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SUTCLIFFE INVESTIGATIONS

GEOTECHNICAL AND ENVIRONMENTAL ASSESSMENT

DOCUMENT VERIFICATION

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Summary

Plus Dane Housing have appointed Sutcliffe Investigations to undertake a Phase II Geotechnical and Environmental Assessment at Mill Lane, West Derby
This report should be read in conjunction with:

- Phase I Desktop Study, Mill Lane, West Derby, Liverpool, February 2012; Ref:26073LG

The site is located on Mill Lane, West Derby, L12 7JA at grid reference 339500, 392740. The site is currently undeveloped and consists of roughly grassed land and hardstanding associated with the former school on site. The site measures approximately 0.96Ha; it is bounded with metal palisade fencing along the north eastern edge, with the south east side of the site formed of a mixture of a brick wall from an adjacent building and palisade fencing; the south western boundary is formed of a mixture of close boarded wooden fencing, metal palisade fencing and wire mesh fencing. The north western boundary of the site is formed of a low brick wall topped with iron railings. A railway cutting is noted along the north eastern boundary of the site into the Sandstone which is visibly exposed; this is no longer active and is now in use as a cycle route.

A plan indicating the site location can be found in Appendix B.

The site is to be developed as 40No. New Houses with car-parking and rear gardens, based on these proposals the site will be assessed against a residential with plant uptake end use. The latest 1% Soil Organic Matter values have been used as this is the most conservative approach.

Site Investigations were carried out on 14th March 2012 & 24th March 2015 and have been designed based upon the findings in the Phase I Desk Study, preliminary risk assessment and conceptual model.

Executive Summary

A summary of salient geo-environmental issues is provided in the table below:

SITE DESCRIPTION	The site is located on Mill Lane, West Derby, L12 7JA at grid reference 339500, 392740. The site is currently undeveloped and consists of roughly grassed land and hardstanding associated with the former school on site. The site measures approximately 0.96Ha; it is bounded with metal palisade fencing along the north eastern edge, with the south east side of the site formed of a mixture of a brick wall from an adjacent building and palisade fencing; the south western boundary is formed of a mixture of close boarded wooden fencing, metal palisade fencing and wire mesh fencing. The north western boundary of the site is formed of a low brick wall topped with iron railings. A railway cutting is noted along the north eastern boundary of the site; this is no longer active.
SITE INVESTIGATION	Site investigation works consisted of the following: • 11No. Trial Holes by JCB excavator; TH1 – TH11 • 10No. Window Samples; WS1 – WS10 • 5No. Gas/water monitoring wells; WS1, WS5-WS7, WS9 • 16No. Soil contamination samples; WS1 – WS10, TH2, TH4, TH8 & TH10 • 6No. Leachate Tests; SA1 – SA4, HD1 & HD2 (March 2015) • 5No. Speciated TPH Tests; WS1, WS5-WS7, WS9 • 4No. Soakaway Tests; SA1- SA4
MADE GROUND	Made Ground was encountered in all 21 exploratory holes and comprised of dark brown gravelly sand with brick, whole and part, ash and concrete. Made ground was noted to a maximum depth of 1.50m in WS6 & TH4. Contamination sampling was targeted in this made ground.
NATURAL GROUND	Natural Strata was noted in all exploratory holes and consisted of red gravelly cobbly SAND. Gravel & cobbles are sub-angular fine to coarse of Sandstone.
SOLID GEOLOGY	Solid Geology was encountered in all of the exploratory holes and consisted of red weathered sandstone over very competent SANDSTONE. Foundations sat on the SANDSTONE should have a safe bearing pressure of 500kN/m².
GROUNDWATER	No groundwater was noted in any of the exploratory holes during investigation works. No water has been noted in monitoring wells during gas/groundwater monitoring visits The site overlies a Principal Aquifer for the bedrock.
CONTAMINATION EVALUATION	**SOIL EVALUATION** The results of the soil sampling undertaken in 2012 have been assessed

	against the latest assessment criteria, primarily the LQM Safe for Use Levels (S4ULs) with the following elevated levels noted. Three elevated levels of Lead were recorded in WS4 at 0.50m and WS6 at 0.50m & 1.10m One elevated level of Benzo(a)anthracene was noted in WS2 at 0.30m Seven elevated levels of Benzo(b)fluoranthene were recorded in WS2 0.30m, WS4 0.50m, WS6 0.50m, WS6 1.10m, WS7 0.20m, WS8 0.30m and WS9 0.50m Seven elevated levels of Benzo(a)pyrene were recorded in WS2 0.30m, WS4 0.50m, WS6 0.50m, WS6 1.10m, WS7 0.20m, WS8 0.30m and WS9 0.50m Nine elevated levels of Dibenzo(ah)anthracene were recorded in WS1 0.40m, WS2 0.30m, WS2 0.80m, WS4 0.50m, WS6 0.50m, WS6 1.10m, WS7 0.20m, WS8 0.30m and WS9 0.50m. Asbestos was detected in TH2 at 0.5m and TH4 at 0.5m. **LEACHATE EVALUATION** **UK Drinking Water Standards (UK DWS)** With the exception of Lead & Benzo(a)pyrene the UK DWS values were below the assessment criteria. Lead results in SA4, HD1 & HD2 exceed the UK DWS of 10µg/l with values of 24µg/l, 12µg/l & 60µg/l respectively. Benzo(a)pyrene results in SA1, HD1 & HD2 exceed the UK DWS of 0.01µg/l with values of 0.02µg/l, 0.04µg/l & 0.03µg/l respectively. **Environmental Quality Standards (EQS)** Copper results in all samples fall within the EQS range of 1-28µg/l with values of between 3µg/l and 18µg/l. The Zinc result in SA4 was noted above the EQS value of 40µg/l with a value of 68µg/l. The Benzo(b)fluoranthene result in HD1 exceed the EQS value of 0.03µg/l with a value of 0.04µg/l. The Benzo(ghi)perylene and Indeno(123cd)pyrene results in SA1, HD1 & HD2 exceed the EQS value of 0.002µg/l with a values of 0.02µg/l/0.01µg/l, 0.04µg/l/0.03µg/l & 0.03µg/l/0.03µg/l respectively. Based upon the above contamination results Sutcliffe Investigations believe remediation is not required for leachates, however as the aquifer is close to the surface a watching brief should be made during construction works to ensure no unexpected contamination is encountered that could migrate to the aquifer.

ASBESTOS	Asbestos fibres are noted in TH2 at 0.50m and TH4 at 0.50m, both samples recorded loose fibres of chrysotile (white) asbestos. Quantification testing was not undertaken at the time of the original sampling and therefore material will have to be tested again and quantification undertaken where asbestos is identified for the purpose of evaluating the hazardous potential of asbestos on site.
GROUND GAS MONITORING	Ground gas monitoring wells have been installed in the 5 window samples on site with response zones generally concentrating on the made ground strata, however with the Sandstone being at such a shallow depth part of the response zone may be in the natural materials. Ground gas monitoring visits have identified the following: • Maximum Methane reading 0.1% • Maximum Carbon Dioxide reading 2.1% • Maximum Flow rate 0.1l/s The GSV classifies the site as Green, indicating no special gas protection measures are required.
FOUNDATIONS / GROUND FLOOR	**Foundations** Ground conditions on site revealed MADE GROUND over bands of SAND. SANDSTONE was noted at relatively shallow depths the maximum being 2.40m. As a site strip is required for formation under the existing building and to facilitate the capping layer; Sutcliffe recommend that a traditional mass concrete foundation solution be adopted sat on the SANDSTONE with a Ground Bearing Pressure of 500kN/m². **Ground Floor Solution** Based upon the amount of Made Ground noted on site it is not recommended that a ground-bearing slab is utilised, Sutcliffe Investigations therefore propose a suspended P.C Unit ground floor be adopted.

REMEDIATION SUMMARY

SOIL CONTAMINATION

Due to site wide contamination of Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenzo(ah)anthracene along with the localised contamination and 2No. Areas of Asbestos, remediation will be required across the site. To break the source-pathway-receptor linkage a (600mm) capping layer in all garden and landscaped areas is proposed, it may be necessary to remove material from these areas to facilitate the capping layer.

Asbestos has also been noted in two samples TH2 and TH4, these areas should be treated separately as Hotspot areas and removed from site as Hazardous Waste with a quantification of <0.1%, the contractor should provide all necessary method statements and risk assessments before removal works commence. Quantification testing was not undertaken at the time of the original sampling and therefore material will have to be tested again and quantification undertaken where asbestos is identified for the purpose of evaluating the hazardous potential of asbestos on site.

LEACHATE CONTAMINATION

UK Drinking Water Standards (UK DWS)
With the exception of Lead & Benzo(a)pyrene the UK DWS values were below the assessment criteria.

Lead results in SA4, HD1 & HD2 exceed the UK DWS of 10µg/l with values of 24µg/l, 12µg/l & 60µg/l respectively.

Benzo(a)pyrene results in SA1, HD1 & HD2 exceed the UK DWS of 0.01µg/l with values of 0.02µg/l, 0.04µg/l & 0.03µg/l respectively.

Environmental Quality Standards (EQS)
Copper results in all samples fall within the EQS range of 1-28µg/l with values of between 3µg/l and 18µg/l.

The Zinc result in SA4 was noted above the EQS value of 40µg/l with a value of 68µg/l.

The Benzo(b)fluoranthene result in HD1 exceed the EQS value of 0.03µg/l with a value of 0.04µg/l.

The Benzo(ghi)perylene and Indeno(123cd)pyrene results in SA1, HD1 & HD2 exceed the EQS value of 0.002µg/l with a values of 0.02µg/l/0.01µg/l, 0.04µg/l/0.03µg/l & 0.03µg/l/0.03µg/l respectively.

Based upon the above contamination results Sutcliffe Investigations believe remediation is not required for leachates, however as the aquifer is close to the surface a watching brief should be made during construction works to ensure no unexpected contamination is encountered that could migrate to the aquifer.

GROUND GAS
Ground gas monitoring wells have been installed in the 5 window samples on site with response zones generally concentrating on the made ground strata, however with the Sandstone being at such a shallow depth part of the response zone may be in the natural materials. Ground gas monitoring visits have identified the following:

- Maximum Methane reading 0.2%
- Maximum Carbon Dioxide reading 2.1%
- Maximum Flow rate 0.1l/s

The GSV classifies the site as Green for the site, indicating no special gas protection measures are required.

Contents

FOREWORD (Geotechnical and Environmental Assessment)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Sutcliffe Investigation; such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their risk and the authors owe them no duty of care and skill.

The report presents observations and factual data obtained during our site investigation, and provides an assessment of Geotechnical and environmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from Sutcliffe Investigation prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Sutcliffe Investigation cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in this report (including review of any third party reports) are based on information obtained from a variety of sources as detailed within this report, and which Sutcliffe Investigation believes are reliable. All reasonable care and skill has been applied in examining the information obtained. Nevertheless, Sutcliffe Investigation cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced Geotechnical and environmental consultants. Sutcliffe Investigations does not provide legal advice and the advice of lawyers may also be required.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by Sutcliffe Investigation, whilst fully appropriate, may not have encountered all significant subsurface conditions. Any opinions expressed as to the possible configuration of strata between or below exploratory holes are for guidance only and no responsibility is accepted as to its accuracy.

It should be borne in mind that the timescale over which the investigation was undertaken might not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels are susceptible to seasonal and other variations and may be higher during the wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

This report assumes that ground levels will not change significantly from those existing at present and that houses will be of two storey construction. If this is not to be the case, then some modification to this report may be required.

It should be noted that the banning of the co-disposal of hazardous and non-hazardous waste was introduced in 2004, as a result of the implementation within the UK of the Landfill Directive. This will considerably affect the current practices and procedures for the handling and disposal of wastes, in particular hazardous wastes. In addition, it will be a requirement for all wastes to be pre-treated and to comply with certain waste acceptance procedures prior to sending wastes to landfill. The full potential effects of these important changes are not known at this stage, but it is perceived that disposal costs will rise, particularly for hazardous wastes, and waste pre-treatment may, in some cases, become an ‘additional’ redevelopment cost with regard to the remediation of contaminated sites.

Should this report recommend that materials could be excavated and removed off site for landfill disposal, then it should be noted that the costs, timescales and implications of the pending changes to waste management legislation couldn’t be predicted at this stage. Sutcliffe Investigation will not be responsible for changing practices, etc that may affect the viability of necessary remedial actions or of the implications of potential alternative treatment techniques.

Sutcliffe Investigation reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

1 Introduction

1.1 Scope of Assessment

1.1.1 Plus Dane Housing (The Client) has appointed Sutcliffe Investigations to conduct an Environmental and Geotechnical Investigation on land at Mill Lane, West Derby (shown in Appendix B). The present report is submitted in fulfilment of that brief and combines the following elements:

- An intrusive investigation exploring the actual ground conditions based on a non-target sampling strategy
- Dual gas and groundwater monitoring wells
- Assessment of the geotechnical properties
- A qualitative and quantitative risk assessment of contamination risks, with respect to potential receptors, including a conceptual site model
- Recommendations for further work and remediation where appropriate.

1.1.2 The report was devised to generally comply with the relevant principals and requirements of a wide range of guidance including BS5930:1999 as amended 2007: “Code of Practice for Site Investigations”, BS10175: 2001 “Investigation of Potentially Contaminated Sites – Code of Practice”, and the DEFRA / Environment Agency Report CLR11 “Model Procedures for the Management of Land Contamination.

1.2 The Proposed Development

1.2.1 The site is to be developed into 40No. new houses with car-parking and garden areas. A copy of the proposed site plan can be found in Appendix B. Based on these proposals the site will be assessed against a residential with plant uptake end use.

1.3 Report Format and Limitations

1.3.1 This report has been prepared and written for the exclusive benefit of the client for the purpose of providing environmental and/or geotechnical information and data relevant to the site and its redevelopment. The client shall not assign charge or otherwise transfer all or any of the contents contained within this report without the prior written consent of the consultant. The report contents should be used only in that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

1.3.2 General notes and limitations relevant to all Sutcliffe Investigations are described in the Foreword and in Appendix A and should be read in conjunction with this report.

1.3.3 Primary aims of this exploratory phase of investigation were to identify salient geotechnical and environmental issues affecting the site to enable the client to obtain budget costs for the necessary site preparatory and remedial works.

2 Site Investigation / Fieldwork

2.1 Investigation Strategy

2.1.1 Sampling Strategy

2.1.1.1 The site was investigated using the Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination R & D Technical Report P5-006/TR.

Due to the history of the site and its historical use as a nursery targeted sampling was undertaken in the area of the former greenhouses for herbicides and pesticides, the remainder of the testing across the site was non-targeted allowing more representative data to be obtained.

The site area is 9600m^2 ÷ 21 sample positions = 457.14m^2 ÷ 0.8 = 571.43m²
√571.43m^2 = a 23.9m grid.
Therefore this gives an 80% probability of finding a circular area of interest of 571.43m^2.

The chosen method of this ground investigation is summarised in Table 2.1 below:

Table 2.1: Purpose of Exploratory Holes

Exploratory Holes	Purpose
Window Samples	To install monitoring wells across the site in order to determine groundwater levels and monitor for hazardous gas. To determine the general nature of soils underlying the site, including the: • Nature, distribution and thickness of Made Ground • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc. • Suitability of the ground for founding structures.
Trial Holes	To determine the general nature of soils underlying the site, including the: • Nature, distribution and thickness of Made Ground • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc. • Suitability of the ground for founding structures.

2.1.1.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.

2.2 Analytical Strategy

2.2.1 For the purpose of the analytical testing suite, consideration has been given to the conceptual model, the Tier 1 Risk Assessment and the former usages of the site as summary of which is noted below;

FORMER SITE USES / FEATURES	POSSIBLE CONTAMINANTS
Field Land Nursery School Potential Boiler House	Metals pH Asbestos PAHs TPHs Pesticides & Herbicides

2.2.2 The analytical suite for soil and leachate samples comprised the following compounds (full suites of testing were not carried out on all of the samples):

SOILS
Arsenic, Boron, Cadmium, Chromium (III, VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, Phenols, Sulphate (Total), Sulphide, Sulphur (Total), pH, Organic Matter, Asbestos, PAH (Speciated), TPH (Speciated), Pesticides and Triazine Herb
LEACHATES
Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, Sulphate, Sulphide, Sulphur (Total), pH, PAH (Speciated)

2.2.3 All samples were analysed by MCERTS accredited soil analysis laboratory ALcontrol. Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation. Soil samples of approximately 500g were recovered in amber jars, amber vials for volatile analysis and plastic tubs. All the samples were labeled and stored in cool boxes prior to being collected by a courier for delivery to ALcontrol laboratory. Samples were tracked using appropriate chain of custody forms provided by ALcontrol.

2.2.4 TPH Speciated aromatic and aliphatic bands with BTEX analysis have been carried out in line with the TPHCWG. The toxicity and migration risk associated with a TPH is dependent on the specific aliphatic aromatic carbon banding. Of particular concern are the low molecular weight compounds, which are highly mobile and show a greater level of toxicity that the higher molecular weight compounds. Therefore a low TPH consisting of low molecular weight aliphatic and aromatic carbon banding compounds may present more of a risk than a high TPH consisting of heavy weight aliphatic and aromatic carbon banding compounds.

2.2.5 Based on the TPHCWG the aromatic band C5 – C7 is considered to consist only of Benzene and the aromatic band C7 – C8 of Toluene. Therefore the more specific BTEX analysis has been used for risk assessment rather than the aromatic bands.

2.2.6 5No. installation well has been installed on the site for ground gas monitoring.

2.3 Ground Investigation

2.3.1 Intrusive investigations are conducted to identify and quantify any contaminants present, in particular those anticipated in the light of the sites previous use. Intrusive investigation also enables the effects of soil conditions on contaminant migration and exposure pathways to be clarified; notably, the presence of groundwater can be determined and the permeability of soil strata can be assessed. Intrusive site investigations are necessary to allow determination of site-specific foundation strata for Geotechnical purposes.

2.3.2 The intrusive site investigation comprised of:

1. 10No. Window samples with a Dando Terrier Rig (Appendix D)
2. 11No. Trial Holes with a JCB excavator (Appendix D)
3. 16No. Soil samples taken for contamination testing purposes at varying depths from the Made Ground (Appendix E)
4. 5No. Speciated TPH sample from the Made Ground material (Appendix E)
5. 5No. Gas monitoring wells. (Appendix D)

2.3.3 The intrusive site investigation took place on the 14th & 15th March 2012. The results of this investigation are reported in Section 3 and 4.

2.4 Installations and In-situ Testing

2.4.1 5No. Gas and groundwater monitoring wells were installed in the window samples across the site to enable monitoring of groundwater levels and soil gas emissions, and sampling of groundwater following the site works. The response zone in the standpipe installation was filter wrapped and installed with a gravel filter.

2.4.2 Details of the installation are presented on the borehole log in Appendix D. The response zones of the groundwater standpipe installations are within the Natural Ground strata.

3 Ground and Groundwater Conditions

3.1 General

3.1.1 A summary of the ground conditions for this site are noted below, but a complete record of strata encountered is given on the various exploratory hole logs, presented in Appendix D. These logs include details of the samples taken, descriptions of the strata and groundwater encountered, results of the in-situ testing and the monitoring well depths.

3.2 Made Ground

3.2.1 Made Ground was encountered in all 21 exploratory holes and comprised of dark brown gravelly sand with brick, whole and part, ash and concrete.
Made ground was noted to a maximum depth of 1.50m in WS6 & TH4.
Contamination sampling was targeted in this made ground.

3.3 Natural Deposits

3.3.1 Natural Strata was noted in all exploratory holes and consisted of red gravelly cobbly SAND. Gravel & cobbles are sub-angular fine to coarse of Sandstone.

3.4 Solid Geology

3.4.1 Solid Geology was encountered in all of the exploratory holes and consisted of red weathered sandstone over very competent SANDSTONE.

The SANDSTONE was encountered at the following depths and these are the levels to which foundations should be taken:

WS1 at 1.60m	WS7 at 0.90m	TH3 at 1.80m	TH9 at 1.70m
WS2 at 1.30m	WS8 at 1.20m	TH4 at 2.40m	TH10 at 1.40m
WS3 at 1.20m	WS9 at 1.20m	TH5 at 1.50m	TH11 at 1.60m
WS4 at 1.20m	WS10 at 1.50m	TH6 at 2.00m	
WS5 at 1.30m	TH1 at 1.55m	TH7 at 2.20m	
WS6 at 1.80m	TH2 at 1.40m	TH8 at 1.50m	

Foundations sat on the SANDSTONE should have a safe bearing pressure of 500kN/m².

3.5 Hydrogeology

3.5.1 No groundwater was noted in any of the exploratory holes during the site investigation works or during monitoring visits. The site overlies a Principal Aquifer for the bedrock.

3.6 Visual & Olfactory Evidence of Organic Contamination

3.6.1 No visual or olfactory evidence of organic contamination was noted in any of the exploratory holes during site investigation works.

3.7 Stability

3.7.1 Stability of excavations within Natural Ground was generally good.

3.8 Geotechnical Testing and Issues

3.8.1 Geotechnical Testing

3.8.1.1 Made Ground

Made Ground was encountered in all 21 exploratory holes and comprised of dark brown gravelly sand with brick, whole and part, ash and concrete.
Made ground was noted to a maximum depth of 1.50m in WS6 & TH4.

Note: Made Ground is not suitable for foundations

3.8.2 Solid Deposits

Solid deposits were encountered in all of the 10 exploratory positions and comprised of weathered SANDSTONE

Table 3.1: Material Properties SANDSTONE

Property	No. of Tests	Range	Average
SPT N Values	10	Refusal	-

3.8.3 Soluble Sulphate and pH

3.8.3.1 It is envisaged foundations will extend through the Made Ground and into the natural strata and samples taken from the Made Ground have been submitted for pH and water-soluble sulphate (2:1 soil/water extract) analysis.

3.8.3.2 The highest water-soluble sulphate concentration and the lowest pH value for the Made Ground are shown in Table 3.2.

Table 3.2: Soluble sulphate and pH classification

Soil Type	Lowest pH Values	Highest Soluble Sulphate Concentration (g/l)
Made Ground	5.97	1.49

3.8.3.3 Therefore, in accordance with Table C2 of BRE: Special Digest 1 2005, sub-surface concrete that is in contact with Made Ground should be Design Sulphate Class **DS-2**, with the ACEC classification of **AC-1s**.

3.8.4 Foundation Recommendations

General

3.8.4.1 It is understood that consideration is being given to the development of 40No. Houses, a site layout has been provided and is in Appendix B.

3.8.4.2 Generally the investigations revealed Made Ground across the site over bands of sands over weathered sandstone.

3.8.4.3 No groundwater was encountered in any of the exploratory holes during the site investigation works. The site overlies a Principal Aquifer for the bedrock. No groundwater has been noted in monitoring wells.

3.8.4.4 Excavations within the natural ground were generally stable.

3.8.4.5 Sub-surface concrete that is only in contact with Made Ground can be Design Sulphate Class DS-2, with an ACEC Classification of AC-1s.

3.8.5 Ground Floor Construction

3.8.5.1 Based upon the amount of Made Ground noted on site it is not recommended that a ground-bearing slab is utilised, Sutcliffe Investigations therefore propose a suspended P.C Unit ground floor be adopted. The under floor void should be vented, which will be provided by the P.C Units.

3.8.6 Designated Concrete Mixes

3.8.6.1 The following designated mix in accordance with BRE Special Digest SD1 and BS 8500: Part1: 2002 will be suitable for use on this site.

Table 3.3: Designated Concrete Mixes

Application	DS-2 Conditions (Made Ground and Natural) ACEC Class AC-1s
Unreinforced strip / trench fill footings	GEN1
Reinforced strip / trench fill footing (mesh reinforcement)	RC30
Reinforced strip / trench fill footings (rebar etc)	RC30
Unreinforced concrete floor slabs	GEN2
In situ reinforced concrete floor slabs	RC30

*Note: Although RC 30 is in line with BS8500, Sutcliffe Investigation recommend the use of RC35 for concrete used in structurally sensitive works, to provide greater certainty of compliance with strength verification tests. Tolerable mixes dispatched by a batching plant are +/- 10%, and delays on site can also result in deterioration of the concrete.

3.8.7 Drainage

3.8.7.1 It is recommended that the developer contact United Utilities with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

Please note the testing suite carried out for this site is for human health purposes and may not cover the suite of contaminants required by United Utilities for pipe selection, therefore further testing may be required.

4 Contamination Hazard Assessment and Evaluation

4.1 General

4.1.1 The site's former usages may have given rise to some ground contamination. Furthermore, Made Ground was encountered in all of the exploratory locations during the ground investigation.

4.2 Testing Schedule

4.2.1 Based on the above assessment, the following testing was carried out at ALcontrol a UKAS accredited laboratory. No visual and/or olfactory evidence was recorded during the ground investigation.

