.

Seven samples of the topsoil (comprising five samples of topsoil, two samples of topsoil/made ground), two samples of the made ground and six of natural ground were submitted for chemical testing at Chemtest Limited in Newmarket.

A further three samples of topsoil and three samples of made ground from the stockpile of rubble on site were tested by Chemtest Limited.

Two samples of the natural ground were selected and submitted for geotechnical testing at Professional Soils Laboratory (PSL) in Doncaster.

The geotechnical testing is discussed in Section 7.0 and the chemical testing is covered in Section 8.0.

6.0 GROUND CONDITIONS

6.1 Surface Covering

The majority of the site is covered by topsoil with a thickness of around 300 to 500 mm. In places this topsoil is mixed in with extraneous fragments such as mattresses, bricks, ceramics and plastic fragments. In the vicinity of the previous house, the site is covered by macadam and demolition rubble. The macadam and associated sub base was around 0.55 m thick.

6.2 Made Ground

Four trial pits encountered made ground.

A stockpile of demolition rubble including timber and bricks, covered the footprint of the demolished house. TPA was excavated on the edge of this stockpile and found the rubble to extend to a depth of 1 m bgl before encountering a concrete slab.

Adjacent to the demolished house, within TP2, reworked grey to brown sandy clay containing occasional sandstone cobbles was found to a depth of 1.2 m bgl.

Next to the septic tank in the south of the site, reworked clay was found to a minimum of 2 m bgl on top of a concrete slab.

TP9 encountered reworked orange clay to 1.55 m bgl in the north east of the site. This was an area where a cluster of small buildings had previously stood until the 1980s.

6.3 Natural Ground

The natural ground encountered comprised clay over mudstones or sandstones. Thin coal seams up to 0.2 m thick were encountered within the trial pits (TP2, TP4, and TP7) at depths of between 1.0 m and 2.15 m bgl.

6.4 Obstructions

TPA and TP8 were terminated due concrete slabs at the base at 1 and 2 m bgl respectively.

Strong bedrock was encountered at 2 m bgl in TP1, 4.2 m bgl in TP2 and 3.6 m bgl in TP7.

No other significant obstructions were encountered within the trial pits.

6.5 Groundwater

A small amount of perched water was encountered in TP1 between 0.5 and 1 m bgl, at the base of the made ground. TP3 found water welling up from the base at 3 m bgl, TP4 encountered water

ingressing between 1.75 and 2.3 m bgl, and in TP9, next to the septic tank, pipes were found discharging clear water at 0.9 m bgl.

No other groundwater ingresses were encountered.

6.6 Evidence of Contamination

Several fly-tipped items were noted within the topsoil on site. These were generally mattresses, bricks, ceramics and plastic fragments. Macadam and demolition rubble were present in the vicinity of the former buildings on site.

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

7.0 GEOTECHNICAL APPRAISAL

7.1 General

Made ground is present in the vicinity of the previous buildings and septic tank on the site. The made ground comprised demolition rubble, reworked sandy clays with sandstone cobbles and reworked clays to a depth of between 1.0 and 2.0 m bgl. Needlewood House, which has now been demolished, is expected to have had a basement. The underlying natural ground comprised firm to stiff clays with thin intermittent coal bands to depths of between 1.65 and 3.70 m. Bedrock of mudstone or sandstone was encountered below the clay.

Two samples were sent for geotechnical testing by PSL in Doncaster. The samples were taken from TP1 at 1.0 m bgl and TP7 at 1.5 m bgl. One sample was described as brown mudstone and recorded as non-plastic. The other sample was described as brown mottled grey sandy very silty clay and was calculated to have modified plasticity index of 22%. This corresponds to a medium volume change potential classification in accordance with the NHBC Chapter 4.2 standards. A copy of the geotechnical test results is included in Appendix 3.

The site falls generally to the south west, becoming steeper south of the access road. Retaining walls may be required in the proposed development.

7.2 Shallow Mining

The Swallow Wood coal is inferred to outcrop across the north eastern corner of the site. This has been opencast worked to the east of the site. It has not been encountered within the exploratory holes undertaken on the site.

The next shallowest coal seam, the Top Haigh Moor, is shown to outcrop across the centre of the site orientated south east to north west. This is inferred on the map to separate into two leaves below the site. It is anticipated that the upper leaf outcrops between TP3 and TP4 and is only recorded in TP4 as 0.2 m thick seam at 1.0 m bgl. The lower leaf is expected to outcrop around TPs 5, 2 and 7 where a thin intact seam (100 to 200 mm thick) was found.

The Low Haigh Moor coal is inferred to outcrop across the south of the site in the vicinity of TP8. Using a dip of 5^{o} and taking into account the rise in topographic ground level, this seam is expected to be the one found in BH1 to BH5 from around 10 to 15 m bgl with a thickness of 400 to 800 mm (average 540 mm). This corresponds with the expected thickness in the area (0.7 m with an overlying 0.25 m of coal and 0.1 m of dirt). There is also expected to be around 10 m of measures between the Low Haigh Moor and the overlying Top Haigh Moor coal, which is what has been found in these boreholes.

The Lidget coal is shown to outcrop approximately 150 m to the south west of the site, and is anticipated around 30 m below the Low Haigh Moor coal seam. From information provided by the geological memoir, the Lidget coal is known to have been significantly worked, however it becomes irregular and untraceable to the west and north of Barnsley. Around 100 m south of the site, mine entries are shown along the Lidget's outcrop, indicating it has been worked in the area. The seam is recorded to be up to 1.25 m thick. In the south of the site the Lidget seam is expected at around 20 m, deepening to around 50 m in the north east. At a depth of at least 20 m, workings within the Lidget are not considered to pose a significant risk to the development.

To conclude, the drilling investigation encountered a number of intact coal seams expected to be the Top and Low Haigh Moor coal seams. No evidence of workings within these seams was encountered. Precautions against the effects of shallow coal mining are therefore not considered necessary.

7.3 Foundations

The proposed development is to comprise residential dwellings of conventional construction.

If the ground levels are remaining the same as existing, traditional unreinforced strip or trench fill foundations are considered to be appropriate across the site, taken through any made or soft ground and into the natural clay or mudstone at a minimum depth of 900 mm.

In the vicinity of the previous buildings where made ground was encountered, the foundations would need to be locally deepened in these areas.

Abundant trees are present on the site, especially in the south and along the northern boundary of the site. Where existing or proposed trees will have an influence, the footings should be deepened and constructed in accordance with the NHBC Standards, Chapter 4.2. Precautions against soil heave will be required for all trench fill footings with a calculated founding depth greater than 1.5 m due to past or present trees.

7.4 Ground Floors

Where there is expected to be less than 600 mm of made ground below the ground floor slab, ground bearing slabs will be appropriate.

In the vicinity of the previous buildings more than 600 mm of made ground is expected therefore in these areas either reinforced suspended in-situ or precast concrete floors with a minimum 150 mm ventilated void will be required. The void height should be increased to 250 mm where heave precautions are required.

7.5 Superstructure Precautions

Additional superstructure precautions should not be required based on the ground conditions encountered on site.

7.6 Excavation Problems

Within the made ground and natural strata perched water was encountered at depths of between 0.5 and 3.0 m bgl. The sides of any excavation may therefore be expected to be unstable due to the ingress of water or where made ground is present.

Strong bedrock was encountered in a number of holes from around 2 to 4 m depth.

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.

7.7 Obstructions

TPA and TP8 were terminated due to a concrete base at 1.0 and 2.0 m bgl respectively.

No other significant obstructions were encountered during the intrusive investigation.

7.8 Surface Water Drainage

Infiltration tests were carried out within the natural ground in order to confirm if the ground is suitable for soakaways. One test each was completed in two trial pits. SA1 was undertaken in TP1 and SA2 in TP2. The locations of the pits are indicated on the Exploratory Hole Location Plan in Appendix 1.