Table 4.1: Testing Schedule

Type of Sample	No. of Samples	Determinants
Made Ground	16	pH, water-soluble boron, total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) and total sulphate, PAH suite.
Made Ground	16	Asbestos
Made Ground	16	Organic matter
Made Ground	5	Speciated TPH Aliphatic / Aromatic

4.3 Hazard Evaluation: Soils

4.3.1 General

4.3.1.1 Laboratory test certificates as received from the laboratory and summary sheets are presented in Appendix E.

4.3.2 Made Ground

4.3.2.1 Of the sixteen samples of Made Ground analysed for contaminant parameters (excluding those samples with asbestos containing material) nine of the samples contained contaminants that could be classified as elevated above the Generic Assessment Criteria (GAC). None of the samples tested for Herbicides & Pesticides were noted above the limit of detection, therefore it is not thought that a risk exists to the redevelopment of the site from this.

4.3.2.2 These samples are classified by comparison of parameters concentrations with the relevant current UK guidance threshold value for a proposed residential with plant uptake end use.

4.3.2.3 The analysis of acidity / alkalinity of the soil samples indicated that the pH of the samples tested was in the acid to alkaline range, with a minimum of 5.97, a maximum of 8.4, and a mean of 7.18.

4.3.2.4 The samples were assessed against Tier 1 values for a residential with plant uptake end use. Elevated levels of Lead, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(ah)anthracene have been noted, along with Asbestos.

4.3.2.5 The statistical analysis results for Lead, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(ah)anthracene are summarised in Table 4.2. Appendix F details the statistics reports for all contaminants.

Table 4.2: Statistical Analysis Results for Made Ground Stratum

Contaminant	Guideline Assessment Value	95% ile	Mean Value Test	Max Value Test	No. of Outliers removed to pass
Lead	200	250.219	Inconclusive	3 Outliers	3 Outliers
Benzo(a)anthracene	7.2	6.607	Pass	1 Outlier	N/A
Benzo(b)fluoranthene	2.6	7.932	Fail	1 Outlier	Inconclusive when removed
Benzo(a)pyrene	2.2	6.786	Fail	1 Outlier	Inconclusive when removed
Dibenzo(ah)anthracene	0.24	1.075	Fail	1 Outlier	Still fails when removed

4.3.2.6 The statistical analysis results for Lead indicate that the upper 95th percentile bound value (US95) is above the relevant UK guidance threshold value for a residential with plant uptake scenario. Lead is inconclusive against the mean value test with three outliers, when these outliers are removed Lead is shown to pass the mean value test, indicating that these represent three hot spot areas of Lead contamination.

4.3.2.7 The statistical analysis results for Benzo(a)anthracene indicate that the upper 95th percentile bound value (US95) is below the relevant UK guidance threshold value for a residential with plant uptake scenario. Benzo(a)anthracene passes the mean value test with one outlier, indicating that the Benzo(a)anthracene poses an acceptable risk to end users of the site.

4.3.2.8 The statistical analysis results for Benzo(b)fluoranthene indicate that the upper 95th percentile bound value (US95) is above the relevant UK guidance threshold value for a residential with plant uptake scenario. Benzo(b)fluoranthene fails the mean value test with one outlier, when the outlier is removed from the dataset Benzo(b)fluoranthene is noted to still be inconclusive indicating that without further testing Benzo(b)fluoranthene will have to be considered as site wide contamination.

4.3.2.9 The statistical analysis results for Benzo(a)pyrene indicate that the upper 95th percentile bound value (US95) is above the relevant UK guidance threshold value for a residential with plant uptake scenario. Benzo(a)pyrene fails the mean value test with one outlier, when the outlier is removed from the dataset Benzo(a)pyrene is noted to still be inconclusive indicating that without further testing Benzo(a)pyrene will have to be considered as site wide contamination.

4.3.2.10 The statistical analysis results for Dibenzo(ah)anthracene indicate that the upper 95th percentile bound value (US95) is above the relevant UK guidance threshold value for a residential with plant uptake scenario. Dibenzo(ah)anthracene fails the mean value test with one outlier, when the outlier is removed from the dataset Dibenzo(ah)anthracene is noted to still fail the mean value test indicating the presence of Dibenzo(ah)anthracene contamination across the site.

4.3.2.11 Due to site wide contamination of Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenzo(ah)anthracene along with the localised contamination and 2No. Areas of Asbestos, remediation will be required across the site. To break the source-pathway-receptor linkage a (600mm) capping layer in all garden and landscaped areas is proposed, it may be necessary to remove material from these areas to facilitate the capping layer.

4.3.3 Asbestos

4.3.3.1 There are also two areas of Asbestos noted on site and these areas will need to be treated as Hotspots and removed from site as a special waste. Quantification testing was not undertaken at the time of the original sampling and therefore material will have to be tested again and quantification undertaken where asbestos is identified for the purpose of evaluating the hazardous potential of asbestos on site.

4.4 Leachates

4.4.1 The results of all the chemical contamination testing for leachable concentrations are summarised in Appendix E, leachate analysis was scheduled on six samples from the Made Ground (SA1 0.40m, SA2 0.50m, SA3 0.50m, SA4 0.30m, HD1 0.50m & HD2 0.50m).

4.4.2 The concentrations of the leachate samples are assessed against the UK Drinking Water standards (UKDWS) for the purpose of the Principal Aquifer and the Environmental Quality Standards (EQS) for the purpose of the nearest surface water feature which is noted 277m west of the site.

UK DRINKING WATER STANDARDS

4.4.3 With the exception of Lead & Benzo(a)pyrene the UK DWS values were below the assessment criteria.

4.4.4 Lead results in SA4, HD1 & HD2 exceed the UK DWS of 10µg/l with values of 24µg/l, 12µg/l & 60µg/l respectively.

4.4.5 Benzo(a)pyrene results in SA1, HD1 & HD2 exceed the UK DWS of 0.01µg/l with values of 0.02µg/l, 0.04µg/l & 0.03µg/l respectively.

ENVIRONMENTAL QUALITY STANDARDS

4.4.6 Copper results in all samples fall within the EQS range of 1-28µg/l with values of between 3µg/l and 18µg/l.

The Zinc result in SA4 was noted above the EQS value of 40µg/l with a value of 68µg/l.

The Benzo(b)fluoranthene result in HD1 exceed the EQS value of 0.03µg/l with a value of 0.04µg/l.

The Benzo(ghi)perylene and Indeno(123cd)pyrene results in SA1, HD1 & HD2 exceed the EQS value of 0.002µg/l with a values of 0.02µg/l/0.01µg/l, 0.04µg/l/0.03µg/l & 0.03µg/l/0.03µg/l respectively.

Based upon the above contamination results Sutcliffe Investigations believe remediation is not required for leachates, however as the aquifer is close to the surface a watching brief should be made during construction works to ensure no unexpected contamination is encountered that could migrate to the aquifer.

4.4.7 Dilution, dispersion and attenuation of any leached contaminants will occur in the unsaturated one, i.e. the volume of ground below the contaminant source but above the groundwater surface (the unsaturated zone), reducing any impact on groundwaters.

4.5 Groundwater

4.5.1 No groundwater was noted in any of the exploratory holes during the site investigation works. The site overlies a Principal Aquifer for the bedrock. No groundwater has been noted in monitoring wells.

4.6 Hazard Evaluation: Soil Gas

4.6.1 Gas monitoring wells were installed in five of the window samples on the site. A full copy of all gas monitoring readings and water levels can be found in Appendix D.

Table 4.3: Gas monitoring results

Window Sample	Visit No	1 28.03.12	2 12.04.12	3 02.05.12	4 23.05.12	5 14.06.12	6 28.06.12
WS1	Methane %	0.1	0.1	0.1	0.1	0.1	0.1
	CO_2 %	1.2	1.5	1.2	1.1	1.3	2.1
	O_2 %	19.5	18.9	19.7	19.8	19.6	17.5
	Atmospheric Pressure	1034 (F)	1004 (R)	1024 (S)	1024 (S)	1015 (S)	995 (S)
	Flow Rate	0.0	0.0	0.0	0.0	0.0	0.0
WS5	Methane %	0.1	0.1	0.1	0.1	0.1	0.1
	CO_2 %	0.8	1.4	0.9	0.9	1.2	1.6
	O_2 %	20.1	19.4	19.9	20.0	19.8	18.9
	Atmospheric Pressure	1034 (F)	1004 (R)	1024 (S)	1024 (S)	1015 (S)	995 (S)
	Flow Rate	0.0	0.0	0.0	0.0	0.0	0.0
WS6	Methane %	0.1	0.1	0.1	0.1	0.1	0.1
	CO_2 %	0.7	1.6	1.0	0.9	1.1	1.2
	O_2 %	20.7	20.0	20.1	20.2	20.0	20.1
	Atmospheric Pressure	1034 (F)	1004 (R)	1024 (S)	1024 (S)	1015 (S)	995 (S)
	Flow Rate	0.0	0.0	0.0	0.0	0.0	0.0
WS7	Methane %	0.1	0.1	0.1	0.1	0.1	0.1
	CO_2 %	0.4	1.7	1.2	1.0	1.3	0.9
	O_2 %	21.4	20.7	20.9	20.9	20.3	21.0
	Atmospheric Pressure	1034 (F)	1004 (R)	1024 (S)	1024 (S)	1015 (S)	995 (S)
	Flow Rate	0.0	0.0	0.0	0.0	0.0	0.0
WS9	Methane %	0.1	0.1	0.1	0.1	0.1	0.1
	CO_2 %	0.7	1.2	0.8	0.7	1.0	1.5
	O_2 %	21.0	20.1	20.4	20.5	20.0	20.4
	Atmospheric Pressure	1034 (F)	1004 (R)	1024 (S)	1024 (S)	1015 (S)	995 (S)
	Flow Rate	0.0	0.0	0.0	0.0	0.0	0.0

Note: Atmospheric Pressure – (R) Rising, (S) Steady, (F) Falling.

4.6.2 The principal components of landfill gas are methane (CH_4) and carbon dioxide (CO_2) and pose a risk to both health and safety if they enter a building. These two gases are also associated with coal strata, river silt, sewage and peat.

4.6.3 Methane is a flammable, asphyxiating gas, and a flammable range being 5 to 15% by volume in air. If such a methane/air mixture is confined in some way and then ignited it will explode. The 5% volume concentration is known as the lower explosive limit.

4.6.4 Carbon dioxide is a non-flammable toxic gas with a long-term exposure limit of 0.5% and a short-term exposure limit of 1.5% by volume.

4.6.5 Assessing gas-contaminated land is difficult for a variety of reasons:

1 Concentrations can vary significantly with time in permeable strata.
2 Methane presents an explosive risk, which is difficult to quantify.
3 Background concentrations of these gases in the ground are not zero and they can be found in high concentrations in innocuous environments.

4.6.6 With many of the natural sources of methane and carbon dioxide, the rate of production of gas is low and so is the quantity of gas. In some cases if the gas becomes trapped, e.g. by an overlying material with low permeability, then when first tapped the rate of emissions may be high, but subsequent emissions will be very much lower because the reservoir is not replenished.

4.6.7 Using CIRIA C665 – Assessing risks posed by hazardous ground gases to buildings the NHBC Traffic light system for the site is Green.

4.6.8 The site is to be developed as new housing and the soil gas investigation has identified a maximum methane concentration of 0.1 per cent methane and a worst case flow rate of 0.1l/hr. The GSV will be calculated as:
Limiting volume flow rate of gas = gas concentration x measured borehole flow rate
= 0.001 x 0.1 (gas concentration in table is %)
= 0.0001

4.6.9 The GSV classifies the site as Green for Methane.

4.6.10 The site is to be developed as new housing and the soil gas investigation has identified a maximum carbon dioxide concentration of 2.1 per cent and a worst case flow rate of 0.1l/hr. The GSV will be calculated as:

Limiting volume flow rate of gas = gas concentration x measured borehole flow rate

= 0.021 x 0.1 (gas concentration in table is %)

= 0.0021

4.6.11 The GSV classifies the site as Green for Carbon Dioxide.

5 Risk Assessment

5.1 Introduction

5.1.1 In order to design a risk management strategy; it is necessary to identify any unacceptable risks. The method used to evaluate any risk from contamination is based upon CIRIA C552 "Contaminated Land Risk Assessment – A Guide to Good Practise". This method of risk evaluation detailed in Appendix G, is a qualitative method and involves the classification of the:

- Magnitude of the potential consequence (severity) of risk occurring.
- Magnitude of the probability (likelihood) of the risk occurring.

5.1.2 The following qualitative risk assessment has been developed to consider the plausible exposure scenarios, in conjunction with the results of laboratory analysis. Each exposure scenario has been assigned a risk classification that is based upon the CIRIA guidance indicated above.

5.1.3 The following groups of receptors have been identified for the site:

- Humans, i.e. current site users, construction / maintenance workers involved in redevelopment and future site users (general public / residents);
- Controlled ground and surface waters
- Vegetation
- Ecosystems (through Environmental Quality Standards)
- Materials used in building and infrastructure development.

Table 5.1 Qualitative Risk Assessment Summary (Page 1 of 5)

Receptor	Contaminant	Pathway	Consequence	Probability	Risk Classification	Comments
Humans (Construction /Maintenance Workers)	Shallow soil toxic 'contamination' Lead, PAHs & Asbestos	Direct Contact Dermal Contact Ingestion Inhalation	Existing Condition: Medium Redeveloped Condition: None Identified	Existing Condition: Likely Redeveloped Condition: None Identified	Existing Condition: Moderate Redeveloped Condition: None Identified	Asbestos has been noted in two samples TH2 and TH4, contractors engaged to remove this material will need to prepare suitable method statements and risk assessments. Site wide contamination of Benzo(a)pyrene has been noted, with localised contamination of Benzo(a)anthracene, Benzo(b)fluoranthene & Dibenzo(ah)anthracene noted; contractors should again prepare suitable method statements and risk assessments. Contractors' personnel engaged in ground works should, as a matter of course, be counselled in good practice with particular regard to the avoidance of dust inhalation and skin contact with soils. Smoking or eating on the immediate worksite should be avoided and the importance of washing after contact with soils or plant operating on the site should be given due consideration. If during earthworks operatives discover any further adverse ground conditions and suspect it to be contaminated then they must contact the relevant parties immediately to report it. Sutcliffe Investigations should be employed with a watching brief with respect to earthworks conducted on site. A full health and safety plan should be prepared before commencement of works on site. Operatives should use suitable PPE and follow guidance in health and safety guidance note HSG66 "Protection of workers and the general public during the development of contaminated land". Other toxic contamination hot spots may exist at the site that could be encountered during the site redevelopment ground works; therefore there is some potential for a pollution linkage occurring. The risks can be adequately controlled by good working practices, particularly hygiene and personal protective equipment.
	Superficial Groundwater contamination – contaminated groundwater could be in contact with a construction worker	Inhalation Ingestion Dermal Contact	Existing Condition: Medium Redeveloped Condition: None Identified	Existing Condition: Low Likelihood Redeveloped Condition: None Identified	Existing Condition: Low Risk Redeveloped Condition: None Identified	No groundwater was noted in any of the exploratory holes during site investigation works or in the monitoring wells during gas / groundwater monitoring visits. Contractors should not be at risk from contaminated groundwater.

Table 5.1 Qualitative Risk Assessment Summary (Page 2 of 5)

Receptor	Contaminant	Pathway	Consequence	Probability	Risk Classification	Comments
Humans (End Users)	Shallow soil toxic 'contamination' Lead, PAHs & Asbestos	Direct Contact Dermal Contact Ingestion Inhalation	Existing Condition: Medium Redeveloped Condition: None Identified	Existing Condition: Likely Redeveloped Condition: None Identified	Existing Condition: Moderate Redeveloped Condition: None Identified	Due to site wide contamination of Benzo(a)pyrene and 2No. Areas of Asbestos, remediation will be required across the site. Localised contamination of Benzo(a)anthracene, Benzo(b)fluoranthene & Dibenzo(ah)anthracene was also noted To accommodate the proposed development, the levels on site may require reduction. Part of the proposed remedial works is to provide a 600mm cover system. The material removed from the areas around TH2 & TH4 for Asbestos will need to be treated as hazardous/special waste. By carrying out this proposed remediation this will break all source pathway receptor linkages.
	Soil Gas	Inhalation Combustion	Existing Condition: Medium Redeveloped Condition: None Identified	Existing Condition: Low Likelihood Redeveloped Condition: None Identified	Existing Condition: Moderate Redeveloped Condition: None Identified	Using CIRIA C665 – Assessing risks posed by hazardous ground gases to buildings the NHBC Traffic light system for the site is Green.

Table 5.1 Qualitative Risk Assessment Summary (Page 3 of 5)

Receptor	Contaminant	Pathway	Consequence	Probability	Risk Classification	Comments
Wider Environment (Adjacent Property and Land Users)	Shallow soil toxic 'contamination' as Lead, PAHs & Asbestos	Migration via wind-blown dust	Existing Condition: Minor Redeveloped Condition: None identified	Existing Condition: Low Likelihood Redeveloped Condition: None identified	Existing Condition: Very Low Risk Redeveloped Condition: None identified	Although the risk is very low, soil contamination as wind-blown dust could theoretically impact on adjacent sites in particular during redevelopment earth works in dry periods. This very low risk can be adequately controlled by using dust control methods (damping). Dust control is also likely to be required to stop dust nuisance.
	Superficial Groundwater contamination Causing Contaminated groundwater	Inhalation Ingestion Dermal Contact	Existing Condition: Medium Redeveloped Condition: None Identified	Existing Condition: Low Likelihood Redeveloped Condition: None Identified	Existing Condition: Low Risk Redeveloped Condition: None Identified	**UK Drinking Water Standards** With the exception of Lead & Benzo(a)pyrene the UK DWS values were below the assessment criteria. Lead results in SA4, HD1 & HD2 exceed the UK DWS of 10µg/l with values of 24µg/l, 12µg/l & 60µg/l respectively. Benzo(a)pyrene results in SA1, HD1 & HD2 exceed the UK DWS of 0.01µg/l with values of 0.02µg/l, 0.04µg/l & 0.03µg/l respectively. **Environmental Quality Standards** Copper results in all samples fall within the EQS range of 1-28µg/l with values of between 3µg/l and 18µg/l. The Zinc result in SA4 was noted above the EQS value of 40µg/l with a value of 68µg/l. The Benzo(b)fluoranthene result in HD1 exceed the EQS value of 0.03µg/l with a value of 0.004µg/l. The Benzo(ghi)perylene and Indeno(123cd)pyrene results in SA1, HD1 & HD2 exceed the EQS value of 0.002µg/l with a values of 0.02µg/l/0.01µg/l, 0.04µg/l/0.03µg/l & 0.03µg/l/0.03µg/l respectively. Based upon the above contamination results Sutcliffe Investigations believe remediation is not required for leachates, however as the aquifer is close to the surface a watching brief should be made during construction works to ensure no unexpected contamination is encountered that could migrate to the aquifer.

Table 5.1 Qualitative Risk Assessment Summary (Page 4 of 5)

Receptor	Contaminant	Pathway	Consequence	Probability	Risk Classification	Comments
Vegetation	Shallow soil toxic 'contamination' Lead, PAHs & Asbestos	Plant uptake	Existing Condition: Minor Redeveloped Condition: None identified	Existing Condition: Low Likelihood Redeveloped Condition: None identified	Existing Condition: Very Low Risk Redeveloped Condition: None identified	No areas of inhibited plant growth due to direct contact of plants with soils have been identified at the site. The proposed development is for houses. Part of the proposed remedial works is to provide in garden / landscaped areas a 600mm cover system. This 600mm capping layer will incorporate 150mm of clean tested imported topsoil material. It is expected that imported topsoil would be used as a growing medium within landscaped/garden areas of the proposed development.
Building Materials	Sulphide in shallow soils	Direct contact (attack on plastic drinking water pipe work)	Existing Condition: Minor Redeveloped Condition: None identified	Existing Condition: Low Likelihood Redeveloped Condition: None identified	Existing Condition: Very Low Risk Redeveloped Condition: None identified	It is recommended for concrete a Design Sulphate Class DS-2, with the ACEC classification of AC-1s to be used for the Made Ground.

Table 5.1: Qualitative Risk Assessment Summary (Page 5 of 5)

Receptor	Contaminant	Pathway	Consequence	Probability	Risk Classification	Comments
Controlled Waters - Groundwaters (Unclassified Shallow Groundwaters)	Shallow soil toxic 'contamination' as Lead, PAHs & Asbestos	Infiltration & percolation of precipitation leaching contaminants from the Made Ground	Existing Condition: Medium Redeveloped Condition: None Identified	Existing Condition: Low Likelihood Redeveloped Condition: None Identified	Existing Condition: Low Risk Redeveloped Condition: None Identified	**UK Drinking Water Standards** With the exception of Lead & Benzo(a)pyrene the UK DWS values were below the assessment criteria. Lead results in SA4, HD1 & HD2 exceed the UK DWS of 10µg/l with values of 24µg/l, 12µg/l & 60µg/l respectively. Benzo(a)pyrene results in SA1, HD1 & HD2 exceed the UK DWS of 0.01µg/l with values of 0.02µg/l, 0.04µg/l & 0.03µg/l respectively. **Environmental Quality Standards** Copper results in all samples fall within the EQS range of 1-28µg/l with values of between 3µg/l and 18µg/l. The Zinc result in SA4 was noted above the EQS value of 40µg/l with a value of 68µg/l. The Benzo(b)fluoranthene result in HD1 exceed the EQS value of 0.03µg/l with a value of 0.04µg/l. The Benzo(ghi)perylene and Indeno(123cd)pyrene results in SA1, HD1 & HD2 exceed the EQS value of 0.002µg/l with a values of 0.02µg/l/0.01µg/l, 0.04µg/l/0.03µg/l & 0.03µg/l/0.03µg/l respectively. Based upon the above contamination results Sutcliffe Investigations believe remediation is not required for leachates, however as the aquifer is close to the surface a watching brief should be made during construction works to ensure no unexpected contamination is encountered that could migrate to the aquifer.
	Dispersion of leachates to surface water courses	Dispersion from Groundwater to Surface Water	Existing & Redeveloped Conditions: Mild	Existing & Redeveloped Conditions: Unlikely	Existing & Conditions: Very Low Risk	In the site's existing condition, leaching of contaminants may occur from contamination hot spots but dilution, dispersion and attenuation will occur in the unsaturated zone, lessening the effect.

6 Conclusion and Recommendations

6.1 Potential Remedial Options

6.1.1 General

6.1.1.1 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

6.1.1.2 The risk assessment has identified potential source – pathway – receptor linkages present once the site is developed. To remove these pollutant linkages the source, pathway or receptor must be removed or broken. Table 6.1 below identifies the pollutant linkages, and mitigation measures.

Table 6.1: Summary of Pollution Linkages and Remediation Proposals

Source	Pathway	Receptor	Mitigation Measures
Contaminants found in soil: • Asbestos • B(b)f • B(a)p • D(ah)a	• Inhalation • Ingestion • Dermal contact	• Human Health • Aquifer	• Due to site wide contamination of Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenzo(ah)anthracene and 2No. areas of Asbestos, remediation will be required across the site. Localised contamination of Lead was also noted • To accommodate the proposed development, the levels on site may require reduction. • Part of the proposed remedial works is to provide a 600mm cover system. • The material removed from the areas around TH2 & TH4 for Asbestos will need to be delineated to see if it has to be treated as hazardous/special waste. • By carrying out this proposed remediation this will break all source pathway receptor linkages.

6.1.1.3 To break the pollutant linkages remediation is required across the site due to Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(ah)anthracene contamination, and 2No. areas of Asbestos (TH2 & TH4). To accommodate the proposed development, levels on site may require reduction. Localised contamination of Lead was also noted

Part of the proposed remedial works is to provide a 600mm cover system which will incorporate 150mm of clean imported tested topsoil and a geo-textile membrane. It is expected that imported topsoil would be used as a growing medium within landscaped/garden areas of the proposed development.

Not only will this break all source pathway receptor linkages it will make the site levels suitable for the build.

6.1.1.4 Within all landscape/garden areas, 150mm of growing medium for plants and grass is required as part of the capping layer.

6.1.1.5 The specification criteria for water supply pipe selection include measures to prevent contamination of water from contaminants in soil. We would therefore recommend a copy of this report to be sent to United Utilities for their guidance.
Please note the testing suite carried out for this site is for human health purposes and may not cover the suite of contaminants required by United Utilities for pipe selection, therefore further testing may be required.

6.1.1.6 Approved remediation works should be carried out in full on site under a quality assurance scheme to demonstrate compliance with the proposed methodology and best practice guidance. If during the works contamination is encountered which has not previously been identified then the additional contamination will need to be fully assessed.

6.1.2 Gas

6.1.2.1 Using CIRIA C665 – Assessing risks posed by hazardous ground gases to buildings the NHBC Traffic light system for the site is Green, indicating no gas protection measures are required.