SA1 was filled with approximately 0.77 m^3 of water and SA2 was filled with approximately 1 m^3 of water. The water level was recorded at regular intervals for 5 hours after filling. None of the water levels in the soakaway tests drained. Based on these findings, soakaways are not considered to be suitable at this site.

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 Unexpected Contamination

The made ground was encountered in the vicinity of the former buildings on site comprised macadam, demolition rubble and reworked sandy clays.

No other visual or olfactory evidence of unexpected contamination was identified during the site investigation.

8.3 Ground Gas

No radon precautions are required.

Some localised deep made ground was encountered during the ground investigation; however, these did not contain a significant proportion of organic material. Therefore the soils beneath the site are unlikely to be a potential source of ground gas.

The coal seams beneath the site were found to be intact. Therefore there should not be a risk of mine gas to the site.

According to the Environment Agency, there are no operational or historical landfill sites within 250 m of the site.

The geological map indicates there are backfilled opencast workings around 50 m east of the site. A few small quarries have been present in the surrounding area at around 230 m from the site. A programme of gas monitoring comprising four rounds was undertaken to determine whether gas measures would be required in the proposed development. The gas wells were destroyed during early construction works after the fourth round, with only BH6 remaining during a fifth site visit.

The maximum carbon dioxide recorded during the gas monitoring was 6.3%. The other carbon dioxide concentrations varied between 0.3 and 4.8%. The maximum flow recorded was 0.2 l/hr. No methane was recorded.

The carbon dioxide gas screening value (GSV) has been calculated to be 0.013 l/hr. The GSV classifies the site as Green i.e. or no gas precautions, in accordance with C665. However, the maximum carbon dioxide value of 6.3% places the site in an Amber 1 classification, as the maximum concentration recorded slightly exceeds the 5% minimum threshold for Amber 1.

8.4 Chemical Testing

Each of the samples was analysed for the suite of contaminants listed in the table below:

Contaminant Type	Actual Contaminants
Metals/Metalloids	Arsenic, cadmium, chromium, lead, mercury, nickel, selenium copper and zinc
PAHs	Speciated PAH
Asbestos	Presence
Sulphates*	pH, water soluble sulphate, acid soluble sulphate and sulphur

*All samples except topsoil.

Testing was undertaken by Chemtest Limited, using MCERTs accredited methodologies, where available. A copy of the test results is included in Appendix 4.

8.5 Assessment Criteria

The proposed development of the site is to be residential with private gardens, and associated hardstanding and landscaping. Therefore the assessment criteria relating to a residential with homegrown produce end use have been used. Tables detailing the relevant assessment concentrations used are included in Appendix 4.

8.6 Chemical Test Results

8.6.1 Topsoil

One sample of topsoil/made ground, from TP5 at 0.2 m bgl, recorded an elevated concentration of lead of 250 mg/kg compared to the residential assessment value of 200 mg/kg. The corrected mean for all 7 samples of topsoil is calculated to be 155 mg/kg, which is below the assessment value.

None of the other six topsoil samples recorded any other elevated concentrations compared to the residential assessment values.

A further three topsoil samples were taken 5 m to the north, west and south around TP5, and no elevated concentrations were recorded compared to the residential assessment values.

8.6.2 Made Ground

Neither of the two samples of made ground recorded any elevated concentrations of contaminants compared to the residential assessment values.

A stockpile of demolition rubble is present in the centre of the site. One of the samples, S1, recorded a slightly elevated concentration of mercury of 1.6 mg/kg compared to the residential assessment value of 1.2 mg/kg. Two of the samples, S2 and S3, recorded elevated concentrations of lead of 250 and 360 mg/kg compared to the residential assessment value of 200 mg/kg.

In two of the samples, up to three PAHs were recorded as elevated in the stockpile of rubble. These elevated concentrations are shown in bold in the table below:

Contaminant	Concentration Recorded (mg/kg)			Residential Assessment Value (mg/kg)
	Sample 1	Sample 2	Sample 3	
Benzo(b)fluoranthene	0.53	**3.2**	**5.7**	2.6
Benzo(a)pyrene	0.31	**2.8**	**5.3**	2.2
Benzo(a,h)anthracene	<0.10	0.11	**0.26**	0.24

8.6.3 Natural Ground

None of the six samples of natural ground recorded any elevated concentrations compared to the residential assessment values.

8.6.4 Asbestos

No asbestos fibres were identified within any of the samples of topsoil, made ground or natural ground that was tested.

8.6.5 Sulphates

The site has been taken as a brownfield location in relation to the Aggressive Chemical Environment for Concrete classifications. Groundwater is expected to be mobile through the made ground and near surface soils.

Made Ground

Two samples of the made ground and three samples of the rubble stockpile were tested for sulphates:

Total Sulphur %	0.012, 0.65, 2.4, 0.14, 0.36
Total Potential Sulphate %	0.04, 1.95, 7.2, 0.42, 1.08
Water Soluble Sulphate mg/l	15, 20, 1400, 97, 1200
Acid Soluble Sulphate %	<0.01, 0.033, 5.8, 0.39, 1.1
pH	7.1, 7.9, 8.4, 8.4, 8.3

Natural Ground

Six samples of natural ground were tested for sulphates:

Total Sulphur %	0.018, 0.034, 0.035, 0.046, 0.064, 0.075
Total Potential Sulphate %	0.10, 0.12, 0.14, 0.16, 0.19, 0.23
Water Soluble Sulphate mg/l	10, 10, 13, 13, 21, 24
Acid Soluble Sulphate %	0.023, 0.024, 0.039, 0.052, 0.059, 0.063
pH	5.1, 5.2, 6.1, 6.6, 7.0, 7.8

As there are more than 5 results, the mean of the highest 2 results can be used to calculate a characteristic value: 0.21% for total potential sulphate and 22.5 mg/l for water soluble sulphate. A characteristic value for pH is calculated to be 5.15.

8.7 Significant Pollutant Linkages

Contaminants	Pathway	Receptor
Lead in topsoil Mercury, lead and PAHs in rubble stockpile	Ingestion, inhalation, direct contact. Migration through soils.	Future residents and visitors to the site. Site construction workers. Secondary A aquifer
High sulphates in the made ground	Direct contact.	Below ground concrete.
PAHs in rubble stockpile	Direct contact.	Water supply pipes
Ground gas from opencast 50 m east of site.	Migration through soils, inhalation	Future residents and visitors to the site.

9.0 RISK ASSESSMENT

9.1 Human Health – Future Residents and Visitors

One elevated concentration of lead (250 mg/kg) was recorded in the topsoil/made ground sample in TP5. This topsoil was noted to be ashy, most likely remnants of a small bonfire. This ashy topsoil was only found in a localised area. Three further samples were taken 5 m away from TP5. None of the additional samples recorded any elevated levels of contaminants. Once mixed with the remaining site won topsoil, which was found to be clean, the lead concentration is expected to be 'diluted'. The lead concentration found in the ashy topsoil is therefore not considered to pose a significant risk to human health once mixed with the remaining site-won clean topsoil.

The pile of demolition rubble on site contains an elevated concentration of mercury, elevated concentrations of lead, and up to three elevated PAHs. If this rubble remains below gardens and landscaped areas, it will need capping with at least 600 mm of clean inert material, including at least 150 mm of topsoil.

The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies such as the Local Authority and the warranty provider.

9.2 Human Health – Construction Workers

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

All ground workers employed on the site should be made aware of normal site procedures such as the wearing of gloves when handling soils, and the washing of hands prior to eating should be implemented.

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

9.3 Construction Materials

The made ground encountered in the vicinity of the former buildings recorded a maximum total potential sulphate of 1.95%. This equates to DS-4 AC4 sulphate precautions in below ground concrete.

The stockpiled rubble recorded significantly elevated concentrations of sulphates. Where below ground concrete is in contact with this rubble, sulphate precautions DS-4 AC-4 should be used.