6.1.3 Waste Classification

6.1.3.1 Asbestos has been noted on site in TP2 & TP4. This material will need to be delineated to determine the spread of asbestos and to allow quantification to be undertaken to classify the material for removal from site.

6.1.4 Validation

6.1.4.1 Validation will be required to determine that the site is suitable for the proposed end use as houses:

- Ensuring material has been removed to a facilitate the 600mm cover system
- Ensuring Asbestos has been removed from site around TH2 & TH4
- Ensure the imported material is suitable for use.
- Ensure the depth of the cover system is 600mm
- Ensure 150mm of imported topsoil is noted in proposed garden areas

6.2 Remedial Strategies

6.2.1 Redevelopment of this site is subject to planning conditions relating to remediation and validation. Sutcliffe have prepared this document in accordance with the proposed development plans enclosed in Appendix B. A detailed remediation / validation strategy will also be completed in due course and will contain details of the removal of material from site to reduce site levels (if necessary), details of the placement of a 600mm cover system, details of the remediation of the asbestos 'hotspot' area and details of the supervision of the works by a suitably qualified consultant, it will also include detailed records of testing requirements, etc.

6.2.2 Validation of the remediated site in the form of a detailed Completion Statement will also be completed to confirm that the works set out in this document are agreed and completed and that the site is suitable for its intended use.

6.3 Health and Safety Issues

6.3.1 Contractors' personnel engaged in ground works should, as a matter of course, be counselled in good practice with particular regard to the avoidance of dust inhalation and skin contact with soils. Smoking or eating on the immediate worksite should be avoided and the importance of washing after contact with soils or plant operating on the site should be given due consideration.

6.3.2 Furthermore, for protection of workers and the general public, contractors would need to adopt effective dust suppression measures including, *inter alia*, water spraying in dry weather conditions and sheeting of lorries transporting site soils.

6.3.3 If during earthworks operatives discover any further adverse ground conditions and suspect it to be contaminated then they must contact the relevant parties immediately to report it. Sutcliffe Investigations should be employed with a watching brief with respect to earthworks conducted on site.

6.3.4 A full health and safety plan should be prepared before commencement of works on site. Operatives should use suitable PPE and follow guidance in health and safety guidance note HSG66 "Protection of workers and the general public during the development of contaminated land".

6.4 Protection of Controlled Waters

UK Drinking Water Standards

6.4.1 With the exception of Lead & Benzo(a)pyrene the UK DWS values were below the assessment criteria.

Lead results in SA4, HD1 & HD2 exceed the UK DWS of 10µg/l with values of 24µg/l, 12µg/l & 60µg/l respectively.

Benzo(a)pyrene results in SA1, HD1 & HD2 exceed the UK DWS of 0.01µg/l with values of 0.02µg/l, 0.04µg/l & 0.03µg/l respectively.

Environmental Quality Standards

6.4.2 Copper results in all samples fall within the EQS range of 1-28µg/l with values of between 3µg/l and 18µg/l.

The Zinc result in SA4 was noted above the EQS value of 40µg/l with a value of 68µg/l.

The Benzo(b)fluoranthene result in HD1 exceed the EQS value of 0.03µg/l with a value of 0.004µg/l.

The Benzo(ghi)perylene and Indeno(123cd)pyrene results in SA1, HD1 & HD2 exceed the EQS value of 0.002µg/l with a values of 0.02µg/l/0.01µg/l, 0.04µg/l/0.03µg/l & 0.03µg/l/0.03µg/l respectively.

Based upon the above contamination results Sutcliffe Investigations believe remediation is not required for leachates, however as the aquifer is close to the surface a watching brief should be made during construction works to ensure no unexpected contamination is encountered that could migrate to the aquifer.

6.4.3 Dilution, dispersion and attenuation of any leached contaminants will occur in the unsaturated zone, i.e. the volume of ground below the contaminant source but above the groundwater surface (the unsaturated zone), reducing any impact on groundwaters.

6.5 Foundations

6.5.1 It is understood that consideration is being given to the development of houses on site.

6.5.2 Ground conditions on site revealed MADE GROUND over bands of SAND. SANDSTONE was noted at relatively shallow depths the maximum being 2.4m. As a site strip is required for formation under the existing building and to facilitate the capping layer; Sutcliffe recommend that a traditional mass concrete foundation solution be adopted sat on the SANDSTONE with a Ground Bearing Pressure of 500kN/m².

6.5.3 No groundwater was noted in any of the exploratory holes during site work. The site overlies a Principal Aquifer for the bedrock. No groundwater has been noted in monitoring wells.

6.5.4 Excavations within the natural ground were generally stable.

6.5.5 Sub-surface concrete that is only in contact with Made Ground can be Design Sulphate Class DS-2, with an ACEC Classification of AC-1s.

6.6 Ground Floor Construction

6.6.1 Based upon the amount of Made Ground noted on site it is not recommended that a ground-bearing slab is utilised, Sutcliffe Investigations therefore propose a suspended P.C Unit ground floor be adopted. The under floor void should be vented, which will be provided by the P.C Units.

6.7 Diversion

6.7.1 Services are noted on site and diversions will be required for this site.

6.8 Recommended Consultations

6.8.1 There are drainage and services at the edge of the site, that may be suitable for re-use. Sutcliffe would recommend a full drainage survey be undertaken.

6.8.2 At the time of writing, the classification of materials removed from the site for waste disposal purposes must be negotiated with the receiving waste management facility. All removal will be included in the remediation / validation report.

6.9 Further Monitoring / Investigation and Management Measures

6.9.1 The following risk reduction / management measures are recommended in order to reduce the identified risks from contamination to an acceptable level:

- Construction workers involved in the redevelopment of the site and future maintenance workers should follow good working practices with regard to contamination, including a site induction, practicing high standards of hygiene and the use of personal protective equipment (PPE).
- The provision of surface water drainage in the redevelopment to prevent infiltration and potential leaching of contaminants into the groundwater. It is likely that this will be part of the planned development anyway.
- Damping-down of earth works in the redevelopment should be undertaken during dry periods when there is the potential for dust blow from the site.
- If deeper foundations are required as part of the development, i.e. below the groundwater level, the Sulphate and Chloride content of the groundwater should also be considered.

- Surplus Made Ground material will need to be disposed of under conditions regulated by the Waste Management Licensing Regulations 1994.

6.9.2 If requested, Sutcliffe Investigations can act as the agent of our client in seeking approval of the Local Authority Contaminated Land Officer and statutory consultees as appropriate. Sutcliffe Investigations can also be employed to provide remediation validation works, and signing-off of works.

6.9.3 The comments given in this report and the opinions expressed assume that the ground conditions do not vary beyond the range revealed by this investigation. There may be, however, conditions within the site, which have not been disclosed by this investigation and consequently have not been considered in this report. Accordingly, a careful watch should be maintained during any future groundwork, and the recommendations of this report reviewed as necessary.

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It should be noted that Sutcliffe Investigations have used reasonable skill, care and diligence in the design of the investigation of this site. The inherent infinite variation of ground conditions allows only definition of the actual conditions at the location and depth of exploratory holes, while those at intermediate locations can only be inferred. This site has not been checked for Japanese Knotweed or other detrimental plants.

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Appendix A – General Notes

Generic Notes – Sutcliffe Investigations

Environmental Setting

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the Correspondence Appendix of the Geoenvironmental Report.

Geology, Mining & Quarrying

In order to establish the geological setting of a site, Sutcliffe Investigations refer to BGS maps for the area and the relevant geological memoir.

A coal mining report is obtained from the Coal Authority. Further information is sourced from the Local Authority and by reference to current and historical OS plans.

Landfills

Sutcliffe Investigations obtain data from the Landmark Information Group, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite) and can move through fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, Sutcliffe Investigations refer to BRE Report BR211, 1999: *"Radon: guidance on protective measures for new dwellings".*

BR211 provides a preliminary indication of the measures required for a particular site, but it is also often necessary to request a Stage 2 Protective Measures Site Report from the BGS.

The level of protection needed is site-specific and is determined by reference to the radon potential map for the area followed by a geological assessment of the site. This information is contained in the Annexes of BR211.

Annex A – derived from statistical analysis of radon measurements in existing houses carried out by the NRPB and grouped on 5km grid.

Annex B – based on an assessment of the same radon measurements grouped by geological units. The maps show the 5km grid squares underlain completely or in part, by geological units which potentially exceed the action levels for radon protective measures. The grid squares are coded according to highest potential within the square. In many cases the actual geological radon potential varies considerably within a grid square.

Sutcliffe Investigations adopt the following procedure when assessing risk associated with radon.

Firstly, Annex A maps are reviewed to see whether the site requires full, basic or no measures. If the site is in a dark brown square, full radon protection measures are required. If the site is in a light brown square, reference should be made to Annex B.

Secondly, Annex B maps are reviewed to see whether a further geological assessment is required which may result in upgrading the result from Annex A. If a site lies within a shaded square, it may require radon protection and Sutcliffe Investigations request a Stage 2 Protective Measures Site Report from the BGS.

If the site is in a square that is not coloured or shaded in either set of maps then no radon protection is needed and therefore a BGS Report is not normally necessary.

The BGS geological assessment involves checking whether the site is on or close to a geological unit that has statistically been found to have elevated radon potential. The geological assessment is based on either 1:50,000 or the 1:250,000 scale data. The search area specified as part of the request is increased by 50m in areas where 1:50,000 data is available and by 500m in areas with 1:250,000 scale data to allow for potential inaccuracies in the position of boundaries. The BGS report indicates the highest level of protection required within the search area and its buffer zone.

When requesting a BGS report, Sutcliffe Projects select the search radius carefully, since too large a search radius may result in the inclusion of areas underlain by geological units of a higher radon potential, thereby giving rise to recommending too high a level of protection.

The report also includes (where available), a list of the geological units included in the assessment. Sutcliffe Investigations check that these actually underlie the site, rather than the buffer zone only.

On the basis of radon measurements in dwellings and on their geological interpretation, the BGS report stipulates the level of protective measures required for the proposed development site, and this could be:

1. no measures
2. basic measures or
3. full measures

Details of these measures are provided in the Hazardous Gas section of this Geoenvironmental Report.

Hydrogeology

Sutcliffe Investigations obtain information from the Environment Agency (EA) and the Landmark Information Group with respect to:

- groundwater quality
- recorded pollution incidents
- licensed groundwater abstractions

Reference is also made to the EA document “Policy and Practice for the Protection of Groundwater” (1998) and the relevant Groundwater Vulnerability Map.

Bedrock and any overlying granular Drift deposits are classified by the EA.

Major aquifers: “*Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public water supply and other purposes*”.

Minor aquifers: “*Fractured or potentially fractured rocks which do not have a high primary permeability, or other formations or variable permeability. Although these acquifers will seldom produce large quantities of water for abstractions, they are important both for local supplies and in supplying base flow to rivers*”.

Non-aquifers: “*Formations which are generally regarded as containing insignificant quantities of groundwater. However groundwater flow through such rocks, although imperceptible, does take place and needs to be considered in assessing the risk associated with persistent pollutants. Some non-acquifers can yield water in sufficient quantities for domestic use*”.

Groundwater vulnerability is determined by 4 variables:

1. The presence and nature of overlying soil (the weathered zone affected by living organisms; soil in the UK can extend up to 2m in depth). Physical properties of the soil affect the downward passage of water and its ability to attenuate pollutants. The EA make reference to a three-fold classification of soil types:-

    - Soils of **low** leaching potential are defined as "*soils in which the pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants*".

    - Soils of **intermediate** leaching potential are defined as "*soils which have a moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-absorbed diffuse source pollutants and liquid discharges could penetrate the soil layer*".

    - Soils of high leaching potential are defined as "*soils with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater*".

    In urban areas and restored mineral workings the soil information is based on fewer observations than elsewhere. A worst-case vulnerability (H) is therefore assumed for these areas and for current mineral workings by the EA. All are given a designation of **HU** unless proved otherwise.

2. The presence and nature of Drift, which often overlies bedrock. Where Drift is of substantial thickness and low permeability, it can provide an effective barrier to surface pollutant migration. Permeability Drift is classified as a Minor Aquifer except where it is in probable hydraulic continuity with a Major Aquifer, where it is regarded as part of the Major Aquifer unless proven otherwise by site investigation.

3. The nature of the geological strata (bedrock). Rocks that contain groundwater in exploitable quantities are called aquifers.

4. The depth of the unsaturated zone; i.e. that part of the aquifer which lies above the water table.

The EA have also designated Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone may vary from tens to several thousand hectares.

Hydrology

Sutcliffes obtain information from the Environment Agency and the Landmark Information Group with respect to:

- Surface water quality
- Recorded pollution incidents
- Licensed abstractions (groundwater & surface waters)
- Licensed discharge consents
- Site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are six GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps provides show natural floodplains – areas potentially at risk of flooding it a river rises above its banks or high tides and stormy seas cause flooding in coastal areas.

There are different kinds of area shown on the Flood Map:

1. Dark blue areas could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 200) or greater chance of happening each year.

2. Light blue areas show the additional extend of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance or occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year (or 1 in 200 year as appropriate) areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist consultant who can advise on appropriate mitigating measures; i.e. raising slab levels, provision of storage etc.

COMAH & Explosive Sites

Sutcliffe Investigations obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. Sutcliffe Investigations' report refers to any that are present and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say and they are likely to place more weight on advice from the HSE).

Preliminary Conceptual Ground Model

The site's environmental setting (and proposed end use) is used by Sutcliffe Investigations to assess the significance of any contamination encountered during the subsequent ground investigation.

Generic Notes – Sutcliffes Geoenvironmental Investigations

2. Ground Investigation Fieldwork

General

Sutcliffe Ground Investigations are undertaken in accordance with current UK guidance including:

- BS5930:1999 "*Code of practice for site investigation*"
- BS10175:2001 "Code of practice for the identification of potentially contaminated sites"
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "*Sampling strategies for contaminated land*"
- "*Guidance on the protection soil sampling strategies for land contamination*" – EA R&D Technical report P5-066/TR (2001)
- AGS: 1996 "*Guide to the selection of Geotechnical Soil Laboratory Testing*"

Exploratory hole logs are represented in Appendices to this Geoenvironmental Report. These logs include details of the:

- Investigation technique adopted
- Samples taken
- Descriptions of the solid strata and any groundwater encountered
- Results of any insitu testing
- Any gas/groundwater monitoring well installed

Exploratory Hole Locations

Exploratory hole locations are selected by Sutcliffe Investigations, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation Techniques

Ground conditions can be investigated by a number of techniques; the procedures used are in general accordance with BS5930: 1999 and BS1377: 1990. Techniques most commonly used by Sutcliffe Investigations include:

- Machine excavated trial pits, usually equipped with a backactor and a 0.6m wide bucket
- Cable percussive (Shell & Auger) boreholes, typically using 150mm diameter tools and casing
- Window or windowless sampling boreholes. Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material).
- Rotary percussive open-hole probeholes are typically drilled using a tricone rock roller bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse.

Where installed, gas/groundwater monitoring wells typically comprise a lower slotted section, surrounded by a filter pack of 10mm non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter steel borehole helmet set in concrete.

Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

Insitu Testing

Where relative densities of granular materials given on the trial pit and window sample logs are based on visual inspection only, they do not relate to any specific bearing capacities. However, wherever possible, Sutcliffe Investigations employ a mackintosh probe to assess relative density. Mackintosh probe results can be related to approximate allowable bearing capacities.

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as N* = x.

The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Representative soil/fill samples are taken at regular intervals from the exploratory holes to assist in description of the ground and to allow selected laboratory testing to be performed. The type of sample taken is dependent on the nature of the stratum and the purpose of the analysis.

Where the soils encountered contain a significant proportion of coarse grained material, truly representative samples are not typically obtained – only the finer fraction is placed in sample containers. However, a visual estimate of the amount of coarse material is made on site.

NB: Coarse constituents not sampled are defined as: coarse gravel, cobble and boulder (i.e. any ‘particles’ with an average diameter greater than 20mm).

Occasionally, unrepresentative ‘spot’ samples are also taken from some exploratory locations for contaminant analysis, typically where unusual, localised pockets of materials are encountered.

Samples of soil for chemical testing are placed into 1 litre plastic tubs prior to delivery to the selected laboratory. Samples of water are taken in one litre brown glass bottles and stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory. Soil/fill samples for organic analysis are also stored in cool boxes.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during this investigation.

Long term monitoring of standpipes of piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

Description of Strata

The soils encountered during an Sutcliffes ground investigation are described (logged) in general accordance with BS 5930. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text.

The materials encountered in the trial pits are logged, samples taken and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to Exploratory Hole Logs

Keys to logs are presented in the Appendix(ces) containing the logs. These are two keys – Symbols and Legends and Terms and Definitions.

Health and Safety

All work was carried out in accordance with the procedures detailed in the DGEL Health and Safety Manuel and SUKD health and Safety Procedures.

Generic Notes – Sutcliffes Geoenvironmental Investigations

3. Geotechnical Laboratory Tests

General

Soil Samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Sutcliffe Investigations. All tests are carried out in accordance with BS 1377:1990.

The test results are presented as received in an Appendix to this Geoenvironmental Report.

The following laboratory testing are routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading
- Compaction tests
- Particle density

Attenberg Limits & Moisture Content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each “type” of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Sutcliffe Investigations typically only consider a soil to be shrinkable if the proportion finer than 63μm is > 35%.

PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003) which advocates the use of modified Plasticity Index (I’p) defined as:

I’p = Ip * (% < 425μm/100)

ie if PI is 30%, but the soil contains 80% < 425μm, then I’p = 30 * 80/100 = 24%

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425μm sieve is routinely reported by testing labs.

Sutcliffe Investigations apply engineering judgement where PI results are spread over a range of classifications. Consideration is given to:

- The average values for each particular soil type (ie differentiate between residual soil and alluvium)
- The number of results in each class and
- The actual values

Unless the judgement strongly indicates otherwise, Sutcliffe Investigations typically adopt a conservative approach and recommend assumption of the higher classification.

Soluble Sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

Sutcliffe Investigations refer to BRE Special Digest 1 (SD1) “Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment” (2001). SD 1 provides definitions of:

- The nature of the site (Greenfield, brownfield or pyretic)
- The groundwater regime (static, mobile or highly mobile)
- The Design Sulphate Class (DC Class) and
- The Aggressive Chemical Environment for Concrete (ACEC Class)

Sutcliffe reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO_4 for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of “representative” sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Generic Notes – Sutcliffe Investigations Geoenvironmental Investigations

4. Contamination Laboratory Analysis & Interpretation (including WAC)

General

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "*Potential contaminants for the assessment of land*" and the relevant DETR Industry Profile(s).

Common Inorganic Contaminants

These include:

- Metals, most notably cadmium, copper, chromium, mercury, lead, nickel and zinc
- Semi-metals, most notably arsenic, selenium and (water soluble) boron
- Non-metals, most notably sulphur
- Inorganic anions, most notably cyanides (free & complex), sulphates, sulphides and nitrates

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction.

Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to uv digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO_4) sulphates etc.

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common Organic Contaminants

Petroleum hydrocarbons are a mixture of hydrocarbons produced from the distillation of crude oil. They include aliphatics (alkanes, alkenes and cycloalkanes), aromatics (single or multi benzene ringed compounds) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen.

Petroleum hydrocarbons can be grouped based on the carbon number range:-

GRO – Gasoline Range Organics (typically C_6 to C_{10}). Also referred to as PRO – Petroleum Range Organics
DRO – Diesel Range Organics (typically C_{10} to C_{28})
LRO – Lubricating Oil Range Organics (typically C_{28} to C_{40})
MRO – Mineral Oil Range Organics (typically C_{18} to C_{44})

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies.

Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C_5 – C_{40}, whereas other define TPH as C_{10} – C_{30}.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (eg petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons rapidly (especially within the C4 to C5 range) that will evaporate. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polyaromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present.

Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar NSO compounds are also present.

Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have more than two fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although insignificantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (Benzo(a)pyrene) and/or mobile in the environment (naphthalene).

Polychlorinated Biphenyls (PCBs)

Volatile Organic Compounds (VOCs) The volatile organic compound (VOC) headspace concentration of all soil samples was made with a photoionization detector (PID) fitted with a 10.2 eV lamp. This gives a semi-quantitative VOC concentration record as parts per million (ppm) (Vol/Vol). Prior to the VOC headspace reading, the background levels of VOCs were recorded. The PID was recalibrated with standard isobutylene in zero air after every 10 headspace readings.

Semi-Volatile Organic Compounds (sVOCs)

Phenols

Solvents, pesticides, herbicides

Dioxins & furans

Methods of Analysis (Organic Compounds)

Toluene Extractable Matter (TEM) results provide a screening test for organic contamination. The sample is air dried a 30°C and ground prior to addition of the solvent (toluene). The solvent extraction is aggressive and most organic compounds (fuels, oils, tars, humic material, animal fats and vegetable oil) are dissolved, as are some other inorganic contaminants such as sulphur. However, the volatiles (lighter fuel fraction etc) are lost during evaporation of the solvent.

Total Petroleum Hydrocarbon (TPH) by IR (also known as mineral oil by some testing laboratories) is undertaken on “as received” samples. Tetrachloroethylene is the solvent, and fluoroscil is used to removed humic material, animal fats and vegetable oil. Consequently this analysis detects a wide range of “mineral” organics from volatiles (BTEX and gasoline) through diesel and oils to tars (including the very heavy, stable tars such as asphalt and bitumen).

TPH by GC-FID is more refined analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C_{10} to C_{40} (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a breakdown of the TPH results into diesel range organics (**DRO**) and heavier lubricating oil range organics (**LRO**).

GRO (PRO) by GC-FID analysis detects the more volatile C_6 – C_9 hydrocarbons (aliphatic and aromatic) including those organic compounds present in petrol.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethlybenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentration of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked up when scheduling TPH by GC-FID. Napthalene (the lightest PAH) is also one of the 58 US EPA VOCs.

Speciated TPH by GC-FID provides a "banded "TPH", initially split into aromatic and aliphatic fractions and then further divided into fraction specific carbon bandings based upon behavioural characteristics.

Note: Risk assessment models require physiochemical properties (solubilities, toxicitities etc) of compounds in order to model their behaviour in the environment. These physiochermical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

If the relative proportion of each carbon banding within the "TPH" impact at a site is known, the risks posed by each individual fraction can be assessed and a simple back calculation applied to calculate an overall "TPH" screening value based upon the percentage weight fraction of each banding present in the "TPH". Specialised analytical techniques and data interpretation skills are required to identify each carbon banding.

Current Guidance

The UK approach to the consideration of contaminated land is based upon the principles of risk assessment. This in turn is founded upon the use of so called source⇒ pathway⇒ target principles in order to establish the presence or potential presence of a pollutant linkage.

Sutcliffe Investigations adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate guidance levels, intervention levels or remedial targets.

In March 2002 DEFRA and the Environment Agency published a series of technical research papers (R & D Publications CLR 7, 8, 9 and 10) introducing the UK approach to the assessment of risk to **human health** from land contamination. This methodology and approach represents current scientific knowledge and thinking. The overall methodology also included the Contaminated Land Exposure Model (CLEA) and some Soil Guidance Values (SGV's).

At the time of writing this report, these guidelines only address seven contaminants and the development of both the CLEA model and additional SGV's in ongoing. Where published, SGV's have been utilised as intervention values for the purpose of an initial Tier 1 assessment.

Where SGV's were not published at the time of writing this report, appropriate Tier 1 human health related assessment have been based upon information that was best available at the time of the study.

With respect to the assessment of potential **phytotoxic effects** of contaminants, Sutcliffe Investigations refer to "The Soil Code" (Maff, 1998) for copper and zinc. The CLEA SGV is adopted for nickel.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, 'Sulphate and Acid Resistance of Concrete in the Ground', 2001.

With respect to the interpretation of the calorific values, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCL Note 61/84 "Notes on the fire hazards of contaminated land" which states that:

"In general ……. it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn".

Tier 1 **groundwater** risk assessments are undertaken by comparing leachate concentrations with the appropriate water quality standard. Depending upon the specific characteristics and environmental setting of the site the appropriate standard is likely to be one of the following:

- Water Supply (Water Quality) Regulations 1989
- Environmental Quality Standards (for Freshwater)
- The Surface Waters (Abstraction for Drinking Water) Regulations

The tier 1 risk assessment of **landfill gas** is undertaken through reference to the following documents:

- Approved Document C, Building Regulations 1991
- CIRIA Report 149, “Protecting Development from Methane”, 1995

Should any Tier 1 criteria be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

- Undertake further statistical following the approach set out in Appendix A of CLR 7 in order to determine whether contaminant concentrations of inorganic contaminants within soil/fill actually present a risk (only applicable to assessing the risk to human health).
- Based on a qualitative risk assessment, advocate an appropriate level of remediation to “break” the pollutant linkage – for example the removal of the contaminated materials or the provision of a clean cover.
- Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.

However, the issue of **averaging area** requires further consideration. CLR 7 is ambiguous and could be interpreted as advocating the concept of a single garden as an appropriate averaging area.

This concept has massive implications with respect to ground investigation design and cost. To comply, investigations for residential development on brownfield sites would need to recover and analyse about 6 samples from each garden; this implies exploratory locations on a very tight grid, perhaps 5m to 10m spacings, with a huge increase in the number of samples analysed (cf test schedules currently issued by most practitioners).

In any case, Sutcliffe Investigations consider the concept of a single garden as an averaging area to be inappropriate. Statistical analysis of sample results by fill type, and/or by former use in a given sub-area of the site (i.e. with reference to the Conceptual Site Model), is considered a more appropriate methodology.

Analysis by soil/fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil/fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass; ie contamination would be normally be more pervasive and significant in granular soils than cohesive soils.

There is a suggestion in para 4.7 of CLR 7 that the approach outlined above was intended and the Environment Agency have confirmed that an averaging area can be larger than a single garden, if:

- Contaminant concentrations are within the same statistical population as determined using the maximum value test. The sample data being representative of the averaging area and the mean concentration of the averaging area.
- “Hot spots” are treated as separate zones or averaging areas (as defined by the maximum value test).
- The sampling strategy takes into account uncertainty (spatial heterogeneity) in contaminant concentration

Waste Classification & WAC

In the context of waste soils generated by remediation and/or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated ‘natural soil, bricks, concrete, tiles & ceramics)
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds).
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds).

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

From 16th July 2005, landfill operators will require Waste Acceptance Citeria (WAC) laboratory data, if soil is classified as **hazardous** and such waste must have been subjected to pre-treatment. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Sutcliffe Investigations typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated for example where redevelopment proposals include basement construction etc.

If off-site disposal of soils classified as hazardous waste were undertaken during redevelopment, then WAC analysis should be scheduled at an early stage in the remediation programme.

However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous. These contaminants can often be dealt with by alternative technologies (eg by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (eg WAC) is required.

Generic Notes – Sutcliffe Investigations

5. Hazardous Gas

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency).

In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 1 – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark information Group, the Environment Agency and the Local Authority and the British Geological Survey.

Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Where landfilling has occurred within 250m of the site boundary, the Local Planning Authority may request a landfill gas investigation in accordance with the Town and Country Planning General Development Order, 1988.

Sources

Potential sources of hazardous gas are:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworks associated with coal extraction
- Geological strata, including peat, organic silts, coal-bearing strata and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a “carrier” for hazardous gas
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Current Guidance

Guidance on landfill gas monitoring control at landfill sites is given two technical memoranda, Waste Management Paper Nos. 26 and 27 published by the Department of the Environment.

Waste Management Paper 27, 1991 recommends that no dwellings should be constructed within 50m of any landfill that has the capacity to produce large volumes of landfill gas. No garden should extend to within 10m of the landfilled waste. However, development closer to landfill has been permitted where a comprehensive gas risk assessment has been completed (typically based on a minimum of 6 to 12 month monitoring programme) and appropriate gas exclusion measures designed.

The current advice with regard to monitoring for landfill gas is that if the trigger value of 1% volume (20% LEL) for methane and 1.5% volume for carbon dioxide is exceeded then remedial/control measures will be required.

It should be noted that the guideline limit for carbon dioxide of 1.5% volume recommended in Waste Management paper No. 27 is the short term (10 minute) occupational exposure limit for carbon dioxide quoted by the Health and Safety Executive in their publication EH40. The long term (8 hour) occupational exposure limit for carbon dioxide is 0.5% volume.

Approved Document C to the Department of the Environment's Building Regulations 1992 requires what where there may be gaseous contamination of the ground but the level of methane is unlikely to exceed 1% by volume, the ground floor of any house or similar small building shall be constructed of suspended concrete and ventilated as described in BRE Digest Report "Construction of New Buildings on Gas Contaminated Land". The document also requires specific design measures to be taken if a level of 5% volume carbon dioxide exists or is exceeded within the ground.

Although the above guidance is still relevant it has been more recently updated within the following documents published by the Construction Industry Research and Information Association (CIRIA).

CIRIA Report 149 'Protecting Development from Methane' (1995)
CIRIA Report 150 'Methane Investigation Strategies' (1995)
CIRIA Report 151 'Interpreting Measurement of Gas in the Ground' (1995)
CIRIA Report 152 'Risk Assessment for Methane and other gases from the ground' (1995)

The above documents are intended to provide advice on how to investigate and deal with the gas contaminated ground with respect to development.

CIRIA Report 149 characterised sites based on the recorded methane/carbon dioxide concentration and emission rates recorded during a suitable gas investigation. Characteristic situation 1 is deemed to be the lowest risk scenario with the risk rating increasing up to 6. The characteristic situations are classified as follows:

Gassing regime in ground			
Methane (% by volume in air)	Carbon dioxide (% by volume in air)	Emission rate [1] (m/s)	Characteristic situation [2]
< 0.1	< 1.5	not detected	1
> 0.1 – 1	> 1.5 – 5	not detected	2
> 1 - 5	< 5	not detected	3
> 5 – 20	< 20	< 0.01	4
> 20	> 20	> 0.01 – 0.05	5
> 20	> 20	> 0.05	6

Notes:
1. Emission rate values measures as equivalent total gas flow velocity from a 50mm diameter borehole: for methods of measurement see Crowhurst and Manchester (1992).
2. Highest measures parameter used as determining factor.

CIRIA Report 151 (1995) identified that there is currently inadequate guidance on trigger concentrations for ground gases. The current emphasis on using gas concentrations for trigger values particularly in Waste Management Paper 27 and the Building Regulations, should be revised to consider gas pressures, borehole flow rates and estimated surface emission rates.

It was concluded that the most important aspect of relating the gas regime below or adjacent to a site, to the risk it poses to any development, is the surface emission rate i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. This is considered further in the DETR Partners in Technology Report 'Passive venting of soil gases beaneath buildings' (September 1997).

CIRIA Report 149 (1995), reference Table 28, reviewed over 100 case studies of development affeceted by gas to establish current UK practices for gas control. The report classified the gassing regimes fround within 6 Characteristic Situations. The highest measures parameter, either methane or carbon dioxide concentration and/or emission rate were used to define the Characteristic Situation for each case history site. The report then related the typical range of mitigation measures that has been adopted at each study site to the characteristic gas situation.

To achieve a more consistent design of protection measures Table 28 of CIRIA 149 was rewritten (Wilson and Card, 1999) in terms of borehole gas volume flow rate and gas concentrations, as reproduced in the table below. This was done to reflect the importance of recognising the gas surface emission rate.

Characteristic situations based on Gas Flux

Characteristic Situation	Limiting CH_4 Concentration (% v/v)	Limiting CO_2 Concentrations (% v/v)	Limiting Borehole Flow Velocity (m/s)	Limiting Borehole Gas Volume Flow (litre/hour)	
				CH_4	CO_2
1	< 0.1	< 0.1	< 0.005	< 0.035	< 0.035
2	< 1.0	< 1.5	< 0.005	< 0.35	< 0.5
3	< 5.0	< 5.0	< 0.005	< 1.75	< 1.75
4	< 20	< 20	< 0.01	< 14	< 14
5	> 20	> 20	< 0.05	< 70	< 70
6	> 20	> 20	< 0.05	> 70	> 70

Gas Monitoring Procedure

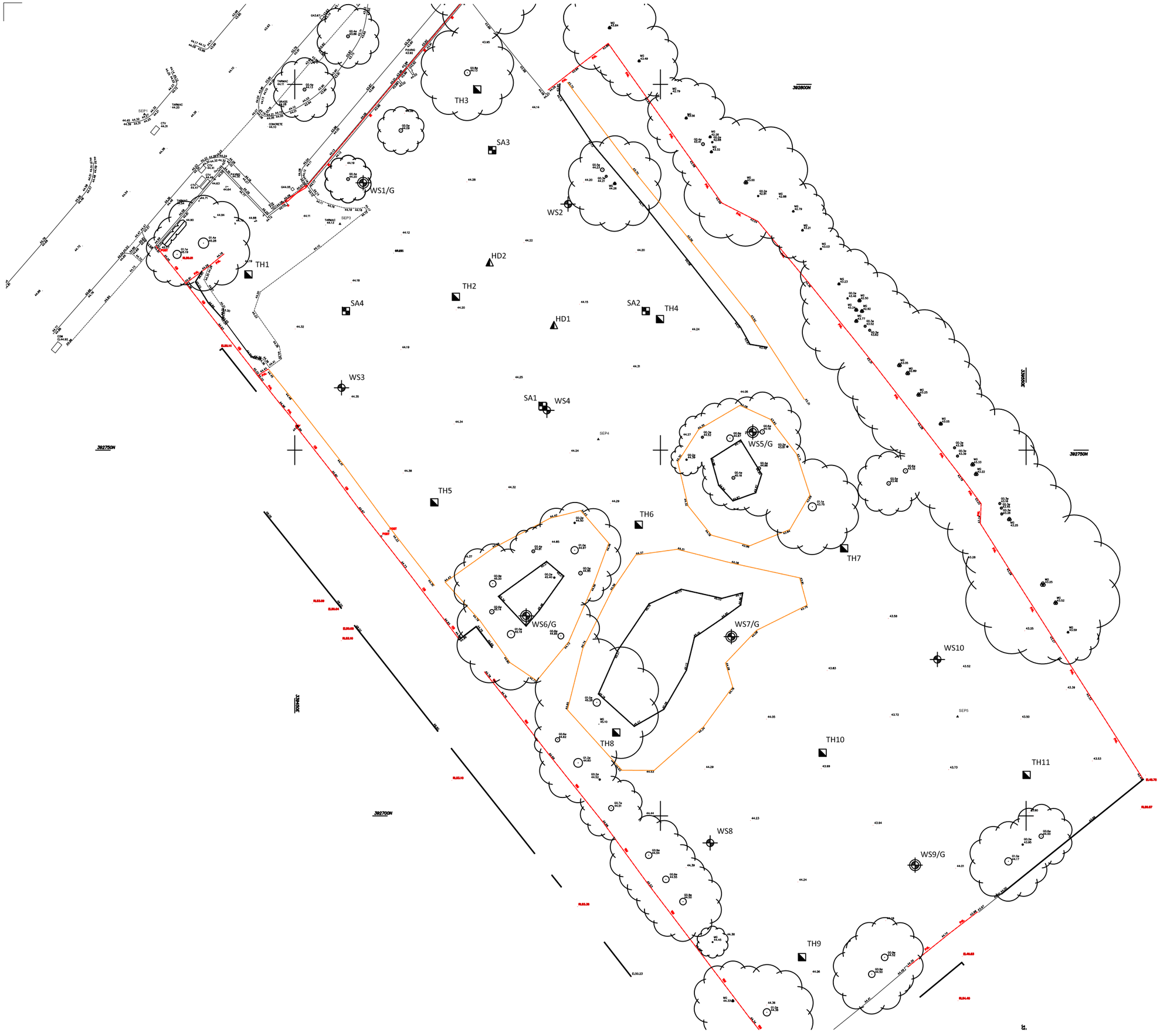
Sutcliffe Investigations adopt a standard gas monitoring procedure, in accordance with CIRIA guidance. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration on site immediately prior to and on completion of monitoring.
- Gas emission rate.
- Methane, oxygen and carbon dioxide concentrations using and infra-red gas analyser.
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism.

Where samples of gas are required for laboratory analysis, Gresham Tubes are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Appendix B – Drawings



DO NOT SCALE OFF THIS DRAWING

GENERAL NOTES

This drawing to read in conjunction with all relevant structural and architectural drawings and specifications.

All dimensions to be checked on site by the contractor / fabricator prior to commencement of works.

All dimensions are in millimetres unless stated otherwise.

All works to be carried out in strict accordance with the engineer's specifications, relevant British Standards and where applicable Local Authorities requirements.

For final setting out information relating to grid lines and wall positions refer to the architect's drawings.

Rev	Date	Checked	Description	By
B	05.06.15	WGB	ADDITIONAL POSITIONS	DB
A	15.05.12	WGB	SITE INVESTIGATION PLAN	DB

NOT WORKING DRAWING

Sutcliffe
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Client
PLUS DANE HOUSING

Project
MILL LANE
WEST DERBY
LIVERPOOL

Drawing title
SITE INVESTIGATION PLAN ON EXISTING SITE LAYOUT

Scale at A3	1:500
Drawn by	D.BOWEN
Date	15.05.12

Drawing number 26073-700
Revision suffix B

Appendix C – Photographs

Plate 1: View showing spoil from TH1.

Plate 2: View showing TH1.

Plate 3: View showing spoil from TH2.

Plate 4: View showing TH2.

Plate 5: View showing spoil from TH3.

Plate 6: View showing TH3.

Plate 7: View showing spoil from TH4.

Plate 8: View showing TH4.

Plate 9: View showing spoil from TH5.

Plate 10: View showing TH5.

Plate 11: View showing spoil from TH6.

Plate 12: View showing TH6.

Plate 13: View showing spoil from TH7.

Plate 14: View showing TH7.

Plate 15: View showing spoil from TH8.

Plate 16: View showing TH8.

Plate 17: View showing spoil from TH9.

Plate 18: View showing TH9.

Plate 19: View showing spoil from TH10.

Plate 20: View showing TH10.

Plate 21: View showing spoil from TH11.

Plate 22: View showing TH11.

Appendix D – Geotechnical Assessment

Window Sample Logs

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	**WS1**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.50)	Grassed TOPSOIL with rare sandstone gravel.			
0.40-0.40	S1				0.50				
1.00-1.20	SPT(C) 50/50		25/50		(1.10)	Red gravelly SAND. Gravel is angular pieces of Sandstone.			
					1.60				
						Terminated at 1.60m			

Remarks
Hole noted as dry.
Window Sample terminated at 1.60m bgl after SPT refusal on weathered Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS9

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.30	S1				(0.50) 0.50	Brown very gravelly sand with angular gravel of brick and angular cobbles of sandstone. (MADE GROUND)		
0.80-0.80	D2				(0.40) 0.90	Dark brown sandy loam with rare angular gravel of brick and some ash and a thin plastic pipe. (MADE GROUND)		
1.00-1.30	SPT(C) 50/150		12,13/30,20		(0.40) 1.30	Red gravelly SAND. Gravel is angular pieces of Sandstone.		
						Terminated at 1.30m		

Remarks
Hole noted as dry.
Window Sample terminated at 1.30m bgl after SPT refusal on Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS2

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Loc. Plan	14/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Brown gravelly TOPSOIL with rare brick fragments.		
0.25-0.25	S1				0.30			
					(0.40)	Brown medium and coarse SAND.		
					0.70			
					(0.50)	Red weathered Sandstone recovered as gravelly SAND.		
1.00-1.30	SPT(C) 50/150		13,12/25,25		1.20			
						Terminated at 1.20m		

Remarks
Hole noted as dry.
Window Sample terminated at 1.20m bgl after SPT refusal in weathered Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS3

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS4

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.80)	Dark brown gravelly sand withbrick whole and part and rare concrete and ash. (MADE GROUND)		
0.50-0.50	S1				0.80			
1.00-1.30	SPT(C) 50/150		7,11/17,23,10		(0.40)	Red weathered sandstone recovered as red gravelly SAND.		
					1.20	Terminated at 1.20m		

Remarks
Hole noted as dry.
Window Sample terminated at 1.20m bgl after SPT refusal on weathered Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS4

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	**WS5**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.30) 0.30	Grassed brown TOPSOIL.			
0.40-0.40	S1				(0.40) 0.70	Brown gravelly SAND with fine roots.			
1.00-1.30	SPT(C) 50/150		19,6/35,15		(0.60) 1.30	Red weathered sandstone recovered as gravelly SAND.			
						Terminated at 1.30m			

Remarks
Hole noted as dry.
Window Sample terminated at 1.30m bgl after SPT refusal in weathered Sandstone.#

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS5

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50-0.50	S1				(1.50)	Dark brown gravelly sand with fragments of brick, glass, metal work, plastic bags and ash. (MADE GROUND)			
1.10-1.10 1.20-1.65	D2 SPT(C) N=25		1,1/7,7,5,6		1.50 (0.30) 1.80	Red weathered sandstone recovered as gravelly SAND.			
						Terminated at 1.80m			

Remarks
Hole noted as dry.
Window Sample terminated at 1.80m bgl after SPT refusal on onstruction, possible weathered Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS6

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS7

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.30-0.30	S1				(0.40) 0.40	Grassed TOPSOIL with fine roots and rare angular fine gravel.			
0.80-1.00	SPT(C) 50/50		25/50		(0.50) 0.90	Red gravelly SAND. Gravel is angular pieces of Sandstone.			
						Terminated at 0.90m			

Remarks
Hole noted as dry.
Window Sample terminated at 0.90m bgl after SPT refusal in Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS7

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS8

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Loc. Plan	14/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.30	S1				(0.40) 0.40	Dark brown gravelly sand with fine roots and angular coarse gravel. (Reworked TOPSOIL)		
					(0.60) 1.00	Brown gravelly SAND. Gravel is pieces of Sandstone		
1.00-1.20	SPT(C) 50/50		26/50		(0.20) 1.20	Red weathered SANDSTONE.		
						Terminated at 1.20m		

Remarks
Hole noted as dry.
WIndow Sample terminated at 1.20m bgl after SPT refusal on weathered Sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS8

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS9

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Loc. Plan	14/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.70)	Brown grassed gravelly sand with brick, rare concrete cobbles and fragments of concrete. (MADE GROUND)			
0.50-0.50	S1				0.70				
					(0.30)	Brown gravelly SAND. Gravel is pieces of Sandstone.			
1.00-1.20	SPT(C) 50/50		25/50		1.00				
					(0.20)	Red gravelly SAND, weathered Sandstone.			
					1.20				
						Terminated at 1.20m			

Remarks
Hole noted as dry.
Window Sample terminated at 1.20m bgl after SPT refusal on weathered sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS9

Sutcliffe Investigations

Site	Number
Mill Lane, Liverpool	WS10

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			Plus Dane Housing	26073LG
	Location See Loc. Plan	**Dates** 14/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.50	S1				(0.90)	Brown grassed gravelly sand with fine roots and some angular sandstone brick fragments. (MADE GROUND)		
1.00-1.40	SPT(C) 60/250		5,7/15,30,15		0.90 (0.50)	Brown gravelly SAND. Gravel is pieces of Sandstone.		
					1.40 (0.10) 1.50	Red gravelly SAND, weathered Sandstone. Terminated at 1.50m		

Remarks
Hole noted as dry.
Window Sample terminated at 1.50m bgl after SPT refusal on weathered sandstone.

Scale (approx)	Logged By
1:50	GF

Figure No. 26073LG.WS9

Trail Hole Logs

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	15/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.20	S1				(0.05) 0.05	Bituminous macadam		
					(0.25) 0.30	Dark brown gravelly sand with many fragments of brick and ash. (MADE GROUND)		
					(0.70) 1.00	Yellow coarse SAND		
					(0.55) 1.55	Red weathered sandstone recovered as gravelly cobbly SAND.		
					(0.05) 1.60	Weathered SANDSTONE		
						Terminated at 1.60m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.60m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH1

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	15/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.05) 0.05	Grassed Topsoil		
						Dark brown gravelly sand with many compact bricks, brickbat and rare metal. (MADE GROUND)		
0.50-0.50	S1				(0.65) 0.70			
						Brown coarse SAND with angular platy sandstone gravel.		
					(0.70) 1.40			
					(0.10) 1.50	Light brown weathered SANDSTONE.		
						Terminated at 1.50m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.50m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH2

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location See Location Plan	**Dates** 15/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.50	S1				(1.00)	Grassed with tree roots dark brown gravelly sand with brick and ash. (MADE GROUND)		
					1.00			
					(0.80)	Red weathered sandstone recovered as gravelly cobbly coarse SAND.		
					1.80			
						Terminated at 1.80m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.80m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH3

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH4

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	15/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.50	S1				(1.50)	Dark brown sand with many bricks, fragments of large concrete slab and pipe work, bituminous macadam, timber & ash. (Demolition Waste) (MADE GROUND)		
1.30-1.30	D2				1.50	Red weathered Sandstone recovered as gravelly cobbly SAND.		
					(0.90)			
					2.40	Terminated at 2.40m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 2.40m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH4

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH5

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	15/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.05) 0.05	Grassed TOPSOIL		
						Dark brown sand with many cobbles of bituminous macadam, ash & timber. (MADE GROUND)		
0.60-0.60	S1				(1.35)			
					1.40 (0.10) 1.50	Red gravelly cobbly SAND.		
						Terminated at 1.50m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.50m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH5

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location See Location Plan	**Dates** 15/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.40	S1				(0.60)	Dark brown grassed topsoil with rare fragments of brick, concrete & timber. (Reworked Topsoil) (MADE GROUND)		
					0.60			
					(1.40)	Red gravelly cobbly coarse SAND.		
					2.00			
						Terminated at 2.00m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 2.00m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH6

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH7

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location See Location	**Dates** 15/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.40	S1				(0.50) 0.50	Grassed dark brown gravelly sandy topsoil with rare fine roots. (MADE GROUND)		
					(1.70) 2.20	Red gravelly cobbly SAND.		
						Terminated at 2.20m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 2.20m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH7

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH8

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location See Location Plan	**Dates** 15/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.40	S1				(0.50) 0.50	Grassed dark brown gravelly sandy TOPSOIL with rare fine roots.		
					(1.00) 1.50	Red weathered Sandstone recovered as red gravelly cobbly SAND.		
						Terminated at 1.50m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.50m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH8

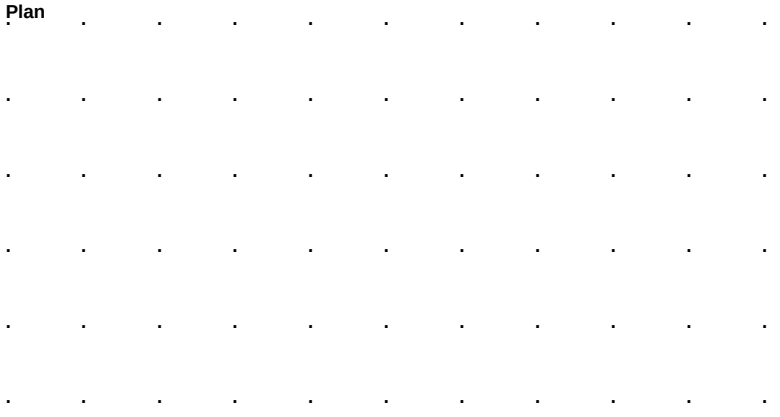
Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH9

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location See Location Plan	**Dates** 15/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.40	S1				(0.50) 0.50	Grassed dark brown gravelly sandy TOPSOIL with rare fine roots.		
					(1.20) 1.70	Red gravelly cobbly SAND.		
						Terminated at 1.70m		

Plan



Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.70m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:25	GF	26073LG.TH9

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	**TH10**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location See Location Plan	**Dates** 15/03/2012	**Engineer** GF	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.40	S1				(0.60) 0.60 (0.80) 1.40	Dark brown grassed TOPSOIL with roots and rare angular brick and flagstone fragments. (MADE GROUND) Red gravelly cobbly SAND. Terminated at 1.40m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.40m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:50	GF	26073LG.TH10

Sutcliffe Investigations

Site	Trial Pit Number
Mill Lane, Liverpool	TH11

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Trial Pit			Plus Dane Housing	26073LG
	Location	**Dates**	**Engineer**	**Sheet**
	See Location Plan	15/03/2012	GF	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.40	S1				(0.60) 0.60	Dark brown grassed TOPSOIL with rare plastic fragments. (MADE GROUND)		
					(1.00) 1.60	Red weathered Sandstone recovered as gravelly cobbly SAND.		
						Terminated at 1.60m		

Plan

Remarks

Trial Hole noted as dry
Trial Hole terminated at 1.60m bgl after machine scraping on rock