The natural ground tested recorded a total potential sulphate characteristic value of 0.23%. This equates to DS-1 AC-1. The water soluble sulphate concentrations are also low with a maximum concentration of 24 mg/l. Whilst a Design Sulphate Class of DS-1 is considered to be appropriate for concrete in contact with only natural ground, an Aggressive Chemical Environment for Concrete (ACEC) class of AC-3z will be required due to the low pH recorded.

All chemical test results should be forwarded to the water supplier to determine the level of protection required for water supply pipes.

9.4 Plants

No elevated concentrations of contaminants were recorded compared with the phytotoxic assessment values. It would be considered to be prudent to utilise 150 mm of topsoil to act as a growing medium for plants in proposed gardens and soft landscaping areas.

9.5 Controlled Waters

The site overlies a Secondary A aquifer and the site does not lie within a Groundwater Source Protection Zone.

There are no significantly elevated contaminants recorded. Materials on site are therefore not considered to pose a significant risk to controlled waters.

9.6 Ground Gas

An area of opencast backfill was located around 50 m to the east of the site. A few small quarries have been present in the surrounding area at around 230 m from the site. A programme of gas monitoring, comprising four rounds, was undertaken.

As stated in C665, the typical maximum concentration can be exceeded if the conceptual model indicates it is safe to do so, and the monitoring has taken place in the worst temporal conditions, which we consider has occurred.

The materials found on site were not found to contain a significant proportion of degradable material, and offsite sources are the opencast coal mining site around 50 m to the south east of the site, and small quarries within 250 m of the site, which were not expected to pose a significant risk to the site due to the relatively impermeable ground conditions expected below and between the site and offsite sources.

It can be considered that the gassing regime can be classified as ‘Green’, due to the very low flow recorded, and that the most commonly recorded carbon dioxide values were between 4 and 4.8% which are less than the 5% minimum for Amber 1.

No radon or ground gas precautions are therefore considered to be required for this site.

9.7 Combustion

Due to the near surface presence of coal there is the potential for combustible material to be present within the proposed gardens. The main risk of combustion would be bonfires. A capping of at least 1 m of non-combustible material should be placed where coal is encountered at the surface of the proposed gardens. In addition, electrical cables should not be laid directly in this material.

10.0 CONTAMINATION - RECOMMENDATIONS AND APPROVALS

19. The demolition rubble from the old house on site contains elevated concentrations of lead, mercury and PAHs. A clean inert capping layer of 600 mm is required over this demolition rubble where it is placed below gardens and landscaped areas.

20. One elevated concentration of lead (250 mg/kg) was recorded in the topsoil/made ground sample in TP5. This topsoil was noted to be ashy, most likely remnants of a small bonfire and was only found in a localised area. Once mixed with the remaining site won topsoil, which was found to be clean, the lead concentration is expected to be 'diluted' and is therefore not considered to pose a significant risk to human health once mixed with the remaining site-won clean topsoil.

21. Where coal is present at surface level in proposed gardens, a 1 m thick non-combustible capping layer will be required.

22. A programme of gas monitoring, comprising four rounds, has been undertaken. No radon or ground gas precautions are required for this site.

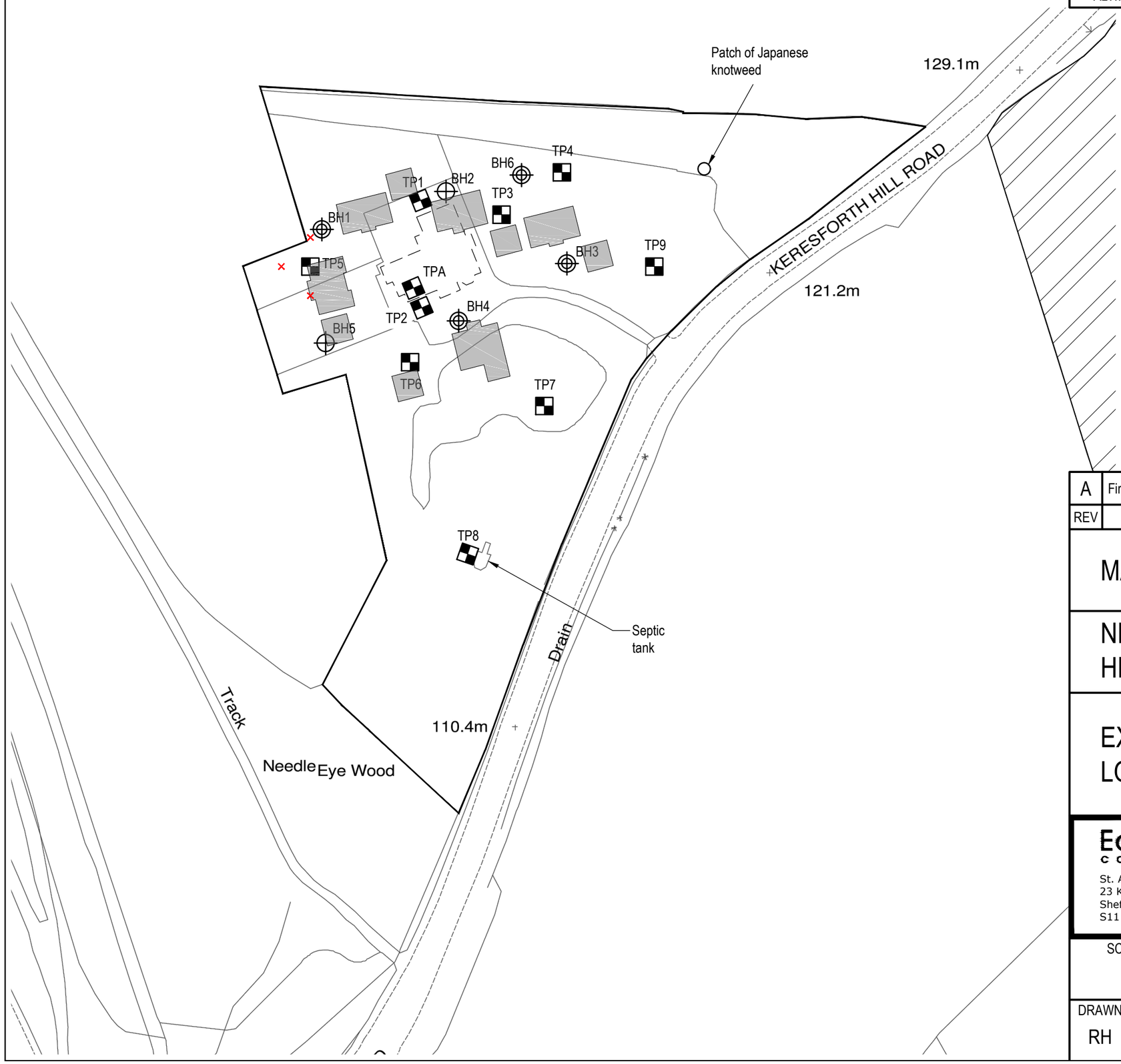
23. DS-4 AC-4 sulphate precautions are required for all sub-surface concrete in contact with the made ground. DS-1 AC-3z sulphate precautions are required for all sub-surface concrete in contact with the natural ground.

24. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies such as the Local Authority and the NHBC (if applicable).

Appendix 1

Exploratory Hole Location Plan, 39353/001A

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



KEY:

- Approximate site boundary.
- Approximate position of trial pits excavated by Eastwood & Partners on 08.01.16.
- Approximate position of former building.
- Approximate position of borehole by Eastwood & Partners on 29.01.16.
- Approximate position of borehole & monitoring wells installed by Eastwood & Partners on 29.01.16.
- Approximate area of opencast coal workings.
- Proposed layout.
- × Additional sample of topsoil taken on 19.02.16

REV	DESCRIPTION	SIG	CHK	DATE
A	First Issue.			