Scale (approx)	Logged By	Figure No.
1:50	GF	26073LG.TH11

Ground Gas Results

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 1 of 2** **Atmospheric Pressure: 1034mb** **Weather: Cloudy, Dry** **Pressure Trend: Falling**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 28.09.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS1		0.1	1.2	19.5	0.0	0.0	0.0	1.3	Dry	-
		0.1	1.1	19.6						
		0.1	1.0	19.8						
		0.1	0.9	19.8						
WS5		0.1	0.8	20.1	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.8	20.1						
		0.1	0.8	20.1						
		0.1	0.8	20.1						
WS6		0.1	0.7	20.7	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.6	20.7						
		0.1	0.5	20.8						
		0.1	0.5	20.8						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 2 of 2** **Atmospheric Pressure: 1034mb** **Weather: Cloudy, Dry** **Pressure Trend: Falling**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 28.09.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS7		0.1	0.4	21.4	0.0	0.0	0.0	0.9	Dry	-
		0.1	0.4	21.4						
		0.1	0.4	21.4						
		0.1	0.4	21.4						
WS9		0.1	0.7	21.0	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.5	21.0						
		0.1	0.5	21.0						
		0.1	0.4	21.0						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 1 of 2** **Atmospheric Pressure: 1004mb** **Weather: Cloudy, Dry** **Pressure Trend: Rising**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 12.04.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS1		0.1	1.4	18.9	0.0	0.0	0.0	1.3	Dry	-
		0.1	1.5	19.0						
		0.1	1.4	19.0						
		0.1	1.3	19.1						
WS5		0.1	1.4	19.4	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.2	19.5						
		0.1	1.0	19.7						
		0.1	1.0	19.7						
WS6		0.1	1.6	20.0	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.5	20.0						
		0.1	1.5	20.0						
		0.1	1.5	20.0						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 2 of 2** **Atmospheric Pressure: 1004mb** **Weather: Cloudy, Dry** **Pressure Trend: Rising**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 12.04.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS7		0.1	1.7	20.7	0.0	0.0	0.0	0.9	Dry	-
		0.1	1.6	20.8						
		0.1	1.6	20.9						
		0.1	1.5	20.9						
WS9		0.1	1.2	20.1	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.2	20.2						
		0.1	1.1	20.3						
		0.1	1.0	20.4						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 1 of 2** **Atmospheric Pressure: 1024mb** **Weather: Cloudy, Dry** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 02.05.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS1		0.1	1.2	19.7	0.0	0.0	0.0	1.3	Dry	-
		0.1	1.1	19.7						
		0.1	1.1	19.8						
		0.1	1.0	19.9						
WS5		0.1	0.9	19.9	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.9	19.9						
		0.1	0.8	19.9						
		0.1	0.7	20.0						
WS6		0.1	1.0	20.1	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.0	20.3						
		0.1	0.9	20.3						
		0.1	0.8	20.4						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 2 of 2** **Atmospheric Pressure: 1024mb** **Weather: Cloudy, Dry** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 02.05.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS7		0.1	1.2	20.9	0.0	0.0	0.0	0.9	Dry	-
		0.1	1.1	20.9						
		0.1	0.8	20.9						
		0.1	0.8	20.9						
WS9		0.1	0.8	20.4	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.7	20.4						
		0.1	0.6	20.7						
		0.1	0.6	20.7						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 1 of 2** **Atmospheric Pressure: 1024mb** **Weather: Cloudy, Dry** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 23.05.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS1		0.1	1.1	19.8	0.0	0.0	0.0	1.3	Dry	-
		0.1	1.1	19.8						
		0.1	1.0	19.9						
		0.1	1.0	20.0						
WS5		0.1	0.9	20.0	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.9	20.1						
		0.1	0.8	20.2						
		0.1	0.8	20.2						
WS6		0.1	0.9	20.2	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.8	20.2						
		0.1	0.7	20.5						
		0.1	0.7	20.5						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 2 of 2** **Atmospheric Pressure: 1024mb** **Weather: Cloudy, Dry** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 23.05.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS7		0.1	1.0	20.9	0.0	0.0	0.0	0.9	Dry	-
		0.1	1.0	20.9						
		0.1	0.9	20.9						
		0.1	0.9	20.9						
WS9		0.1	0.7	20.5	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.7	20.5						
		0.1	0.6	20.5						
		0.1	0.6	20.5						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 1 of 2** **Atmospheric Pressure: 1015mb** **Weather: Cloudy, Dry** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 14.06.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS1		0.1	1.3	19.6	0.0	0.0	0.0	1.3	Dry	-
		0.1	1.2	19.6						
		0.1	1.1	19.7						
		0.1	1.0	20.7						
WS5		0.1	1.2	19.8	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.2	19.9						
		0.1	1.1	20.0						
		0.1	1.0	20.0						
WS6		0.1	1.1	20.0	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.0	20.0						
		0.1	1.0	20.0						
		0.1	0.9	20.0						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 2 of 2** **Atmospheric Pressure: 1015mb** **Weather: Cloudy, Dry** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 14.06.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS7		0.1	1.3	20.3	0.0	0.0	0.0	0.9	Dry	-
		0.1	1.2	20.4						
		0.1	1.2	20.4						
		0.1	1.1	20.5						
WS9		0.1	1.0	20.0	0.0	0.0	0.0	1.0	Dry	-
		0.1	0.9	20.1						
		0.1	0.9	20.1						
		0.1	0.8	20.3						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 1 of 2** **Atmospheric Pressure: 995 mb** **Weather: Overcast** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 28.09.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS1		0.1	2.1	17.5	0.0	0.0	0.0	1.3	Dry	-
		0.1	1.6	18.3						
		0.1	1.5	18.8						
		0.1	1.4	18.6						
WS5		0.1	1.6	18.9	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.6	19.2						
		0.1	1.4	19.4						
		0.1	1.2	19.7						
WS6		0.1	1.2	20.1	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.1	20.3						
		0.1	1.0	20.4						
		0.1	1.0	20.4						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

	SUTCLIFFE INVESTIGATIONS TEL: 0151 227 3155 FAX: 0151 227 3156	**GAS MEASUREMENTS AND WATER LEVELS**	**Sheet No.: 2 of 2** **Atmospheric Pressure: 995 mb** **Weather: Overcast** **Pressure Trend: Steady**
	CLIENT: Plus Dane Housing	**SITE: Mill Lane**	
	Date of Fieldwork: 28.09.12	**Logged By: CB**	**Job No.: 26073LG**

B/H REF	CH_4		CO_2	O_2	Relative Pressure	Flow Rate	P.I.D	Base of Borehole	Water Level	Reduced Water Level
	%LEL	%by vol	%by vol	%by vol	(mb)	(l/h)		(mbgl)	(mbgl)	(m) A.O.D
WS7		0.1	0.9	21.0	0.0	0.0	0.0	0.9	Dry	-
		0.1	0.9	21.0						
		0.1	0.8	21.0						
		0.1	0.7	21.2						
WS9		0.1	1.4	20.4	0.0	0.0	0.0	1.0	Dry	-
		0.1	1.5	20.5						
		0.1	1.4	20.6						
		0.1	1.3	20.6						

COMMENTS:

INSTRUMENT USED:	ACCURACY OF INSTRUMENT (% by volume)	CH_4	CO_2	O_2
		± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 0.5% @ 5% ± 1.0% @15% ±3.0% @>15%	± 1.0%

A = Accumulated Type Sample SS = Steady State Type SampleP = Peak Type Sample l/h = Litres per hour

%LEL = Lower Explosive Limit (for CH4 in air 100% = 5% by volume) mb = Millibar mbgl = Metres Below Ground Level

Geotechnical Results

Appendix E – Contamination Results

Job Name:	Mill Lane, West Derby
Job Number:	26073LG

			REVISED 31/03/11																						
			RESIDENTIAL WITH PLANT UPTAKE							120315-65	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65	120316-83	120316-83	120316-83	120316-83
							LQM			5324090	5324091	5324093	5324094	5324095	5324096	5324097	5324098	5324099	5324100	5324102	5324105	5330496	5330498	5330507	5330511
Contaminant	**Units**	**SGV**	**Atkins Atrisk 1% SOM**	**Additional Values for 1% SOM (mg/kg) See notes**	**Atkins Atrisk 6% SOM**	**Additional Values for 6% SOM (mg/kg) See notes**	**SOM 1%**	**SOM 2.5%**	**SOM 5%**	**WS1 0.40m**	**WS2 0.30m**	**WS2 0.80m**	**WS3 0.25m**	**WS4 0.50m**	**WS5 0.40m**	**WS6 0.50m**	**WS6 1.10m**	**WS7 0.20m**	**WS8 0.30m**	**WS9 0.50m**	**WS10 0.50m**	**TH2 0.50m**	**TH4 0.50m**	**TH8 0.40m**	**TH10 0.40m**
Arsenic (Total)	mg/kg	32	32		32					7.9	10.2	14.1	3.6	10.4	7.07	19.9	15.3	13.2	30.2	26.2	11.5	5.03	8.07	4.98	9.96
Boron (Soluble)	mg/kg							291		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cadmium (Total)	mg/kg		10		10			3		0.124	0.127	0.0794	<0.02	0.15	0.0315	0.0588	0.34	0.184	0.143	0.192	0.0888	0.217	0.094	<0.02	0.114
Chromium III	mg/kg		12800		12900			627		14.2	16.2	14.3	9.46	12.3	11.4	20.3	16.6	15.8	12.7	14.4	12.2	11.5	12.6	12	13.1
Chromium VI	mg/kg		14.2		14.5			4.3		<1.2	<0.6	<0.6	<0.6	<1.2	<1.2	<1.2	<1.2	<3	<1.2	<3	<1.2	<0.6	<0.6	<1.2	<0.6
Copper (Total)	mg/kg		3970		4020			2330		23.7	31.6	39.5	5.14	36.6	20.9	65.2	52	40.2	72.8	45.8	34.3	12.8	15.6	13.7	28.9
Lead (Total)	mg/kg		276		342					84.2	73.4	125	12.8	254	64.5	315	392	159	148	164	105	112	57.5	48.4	112
Mercury (Total)	mg/kg	170	170		170					<0.14	<0.14	0.151	<0.14	<0.14	<0.14	0.253	0.213	0.178	0.179	0.162	0.165	<0.14	<0.14	<0.14	0.221
Nickel (Total)	mg/kg	130	130		130					10	17.6	13.5	8.98	11.4	7.73	22.9	17.2	14.1	15.7	19.9	10.7	9.64	11.7	7.99	12.9
Selenium (Total)	mg/kg	350	350		350					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc (Total)	mg/kg		16900		17200			3750		70.5	65.9	72.1	27.4	329	50.8	237	288	93.8	98	116	67.6	70.7	72.7	31.3	70.3
Cyanide (Total)	mg/kg		34		34					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenols (Total)	mg/kg		162		420		210	390	780	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Organic matter	%									2.97	5.02	4.47	0.583	2.76	<0.35	5.22	5.91	4	3.47	4.02	2.62	0.497	0.543	1.49	5.12
Sulphate (Total) as SO3	%									181	422	420	231	10100	116	246	264	174	254	6700	142	1040	637	120	182
Sulphate as Water Soluble	g/l									<0.008	0.0694	0.102	0.0862	1.49	<0.008	0.0179	0.039	<0.008	0.0639	0.0253	<0.008	0.417	0.0734	<0.008	<0.008
Sulphide	mg/kg									<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
pH	pH units									7.33	8.24	7.74	8.04	6.8	5.97	6.56	6.8	6.82	6.76	7.31	6.86	7.92	8.4	6.82	6.48
Sulphur (Elemental)	mg/kg									<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Asbestos										No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No
>> TPH SUITE <<																									
TPH (Total)																									
Total Aliphatic																									
>C5 to C6 aliphatic	mg/kg		30.1		259		30	55	110	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C6 to C8 aliphatic	mg/kg		69.8		14700	769	73	160	370	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C8 to C10 aliphatic	mg/kg		9.79		144		19	46	110	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C10 to C12 aliphatic	mg/kg		1390	49.9	4140	297	93	230	540	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C12 to C16 aliphatic	mg/kg		5100	21	5260	126	740	1700	3000	1.47	N/S	N/S	N/S	N/S	<0.1	2.43	N/S	2.27	N/S	2.88	N/S	N/S	N/S	N/S	N/S
>C16 to C35 aliphatic	mg/kg		145000		145000		45000	64000	76000	23.24	N/S	N/S	N/S	N/S	12.7	36.92	N/S	37.94	N/S	30.8	N/S	N/S	N/S	N/S	N/S
>C35 to C44 aliphatic	mg/kg						45000	64000	76000	5.6	N/S	N/S	N/S	N/S	0.29	4.43	N/S	3.09	N/S	2.66	N/S	N/S	N/S	N/S	N/S
Total Aromatic																									
>C5 to C7 aromatic (Benzene)	mg/kg		0.0493		0.33		65	130	280	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C7 to C8 aromatic (Toluene)	mg/kg		86.9		610		120	270	611	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C8 to C10 aromatic	mg/kg		14.8		177		27	65	151	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C10 to C12 aromatic	mg/kg		57.3		389		69	160	346	<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
>C12 to C16 aromatic	mg/kg		142		687		140	310	593	1.73	N/S	N/S	N/S	N/S	<0.1	6.72	N/S	13.3	N/S	4.53	N/S	N/S	N/S	N/S	N/S
>C16 to C21 aromatic	mg/kg		272		804		250	480	770	13.5	N/S	N/S	N/S	N/S	5.73	34.6	N/S	73.4	N/S	30.2	N/S	N/S	N/S	N/S	N/S
>C21 to C35 aromatic	mg/kg		888		1220		890	1100	1230	52.3	N/S	N/S	N/S	N/S	24.2	124	N/S	185	N/S	106	N/S	N/S	N/S	N/S	N/S
>C35 to C44 aromatic	mg/kg						890	1100	1230	16.2	N/S	N/S	N/S	N/S	4.68	39.2	N/S	55	N/S	33.3	N/S	N/S	N/S	N/S	N/S
>> BTEX SUITE <<																									
benzene	mg/kg	0.33	0.0493		0.33					<0.01	N/S	N/S	N/S	N/S	<0.01	<0.01	N/S	<0.01	N/S	<0.01	N/S	N/S	N/S	N/S	N/S
toluene	mg/kg	610	86.9		610					<0.002	N/S	N/S	N/S	N/S	<0.002	<0.002	N/S	<0.002	N/S	<0.002	N/S	N/S	N/S	N/S	N/S
ethylbenzene	mg/kg	350	38.2		350					<0.003	N/S	N/S	N/S	N/S	<0.003	<0.003	N/S	<0.003	N/S	<0.003	N/S	N/S	N/S	N/S	N/S
m&p xylene	mg/kg	230	17.2		230					<0.006	N/S	N/S	N/S	N/S	<0.006	<0.006	N/S	<0.006	N/S	<0.006	N/S	N/S	N/S	N/S	N/S
o-xylene	mg/kg	250	18.9		250					<0.003	N/S	N/S	N/S	N/S	<0.003	<0.003	N/S	<0.003	N/S	<0.003	N/S	N/S	N/S	N/S	N/S
>> PAH SUITE <<																									
naphthalene	mg/kg		0.585		8.71		1.5	3.7	8.7	0.0409	0.15	0.0863	<0.009	0.24	0.0278	0.102	0.0911	0.0863	1.28	0.0751	0.0501	0.0383	0.0509	0.0189	0.0633
acenaphthylene	mg/kg						170	400	850	0.0277	0.483	0.0422	<0.012	0.0684	<0.012	0.115	0.0754	0.0727	0.682	0.0653	0.0375	0.0144	0.0231	<0.012	0.0302
acenaphthene	mg/kg		588	157	2130	937	210	480	1000	0.133	2.33	0.0949	<0.008	0.374	0.0339	0.385	0.611	0.363	2.34	0.429	0.121	0.0528	0.0509	0.0301	0.312
fluorene	mg/kg		615	125	1930	746	160	380	780	0.0754	2.1	0.0582	<0.01	0.268	0.0182	0.244	0.406	0.319	1.61	0.218	0.0638	0.0258	0.0254	0.019	0.134
phenanthrene	mg/kg						92	200	380	1.31	19.3	0.898	0.0375	3.73	0.282	2.38	3.68	4.65	10.9	3.04	1.04	0.549	0.484	0.315	1.97
anthracene	mg/kg		8270	3.48	18300	20.9	2300	4900	9200	0.35	7.16	0.228	<0.016	0.733	0.0561	0.516	0.547	1.25	2.54	0.695	0.235	0.147	0.161	0.0616	0.388
fluoranthene	mg/kg		822	18.9	2160	113	260	460	670	2.78	34.4	2.02	0.0815	5.11	0.615	4.42	4.14	8.6	12.2	6.55	1.9	1.56	1.55	0.599	3.79
pyrene	mg/kg		563	2.2	1550	13.2	560	1000	1600	2.44	25.6	1.86	0.0761	4.65	0.581	3.99	3.83	6.84	10.5	5.79	1.72	1.33	1.34	0.538	3.42
benzo(a)anthracene	mg/kg		4.52	1.71	8.54		3.1	4.7	5.9	1.52	15.2	1.14	0.0523	2.64	0.352	2.28	2.05	4.14	5.26	3.23	0.98	0.729	0.704	0.251	1.45
chrysene	mg/kg		585	0.44	927	2.64	6	8	9.3	1.25	11.9	1.01	0.0347	2.24	0.33	2.09	2.07	3.65	4.67	2.83	0.839	0.644	0.652	0.291	1.53
benzo(b)fluoranthene	mg/kg		7.72	1.22	9.86	7.29	5.6	6.5	7	1.98	17.8	1.7	0.0638	3.3	0.521	3.45	3.04	5.01	6.14	4.34	1.5	0.903	0.922	0.354	1.88
benzo(k)fluoranthene	mg/kg		84.4	0.686	100	4.12	8.5	9.6	10	0.673	6.07	0.51	0.0242	1.03	0.164	1.11	0.866	1.85	2.05	1.46	0.446	0.346	0.389	0.134	0.642
benzo(a)pyrene	mg/kg		0.818		0.998		0.83	0.94	1	1.58	15.4	1.38	0.053	2.67	0.402	2.6	2.31	4.24	5.38	3.74	1.15	0.736	0.772	0.244	1.49
dibenzo(ah)anthracene	mg/kg		0.838	0.00393	1	0.0236	0.76	0.86	0.9	0.264	2.43	0.258	<0.023	0.455	0.0704	0.477	0.411	0.601	0.818	0.617	0.212	0.124	0.115	0.0463	0.226
benzo(ghi)perylene	mg/kg		96.2	0.0187	103	0.112	44	46	47	1.1	8.99	1.06	0.0378	1.73	0.29	1.95	1.65	2.46	3.3	2.61	0.937	0.535	0.566	0.219	1.12
indeno(123cd)pyrene	mg/kg		7.31	0.0614	9.75	0.368	3.2	3.9	4.2	0.929	8.35	0.862	0.0313	1.48	0.233	1.62	1.32	2.02	2.77	2.19	0.757	0.434	0.432	0.159	0.812

Job Name:	Mill Lane
Job Number:	26073LG

	LEACHATES			15/01995	15/01995	15/01995	15/01995	15/01995	15/01995
CAS Number:	**Units**	**Site Specific Guidelines**		15/01995/1	15/01995/2	15/01995/3	15/01995/4	15/01995/5	15/01995/6
Sample Ref				SA1	SA2	SA3	SA4	HD1	HD2
Determinand Name		EQS	UK DWS	0.40m	0.50m	0.50m	0.30m	0.50m	0.50m
Leachate Prep (10:1 Std NRA)*									
Arsenic (Soluble)*	µg/l	50	10	6	1	8	8	9	8
Boron (Soluble)	µg/l	2000	1000	12	14	15	13	20	16
Cadmium (Soluble)	µg/l	0.45 - 1.5	5	<1	<1	<1	<1	<1	<1
Chromium (Soluble)	µg/l	32	50	2	3	<1	5	4	1
Copper (Soluble)	µg/l	1 to 28	2000	6	3	8	7	10	18
Lead (Soluble)	µg/l	7.2	10	6	6	6	24	12	60
Mercury (Soluble)	µg/l	0.07	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel (Soluble)	µg/l	20	20	<1	<1	2	2	2	2
Selenium (Soluble)*	µg/l		10	<1	<1	<1	<1	<1	<1
Sulphur (Free)	mg/l			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc (Soluble)	µg/l	40	5000	20	6	24	68	37	38
Cyanide (Total)*	mg/l	5	50	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Phenols (Total)	µg/l	46		<10	<10	<10	<10	<10	<10
Sulphate as SO3	mg/l	400	250	3.77	212.21	<1.00	7.39	1.95	8.5
Sulphide as S	µg/l	0.25		<100	<100	<100	<100	<100	<100
pH	pH units			6.85	7.37	7.01	7.08	6.91	7.12
TPH Total C6-C40 (leachable)				<100	<100	<100	<100	<100	<100
>> PAH SUITE << *									
naphthalene*	µg/l	2.4		0.09	<0.01	<0.01	0.05	0.07	0.08
acenaphthylene*	µg/l			<0.01	<0.01	<0.01	0.01	<0.01	0.01
acenaphthene*	µg/l			0.02	<0.01	<0.01	<0.01	<0.01	0.02
fluorene*	µg/l			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
phenanthrene*	µg/l			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
anthracene*	µg/l	0.4		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
fluoranthene*	µg/l	0.1		0.02	<0.01	<0.01	<0.01	0.03	0.03
pyrene*	µg/l			0.02	<0.01	<0.01	<0.01	0.03	0.03
benzo(a)anthracene*	µg/l			0.01	<0.01	<0.01	<0.01	0.02	0.02
chrysene*	µg/l			0.02	<0.01	<0.01	<0.01	0.04	0.03
benzo(b)fluoranthene*	µg/l			0.02	<0.01	<0.01	<0.01	0.04	0.04
benzo(k)fluoranthene*	µg/l	0.03		<0.01	<0.01	<0.01	<0.01	0.01	0.01
benzo(a)pyrene*	µg/l	0.1	0.01	0.02	<0.01	<0.01	<0.01	0.04	0.03
dibenzo(ah)anthracene*	µg/l			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
benzo(ghi)perylene*	µg/l			0.02	<0.01	<0.01	<0.01	0.04	0.03
indeno(123cd)pyrene*	µg/l	0.002		0.01	<0.01	<0.01	<0.01	0.03	0.03

ALcontrol Laboratories

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Sutcliffe
18-20 Harrington Street
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Merseyside
L2 9QA

Attention: Sara Hale

CERTIFICATE OF ANALYSIS

Date:	02 April 2012
Customer:	H_SUTCLIFF_LPL
Sample Delivery Group (SDG):	120315-65
Your Reference:	26073LG
Location:	Mill Lane
Report No:	176272

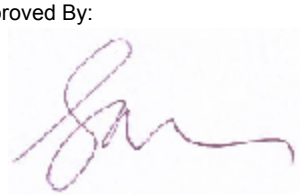
This report has been revised and directly supersedes 176269 in its entirety.