MATON HOMES LTD

NEEDLEWOOD, KERESFORTH HILL ROAD, BARNSLEY

EXPLORATORY HOLE LOCATION PLAN

Eastwood & Partners CONSULTING ENGINEERS

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SCALE WHEN PLOTTED AT A3	DRAWING STATUS
1:1000	INFORMATION

DRAWN	CHECKED	DATE	DRAWING NUMBER	REV
RH	DES	11.01.16	39353/001	A

Appendix 2

Trial Pit Logs, TP1 to TP9 and TPA

Borehole Logs, BH1 to BH6

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Trialpit No
TP1
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
Client: Maton Homes Ltd		Depth 2.15m	Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Macadam.
			0.20			MADE GROUND: Moderately strong yellow fine grained sandstone cobbles.
			0.55			Copper pipe seen in side of pit @ 0.5 m bgl.
1.00	D					Moderately strong brown sandy MUDSTONE recovered as angular cobbles.
			1.30			Moderately weak dark grey MUDSTONE recovered as angular cobbles.
			1.50			Moderately strong light brown sandy MUDSTONE recovered as fine to medium angular gravel.
			2.05			Strong orange MUDSTONE recovered as angular cobbles.
			2.15			Trialpit Complete at 2.15 m

Remarks: Becoming solid at base. Terminated at this depth in order to carry out SA1.

Groundwater: Perched water ingressing between 0.5 and 1 m bgl.

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Trialpit No
TP2
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
		Depth 4.20m	
Client: Maton Homes Ltd			Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.15			MADE GROUND: Macadam.
			0.40			MADE GROUND: Reworked grey clay with bricks and coarse angular sandstone cobbles.
0.60	D					MADE GROUND: Reworked orange to yellow mottled firm sandy clay.
			0.85			MADE GROUND: Reworked dark brown to grey firm sandy clay. Slight 'stagnant' type odour noted.
1.00	D					
			1.20			Firm to stiff orange to light grey CLAY.
1.50	IPP 1	300				
1.50	IPP 2	450				
1.50	IPP 3	300				
1.50	D					
			2.05			Poor COAL recovered as black to dark grey fine gravel.
			2.15			Firm very sandy dry light grey desiccated CLAY.
			3.70			Moderately strong grey MUDSTONE recovered as coarse gravel.
			4.20			Trialpit Complete at 4.20 m

Remarks: Terminated due to hard ground at base. SA2 undertaken in this pit.

Groundwater: None encountered.

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Trialpit No
TP3
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
		Depth 3.00m	
Client: Maton Homes Ltd			Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Black to dark brown clay.
			0.30			Firm to stiff orange to yellow grey mottled CLAY.
0.70	IPP 1	175				
0.70	IPP 2	125				
0.70	IPP 3	150				
0.70	D					
1.40	D					
			1.65			Moderately strong light brown MUDSTONE recovered as sandy medium to coarse angular gravel.
			2.30			Moderately weak dark grey to brown flaggy shaley MUDSTONE.
			3.00			Trialpit Complete at 3.00 m

Remarks: Pit moved initially due to cables between 0.3 and 0.5 m bgl with no electrical signal being found - no damage to these.

Groundwater: Water welling up from base @ 3 m bgl.

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Trialpit No
TP4
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
Client: Maton Homes Ltd		Depth 3.65m	Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Black to dark brown clay.
			0.40			Firm orange to grey CLAY.
0.90	IPP 1	225				
0.90	IPP 2	250				
0.90	IPP 3	250	1.00			Poor COAL.
0.90	D		1.20			Firm yellow gravelly CLAY. Gravel is of muddy sandstone.
			1.75			Moderately strong brown to orange muddy SANDSTONE recovered as flaggy laminated cobbles.
			2.30			Moderately strong grey brown MUDSTONE recovered as gravel in a dry brown sandy clay matrix.
			3.65			Trialpit Complete at 3.65 m

Remarks: Terminated on engineer's instructions.

Groundwater: Water ingressing from between 1.75 and 2.3 m bgl.

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Trialpit No
TP5
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
Client: Maton Homes Ltd		Depth 4.55m	Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D					TOPSOIL/MADE GROUND: Ashy brown sand with mattresses.
			0.35			Firm orange and grey mottled gravelly CLAY. Gravel is moderately weak, orange, coarse angular of mudstone.
1.30	D					
			2.45			Moderately strong blue grey MUDSTONE recovered as angular cobbles and coarse angular gravel.
			4.55			Trialpit Complete at 4.55 m

Remarks: Terminated due to reach.

Groundwater: None encountered.

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Trialpit No
TP6
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
		Depth 3.80m	
Client: Maton Homes Ltd			Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL: Brown sandy clay.
			0.45			Firm grey to orange CLAY with tree roots.
						Broken drain @ 0.6 m bgl with some water inside.
0.90	IPP 1	225				
0.90	IPP 2	375				
0.90	IPP 3	325				
0.90	D					
			2.50			Moderately strong blue grey MUDSTONE recovered as angular cobbles and coarse angular gravel.
			3.80			Trialpit Complete at 3.80 m

Remarks: Terminated on engineer's instructions.

Groundwater: None encountered.

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Trialpit No
TP7
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
Client: Maton Homes Ltd		Depth 3.60m	Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D					TOPSOIL: Brown very sandy clay with roots.
			0.35			Firm orange mottled grey sandy CLAY.
1.50	IPP 1	300				
1.50	IPP 2	400				
1.50	IPP 3	275				
1.50	D		1.70			Poor COAL.
			1.80			Firm orange mottled grey sandy CLAY.
			2.40			Moderately strong grey MUDSTONE recovered as coarse angular gravel in dry sand matrix. Iron nodules encountered at the base.
			3.60			Trialpit Complete at 3.60 m

Remarks: Terminated due to hard ground at base.

Groundwater: None encountered.

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Trialpit No
TP8
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
		Depth 2.00m	
Client: Maton Homes Ltd			Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D		0.30			TOPSOIL: Brown slightly sandy clay with roots.
1.00	D					MADE GROUND: Reworked brown clay. Water ingressing from pipes @ 0.9 m bgl.
			2.00			Trialpit Complete at 2.00 m

Remarks: Dug next to septic tank. Terminated on concrete base.

Groundwater: Water ingressing from pipes at 0.9 m bgl causing side collapses.

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Trialpit No
TP9
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
Client: Maton Homes Ltd		Depth 4.20m	Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					TOPSOIL/MADE GROUND: Black clay with plastic, bricks, and ceramic fragments.
			0.50			MADE GROUND: Reworked orange clay.
			1.55			Firm orange mottled grey sandy CLAY.
1.80	IPP 1	175				
1.80	IPP 2	200				
1.80	IPP 3	225				
1.80	D					
			2.80			Weak very weathered grey MUDSTONE, almost clay.
			4.20			Trialpit Complete at 4.20 m

Remarks: Terminated due to reach.

Groundwater: None encountered.

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Trialpit No
TPA
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Needlewood	39353	Level: -	08/01/2016
Location: Keresforth Road, Barnsley		Dimensions: -	Scale 1:25
		Depth 1.00m	
Client: Maton Homes Ltd			Logged By DES

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Bricks, timber floorboards, metal pipes. Underfloor construction seen. Concrete floor at base. [Floor of house?]
			1.00			Trialpit Complete at 1.00 m

Remarks: Terminated on solid concrete.

Groundwater: None encountered.