We received 12 samples on Thursday March 15, 2012 and 12 of these samples were scheduled for analysis which was completed on Monday April 02, 2012. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

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

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
5324090	WS1		0.40	14/03/2012
5324105	WS10		0.50	14/03/2012
5324091	WS2		0.30	14/03/2012
5324093	WS2		0.80	14/03/2012
5324094	WS3		0.25	14/03/2012
5324095	WS4		0.50	14/03/2012
5324096	WS5		0.40	14/03/2012
5324097	WS6		0.50	14/03/2012
5324098	WS6		1.10	14/03/2012
5324099	WS7		0.20	14/03/2012
5324100	WS8		0.30	14/03/2012
5324102	WS9		0.50	14/03/2012

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

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	5324090	5324091	5324093	5324094	5324095	5324096	5324097	5324098	5324099	5324100	5324102	5324105
			Customer Sample Reference	WS1	WS2	WS2	WS3	WS4	WS5	WS6	WS6	WS7	WS8	WS9	WS10
			AGS Reference												
			Depth (m)	0.40	0.30	0.80	0.25	0.50	0.40	0.50	1.10	0.20	0.30	0.50	0.50
			Container	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)
% Stones Greater than 10mm	All	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	
Anions by Kone (soil)	All	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	
Asbestos Identification (Soil)	All	NDPs: 0 Tests: 12			X		X	X	X	X	X	X		X			X			X		X			X			X	
Boron Water Soluble	All	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	
Chromium III	All	NDPs: 0 Tests: 12			X		X	X	X	X	X	X		X			X			X		X			X			X	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 12			X		X	X	X	X	X	X		X			X			X		X			X			X	
Easily Liberated Sulphide	All	NDPs: 0 Tests: 12			X		X	X	X	X	X	X		X			X			X		X			X			X	
Elemental Sulphur	All	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 5		X						X	X		X			X			X										
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 5		X						X	X		X			X			X										
GRO by GC-FID (S)	All	NDPs: 0 Tests: 5				X						X		X						X					X				
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 12			X		X	X	X	X	X	X		X			X			X		X			X			X	
Metals by iCap-OES (Soil)	Arsenic	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	
	Cadmium	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	
	Chromium	NDPs: 0 Tests: 12		X		X	X	X	X	X	X		X		X	X		X	X		X			X			X	

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

SOLID

Results Legend

- **X** Test
- **N** No Determination Possible

SOLID	Lab Sample No(s)		5324090			5324091		5324093		5324094		5324095		5324096			5324097			5324098		5324099			5324100		5324102			5324105	
	Customer Sample Reference		WS1			WS2		WS2		WS3		WS4		WS5			WS6			WS6		WS7			WS8		WS9			WS10	
	AGS Reference																														
	Depth (m)		0.40			0.30		0.80		0.25		0.50		0.40			0.50			1.10		0.20			0.30		0.50			0.50	
	Container		250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)
Metals by iCap-OES (Soil)	Copper	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
	Lead	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
	Mercury	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
	Nickel	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
	Selenium	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
	Zinc	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
OC, OP Pesticides and Triazine Herb	All	NDPs: 0 Tests: 3															X					X			X						
PAH by GCMS	All	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
pH	All	NDPs: 0 Tests: 12		X			X		X		X		X		X			X			X		X			X		X			X
Phenols by HPLC (S)	All	NDPs: 0 Tests: 12		X			X		X		X		X		X			X			X		X			X		X			X
Sample description	All	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
Total Organic Carbon	All	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
Total Sulphate	All	NDPs: 0 Tests: 12	X			X		X		X		X		X			X			X		X			X		X			X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 5	X											X			X					X					X				

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Sample Descriptions

Grain Sizes

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

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
5324090	WS1	0.40	Dark Brown	Silt Loam	<0.063 mm	Brick	Stones
5324091	WS2	0.30	Dark Brown	Silt Loam	0.1 - 2 mm	Brick	Coal fragments
5324093	WS2	0.80	Dark Brown	Silt Loam	<0.063 mm	Brick	Vegetation
5324094	WS3	0.25	Orange	Sand	<0.063 mm	Brick	None
5324095	WS4	0.50	Dark Brown	Loamy Sand	0.1 - 2 mm	Crushed Brick	Vegetation
5324096	WS5	0.40	Dark Brown	Top Soil	0.1 - 2 mm	Stones	Vegetation
5324097	WS6	0.50	Dark Brown	Silt Loam	<0.063 mm	Brick	Vegetation
5324098	WS6	1.10	Dark Brown	Silt Loam	<0.063 mm	Brick	Vegetation
5324099	WS7	0.20	Dark Brown	Silt Loam	<0.063 mm	Brick	Vegetation
5324100	WS8	0.30	Dark Brown	Top Soil	0.1 - 2 mm	Crushed Brick	Vegetation
5324102	WS9	0.50	Dark Brown	Top Soil	0.1 - 2 mm	Crushed Brick	Vegetation
5324105	WS10	0.50	Dark Brown	Top Soil	0.1 - 2 mm	Crushed Brick	Vegetation

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

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

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

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS1	WS2	WS2	WS3	WS4	WS5
			Depth (m)	0.40	0.30	0.80	0.25	0.50	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012
			Date Received	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012
			SDG Ref	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65
			Lab Sample No.(s)	5324090	5324091	5324093	5324094	5324095	5324096
			AGS Reference						
Moisture content ratio, Natural	%	PM024		13	14	16	12	16	14
Stones > 10 mm	%	TM008		0	0	0	0	27.1	8.16
Phenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Cresols	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	0.0114 M
Xylenols	<0.015 mg/kg	TM062 (S)		<0.015 M	<0.015 M	<0.015 M	<0.015 M	<0.015 M	<0.015 M
1-Naphthol	<0.01 mg/kg	TM062 (S)		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,3,5-Trimethylphenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)		<0.035 M	<0.035 M	<0.035 M	<0.035 M	<0.035 M	<0.035 M
Organic Matter, Total	<0.35 %	TM132		2.97 #	5.02 #	4.47 #	0.583 #	2.76 #	<0.35 #
pH	1 pH Units	TM133		7.33 M	8.24 M	7.74 M	8.04 M	6.8 M	5.97 M
Sulphur, Elemental	<5 mg/kg	TM136		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<1.2 #	<0.6 #	<0.6 #	<0.6 #	<1.2 #	<1.2 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 #	<15 #	<15 #	<15 #	<15 #	<15 #
Chromium, Trivalent	<0.9 mg/kg	TM181		14.2	16.2	14.3	9.46	12.3	11.4
Arsenic	<0.6 mg/kg	TM181		7.9 M	10.2 M	14.1 M	3.6 M	10.4 M	7.07 M
Cadmium	<0.02 mg/kg	TM181		0.124 M	0.127 M	0.0794 M	<0.02 M	0.15 M	0.0315 M
Chromium	<0.9 mg/kg	TM181		14.2 M	16.2 M	14.3 M	9.46 M	12.3 M	11.4 M
Copper	<1.4 mg/kg	TM181		23.7 M	31.6 M	39.5 M	5.14 M	36.6 M	20.9 M
Lead	<0.7 mg/kg	TM181		84.2 M	73.4 M	125 M	12.8 M	254 M	64.5 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	0.151 M	<0.14 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		10 M	17.6 M	13.5 M	8.98 M	11.4 M	7.73 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		70.5 M	65.9 M	72.1 M	27.4 M	329 M	50.8 M
Sulphate, Total	<48 mg/kg	TM221		181 M	422 M	420 M	231 M	10100 M	116 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		<0.008 M	0.0694 M	0.102 M	0.0862 M	1.49 M	<0.008 M

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS6	WS6	WS7	WS8	WS9	WS10
			Depth (m)	0.50	1.10	0.20	0.30	0.50	0.50
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012
			Date Received	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012
			SDG Ref	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65
			Lab Sample No.(s)	5324097	5324098	5324099	5324100	5324102	5324105
			AGS Reference						
Moisture content ratio, Natural	%	PM024		14	15	16	13	19	16
Stones > 10 mm	%	TM008		0	0	0	10.8	8.59	9.09
Phenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Cresols	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Xylenols	<0.015 mg/kg	TM062 (S)		<0.015 M	<0.015 M	<0.015 M	<0.015 M	<0.015 M	<0.015 M
1-Naphthol	<0.01 mg/kg	TM062 (S)		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,3,5-Trimethylphenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)		<0.035 M	<0.035 M	<0.035 M	<0.035 M	<0.035 M	<0.035 M
Organic Matter, Total	<0.35 %	TM132		5.22 #	5.91 #	4 #	3.47 #	4.02 #	2.62 #
pH	1 pH Units	TM133		6.56 M	6.8 M	6.82 M	6.76 M	7.31 M	6.86 M
Sulphur, Elemental	<5 mg/kg	TM136		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<1.2 #	<1.2 #	<3 #	<1.2 #	<3 #	<1.2 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 #	<15 #	<15 #	<15 #	<15 #	<15 #
Chromium, Trivalent	<0.9 mg/kg	TM181		20.3	16.6	15.8	12.7	14.4	12.2
Arsenic	<0.6 mg/kg	TM181		19.9 M	15.3 M	13.2 M	30.2 M	26.2 M	11.5 M
Cadmium	<0.02 mg/kg	TM181		0.0588 M	0.34 M	0.184 M	0.143 M	0.192 M	0.0888 M
Chromium	<0.9 mg/kg	TM181		20.3 M	16.6 M	15.8 M	12.7 M	14.4 M	12.2 M
Copper	<1.4 mg/kg	TM181		65.2 M	52 M	40.2 M	72.8 M	45.8 M	34.3 M
Lead	<0.7 mg/kg	TM181		315 M	392 M	159 M	148 M	164 M	105 M
Mercury	<0.14 mg/kg	TM181		0.253 M	0.213 M	0.178 M	0.179 M	0.162 M	0.165 M
Nickel	<0.2 mg/kg	TM181		22.9 M	17.2 M	14.1 M	15.7 M	19.9 M	10.7 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		237 M	288 M	93.8 M	98 M	116 M	67.6 M
Sulphate, Total	<48 mg/kg	TM221		246 M	264 M	174 M	254 M	6700 M	142 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		0.0179 M	0.039 M	<0.008 M	0.0639 M	0.0253 M	<0.008 M

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

OC, OP Pesticides and Triazine Herb

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS6	WS7	WS8			
			Depth (m)	0.50	0.20	0.30			
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
			Date Sampled	14/03/2012	14/03/2012	14/03/2012			
			Date Received	15/03/2012	15/03/2012	15/03/2012			
			SDG Ref	120315-65	120315-65	120315-65			
			Lab Sample No.(s)	5324097	5324099	5324100			
			AGS Reference						
Mevinphos	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Dichlorvos	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
alpha-Hexachlorocyclohexane (HCH / Lindane)	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Diazinon	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
gamma-Hexachlorocyclohexane (HCH / Lindane)	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Heptachlor	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Aldrin	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
beta-Hexachlorocyclohexane (HCH / Lindane)	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Methyl parathion	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Malathion	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Fenitrothion	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Heptachlor epoxide	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Parathion	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
o,p-DDE	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Endosulphan I	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
p,p-DDE	<0.05 mg/kg	TM073		<0.25	<0.1	<0.05			
o,p-TDE (DDD)	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Dieldrin	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
o,p-DDT	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Endrin	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Ethion	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
p,p-TDE (DDD)	<0.05 mg/kg	TM073		<0.25	<0.1	<0.05			
p,p-DDT	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Endosulphan II	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
o,p-Methoxychlor	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
p,p-Methoxychlor	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Endosulphan sulphate	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			
Azinphos-methyl	<0.05 mg/kg	TM073		<0.25	<0.1	<0.1			

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

PAH by GCMS

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS1	WS2	WS2	WS3	WS4	WS5
			Depth (m)	0.40	0.30	0.80	0.25	0.50	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012
			Date Received	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012
			SDG Ref	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65
			Lab Sample No.(s)	5324090	5324091	5324093	5324094	5324095	5324096
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		104	104	101	101	103	100
Acenaphthene-d10 % recovery**	%	TM218		103	102	99.3	99.5	102	98.9
Phenanthrene-d10 % recovery**	%	TM218		101	100	97.1	97.7	99.9	97.8
Chrysene-d12 % recovery**	%	TM218		115	113	92.4	89.8	94.9	88.7
Perylene-d12 % recovery**	%	TM218		112	119	100	96.4	104	97.9
Naphthalene	<0.009 mg/kg	TM218		0.0409 M	0.15 M	0.0863 M	<0.009 M	0.24 M	0.0278 M
Acenaphthylene	<0.012 mg/kg	TM218		0.0277 M	0.483 M	0.0422 M	<0.012 M	0.0684 M	<0.012 M
Acenaphthene	<0.008 mg/kg	TM218		0.133 M	2.33 M	0.0949 M	<0.008 M	0.374 M	0.0339 M
Fluorene	<0.01 mg/kg	TM218		0.0754 M	2.1 M	0.0582 M	<0.01 M	0.268 M	0.0182 M
Phenanthrene	<0.015 mg/kg	TM218		1.31 M	19.3 M	0.898 M	0.0375 M	3.73 M	0.282 M
Anthracene	<0.016 mg/kg	TM218		0.35 M	7.16 M	0.228 M	<0.016 M	0.733 M	0.0561 M
Fluoranthene	<0.017 mg/kg	TM218		2.78 M	34.4 M	2.02 M	0.0815 M	5.11 M	0.615 M
Pyrene	<0.015 mg/kg	TM218		2.44 M	25.6 M	1.86 M	0.0761 M	4.65 M	0.581 M
Benz(a)anthracene	<0.014 mg/kg	TM218		1.52 M	15.2 M	1.14 M	0.0523 M	2.64 M	0.352 M
Chrysene	<0.01 mg/kg	TM218		1.25 M	11.9 M	1.01 M	0.0347 M	2.24 M	0.33 M
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		1.98 M	17.8 M	1.7 M	0.0638 M	3.3 M	0.521 M
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		0.673 M	6.07 M	0.51 M	0.0242 M	1.03 M	0.164 M
Benzo(a)pyrene	<0.015 mg/kg	TM218		1.58 M	15.4 M	1.38 M	0.053 M	2.67 M	0.402 M
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		0.929 M	8.35 M	0.862 M	0.0313 M	1.48 M	0.233 M
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.264 M	2.43 M	0.258 M	<0.023 M	0.455 M	0.0704 M
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		1.1 M	8.99 M	1.06 M	0.0378 M	1.73 M	0.29 M
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		16.4	178	13.2	0.492	30.7	3.98

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

PAH by GCMS

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS6	WS6	WS7	WS8	WS9	WS10
			Depth (m)	0.50	1.10	0.20	0.30	0.50	0.50
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012
			Date Received	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012
			SDG Ref	120315-65	120315-65	120315-65	120315-65	120315-65	120315-65
			Lab Sample No.(s)	5324097	5324098	5324099	5324100	5324102	5324105
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		103	102	101	100	102	101
Acenaphthene-d10 % recovery**	%	TM218		102	101	101	98.8	101	99.5
Phenanthrene-d10 % recovery**	%	TM218		99.7	99.2	101	96.5	99.3	98
Chrysene-d12 % recovery**	%	TM218		95.9	96.4	100	93.6	96.8	92.7
Perylene-d12 % recovery**	%	TM218		105	105	104	104	106	104
Naphthalene	<0.009 mg/kg	TM218		0.102 M	0.0911 M	0.0863 M	1.28 M	0.0751 M	0.0501 M
Acenaphthylene	<0.012 mg/kg	TM218		0.115 M	0.0754 M	0.0727 M	0.682 M	0.0653 M	0.0375 M
Acenaphthene	<0.008 mg/kg	TM218		0.385 M	0.611 M	0.363 M	2.34 M	0.429 M	0.121 M
Fluorene	<0.01 mg/kg	TM218		0.244 M	0.406 M	0.319 M	1.61 M	0.218 M	0.0638 M
Phenanthrene	<0.015 mg/kg	TM218		2.38 M	3.68 M	4.65 M	10.9 M	3.04 M	1.04 M
Anthracene	<0.016 mg/kg	TM218		0.516 M	0.547 M	1.25 M	2.54 M	0.695 M	0.235 M
Fluoranthene	<0.017 mg/kg	TM218		4.42 M	4.14 M	8.6 M	12.2 M	6.55 M	1.9 M
Pyrene	<0.015 mg/kg	TM218		3.99 M	3.83 M	6.84 M	10.5 M	5.79 M	1.72 M
Benz(a)anthracene	<0.014 mg/kg	TM218		2.28 M	2.05 M	4.14 M	5.26 M	3.23 M	0.98 M
Chrysene	<0.01 mg/kg	TM218		2.09 M	2.07 M	3.65 M	4.67 M	2.83 M	0.839 M
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		3.45 M	3.04 M	5.01 M	6.14 M	4.34 M	1.5 M
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		1.11 M	0.866 M	1.85 M	2.05 M	1.46 M	0.446 M
Benzo(a)pyrene	<0.015 mg/kg	TM218		2.6 M	2.31 M	4.24 M	5.38 M	3.74 M	1.15 M
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		1.62 M	1.32 M	2.02 M	2.77 M	2.19 M	0.757 M
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.477 M	0.411 M	0.601 M	0.818 M	0.617 M	0.212 M
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		1.95 M	1.65 M	2.46 M	3.3 M	2.61 M	0.937 M
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		27.7	27.1	46.2	72.4	37.9	12

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

TPH CWG (S)

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS1	WS5	WS6	WS7	WS9
			Depth (m)	0.40	0.40	0.50	0.20	0.50
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	14/03/2012	14/03/2012	14/03/2012	14/03/2012	14/03/2012
			Date Received	15/03/2012	15/03/2012	15/03/2012	15/03/2012	15/03/2012
			SDG Ref	120315-65	120315-65	120315-65	120315-65	120315-65
			Lab Sample No.(s)	5324090	5324096	5324097	5324099	5324102
			AGS Reference					
GRO Surrogate % recovery**	%	TM089		92	102	83	78	82
GRO >C5-C12	<0.044 mg/kg	TM089		<0.044	<0.044	<0.044	<0.044	<0.044
Methyl tertiary butyl ether (MTBE)	<0.005 mg/kg	TM089		<0.005 #	<0.005 #	<0.005 #	<0.005 #	<0.005 #
Benzene	<0.01 mg/kg	TM089		<0.01 M	<0.01 M	<0.01 M	<0.01 M	<0.01 M
Toluene	<0.002 mg/kg	TM089		<0.002 M	<0.002 M	<0.002 M	<0.002 M	<0.002 M
Ethylbenzene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
m,p-Xylene	<0.006 mg/kg	TM089		<0.006 M	<0.006 M	<0.006 M	<0.006 M	<0.006 M
o-Xylene	<0.003 mg/kg	TM089		<0.003 M	<0.003 M	<0.003 M	<0.003 M	<0.003 M
sum of detected mpo xylene by GC	<0.009 mg/kg	TM089		<0.009	<0.009	<0.009	<0.009	<0.009
sum of detected BTEX by GC	<0.024 mg/kg	TM089		<0.024	<0.024	<0.024	<0.024	<0.024
Aliphatics >C5-C6	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C6-C8	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C8-C10	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C10-C12	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C12-C16	<0.1 mg/kg	TM173		1.47	<0.1	2.43	2.27	2.88
Aliphatics >C16-C21	<0.1 mg/kg	TM173		4.54	<0.1	6.82	7.14	5.7
Aliphatics >C21-C35	<0.1 mg/kg	TM173		18.7	12.7	30.1	30.8	25.1
Aliphatics >C35-C44	<0.1 mg/kg	TM173		5.6	0.29	4.43	3.09	2.66
Total Aliphatics >C12-C44	<0.1 mg/kg	TM173		30.4	13	43.8	43.3	36.4
Aromatics >EC5-EC7	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >EC7-EC8	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >EC8-EC10	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >EC10-EC12	<0.01 mg/kg	TM089		<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >EC12-EC16	<0.1 mg/kg	TM173		1.73	<0.1	6.72	13.3	4.53
Aromatics >EC16-EC21	<0.1 mg/kg	TM173		13.5	5.73	34.6	73.4	30.2
Aromatics >EC21-EC35	<0.1 mg/kg	TM173		52.3	24.2	124	185	106
Aromatics >EC35-EC44	<0.1 mg/kg	TM173		16.2	4.68	39.2	55	33.3
Aromatics >EC40-EC44	<0.1 mg/kg	TM173		6.83	0.826	12.4	17.2	11.9
Total Aromatics >EC12-EC44	<0.1 mg/kg	TM173		83.8	34.6	205	327	174
Total Aliphatics >C5-35	<0.1 mg/kg	TM173		24.8	12.7	39.4	40.2	33.7
Total Aromatics >C5-35	<0.1 mg/kg	TM173		67.6	30	166	272	141
Total Aliphatics & Aromatics >C5-35	<0.1 mg/kg	TM173		92.3	42.7	205	312	174
Total Aliphatics & Aromatics >C5-C44	<0.1 mg/kg	TM173		114	47.6	249	370	210

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS1 NS Z 0.40 SOLID 14/03/2012 00:00:00 120315-65 5,324,090 TM048	20/03/12	Tomasz Pawlikowski	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS10 NS Z 0.50 SOLID 14/03/2012 00:00:00 120315-65 5,324,105 TM048	20/03/12	Tomasz Pawlikowski	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS2 NS Z 0.30 SOLID 14/03/2012 00:00:00 120315-65 5,324,091 TM048	20/03/12	Tomasz Pawlikowski	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS2 NS Z 0.80 SOLID 14/03/2012 00:00:00 120315-65 5,324,093 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS3 NS Z 0.25 SOLID 14/03/2012 00:00:00 120315-65 5,324,094 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS4 NS Z 0.50 SOLID 14/03/2012 00:00:00 120315-65 5,324,095 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS5 NS Z 0.40 SOLID 14/03/2012 00:00:00 120315-65 5,324,096 TM048	20/03/12	Tomasz Pawlikowski	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS6 NS Z 0.50 SOLID 14/03/2012 00:00:00 120315-65 5,324,097 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS6 NS Z 1.10 SOLID 14/03/2012 00:00:00 120315-65 5,324,098 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS7 NS Z 0.20 SOLID 14/03/2012 00:00:00 120315-65 5,324,099 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS8 NS Z 0.30 SOLID 14/03/2012 00:00:00 120315-65 5,324,100 TM048	21/03/12	Kevin Bowron	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS9 NS Z 0.50 SOLID 14/03/2012 00:00:00 120315-65 5,324,102 TM048	20/03/12	Tomasz Pawlikowski	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM008	BS 1377:Part 1977	Particle size distribution of solid samples		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM073	MEWAM BOOK 60 1980,95 1985, HMSO / Modified: US EPA Method 8081A & 8141A	Determination of organochlorine and organophosphorous pesticides by GCMS		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM221	Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd	Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		
TM321		Organic matter Content of Soil By Titration		

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

CERTIFICATE OF ANALYSIS

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Test Completion Dates

Lab Sample No(s)	5324090	5324091	5324093	5324094	5324095	5324096	5324097	5324098	5324099	5324100
Customer Sample Ref.	WS1	WS2	WS2	WS3	WS4	WS5	WS6	WS6	WS7	WS8
AGS Ref.										
Depth	0.40	0.30	0.80	0.25	0.50	0.40	0.50	1.10	0.20	0.30
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
% Stones Greater than 10mm	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012
Anions by Kone (soil)	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012
Asbestos Identification (Soil)	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012
Boron Water Soluble	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012
Chromium III	23-Mar-2012	26-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012
Cyanide Comp/Free/Total/Thiocyanate	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012
Easily Liberated Sulphide	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012
Elemental Sulphur	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	22-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012
EPH CWG (Aliphatic) GC (S)	22-Mar-2012					22-Mar-2012	22-Mar-2012		22-Mar-2012	
EPH CWG (Aromatic) GC (S)	22-Mar-2012					22-Mar-2012	22-Mar-2012		22-Mar-2012	
GRO by GC-FID (S)	21-Mar-2012					21-Mar-2012	21-Mar-2012		21-Mar-2012	
Hexavalent Chromium (s)	23-Mar-2012	26-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012	23-Mar-2012
Metals by iCap-OES (Soil)	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012
OC, OP Pesticides and Triazine Herb							02-Apr-2012		02-Apr-2012	02-Apr-2012
PAH by GCMS	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	24-Mar-2012	22-Mar-2012
pH	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012
Phenols by HPLC (S)	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012	21-Mar-2012
Sample description	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012	20-Mar-2012
Total Organic Carbon	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012
Total Sulphate	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012	22-Mar-2012
TPH CWG GC (S)	22-Mar-2012					22-Mar-2012	22-Mar-2012		22-Mar-2012	

Lab Sample No(s)	5324102	5324105
Customer Sample Ref.	WS9	WS10
AGS Ref.		
Depth	0.50	0.50
Type	SOLID	SOLID
% Stones Greater than 10mm	21-Mar-2012	21-Mar-2012
Anions by Kone (soil)	22-Mar-2012	22-Mar-2012
Asbestos Identification (Soil)	21-Mar-2012	21-Mar-2012
Boron Water Soluble	22-Mar-2012	22-Mar-2012
Chromium III	23-Mar-2012	23-Mar-2012
Cyanide Comp/Free/Total/Thiocyanate	21-Mar-2012	21-Mar-2012
Easily Liberated Sulphide	21-Mar-2012	21-Mar-2012
Elemental Sulphur	23-Mar-2012	23-Mar-2012
EPH CWG (Aliphatic) GC (S)	22-Mar-2012	
EPH CWG (Aromatic) GC (S)	22-Mar-2012	
GRO by GC-FID (S)	21-Mar-2012	
Hexavalent Chromium (s)	23-Mar-2012	23-Mar-2012
Metals by iCap-OES (Soil)	22-Mar-2012	22-Mar-2012
PAH by GCMS	22-Mar-2012	22-Mar-2012
pH	21-Mar-2012	21-Mar-2012
Phenols by HPLC (S)	21-Mar-2012	21-Mar-2012
Sample description	20-Mar-2012	20-Mar-2012
Total Organic Carbon	22-Mar-2012	22-Mar-2012
Total Sulphate	22-Mar-2012	22-Mar-2012
TPH CWG GC (S)	22-Mar-2012	

SDG:	120315-65	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-140	**Customer:**	Sutcliffe	**Report Number:**	176272
Client Reference:	26073LG	**Attention:**	Sara Hale	**Superseded Report:**	176269

Appendix

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

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

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

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

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

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

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

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

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

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

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

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

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

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

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

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

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

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

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

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D&C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB AROCLOR 1254 / PCB CON	D&C	HEXANE:ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE:ACETONE	MICROWAVE TM218.	GC-MS
>C6-C40	WET	HEXANE:ACETONE	SHAKER	GC-FID
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE:ACETONE	SHAKER	GC-FID
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM:ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB AROCLOR 1254	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OC POP P	DCM	LIQUID/LIQUID SHAKE	GC MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC MS
PHENOLS MS	ACETONE	SOLID PHASE EXTRACTION	GC MS
TPH by INFRARED (IR)	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
MINERAL OIL by IR	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
GLYCOLS	NONE	DIRECT INJECTION	GC FID

Identification of Asbestos in Bulk Materials & Soils

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

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

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

Visual Estimation Of Fibre Content

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

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

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

ALcontrol Laboratories

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Sutcliffe
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Liverpool
Merseyside
L2 9QA