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Borehole No
BH 1
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			Topsoil
					0.80			CLAY
								Brown MUDSTONE
					2.60			COAL
					2.80			Grey MUDSTONE
					13.00			Black MUDSTONE with coal traces
					13.40			Grey MUDSTONE
			Type	Results				Continued next sheet

Remarks:

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Borehole No
BH 1
Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								Grey MUDSTONE
					22.70			Black MUDSTONE
					23.30			Grey MUDSTONE
					24.00			End of Borehole at 24.00 m

20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

Type Results

Remarks:

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Borehole No
BH 2
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.50			MADE GROUND
					0.80			CLAY
								Brown MUDSTONE
					3.50			COAL
					3.70			Grey MUDSTONE
					13.90			Black MUDSTONE with coal traces
					15.50			Grey MUDSTONE
					16.00			End of Borehole at 16.00 m
			Type	Results				

Remarks:

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Borehole No
BH 3
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								MADE GROUND
					0.60			CLAY
					1.10			Brown MUDSTONE
					4.70			COAL
					4.90			Grey MUDSTONE
					14.80			Black MUDSTONE with coal traces
					15.20			Grey MUDSTONE
			Type	Results				Continued next sheet

Remarks:

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Borehole No
BH 3
Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								Grey MUDSTONE
					24.30			Black MUDSTONE
					24.90			Grey MUDSTONE
					30.00			End of Borehole at 30.00 m

Type Results

Remarks:

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Borehole No
BH 4
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								MADE GROUND
					1.40			CLAY
					1.70			Brown MUDSTONE
					2.50			COAL
					2.70			Grey MUDSTONE
					13.20			Black MUDSTONE with coal fragments
					13.70			Grey MUDSTONE
			Type	Results				Continued next sheet

Remarks:

AGS

HoleBASE 3.1 (Bld 426.48) Standard Borehole Log v2 dated 27th Nov 03

Eastwood & Partners
CONSULTING ENGINEERS

Eastwood & Partners
St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS

Borehole No
BH 4
Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Grey MUDSTONE
					23.00			Black MUDSTONE
					23.60			Grey MUDSTONE
					30.00			End of Borehole at 30.00 m
			Type	Results				

20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

Remarks:

AGS

HoleBASE 3.1 (Bld 426.48) Standard Borehole Log v2 dated 27th Nov 03

Eastwood & Partners
CONSULTING ENGINEERS

Eastwood & Partners
St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS

Borehole No
BH 5
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			TOPSOIL
					0.60			MADE GROUND
								CLAY
					1.80			Brown MUDSTONE
					3.30			Grey MUDSTONE
					10.00			Black MUDSTONE with coal traces
					10.60			Grey MUDSTONE
					12.00			End of Borehole at 12.00 m
			Type	Results				

Remarks:

AGS

HoleBASE 3.1 (Bld 426.48) Standard Borehole Log v2 dated 27th Nov 03

Eastwood & Partners
CONSULTING ENGINEERS

Eastwood & Partners
St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS

Borehole No
BH 6
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Needlewood	39353		RO
Location: Keresforth Road, Barnsley		Level: -	Scale 1:100
Client: Maton Homes Ltd		Dates: 29/01/2016	Logged By GSS

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			TOPSOIL
					0.70			MADE GROUND
								CLAY
					1.40			Brown MUDSTONE
					3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks:

AGS

HoleBASE 3.1 (Bld 426.48) Standard Borehole Log v2 dated 27th Nov 03

Appendix 3

Geotechnical Test Results, Report Number PSL16/0170

LABORATORY REPORT

4043

Contract Number: PSL16/0170

Report Date: 19 January 2016

Client's Reference: 39353

Client Name: Eastwood & Partners
St Andrews House
23 Kingfield Road
Sheffield
S11 9AS

For the attention of: Dani Sempers

Contract Title: Needlewood

Date Received: 14/1/2016
Date Commenced: 14/1/2016
Date Completed: 19/1/2016

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

D Lambe (Senior Technician)
S Royle (Senior Technician)
W Allen (Senior Technician)

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

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP1			1.00		Brown MUDSTONE.
TP7			1.50		Brown mottled grey sandy very silty CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Checked / Approved	Date 19/01/16	Contract No: PSL16/0170
		Needlewood		Client Ref: 39353

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP1			1.00		12				NP			
TP7			1.50		20			44	22	22	100	Intermediate plasticity CI.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

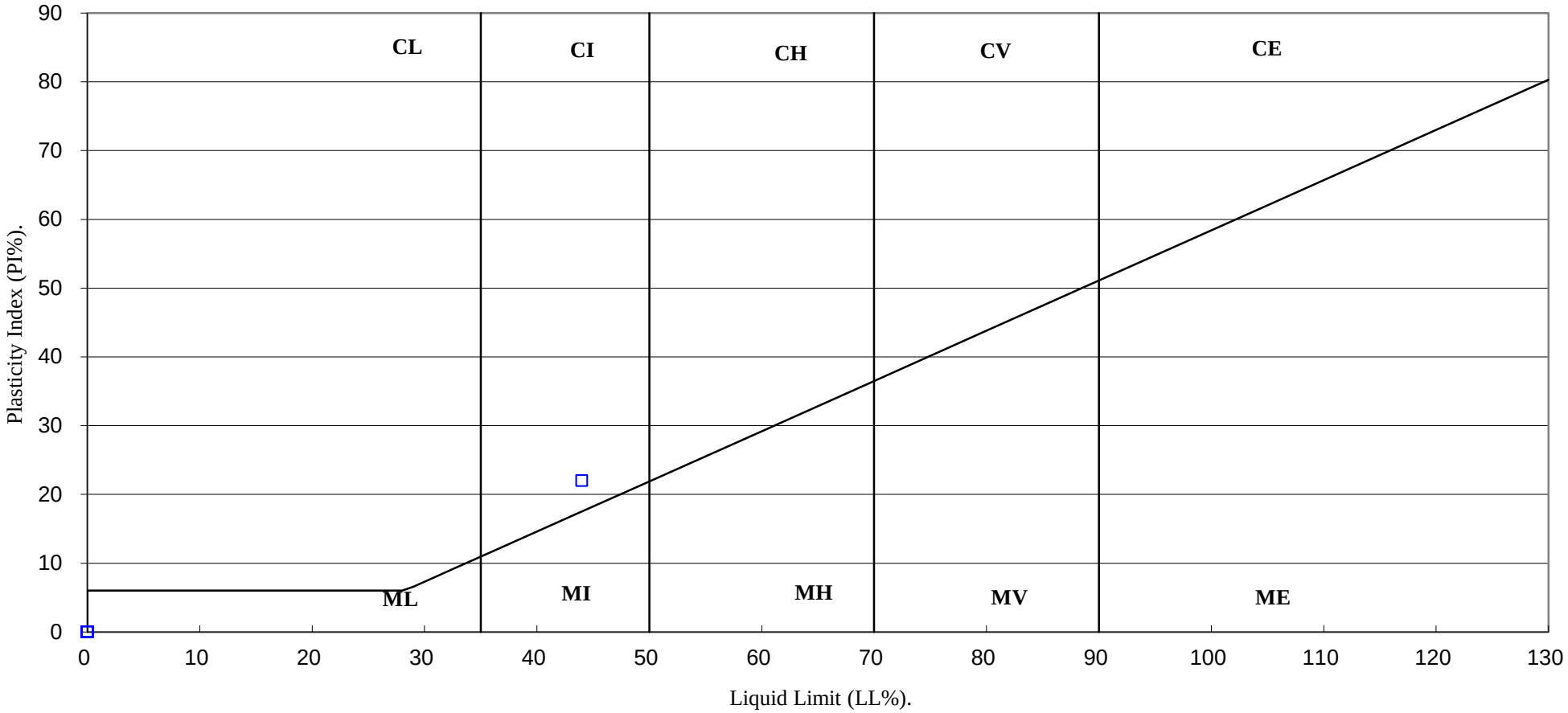
UKAS TESTING 4043

PSL Professional Soils Laboratory

Checked / Approved	WJAM	Date	19/01/16	Contract No:
Needlewood				PSL16/0170
				Client Ref:
				39353

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



UKAS TESTING 4043	PSL Professional Soils Laboratory	**Checked /Approved**	NJAM	**Date**	19/01/16	**Contract No:**
		Needlewood				**PSL16/0170**
						Client Ref:
						39353

Appendix 4

Chemical Test Results, Chemtest Report Nos. 16-00528 and 16-04237

Table of Assessment Values - Residential with Homegrown Produce

Corrected Mean – Lead in Topsoil

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	16-00528-1
Initial Date of Issue:	18-Jan-2016
Client	Eastwood & Partners
Client Address:	St. Andrews House 23 Kingfield Road Sheffield South Yorkshire S11 9AS
Contact(s):	Dani Sempers
Project	39353 - Needlewood, Keresforth Hill Road, Barnsley

Quotation No.:		**Date Received:**	12-Jan-2016
Order No.:		**Date Instructed:**	12-Jan-2016
No. of Samples:	15	**Target Date:**	18-Jan-2016
Turnaround (Wkdays):	5	**Results Due:**	18-Jan-2016

Date Approved: 18-Jan-2016

Approved By:



Details: Robert Monk, Technical Development Chemist

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 39353 - Needlewood, Keresforth Hill Road, Barnsley

Client: Eastwood & Partners					**Chemtest Job No.:**	16-00528	16-00528	16-00528	16-00528	16-00528	16-00528	16-00528	16-00528	16-00528
Quotation No.:					**Chemtest Sample ID.:**	239184	239186	239187	239189	239190	239191	239192	239193	239194
Order No.:					Client Sample Ref.:	TP2	TP3	TP3	TP4	TP4	TP5	TP5	TP6	TP6
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.60	0.10	0.70	0.10	0.90	0.20	1.30	0.10	0.90
					Date Sampled:	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
ACM Type	U	2192		N/A		-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020		18	22	18	17	21	21	8.9	22	16
Soil Colour	N	2040		N/A		brown	brown	brown	brown	brown	brown	brown	brown	brown
Other Material	N	2040		N/A		stones	stones, roots	stones	stones, roots	stones	stones, roots	stones	stones, roots	stones, roots
Soil Texture	N	2040		N/A		clay	loam	clay	loam	clay	loam	clay	clay	clay
pH	M	2010		N/A		7.9	7.9	7.8	7.4	6.6	7.3	7.0	5.8	5.2
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		0.015		0.013		0.010		0.021		0.013
Total Sulphur	M	2175	%	0.010		0.65		0.046		0.064		0.035		0.018
Sulphate (Acid Soluble)	M	2430	%	0.010		< 0.010		0.059		0.063		0.039		0.052
Arsenic	M	2450	mg/kg	1.0		5.9	22	36	26	18	37	12	2.8	11
Cadmium	M	2450	mg/kg	0.10		< 0.10	0.33	0.24	0.13	0.20	1.6	0.34	0.10	0.15
Chromium	M	2450	mg/kg	1.0		28	35	39	28	29	50	31	27	27
Copper	M	2450	mg/kg	0.50		28	42	70	42	50	150	49	35	37
Mercury	M	2450	mg/kg	0.10		< 0.10	0.26	0.21	0.12	0.15	0.21	< 0.10	0.13	0.18
Nickel	M	2450	mg/kg	0.50		34	33	37	30	32	36	42	48	35
Lead	M	2450	mg/kg	0.50		43	110	80	90	200	250	58	31	58
Selenium	M	2450	mg/kg	0.20		< 0.20	0.20	< 0.20	< 0.20	0.39	0.27	0.20	< 0.20	< 0.20
Zinc	M	2450	mg/kg	0.50		84	140	140	100	110	230	110	100	100
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Naphthalene	M	2800	mg/kg	0.10		< 0.10	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10		< 0.10	1.0	0.49	0.69	0.34	0.20	< 0.10	< 0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10		< 0.10	0.24	0.11	0.14	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10		< 0.10	2.4	1.3	1.5	0.82	0.44	< 0.10	< 0.10	0.23
Pyrene	M	2800	mg/kg	0.10		< 0.10	2.3	1.1	1.3	0.74	0.38	< 0.10	< 0.10	0.21
Benzo[a]anthracene	M	2800	mg/kg	0.10		< 0.10	1.8	0.59	0.64	0.30	0.16	< 0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10		< 0.10	1.7	0.56	0.64	0.29	0.16	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10		< 0.10	2.6	0.75	0.68	0.35	0.19	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10		< 0.10	0.80	0.19	0.17	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10		< 0.10	2.2	0.48	0.49	0.26	0.16	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10		< 0.10	1.6	0.30	0.24	0.13	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		< 0.10	0.18	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10		< 0.10	1.3	0.35	0.27	0.15	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0		< 2.0	18	6.2	6.8	3.4	< 2.0	< 2.0	< 2.0	< 2.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 39353 - Needlewood, Keresforth Hill Road, Barnsley

Client: Eastwood & Partners					**Chemtest Job No.:**	16-00528	16-00528	16-00528	16-00528	16-00528	16-00528
Quotation No.:					**Chemtest Sample ID.:**	239195	239196	239197	239198	239199	239200
Order No.:					Client Sample Ref.:	TP7	TP7	TP8	TP8	TP9	TP9
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.20	1.50	0.20	1.00	0.10	1.80
					Date Sampled:	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016	08-Jan-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type	U	2192		N/A		-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020		23	13	16	20	30	17
Soil Colour	N	2040		N/A		brown	brown	brown	brown	brown	brown
Other Material	N	2040		N/A		stones, roots	stones	stones	stones	roots, grass	none
Soil Texture	N	2040		N/A		loam	loam	loam	clay	loam	clay
pH	M	2010		N/A		5.2	5.1	7.0	7.1	7.6	6.1
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010		0.020		0.024
Total Sulphur	M	2175	%	0.010			0.034		0.012		0.075
Sulphate (Acid Soluble)	M	2430	%	0.010			0.024		0.033		0.023
Arsenic	M	2450	mg/kg	1.0		13	10	16	11	20	< 1.0
Cadmium	M	2450	mg/kg	0.10		0.21	< 0.10	0.27	0.14	0.91	< 0.10
Chromium	M	2450	mg/kg	1.0		24	28	23	21	25	28
Copper	M	2450	mg/kg	0.50		32	36	42	31	67	32
Mercury	M	2450	mg/kg	0.10		0.13	< 0.10	0.25	< 0.10	0.24	< 0.10
Nickel	M	2450	mg/kg	0.50		26	39	33	35	23	31
Lead	M	2450	mg/kg	0.50		64	36	110	36	140	18
Selenium	M	2450	mg/kg	0.20		< 0.20	< 0.20	0.40	0.37	0.83	< 0.20
Zinc	M	2450	mg/kg	0.50		97	98	170	89	300	79
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Naphthalene	M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10	< 0.10	0.15	< 0.10	0.28	< 0.10
Acenaphthene	M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10		0.12	< 0.10	1.2	< 0.10	1.3	< 0.10
Anthracene	M	2800	mg/kg	0.10		< 0.10	< 0.10	0.29	< 0.10	0.42	< 0.10
Fluoranthene	M	2800	mg/kg	0.10		0.32	< 0.10	3.0	< 0.10	4.4	< 0.10
Pyrene	M	2800	mg/kg	0.10		0.24	< 0.10	2.6	< 0.10	3.6	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10		< 0.10	< 0.10	1.4	< 0.10	2.2	< 0.10
Chrysene	M	2800	mg/kg	0.10		< 0.10	< 0.10	1.6	< 0.10	2.2	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10		< 0.10	< 0.10	1.9	< 0.10	2.6	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10		< 0.10	< 0.10	0.67	< 0.10	0.85	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10		< 0.10	< 0.10	1.5	< 0.10	2.1	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10		< 0.10	< 0.10	0.86	< 0.10	1.4	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	0.15	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10		< 0.10	< 0.10	0.76	< 0.10	1.2	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0		< 2.0	< 2.0	16	< 2.0	23	< 2.0