Attention: Graeme Fearn

CERTIFICATE OF ANALYSIS

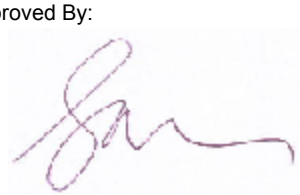
Date:	02 April 2012
Customer:	H_SUTCLIFF_LPL
Sample Delivery Group (SDG):	120316-83
Your Reference:	26073lg
Location:	Mill Lane
Report No:	176309

We received 12 samples on Friday March 16, 2012 and 4 of these samples were scheduled for analysis which was completed on Monday April 02, 2012. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

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

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
5330495	TH1		0.20	15/03/2012
5330511	TH10		0.40	15/03/2012
5330513	TH11		0.40	15/03/2012
5330496	TH2		0.50	15/03/2012
5330497	TH3		0.50	15/03/2012
5330498	TH4		0.50	15/03/2012
5330502	TH4		1.30	15/03/2012
5330504	TH5		0.60	15/03/2012
5330505	TH6		0.40	15/03/2012
5330506	TH7		0.40	15/03/2012
5330507	TH8		0.40	15/03/2012
5330510	TH9		0.40	15/03/2012

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

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			5330496	TH2		0.50	250g Amber Jar (AL
			5330498	TH4		0.50	400g Tub (ALE214)
			5330507	TH8		0.40	250g Amber Jar (AL
			5330511	TH10		0.40	400g Tub (ALE214)
% Stones Greater than 10mm	All	NDPs: 0 Tests: 4	X	X	X	X	
Anions by Kone (soil)	All	NDPs: 0 Tests: 4	X	X	X	X	
Asbestos Identification (Soil)	All	NDPs: 0 Tests: 4	X	X	X	X	X
Boron Water Soluble	All	NDPs: 0 Tests: 4	X	X	X	X	
Chromium III	All	NDPs: 0 Tests: 4	X	X	X	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4	X	X	X	X	X
Easily Liberated Sulphide	All	NDPs: 0 Tests: 4	X	X	X	X	X
Elemental Sulphur	All	NDPs: 0 Tests: 4	X	X	X	X	
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 4	X	X	X	X	X
Metals by iCap-OES (Soil)	Arsenic	NDPs: 0 Tests: 4	X	X	X	X	
	Cadmium	NDPs: 0 Tests: 4	X	X	X	X	
	Chromium	NDPs: 0 Tests: 4	X	X	X	X	
	Copper	NDPs: 0 Tests: 4	X	X	X	X	
	Lead	NDPs: 0 Tests: 4	X	X	X	X	
	Mercury	NDPs: 0 Tests: 4	X	X	X	X	

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			5330496	TH2		0.50	250g Amber Jar (AL
			5330498	TH4		0.50	400g Tub (ALE214)
			5330507	TH8		0.40	250g Amber Jar (AL
			5330511	TH10		0.40	400g Tub (ALE214)
Metals by iCap-OES (Soil)	Nickel	NDPs: 0 Tests: 4	X		X	X	X
	Selenium	NDPs: 0 Tests: 4	X		X	X	X
	Zinc	NDPs: 0 Tests: 4	X		X	X	X
OC, OP Pesticides and Triazine Herb	All	NDPs: 0 Tests: 2				X	X
PAH by GCMS	All	NDPs: 0 Tests: 4	X		X	X	X
pH	All	NDPs: 0 Tests: 4		X		X	X
Phenols by HPLC (S)	All	NDPs: 0 Tests: 4		X		X	X
Sample description	All	NDPs: 0 Tests: 4	X		X	X	X
Total Organic Carbon	All	NDPs: 2 Tests: 2	N	N		X	X
Total Organic Carbon (Asb)	All	NDPs: 0 Tests: 2	X				
Total Sulphate	All	NDPs: 0 Tests: 4	X		X	X	X

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Sample Descriptions

Grain Sizes

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

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
5330496	TH2	0.50	Light Brown	Sand	0.063 - 0.1 mm	Brick	Stones
5330498	TH4	0.50	Red	Sand	0.1 - 2 mm	Stones	None
5330507	TH8	0.40	Light Brown	Sand	0.1 - 2 mm	Stones	Vegetation
5330511	TH10	0.40	Dark Brown	Sandy Clay Loam	0.1 - 2 mm	Brick	Stones

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

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

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

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TH2	TH4	TH8	TH10		
			Depth (m)	0.50	0.50	0.40	0.40		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	15/03/2012	15/03/2012	15/03/2012	15/03/2012		
			Date Received	16/03/2012	16/03/2012	16/03/2012	16/03/2012		
			SDG Ref	120316-83	120316-83	120316-83	120316-83		
			Lab Sample No.(s)	5330496	5330498	5330507	5330511		
			AGS Reference						
Moisture content ratio, Natural	%	PM024		12	21	13	15		
Stones > 10 mm	%	TM008		0	56.3	62.6	51.1		
Phenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M		
Cresols	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M		
Xylenols	<0.015 mg/kg	TM062 (S)		<0.015 M	<0.015 M	<0.015 M	<0.015 M		
1-Naphthol	<0.01 mg/kg	TM062 (S)		<0.01	<0.01	<0.01	<0.01		
2,3,5-Trimethylphenol	<0.01 mg/kg	TM062 (S)		<0.01 M	<0.01 M	<0.01 M	<0.01 M		
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)		<0.035 M	<0.035 M	<0.035 M	<0.035 M		
Organic Matter, Total	<0.35 %	TM132				1.49 #	5.12 #		
pH	1 pH Units	TM133		7.92 M	8.4 M	6.82 M	6.48 M		
Sulphur, Elemental	<5 mg/kg	TM136		<5 M	<5 M	<5 M	<5 M		
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<1.2 #	<0.6 #		
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M	<1 M		
Sulphide, Easily liberated	<15 mg/kg	TM180		<15 § #	<15 § #	<15 § #	<15 § #		
Chromium, Trivalent	<0.9 mg/kg	TM181		11.5	12.6	12	13.1		
Arsenic	<0.6 mg/kg	TM181		5.03 M	8.07 M	4.98 M	9.96 M		
Cadmium	<0.02 mg/kg	TM181		0.217 M	0.094 M	<0.02 M	0.114 M		
Chromium	<0.9 mg/kg	TM181		11.5 M	12.6 M	12 M	13.1 M		
Copper	<1.4 mg/kg	TM181		12.8 M	15.6 M	13.7 M	28.9 M		
Lead	<0.7 mg/kg	TM181		112 M	57.5 M	48.4 M	112 M		
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	0.221 M		
Nickel	<0.2 mg/kg	TM181		9.64 M	11.7 M	7.99 M	12.9 M		
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #		
Zinc	<1.9 mg/kg	TM181		70.7 M	72.7 M	31.3 M	70.3 M		
Sulphate, Total	<48 mg/kg	TM221		1040 M	637 M	120 M	182 M		
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M		
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		0.417 M	0.0734 M	<0.008 M	<0.008 M		
Soil Organic Matter (SOM)	<0.1 %	TM321		0.497 #	0.543 #				

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

OC, OP Pesticides and Triazine Herb

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TH8	TH10				
			Depth (m)	0.40	0.40				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	15/03/2012	15/03/2012				
			Date Received	16/03/2012	16/03/2012				
			SDG Ref	120316-83	120316-83				
			Lab Sample No.(s)	5330507	5330511				
			AGS Reference						
Mevinphos	<0.05 mg/kg	TM073		<0.05	<0.25				
Dichlorvos	<0.05 mg/kg	TM073		<0.05	<0.25				
alpha-Hexachlorocyclohexane (HCH / Lindane)	<0.05 mg/kg	TM073		<0.05	<0.25				
Diazinon	<0.05 mg/kg	TM073		<0.05	<0.25				
gamma-Hexachlorocyclohexane (HCH / Lindane)	<0.05 mg/kg	TM073		<0.05	<0.25				
Heptachlor	<0.05 mg/kg	TM073		<0.05	<0.25				
Aldrin	<0.05 mg/kg	TM073		<0.05	<0.25				
beta-Hexachlorocyclohexane (HCH / Lindane)	<0.05 mg/kg	TM073		<0.05	<0.25				
Methyl parathion	<0.05 mg/kg	TM073		<0.05	<0.25				
Malathion	<0.05 mg/kg	TM073		<0.05	<0.25				
Fenitrothion	<0.05 mg/kg	TM073		<0.05	<0.25				
Heptachlor epoxide	<0.05 mg/kg	TM073		<0.05	<0.25				
Parathion	<0.05 mg/kg	TM073		<0.05	<0.25				
o,p-DDE	<0.05 mg/kg	TM073		<0.05	<0.25				
Endosulphan I	<0.05 mg/kg	TM073		<0.05	<0.25				
p,p-DDE	<0.05 mg/kg	TM073		<0.05	<0.25				
o,p-TDE (DDD)	<0.05 mg/kg	TM073		<0.05	<0.25				
Dieldrin	<0.05 mg/kg	TM073		<0.05	<0.25				
o,p-DDT	<0.05 mg/kg	TM073		<0.05	<0.5				
Endrin	<0.05 mg/kg	TM073		<0.05	<0.25				
Ethion	<0.05 mg/kg	TM073		<0.05	<0.25				
p,p-TDE (DDD)	<0.05 mg/kg	TM073		<0.05	<0.25				
p,p-DDT	<0.05 mg/kg	TM073		<0.05	<0.5				
Endosulphan II	<0.05 mg/kg	TM073		<0.05	<0.25				
o,p-Methoxychlor	<0.05 mg/kg	TM073		<0.05	<0.25				
p,p-Methoxychlor	<0.05 mg/kg	TM073		<0.05	<0.5				
Endosulphan sulphate	<0.05 mg/kg	TM073		<0.05	<0.25				
Azinphos-methyl	<0.05 mg/kg	TM073		<0.05	<0.25				

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

PAH by GCMS

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TH2	TH4	TH8	TH10		
			Depth (m)	0.50	0.50	0.40	0.40		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	15/03/2012	15/03/2012	15/03/2012	15/03/2012		
			Date Received	16/03/2012	16/03/2012	16/03/2012	16/03/2012		
			SDG Ref	120316-83	120316-83	120316-83	120316-83		
			Lab Sample No.(s)	5330496	5330498	5330507	5330511		
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		87	95.9	89.2	94.2		
Acenaphthene-d10 % recovery**	%	TM218		84.9	91	84.2	89.8		
Phenanthrene-d10 % recovery**	%	TM218		82.9	92.5	84.5	91.5		
Chrysene-d12 % recovery**	%	TM218		79	90.4	79.7	89.1		
Perylene-d12 % recovery**	%	TM218		80.8	91.6	77.8	89.8		
Naphthalene	<0.009 mg/kg	TM218		0.0383 M	0.0509 M	0.0189 M	0.0633 M		
Acenaphthylene	<0.012 mg/kg	TM218		0.0144 M	0.0231 M	<0.012 M	0.0302 M		
Acenaphthene	<0.008 mg/kg	TM218		0.0528 M	0.0509 M	0.0301 M	0.312 M		
Fluorene	<0.01 mg/kg	TM218		0.0258 M	0.0254 M	0.019 M	0.134 M		
Phenanthrene	<0.015 mg/kg	TM218		0.549 M	0.484 M	0.315 M	1.97 M		
Anthracene	<0.016 mg/kg	TM218		0.147 M	0.161 M	0.0616 M	0.388 M		
Fluoranthene	<0.017 mg/kg	TM218		1.56 M	1.55 M	0.599 M	3.79 M		
Pyrene	<0.015 mg/kg	TM218		1.33 M	1.34 M	0.538 M	3.42 M		
Benz(a)anthracene	<0.014 mg/kg	TM218		0.729 M	0.704 M	0.251 M	1.45 M		
Chrysene	<0.01 mg/kg	TM218		0.644 M	0.652 M	0.291 M	1.53 M		
Benzo(b)fluoranthene	<0.015 mg/kg	TM218		0.903 M	0.922 M	0.354 M	1.88 M		
Benzo(k)fluoranthene	<0.014 mg/kg	TM218		0.346 M	0.389 M	0.134 M	0.642 M		
Benzo(a)pyrene	<0.015 mg/kg	TM218		0.736 M	0.772 M	0.244 M	1.49 M		
Indeno(1,2,3-cd)pyrene	<0.018 mg/kg	TM218		0.434 M	0.432 M	0.159 M	0.812 M		
Dibenzo(a,h)anthracene	<0.023 mg/kg	TM218		0.124 M	0.115 M	0.0463 M	0.226 M		
Benzo(g,h,i)perylene	<0.024 mg/kg	TM218		0.535 M	0.566 M	0.219 M	1.12 M		
PAH, Total Detected USEPA 16	<0.118 mg/kg	TM218		8.17	8.23	3.28	19.3		

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Asbestos Identification - Soil

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TH10 NS Z 0.40 SOLID 15/03/2012 00:00:00 120316-83 5,330,511 TM048	28/03/12	Martin Cotterell	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TH2 NS Z 0.50 SOLID 15/03/2012 00:00:00 120316-83 5,330,496 TM048	28/03/12	Martin Cotterell	Loose fibres in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TH4 NS Z 0.50 SOLID 15/03/2012 00:00:00 120316-83 5,330,498 TM048	28/03/12	Martin Cotterell	Soil containing loose fibres and material typical of asbestos bitumen	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TH8 NS Z 0.40 SOLID 15/03/2012 00:00:00 120316-83 5,330,507 TM048	28/03/12	Martin Cotterell	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Notification of Deviating Samples

Sample Number	Customer Sample Ref.	Depth (m)	Matrix	Test Name	Component Name	Comment
5365816	TH8	0.40	SOLID	Easily Liberated Sulphide	Sulphide, Easily liberated	Sample holding time exceeded
5365819	TH10	0.40	SOLID	Easily Liberated Sulphide	Sulphide, Easily liberated	Sample holding time exceeded
5365875	TH4	0.50	SOLID	Easily Liberated Sulphide	Sulphide, Easily liberated	Sample holding time exceeded
5365907	TH2	0.50	SOLID	Easily Liberated Sulphide	Sulphide, Easily liberated	Sample holding time exceeded

Note : Test results may be compromised

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Notification of NDPs (No determination possible)

Date Received : 16/03/2012 14:23:25

Sample No	Customer Sample Ref.	Depth (m)	Test	Comment
5330496	TH2	0.50	Total Organic Carbon	Test unsuitable for analysis - Asbestos
5330498	TH4	0.50	Total Organic Carbon	Test unsuitable for analysis - Asbestos

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM008	BS 1377:Part 1977	Particle size distribution of solid samples		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM073	MEWAM BOOK 60 1980,95 1985, HMSO / Modified: US EPA Method 8081A & 8141A	Determination of organochlorine and organophosphorous pesticides by GCMS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM221	Inductively Coupled Plasma - Atomic Emission Spectroscopy. An Atlas of Spectral Information: Winge, Fassel, Peterson and Floyd	Determination of Acid extractable Sulphate in Soils by IRIS Emission Spectrometer		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM243		Mixed Anions In Soils By Kone		
TM321		Organic matter Content of Soil By Titration		

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

CERTIFICATE OF ANALYSIS

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	5330496	5330498	5330507	5330511
Customer Sample Ref.	TH2	TH4	TH8	TH10
AGS Ref.				
Depth	0.50	0.50	0.40	0.40
Type	SOLID	SOLID	SOLID	SOLID
% Stones Greater than 10mm	28-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Anions by Kone (soil)	29-Mar-2012	29-Mar-2012	29-Mar-2012	29-Mar-2012
Asbestos Identification (Soil)	28-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Boron Water Soluble	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Chromium III	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Cyanide Comp/Free/Total/Thiocyanate	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Easily Liberated Sulphide	29-Mar-2012	27-Mar-2012	27-Mar-2012	27-Mar-2012
Elemental Sulphur	02-Apr-2012	30-Mar-2012	30-Mar-2012	30-Mar-2012
Hexavalent Chromium (s)	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Metals by iCap-OES (Soil)	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
OC, OP Pesticides and Triazine Herb			29-Mar-2012	29-Mar-2012
PAH by GCMS	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
pH	28-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Phenols by HPLC (S)	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012
Sample description	26-Mar-2012	26-Mar-2012	26-Mar-2012	26-Mar-2012
Total Organic Carbon			29-Mar-2012	29-Mar-2012
Total Organic Carbon (Asb)	30-Mar-2012	28-Mar-2012		
Total Sulphate	29-Mar-2012	28-Mar-2012	28-Mar-2012	28-Mar-2012

SDG:	120316-83	**Location:**	Mill Lane	**Order Number:**	4175 / SH / 26073LG
Job:	H_SUTCLIFF_LPL-145	**Customer:**	Sutcliffe	**Report Number:**	176309
Client Reference:	26073lg	**Attention:**	Graeme Fearn	**Superseded Report:**	

Appendix

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

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

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

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

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

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

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

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

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

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

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

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

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

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

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

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

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

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

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

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D&C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB AROCLOR 1254 / PCB CON	D&C	HEXANE:ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE:ACETONE	MICROWAVE TM218.	GC-MS
>C6-C40	WET	HEXANE:ACETONE	SHAKER	GC-FID
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE:ACETONE	SHAKER	GC-FID
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM:ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB AROCLOR 1254	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PESTOC PCP P	DCM	LIQUID/LIQUID SHAKE	GC MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC MS
PHENOLS MS	ACETONE	SOLID PHASE EXTRACTION	GC MS
TPH by INFRARED (IR)	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
MINERAL OIL by IR	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
GLYCOLS	NONE	DIRECT INJECTION	GC FID

Identification of Asbestos in Bulk Materials & Soils

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

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

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

Visual Estimation Of Fibre Content

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

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

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

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 15/01995
Issue Number: 1 **Date:** 10 April, 2015

Client: Sutcliffe
18-20 Harrington Street
Liverpool
L2 9QA

Project Manager: Alex Tosh/Roly Seal
Project Name: Mill Lane, West Derby
Project Ref: Not specified
Order No: TBC
Date Samples Received: 27/03/15
Date Instructions Received: 30/03/15
Date Analysis Completed: 10/04/15

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Carolyn Field
Sales Executive

UKAS TESTING
1247

Envirolab Job Number: 15/01995

Client Project Name: Mill Lane, West Derby

Client Project Ref: Not specified

Lab Sample ID	15/01995/1	15/01995/2	15/01995/3	15/01995/4	15/01995/5	15/01995/6			Units	Method ref
Client Sample No	1	1	1	1	1	1				
Client Sample ID	SA1	SA2	SA3	SA4	HD1	HD2				
Depth to Top	0.40	0.50	0.50	0.30	0.50	0.50				
Depth To Bottom										
Date Sampled	24-Mar-15	24-Mar-15	24-Mar-15	24-Mar-15	24-Mar-15	24-Mar-15				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
MCERTS Sample Matrix Code	4AE	1A	4A	1A	4AE	1AE				
% Stones >10mm$_A^\#$	<0.1	<0.1	5.2	5.8	7.7	13.4			% w/w	A-T-044
% Moisture~$_A$	15.0	15.2	11.2	12.5	11.5	10.2			% w/w	A-T-044
% Stones >10mm~$_A^\#$	<0.1	<0.1	5.2	5.8	7.7	13.4			% w/w	A-T-044
Leachate Prep NRA (10:1)$_A$										A-T-047
pH (leachable)$_A$	6.85	7.37	7.01	7.08	6.91	7.12			pH	A-T-031w
Sulphate (leachable)$_A^\#$	3.77	212.21	<1.00	7.39	1.95	8.50			mg/l	A-T-026w
Cyanide (total) (leachable)$_A$	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005			mg/l	A-T-042wTCN
Phenols (total by HPLC) (leachable)$_A$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			mg/l	A-T-050w
Sulphide (leachable)$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/l	A-T-S2-w
DOC (leachable)$_A^\#$	3.1	1.9	4.2	2.5	3.8	3.9			mg/l	A-T-032w
Arsenic (leachable)$_A^\#$	6	1	8	8	9	8			µg/l	A-T-025w
Boron (leachable)$_A^\#$	12	14	15	13	20	16			µg/l	A-T-025w
Cadmium (leachable)$_A^\#$	<1	<1	<1	<1	<1	<1			µg/l	A-T-025w
Copper (leachable)$_A^\#$	6	3	8	7	10	18			µg/l	A-T-025w
Chromium (leachable)$_A^\#$	2	3	<1	5	4	1			µg/l	A-T-025w
Chromium (hexavalent) (leachable)$_A$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			mg/l	A-T-040w
Chromium (trivalent) (leachable)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			mg/l	Calc
Lead (leachable)$_A^\#$	6	6	6	24	12	60			µg/l	A-T-025w
Mercury (leachable)$_A^\#$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			µg/l	A-T-025w
Nickel (leachable)$_A^\#$	<1	<1	2	2	2	2			µg/l	A-T-025w
Selenium (leachable)$_A^\#$	<1	<1	<1	<1	<1	<1			µg/l	A-T-025w
Sulphur (elemental/free) (leachable)$_A$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			mg/l	A-T-029w
Zinc (leachable)$_A^\#$	20	6	24	68	37	38			µg/l	A-T-025w
TPH Total >C6-C40 (leachable)$_A$	<100	<100	<100	<100	<100	<100			µg/l	A-T-007w

Envirolab Job Number: 15/01995

Client Project Name: Mill Lane, West Derby

Client Project Ref: Not specified

Lab Sample ID	15/01995/1	15/01995/2	15/01995/3	15/01995/4	15/01995/5	15/01995/6			Units	Method ref
Client Sample No	1	1	1	1	1	1				
Client Sample ID	SA1	SA2	SA3	SA4	HD1	HD2				
Depth to Top	0.40	0.50	0.50	0.30	0.50	0.50				
Depth To Bottom										
Date Sampled	24-Mar-15	24-Mar-15	24-Mar-15	24-Mar-15	24-Mar-15	24-Mar-15				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES				
MCERTS Sample Matrix Code	4AE	1A	4A	1A	4AE	1AE				
PAH-16MS (leachable)										
Acenaphthene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	<0.01	0.02			µg/l	A-T-019w
Acenaphthylene (leachable)$_A$	<0.01	<0.01	<0.01	0.01	<0.01	0.01			µg/l	A-T-019w
Anthracene (leachable)$_A$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	A-T-019w
Benzo(a)anthracene (leachable)$_A$	0.01	<0.01	<0.01	<0.01	0.02	0.02			µg/l	A-T-019w
Benzo(a)pyrene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	0.04	0.03			µg/l	A-T-019w
Benzo(b)fluoranthene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	0.04	0.04			µg/l	A-T-019w
Benzo(ghi)perylene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	0.04	0.03			µg/l	A-T-019w
Benzo(k)fluoranthene (leachable)$_A$	<0.01	<0.01	<0.01	<0.01	0.01	0.01			µg/l	A-T-019w
Chrysene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	0.04	0.03			µg/l	A-T-019w
Dibenzo(ah)anthracene (leachable)$_A$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	A-T-019w
Fluoranthene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	0.03	0.03			µg/l	A-T-019w
Fluorene (leachable)$_A$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	A-T-019w
Indeno(123-cd)pyrene (leachable)$_A$	0.01	<0.01	<0.01	<0.01	0.03	0.03			µg/l	A-T-019w
Naphthalene (leachable)$_A$	0.09	<0.01	<0.01	0.05	0.07	0.08			µg/l	A-T-019w
Phenanthrene (leachable)$_A$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			µg/l	A-T-019w
Pyrene (leachable)$_A$	0.02	<0.01	<0.01	<0.01	0.03	0.03			µg/l	A-T-019w
PAH (total 16) (leachable)$_A$	0.25	<0.01	<0.01	0.06	0.35	0.36			µg/l	A-T-019w

REPORT NOTES

Notes - Soil chemical analysis
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General
This report shall not be reproduced, except in full, without written approval from Envirolab.
Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.
All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.
All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts.
Superscript "M" indicates method accredited to MCERTS.
If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

TPH analysis of water by method A-T-007
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos in soil
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if present as discrete fibres/fragments. Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified a being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER.
Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations.

Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Appendix F – Statistical Analysis

Client/client ref: Plus Dane Housing
Project ref: 26073LG
Site ref: Mill Lane, West Derby
Data description: Made Ground
Contaminant(s): Metals
Test scenario: Planning
Date: 19.05.15
User details: DB

	Arsenic (Total) (mg/kg)	Boron (Soluble) (mg/kg)	Cadmium (Total) (mg/kg)	Chromium III (mg/kg)	Chromium VI (mg/kg)	Copper (Total) (mg/kg)	Lead (Total) (mg/kg)	Mercury (Total) (mg/kg)	Nickel (Total) (mg/kg)	Selenium (Total) (mg/kg)	Zinc (Total) (mg/kg)	Cyanide (Total) (mg/kg)	Phenols (Total) (mg/kg)
Critical concentration, C_c	**37**	**290**	**11**	**910**	**6**	**2400**	**200**	**40**	**180**	**250**	**37000**	**34**	**280**
Notes	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	C4SL	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	Atkins Atisk	LQM S4UL
Sample size, n	16	16	16	16	16	16	16	16	16	16	16	16	16
Sample mean, $\overline{X}$	12.350625	1	0.12396875	13.69125	1.2	33.67125	139.175	0.165125	13.24625	1	110.06875	1	0.035
Standard deviation, s	7.50668899	0	0.08296283	2.60136342	0.75894664	18.9004239	101.901655	0.03535887	4.40509383	0	90.917015	0	1.4333E-17
Number of non-detects	0	**16**	**2**	0	**16**	0	0	**8**	0	**16**	0	**16**	**16**
Set non-detect values to:	Half detection limit	Detection limit	Detection limit	Half detection limit	Detection limit	Half detection limit	Half detection limit	Detection limit	Half detection limit	Detection limit	Half detection limit	Detection limit	Detection limit
Outliers?	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No
Distribution	Non-normal	Single value	Normal	Normal	Non-normal	Normal	Non-normal	Non-normal	Normal	Single value	Non-normal	Single value	Non-normal
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: One-sample t	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**		**95%**	Use Normal distribution to test for outliers					
t statistic, t_0 (or k_0)	-13.13461902	N/A	-524.3809009	-1378.213811	-25.29822128	-500.7990843	-2.387596153	-4506.351026	-151.419022	N/A	-1623.015504	N/A	-7.8132E+19
Upper confidence limit (on true mean concentration, μ)	20.5308497	1	0.16032826	14.8313303	2.02704293	41.9545987	250.219754	0.20365644	15.1768378	1	209.14327	1	0.035
Evidence level	**99%**	**100%**	**100%**	**100%**	**100%**	**100%**	**85%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ ≈≥ Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**
Select dataset	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

Client/client ref: Plus Dane Housing
Project ref: 26073LG
Site ref: Mill Lane, West Derby
Data description: Made Ground
Contaminant(s): Metals
Test scenario: Planning
Date: 19.05.15
User details: DB

	Arsenic (Total) (mg/kg)	Boron (Soluble) (mg/kg)	Cadmium (Total) (mg/kg)	Chromium III (mg/kg)	Chromium VI (mg/kg)	Copper (Total) (mg/kg)	Lead (Total) (mg/kg)	Mercury (Total) (mg/kg)	Nickel (Total) (mg/kg)	Selenium (Total) (mg/kg)	Zinc (Total) (mg/kg)	Cyanide (Total) (mg/kg)	Phenols (Total) (mg/kg)	Outliers: Lead (Total) (mg/kg)
Critical concentration, C_c	**37**	**290**	**11**	**910**	**6**	**2400**	**200**	**40**	**180**	**250**	**37000**	**34**	**280**	**200**
Notes	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	C4SL	LQM S4UL	LQM S4UL	LQM S4UL	LQM S4UL	Atkins Atisk	LQM S4UL	
Sample size, n	16	16	16	16	16	16	13	16	16	16	16	16	16	3
Sample mean, $\overline{X}$	12.350625	1	0.12396875	13.69125	1.2	33.67125	97.3692308	0.165125	13.24625	1	110.06875	1	0.035	320.333333
Standard deviation, s	7.50668899	0	0.08296283	2.60136342	0.75894664	18.9004239	45.6610042	0.03535887	4.40509383	0	90.917015	0	1.4333E-17	69.1544166
Number of non-detects	0	**16**	**2**	0	**16**	0	0	**8**	0	**16**	0	**16**	**16**	0
Set non-detect values to:	Half detection limit	Detection limit	Detection limit	Half detection limit	Detection limit	Half detection limit	Half detection limit	Detection limit	Half detection limit	Detection limit	Half detection limit	Detection limit	Detection limit	Half detection limit
Outliers?	No	No	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Distribution	Non-normal	Single value	Normal	Normal	Non-normal	Normal	Normal	Non-normal	Normal	Single value	Non-normal	Single value	Non-normal	Normal
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t	Auto: One-sample t	Auto: Chebychev	Auto: One-sample t	Auto: One-sample t	Auto: Chebychev	Auto: One-sample t	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**		**95%**	Use Normal distribution to test for outliers						
t statistic, t_0 (or k_0)	-13.13461902	N/A	-524.3809009	-1378.213811	-25.29822128	-500.7990843	-8.104081527	-4506.351026	-151.419022	N/A	-1623.015504	N/A	-7.8132E+19	3.013884831
Upper confidence limit (on true mean concentration, μ)	20.5308497	1	0.16032826	14.8313303	2.02704293	41.9545987	119.94027	0.20365644	15.1768378	1	209.14327	1	0.035	436.917615
Evidence level	**99%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**5%**
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ ≥ Cc**
Select dataset	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

Client/client ref: Plus Dane Housing
Project ref: 26073LG
Site ref: Mill Lane, West Derby
Data description: Made Ground
Contaminant(s): TPH
Test scenario: Planning
Date: 19.05.15
User details: DB

	>C5 to C6 aliphatic (mg/kg)	>C6 to C8 aliphatic (mg/kg)	>C8 to C10 aliphatic (mg/kg)	>C10 to C12 aliphatic (mg/kg)	>C12 to C16 aliphatic (mg/kg)	>C16 to C35 aliphatic (mg/kg)	>C35 to C44 aliphatic (mg/kg)	>C5 to C7 aromatic (Benzene) (mg/kg)	>C7 to C8 aromatic (Toluene) (mg/kg)	>C8 to C10 aromatic (mg/kg)	>C10 to C12 aromatic (mg/kg)	>C12 to C16 aromatic (mg/kg)	>C16 to C21 aromatic (mg/kg)	>C21 to C35 aromatic (mg/kg)	>C35 to C44 aromatic (mg/kg)
Critical concentration, C_c	**42**	**100**	**27**	**130**	**1100**	**65000**	**65000**	**70**	**130**	**34**	**74**	**140**	**260**	**1100**	**1100**
Notes	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM
Sample size, n	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Sample mean, $\overline{X}$	0.01	0.01	0.01	0.01	1.83	28.32	3.214	0.01	0.01	0.01	0.01	5.276	31.486	98.3	29.676
Standard deviation, s	0	0	0	0	1.09300046	10.5171954	2.00273064	0	0	0	0	5.15730841	26.2440561	62.9354431	19.694844
Number of non-detects	**5**	**5**	**5**	**5**	**1**	0	0	**5**	**5**	**5**	**5**	**1**	0	0	0
Set non-detect values to:	Detection limit	Detection limit	Detection limit	Detection limit	Detection limit	Half detection limit	Half detection limit	Detection limit	Detection limit	Detection limit	Detection limit	Detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Distribution	Single value	Single value	Single value	Single value	Normal	Normal	Normal	Single value	Single value	Single value	Single value	Normal	Normal	Normal	Normal
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t-	Auto: One-sample t-	Auto: One-sample t-	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t-	Auto: One-sample t-	Auto: One-sample t-	Auto: One-sample t-
Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**		**95%**	Use Normal distribution to test for outliers							
t statistic, t_0 (or k_0)	N/A	N/A	N/A	N/A	-2246.643864	-13813.67246	-72569.53542	N/A	N/A	N/A	N/A	-58.41264444	-19.47004061	-35.58995031	-121.5199888
Upper confidence limit (on true mean concentration, μ)	0.01	0.01	0.01	0.01	2.87205665	38.3469981	5.1233851	0.01	0.01	0.01	0.01	10.1929307	56.5068434	158.302077	48.4528844
Evidence level	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**
Select dataset	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

Client/client ref: Plus Dane Housing
Project ref: 26073LG
Site ref: Mill Lane, West Derby
Data description: Made Ground
Contaminant(s): BTEX
Test scenario: Planning
Date: 19.05.15
User details: DB

	benzene (mg/kg)	toluene (mg/kg)	ethylbenzene (mg/kg)	m&p xylene (mg/kg)	o-xylene (mg/kg)						
Critical concentration, C_c	**0.87**	**130**	**47**	**56**	**60**						
Notes	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM						
Sample size, n	5	5	5	5	5	0	0	0	0	0	0
Sample mean, $\overline{X}$	0.01	0.002	0.003	0.006	0.003	No Data	No Data	No Data	No Data	No Data	No Data
Standard deviation, s	0	0	0	0	0						
Number of non-detects	**5**	**5**	**5**	**5**	**5**						
Set non-detect values to:	Detection limit	Detection limit	Detection limit	Detection limit	Detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	No	No	No	No	No						
Distribution	Single value	Single value	Single value	Single value	Single value						
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto	Auto	Auto	Auto	Auto	Auto

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**		**95%**	Use Normal distribution to test for outliers			
t statistic, t_0 (or k_0)	N/A	N/A	N/A	N/A	N/A						
Upper confidence limit (on true mean concentration, μ)	0.01	0.002	0.003	0.006	0.003						
Evidence level	**100%**	**100%**	**100%**	**100%**	**100%**						
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level						
Result	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**	**μ < Cc**						
Select dataset	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y

Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

Client/client ref: Plus Dane Housing
Project ref: 26073LG
Site ref: Mill Lane, West Derby
Data description: Made Ground
Contaminant(s): PAHs
Test scenario: Planning
Date: 19.05.15
User details: DB

	naphthalene (mg/kg)	acenaphthylene (mg/kg)	acenaphthene (mg/kg)	fluorene (mg/kg)	phenanthrene (mg/kg)	anthracene (mg/kg)	fluoranthene (mg/kg)	pyrene (mg/kg)	benzo(a)anthracene (mg/kg)	chrysene (mg/kg)	benzo(b)fluoranthene (mg/kg)	benzo(k)fluoranthene (mg/kg)	benzo(a)pyrene (mg/kg)	dibenzo(ah)anthracene (mg/kg)	benzo(ghi)perylene (mg/kg)	indeno(123cd)pyrene (mg/kg)
Critical concentration, C_c	2.3	170	210	170	95	2400	280	620	7.2	15	2.6	77	2.2	0.24	320	27
Notes	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM
Sample size, n	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Sample mean, $\overline{X}$	0.15034375	0.11080625	0.4790375	0.3493625	3.41034375	0.94223125	5.64471875	4.65656875	2.62364375	2.25191875	3.3064875	1.1102625	2.7591875	0.4460125	1.784675	1.52495625
Standard deviation, s	0.30653813	0.1899372	0.74637931	0.60706075	5.0159579	1.77191934	8.31627991	6.21534861	3.6551707	2.87454039	4.24456332	1.45056574	3.69494951	0.5776197	2.13442736	1.98183825
Number of non-detects	1	3	1	1	0	1	0	0	0	0	0	0	0	1	0	0
Set non-detect values to:	Half detection limit	Detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distribution	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev
Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				Evidence level required:		95%	Use Normal distribution to test for outliers								
t statistic, t_0 (or k_0)	-28.05075137	-3577.797194	-1122.86587	-1117.849484	-73.03861646	-5415.726816	-131.9605806	-396.0153932	-5.008090318	-17.73929672	0.665781091	-209.2693502	0.605353332	1.426630715	-596.347913	-51.41699887
Upper confidence limit (on true mean concentration, μ)	0.48438594	0.31778551	1.29238549	1.01089162	8.87635714	2.87313558	14.7071747	11.4295879	6.60677368	5.38437652	7.93189315	2.69097987	6.78566538	1.07545897	4.11061329	3.68461441
Evidence level	100%	100%	100%	100%	100%	100%	100%	100%	96%	100%	0%	100%	0%	0%	100%	100%
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ < Cc	μ ≥ Cc	μ < Cc	μ ≥ Cc	μ ≥ Cc	μ < Cc	μ < Cc
Select dataset	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

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

Client/client ref: Plus Dane Housing
Project ref: 26073LG
Site ref: Mill Lane, West Derby
Data description: Made Ground
Contaminant(s): PAH Outliers
Test scenario: Planning
Date: 23.04.13
User details: DB

	benzo(b)fluoranthene (mg/kg)	benzo(a)pyrene (mg/kg)	dibenzo(ah)anthracene (mg/kg)	Outliers: benzo(b)fluoranthene (mg/kg)	Outliers: benzo(a)pyrene (mg/kg)	Outliers: dibenzo(ah)anthracene (mg/kg)					
Critical concentration, C_c	**2.6**	**2.2**	**0.24**	**2.6**	**2.2**	**0.24**					
Notes	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM	LQM S4UL's 1% SOM								
Sample size, n	15	15	15	1	1	1	0	0	0	0	0
Sample mean, $\overline{X}$	2.34025333	1.91646667	0.31374667	17.8	15.4	2.43	No Data	No Data	No Data	No Data	No Data
Standard deviation, s	1.8161721	1.56631874	0.23994754	0	0	0					
Number of non-detects	0	0	**1**	0	0	0					
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	No	No	No	N/A (n<3)	N/A (n<3)	N/A (n<3)					
Distribution	Normal	Normal	Normal	Single value	Single value	Single value					
Statistical approach	Auto: One-sample t-	Auto: One-sample t-	Auto: One-sample t-	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto	Auto	Auto	Auto	Auto

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?			**Evidence level required:**		95%	Use Normal distribution to test for outliers				
t statistic, t_0 (or k_0)	-0.553909243	-0.701083277	1.190341883	N/A	N/A	N/A					
Upper confidence limit (on true mean concentration, μ)	3.16619087	2.62877881	0.42286721	17.8	15.4	2.43					
Evidence level	**71%**	**75%**	**13%**	**0%**	**0%**	**0%**					
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level					
Result	**μ ≈≥ Cc**	**μ ≈≥ Cc**	**μ ≥ Cc**	**μ ≥ Cc**	**μ ≥ Cc**	**μ ≥ Cc**					
Select dataset	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

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

Appendix G – Risk Assessment

RISK ASSESSMENT METHODOLOGY

GENERAL

The purpose of this appendix is to describe in detail the concepts underlying the risk based approach to assessing potentially contaminated land, introduce the roles of key legislation and describe the qualitative methodology adopted for evaluating and characterising risk.

Current best practice in the UK promotes a risk-based approach to dealing with both soil and groundwater contamination. The principal aim of the approach is to ensure protection of human health and the environment in a thorough, transparent and cost-effective manner.

Fundamental to the risk-based approach is the concept that for 'Contaminated Land' to be designated, as a consequence of historic activities, a pathway for contamination must be shown to exist between a source of contamination and a receptor. The combined presence of a source, pathway and a receptor is described as a 'pollutant linkage'.

The concepts associated with a contaminant source, pathway and receptor are defined in DETR Circular 02/2000 'Contaminated Land Environmental Protection Act 1990: Part II A'. A ***source*** of contamination may be considered as a 'substance, which is in, on or under land that has the potential to cause harm or to cause pollution of controlled waters'. A ***receptor*** can be considered as either 'a living organism, a group of living organisms, an ecological system or a piece of property which is being, or could be harmed, by a contaminant or controlled waters which are being, or could be, polluted by a contaminant'. A ***pathway*** may be considered as one or more routes by, or through, which a receptor is being, or could be, exposed to or affected, by a contaminant. Typical pathways may include migration in groundwater, surface water run-off or infiltration, inhalation, dermal contact and ingestion.

The risks posed by an identified pollutant linkage can often be mitigated by removing the source of contamination, treating the source of contamination, blocking the relevant pathway(s) or by protecting the receptor.

PRINCIPLES OF RISK EVALUATION

The risk evaluation methodology presented below is qualitative in nature, and is therefore a subjective method. It is based upon guidance presented in CIRIA publication referenced C552, 'Contaminated land risk assessment - A guide to good practice', 2001 and involves the classification of the following.

The magnitude of the potential **consequence** (severity) of risks occurring (Table 1).

The magnitude of the **probability** (likelihood) of the risk occurring (Table 2).

These are then considered in conjunction to give a risk matrix (Table 3)

Table 1 - Classification of consequence

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (Note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR, 2000).	Concentrations of a contaminant from site exceed the generic or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the *Draft Circular on Contaminated Land*, DETR, 2000). Damage to sensitive buildings/structures/ services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

Table 2 - Classification of probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 3 - Comparison of consequence against probability

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

Table 4 - Description of the classified risks and likely action required

Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Table 5 - Response action likely to be required in relation to estimated risk

KEY

- Mitigation and remedial measures required
- Mitigation and remedial measures likely
- Remedial measures unlikely
- Remedial measures not required

RISK ASSESSMENT FOR THE WATER ENVIRONMENT

The risk assessment has been developed to provide a greater level of standardisation. It includes relevant elements from TAG (Transport Analysis Guidance) Table 1 relating to the features described as river, floodplain, groundwater and stillwaters, including their attributes/services and selected/modified indicators of quality and possible measures. Two additional columns have been added for 'grading' and 'importance level'. These columns expand on the limited number of examples provided in TAG Table 2. Table 1 has been developed with reference to TAG, Highways Agency's 'New Approach to Appraisal' (NATA), the Water Framework Directive and other sources as referenced in the table.

Table 1 here relies on easily available data to avoid unnecessary data collection. Should inadequate data be available a 'worst case' should be assumed. The table is designed to act as a guide to determining importance and to raise the level of compatibility in predicting the significance of impacts on the water environment.

Once Table 1 has been used to determine the importance of the environmental attributes that may be affected by a particular development project, Tables 3 and 4 of TAG Unit 3.3.11 can be used to estimate the significance of potential impacts. These tables are reproduced here as Tables 2 and 3 respectively. Table 2 provides a methodology for determining impact magnitude. Table 3 is a matrix that allows the significance of the impact to be calculated based on the impact magnitude and the importance of the attribute. The significance of impacts can range from 'insignificant' to 'very significant'.

Table 1: Water features, their attributes, indicators of quality, grading and importance (adapted from Table 1 of TAG unit 3.3.11)

Feature	Attribute / Service	Indicator of Quality	Measure	Grading	Importance Level
River	Water Supply	Chemical water quality	Environment Agency's Chemical General Quality Assessment (GQA)	A B C-D E-F	Very High High Medium Low
		Industrial / agricultural abstractions	Location and volume of abstraction	All abstractions within 2km downstream: >1000m3/day 500-1000m3/day 50-499m3/day <50m3/day	 Very High High Medium Low
		Drinking water supply	Classification defined within The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996. No 3001[2]	Classification: DW1 or DW2 within critical travel time for pollution downstream DW3 within critical time downstream Not designated	 Very High High Medium - Low
	Biodiversity[3]	Biological Water Quality	Environment Agency's Biological GQA[1]	A B C-D E-F	Very High High Medium Low
		Fisheries Quality	Fisheries status as defined within the Freshwater Fish Directive 78/659/EEC	Designated salmonid fishery Designated cyprinid fishery Undesignated fishery Not a fishery	Very High High Medium Low

Feature	Attribute / Service	Indicator of Quality	Measure	Grading	Importance Level
River	Transport and dilution of waste product	Surface Water / effluent discharges	Type of discharges with reference to the EC Dangerous Substances Directive (76/464/EEC and Daughter Directives)	All discharges within 2km up or downstream: List I List II Other discharge / no discharge	 Very High - High Medium Medium - Low
	Recreation	Riverside access	Presence / absence of route and importance	National trail / cycleway Regional trail Definitive footpath / bridleway No route	Very High High Medium Low
		Presence of clubs/ recreation use	Presence / absence	Club recreation use present No club / recreation use	Very High - High - Medium Low
	Conveyance of flow and material	Presence of water courses	Size of watercourses[5]	Main River > 10m wide Main River < 10m wide Ordinary watercourse >5m wide Other	Very High High Medium Low
Floodplain	Flood defence	Importance in relation to flood defence	Status of flood plain area	Designated washland Active floodplain Existing defended area Does not flood	Very High High Medium Low
			Return period	> (ie more frequent then) 1 in 25 years < 1 in 25 years <1 in 100 years (urban) <1 in 50 years <1 in 200 years	Very High High Medium Medium Low
Groundwater	Water supply	Industrial / agricultural abstractions	Location and volume of abstraction	All abstraction points within zone of influence of development: >1000m3/day >500-1000m3/day 50-499m3/day <50m3/day	 Very High High Medium Low
		Drinking water supply	Presence of potable public supply or private water supply within zone of influence of development	Public supply Private water supply >10m3/day or serves >50 people[6] Other private water supply No supply	Very High High Medium Low
		Groundwater vulnerability	Source protection status	Within zone 1,2 or 3 of a source protection zone Not within a source protection zone	Very High High Medium Low
			Classification of aquifer vulnerability	Major aquifer with H soils or I soils or U soils. Minor aquifer with H soils or U soils Major aquifer with L soils. Minor aquifer with L soils or non aquifer	Very High High Medium Low
	Conveyance of flood flows	Acceptance potential of flood flows	Soil type / groundwater table levels[8]	Gravels with low water table (>1m below infiltration point) Sands with low water table All soil types with high water table Clay	Very High High Medium Low
Stillwaters (lakes and ponds)	Biodiversity[3]	Biological water quality	Classification system to be developed under the Water Framework Directive for ecological status / potential		
		Fisheries quality	Fisheries status as defined within the Freshwater Fish Directive 78/659/EEC	Designated salmonid fishery Designated cyprinid fishery Undesignated fishery Not a fishery	Very High-high High - medium Medium - low Low
	Water supply	Use for abstraction	Presence / absence	Abstraction No abstraction	Very High - High – Medium[9] Low
	Recreation	Presence of clubs / recreation use	Presence / absence	Club recreation use present No club / recreation use	Very High - High - Medium[4] Low

Notes to Table 1

1 If the river is unclassified and hence has no GQA grade, the quality can be measured or assumptions can be made based on the grade of the nearest classified stretch.

2 An importance level of high or very high must also be awarded if the water feature provides more than 10m3/day of drinking water, or serves more than 50 people, which is the definition used in the Water Framework Directive to define drinking water protected areas.

3 Conservation value is not included, as this should be included within an ecology/nature conservation assessment.

4 This required judgement on a case by case basis because the importance of use by people is being assessed, and they are sensitive to being categorised as unimportant. Careful assessment is thus required, using as much data as possible eg on the facilities, their scale and frequency of use, membership levels and economic value.

5 An importance level of 'Medium' or greater must also be awarded if a river has a catchment greater than 10km2, as this means that it will be classified as a water body under the Water Framework Directive. Other measures are available for describing the ability of watercourses to convey flow and material (such as the carrying capacity of the channel for flood flows) and could if necessary be substituted.

6 Based on criteria given within the Water Frame Work Directive for features to be designated as drinking water protected areas.

7 Adapted from NRA Policy and Practice for the Protection of Groundwater, Groundwater Vulnerability Sheets, NRA 1994. Because soil information in urban areas is less reliable and based on fewer observations than in rural areas, the worst case is assumed and such land is classified as being high of leaching potential. H = high, I = Intermediate, L = Low and U = Unclassified leaching potential.

8 This uses a coarse basis of permeability together with the ability of the existing ground conditions to accept additional flows. For example, gravels in a river floodplain are unlikely to have a high acceptance potential because of raised water table due to river flows. Sands above a relatively dry substrata would have a high potential, however caution is required in areas such as chalk with highly fluctuating groundwater levels.

9 Depends on use of water, volume abstracted etc. An importance level of 'High' or 'Very high' mus be awarded if the water feature provides more than 10m3/day of drinking water, or serves more than 50 people, which is the definition used in the Water Framework Directive to define drinking water protected areas.

Table 2: Criteria for determining impact magnitude (reproduced from Table 3 of TAG unit 3.3.11)

Magnitude	Criteria	Example
Major	Results in loss of attribute	• Loss of EC designated Salmonid fishery • Compromise employment source • Pollution of potable source of abstraction • Change in GQA grade of river reach • Loss of flood storage / increased flood risk
Moderate	Results in impact on integrity of attribute or loss of art of attribute	• Loss in productivity of a fishery • Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its GQA grade • Reduction in the economic value of the feature
Minor	Results in minor impact on attribute	• Measurable change in attribute, but of limited size and/or proportion
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use / integrity	• Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity • No significant impact on the economic value of the feature • No increase in flood risk

Table 3: Significance Criteria of Potential Impacts
(Reproduced from Table 4 of TAG unit 3.3.11)

Magnitude of Potential impact	Importance of Attribute			
	Very High	**High**	**Medium**	**Low**
Major	Very Significant	Very Significant	Significant	Low Significant
Moderate	Very Significant	Significant	Low Significant	Insignificant
Minor	Significant	Low Significant	Insignificant	Insignificant
Negligible	Low Significant	Insignificant	Insignificant	Insignificant

Table 4: Proposed impact assessment summary table

Feature	Attribute / Service	Importance Level	Magnitude of Impact	Significance of Impact
River	Water Supply	Very High	Minor	Significant

References

1 The Highways Agency et al, Design Manual for Roads and Bridges, Vol 11. Environmental Assessment, 1993.
2 DETR 'Guidance on the New Approach to Appraisal, 1998.
3 Department for Transport, Transport Analysis Guidance (TAG) 2003