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at our Coventry laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 60 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING
2183

Final Report

Report No.:	16-04237-1
Initial Date of Issue:	29-Feb-2016
Client	Eastwood & Partners
Client Address:	St. Andrews House 23 Kingfield Road Sheffield South Yorkshire S11 9AS
Contact(s):	Dani Sempers
Project	39353 - Needlewood, Keresforth Hill Road, Barnsley

Quotation No.:		**Date Received:**	23-Feb-2016
Order No.:		**Date Instructed:**	23-Feb-2016
No. of Samples:	6	**Target Date:**	29-Feb-2016
Turnaround (Wkdays):	5	**Results Due:**	29-Feb-2016
Date Approved:	29-Feb-2016		

Approved By:



Details: Robert Monk, Technical Development Chemist

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 39353 - Needlewood, Keresforth Hill Road, Barnsley

Client: Eastwood & Partners					**Chemtest Job No.:**	16-04237	16-04237	16-04237	16-04237	16-04237	16-04237
Quotation No.:					**Chemtest Sample ID.:**	258115	258116	258117	258118	258119	258120
Order No.:					Client Sample Ref.:	Made Ground	Made Ground	Made Ground	Topsoil	Topsoil	Topsoil
					Client Sample ID.:	S1	S2	S3	TS - 1	TS - 2	TS - 3
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.10	0.10	0.10	0.10	0.10	0.10
					Date Sampled:	19-Feb-2016	19-Feb-2016	19-Feb-2016	19-Feb-2016	19-Feb-2016	19-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type	U	2192		N/A		-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020		24	19	26	26	30	30
Soil Colour	N	2040		N/A		Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A		Stones, Textiles	Stones	Stones, Textiles	Stones, Roots	Stones, Roots	Roots
Soil Texture	N	2040		N/A		Sand	Sand	Sand	Clay	Clay	Clay
pH	M	2010		N/A		8.4	8.4	8.3	5.8	5.3	5.4
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		1.4	0.97	1.2			
Total Sulphur	M	2175	%	0.010		2.4	0.14	0.36			
Sulphate (Acid Soluble)	M	2430	%	0.010		5.8	0.39	1.1			
Arsenic	M	2450	mg/kg	1.0		15	13	12	25	17	18
Cadmium	M	2450	mg/kg	0.10		0.40	0.35	0.44	0.34	0.33	0.28
Chromium	M	2450	mg/kg	1.0		20	30	56	25	38	33
Copper	M	2450	mg/kg	0.50		50	24	35	38	31	26
Mercury	M	2450	mg/kg	0.10		1.6	< 0.10	0.16	0.17	0.22	0.19
Nickel	M	2450	mg/kg	0.50		33	14	18	24	23	21
Lead	M	2450	mg/kg	0.50		150	360	250	110	85	74
Selenium	M	2450	mg/kg	0.20		< 0.20	0.27	0.24	1.3	0.78	0.70
Zinc	M	2450	mg/kg	0.50		160	93	760	160	120	100
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Naphthalene	M	2800	mg/kg	0.10		0.27	0.24	0.56	0.45	0.28	0.44
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10	0.49	0.73	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10		< 0.10	0.17	0.46	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10		< 0.10	0.71	0.96	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10		0.79	6.2	11	0.51	0.16	0.12
Anthracene	M	2800	mg/kg	0.10		< 0.10	1.7	3.3	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10		1.9	7.8	15	0.65	0.17	0.26
Pyrene	M	2800	mg/kg	0.10		1.6	6.4	12	0.45	0.13	0.20
Benzo[a]anthracene	M	2800	mg/kg	0.10		0.40	3.4	6.1	0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10		0.54	3.2	5.4	0.11	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10		0.53	3.2	5.7	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10		0.11	1.1	2.2	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10		0.31	2.8	5.3	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10		0.25	1.9	3.1	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		< 0.10	0.11	0.26	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10		0.28	1.4	2.7	< 0.10	< 0.10	< 0.10

Results - Soil

Project: 39353 - Needlewood, Keresforth Hill Road, Barnsley

Client: Eastwood & Partners			**Chemtest Job No.:**		16-04237	16-04237	16-04237	16-04237	16-04237	16-04237
Quotation No.:			**Chemtest Sample ID.:**		258115	258116	258117	258118	258119	258120
Order No.:			Client Sample Ref.:		Made Ground	Made Ground	Made Ground	Topsoil	Topsoil	Topsoil
			Client Sample ID.:		S1	S2	S3	TS - 1	TS - 2	TS - 3
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.10	0.10	0.10	0.10	0.10	0.10
			Date Sampled:		19-Feb-2016	19-Feb-2016	19-Feb-2016	19-Feb-2016	19-Feb-2016	19-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Total Of 16 PAH's	N	2800	mg/kg	2.0	7.0	41	75	2.3	< 2.0	< 2.0

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at our Coventry laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 60 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

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	10
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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Prepared	KDL	Checked	CAT	Date	29.03.16	Job No	39353

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NEEDLEWOOD, KERESFORTH HILL ROAD, BARNSLEY

ASSESSMENT CRITERIA – RESIDENTIAL WITH HOMEGROWN PRODUCE

Contaminant	Phytotoxicity			
	pH 5.0 to 5.5	pH 5.5 to 6.0	pH 6.0 to 6.5	pH >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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Prepared	KDL	Checked	CAT	Date	29.03.16	Job No	39353

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ASSESSMENT CRITERIA – RESIDENTIAL WITH HOMEGROWN PRODUCE

Eastwood & Partners
CONSULTING ENGINEERS

E P

PROJECT: Needlewood, Keresforth Hill Road, Barnsley	Job No. 39353	Date 21.01.16
SUBJECT: Mean Value Test for Lead in Site-Won Topsoil	Prepared DES	Checked KLG
	Sheet No.	1 of 1

The method uses the geometric mean rather than the arithmetic mean which is used for other contaminants.

Sample results mg/kg	Log sample results	
110	2.041	TP3
90	1.954	TP4
250	2.398	TP5
31	1.491	TP6
64	1.806	TP7
110	2.041	TP8
140	2.146	TP9

Calculations based on log results

Number of results : n	7
Mean : X =	1.983
Standard deviation : s	0.283
T value : t =	1.943
Corrected mean (95% confidence) =	
= X + t * s / n^0.5 =	2.190

Final results

Mean : X = 96 mg/kg

Corrected mean (95% confidence) = 154.98 mg/kg

Appendix 5

Gas Monitoring Results

Table of Atmospheric Pressures

Monitoring Date 19.02.16	CH_4 %	CO_2 %	O_2 %	H_2S (ppm)	CO (ppm)	Atmospheric Pressure. (mb)	Flow (l/hr)	Water Level (mbgl)	Base of Pipe (mbgl)
BH1	0	4.3	12.0	2	0	988	0.0	3.00	3.00
BH3	0	1.3	18.3	1	1	988	0.0	1.45	3.05
BH4	0	4.0	15.4	0	1	988	-0.1	2.40	3.00
BH6	0	4.3	17.6	1	1	987	0.0	3.00	3.00

SRI

Monitoring Date 08.03.16	CH_4 %	CO_2 %	O_2 %	H_2S (ppm)	CO (ppm)	Atmospheric Pressure. (mb)	Flow (l/hr)	Water Level (mbgl)	Base of Pipe (mbgl)
BH1	0	4.8	13.8	0	3	989	0.0	2.75	3.00
BH3	0	0.3	20.6	1	1	989	-40 to 0	0.70	3.05
BH4	0	3.0	17.5	1	3	989	0.0	2.30	3.00
BH6	0	1.2	17.8	1	3	989	-55 to 0	0.80	3.00

MDY

Monitoring Date 23.03.16	CH_4 %	CO_2 %	O_2 %	H_2S (ppm)	CO (ppm)	Atmospheric Pressure. (mb)	Flow (l/hr)	Water Level (mbgl)	Base of Pipe (mbgl)
BH1	0	6.3	10.2	1	1	985	0.0		3.00
BH3	0	3.0	18.7	1	1	986	0.0		3.05
BH4	0	3.3	15.6	2	3	986	-0.1		3.00
BH6	0	2.2	15.6	1	1	986	-0.1		3.00

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NEEDLEWOOD, KERESFORTH HILL ROAD, BARNSLEY

MATON HOMES

GROUND GAS MONITORING RESULTS

JOB NO. 39353

DATE February – June 2016

Monitoring Date 08.04.16	CH_4 %	CO_2 %	O_2 %	H_2S (ppm)	CO (ppm)	Atmospheric Pressure. (mb)	Flow (l/hr)	Water Level (mbgl)	Base of Pipe (mbgl)
BH1	0.0	0.8	21.1	1-3	1-4	992	-0.1 to 0.0	2.94	3.00
BH3	0.0	1.8	14.7	0-2	1-4	992	-0.1 to 0.0	1.19	3.05
BH4	0.0	3.9	14.2	1	3	993	0.0 to 0.2	2.35	3.00
BH6	0.0	4.4	17.6	0-1	1-3	991	-0.1 to 0.0	1.88	3.00

Monitoring Date 25.05.16	CH_4 %	CO_2 %	O_2 %	H_2S (ppm)	CO (ppm)	Atmospheric Pressure. (mb)	Flow (l/hr)	Water Level (mbgl)	Base of Pipe (mbgl)
BH1*									3.00
BH3*									3.05
BH4*									3.00
BH6	0.0	0.0	19.9	-	-	1004	-0.3	2.4	3.00

*Works had begun on site – wells destroyed/not located

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NEEDLEWOOD, KERESFORTH HILL ROAD, BARNSLEY

MATON HOMES

GROUND GAS MONITORING RESULTS

JOB NO. 39353

DATE February – June 2016

Date	Atmospheric Pressure (mb)	Atmospheric Trend	Relative Humidity (%)	Temp (°C)	Weather
01.02.16	1003	Rising	93	9	Mostly Cloudy
02.02.16	1005	Falling	70	5	Light Rain
03.02.16	1013	Rising	93	2	Partly Cloudy
04.02.16	1019	Rising	93	8	Scattered Clouds
05.02.16	1013	Falling	87	8	Scattered Clouds
08.02.16	970	Rising	87	5	Light Rain
09.02.16	981	Falling	100	2	Light Rain
10.02.16	993	Rising	87	2	Partly Cloudy
11.02.16	1002	Falling	93	1	Partly Cloudy
12.02.16	999	Falling	98	1	Thick Cloud
15.02.16	1026	Rising	77	1	Sunny Intervals
16.02.16	1033	Falling	76	1	Sunny
17.02.16	1015	Falling	93	2	Sleet
18.02.16	1012	Rising	85	2	Sunny
19.02.16	1014	Falling	88	1	Light Rain
22.02.16	1005	Rising	81	4	Partly Cloudy
23.02.16	1016	Rising	70	3	Clear
24.02.16	1017	Falling	93	0	Clear
25.02.16	1015	Rising	93	1	Clear
26.02.16	1009	Falling	87	2	Mostly Cloudy
29.02.16	1026	Falling	100	2	Scattered Clouds
01.03.16	1001	Falling	100	8	Light Rain
02.03.16	988	Rising	100	0	Light Snow
03.03.16	1004	Falling	81	4	Clear
04.03.16	986	Rising	100	1	Light Snow
07.03.16	1009	Rising	65	2	Clear
08.03.16	1010	Falling	87	3	Scattered Clouds
09.03.16	997	Rising	100	3	Light Rain
10.03.16	1020	Rising	100	3	Overcast
11.03.16	1028	Falling	100	4	Fog
14.03.16	1037	Falling	81	4	Scattered Clouds
15.03.16	1033	Falling	100	5	Light Drizzle
16.03.16	1034	Falling	100	5	Overcast
17.03.16	1033	Falling	81	4	Overcast
18.03.16	1028	Steady	93	4	Mostly Cloudy
21.03.16	1022	Falling	76	6	Mostly Cloudy
22.03.16	1017	Falling	87	7	Scattered Clouds
23.03.16	1016	Falling	81	5	Mostly Cloudy
24.03.16	1008	Falling	81	7	Scattered Clouds
25.03.16	1012	Steady	71	8	Partly Cloudy

Readings taken from bbc.co.uk/weather and wunderground.com using postcode S70

*Wells installed on 29.01.16. First monitoring can take place from 12.02.16.

Prepared	DES	Date	11.02.16	Job	39353

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ATMOSPHERIC CONDITIONS

Date	Atmospheric Pressure (mb)	Atmospheric Trend	Relative Humidity (%)	Temp (°C)	Weather
28.03.16	977	Rising	93	30	Light Rain
29.03.16	996	Rising	93	4	Light Rain Showers
30.03.16	1003	Rising	93	3	Scattered Showers
31.03.16	1015	Rising	100	4	Partly Cloudy
01.04.16	1016	Falling	70	5	Clear
04.04.16	999	Steady	100	9	Light Drizzle
05.04.16	1002	Rising	93	7	Light Rain
06.04.16	999	Steady	76	7	Partly Cloudy
07.04.16	1002	Rising	100	5	Mostly Cloudy
08.04.16	1011	Falling	81	7	Partly Cloudy
11.04.16	1010	Falling	87	8	Scattered Clouds
12.04.16	1005	Steady	100	7	Fog
13.04.16	1006	Rising	93	6	Clear
14.04.16	1011	Falling	84	6	Scattered Clouds
15.04.16	1002	Falling	87	5	Partly Cloudy
18.04.16	1015	Rising	81	7	Mostly Cloudy
19.04.16	1027	Rising	70	6	Clear
20.04.16	1032	Falling	71	7	Clear
21.04.16	1027	Falling	71	7	Clear
22.04.16	1025	Falling	81	6	Scattered Clouds
25.04.19	1009	Falling	76	6	Scattered Clouds
26.04.19	1007	Rising	61	4	Scattered Clouds
27.04.19	1012	Rising	81	3	Partly Cloudy
28.04.19	1011	Falling	87	3	Partly Cloudy
29.04.16	1000	Rising	100	0	Snow Showers
02.05.16	1012	Rising	77	8	Light Rain Showers
03.05.16	1021	Rising	66	9	Partly Cloudy
04.05.16	1024	Falling	71	9	Partly Cloudy
05.05.16	1020	Falling	67	11	Clear
06.05.16	1014	Falling	71	4	Clear
09.05.16	1010	Falling	100	8	Mostly Cloudy
10.05.16	1010	Falling	100	9	Partly Cloudy
11.05.16	1008	Falling	94	11	Light Drizzle
12.05.16	1007	Rising	94	11	Scattered Clouds
13.05.16	1013	Rising	93	8	Scattered Clouds
16.05.16	1021	Falling	76	9	Partly Cloudy
17.05.16	1015	Falling	76	10	Partly Cloudy
18.05.16	1001	Rising	100	10	Mostly Cloudy
19.05.16	1010	Falling	94	10	Mostly Cloudy
20.05.16	1010	Falling	82	12	Scattered Clouds

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ATMOSPHERIC CONDITIONS

Date	Atmospheric Pressure (mb)	Atmospheric Trend	Relative Humidity (%)	Temp (°C)	Weather
23.05.16	1017	Rising	94	10	Scattered Clouds
24.05.16	1024	Falling	62	11	Clear
25.05.16	1020	Falling	100	7	Mostly Cloudy
26.05.16	1015	Rising	100	9	Light Rain
27.05.16	1019	Steady	100	9	Fog

Prepared	DES	Date	11.02.16	Job	39353

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