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ENVIRONMENTAL CONSULTANTS

Land at Woodland Drive, Dodworth, Barnsley

Phase 2 Site Investigation Report

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Phase 2 Site Investigation Report

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Executive Summary

Site Location and Current Condition	The site is located off Woodland Drive, Dodworth, Barnsley at National Grid Reference 432760, 405910. The site currently comprises an open grassed area.	
Site Investigation	20no. windowless sampler boreholes were drilled on 13th February and 7th March 2012. 5no. rotary boreholes were drilled using water flush to a depth of 30m on 7th and 8th March 2012. The site investigation was followed by a programme of ground gas monitoring, which is due for completion at the end of March 2012.	
Ground Conditions	Made Ground:	Recorded up to a maximum depth of 0.65m below ground level and generally comprising topsoil, with localised minor amounts of clay and sand.
	Subsoil:	Stiff clay (weathered Coal Measures strata) was encountered across the site.
	Rock:	Encountered at depths of 0.55m to 1.95m, comprising very weak to weak mudstone.
	Coal Mining:	Rotary borehole drilling proved intact Coal Measures rock strata to a depth of 30m.
	Ground-water:	Observations from the site investigation and subsequent borehole monitoring indicate that there is no continuous shallow groundwater beneath the site.
Contamination Assessment	Human Health:	Low risk to human health from exposure to soil contaminants following redevelopment; no remediation required.
	Ground Gases:	Elevated concentrations of carbon dioxide recorded during ground gas monitoring; basic ground gas protection measures are required.
	Controlled Waters	Low risk of pollution of groundwater and surface water from the site.
Geotechnical Assessment	Foundation Design:	Strip / trench-fill foundations will be suitable for the site, founding at a minimum depth of 0.9m and designed based on an allowable ground bearing pressure of 200kN/m^2. Additional deepening due to the potential effects of trees on clay soils may be required.
	Floor Slabs	A ground-bearing floor slab may be used. Basic ground gas protection measures are required.
Surface Water Drainage	Soakaways are not suitable due to the presence of clay soils across the site.	

1 Introduction

1.1 Terms of Reference

1.1.1 Ecus Ltd were commissioned by J. F. Finnegan Ltd to carry out a Phase 2 Site Investigation for an area of land adjacent at Woodland Drive, Dodworth, Barnsley, South Yorkshire, hereafter referred to as 'the site'.

1.1.2 A Geo-environmental Desk Study report was produced by Ove Arup & Partners Ltd (document reference REP/REV/01, dated 10th February 2012)) for the site. Reference should be made to this report for a full description of the site layout, its surroundings, historical development, geological and hydrogeological settings etc.

1.1.3 A summary of the preliminary conceptual model from the Desk Study Report is included in Section 2 of this report. Details of the methods used in the intrusive site investigation are presented in Section 3, with the results presented in Section 4. Section 5 provides a revised conceptual model and risk assessment for the site. A geotechnical assessment is provided in Section 6. Section 7 includes conclusions and remediation recommendations. Supporting information is included in Appendices A - E.

1.1.4 Figure A1, Appendix A shows the location of the site which approximately centres on National Grid Reference 432760, 405910.

1.1.5 The site currently comprises an area of open grassed land, currently used for casual recreation including dog walking. The land is essentially featureless.

1.1.6 The land slopes gently from south to north, with a break in slope in the central area of around 2m, understood to be the site of a previous building on the site.

1.2 Objectives of the Phase 2 Investigation

1.2.1 The general objectives of the assessment are as follows:

- To provide factual data on ground conditions and soil and ground gas contamination;
- To refine the conceptual model presented in the Desk Study Report;
- To determine the risk to the identified receptors from soil, groundwater and ground gas contamination;
- To identify where remediation measures are required within the proposed development to reduce the risk of contamination to the receptors;
- To give a geotechnical assessment of the site in relation to the proposed development.

1.2.2 The assessment has been carried out in general accordance with the requirements of British Standards BS10175 (2011) – Code of Practice for the Investigation of Potentially Contaminated Sites and BS5930 (1999) – Code of Practice for Site Investigations.

1.3 Proposed Form of Development

1.3.1 It is proposed to redevelop the site with a medical centre, as shown on Figure A2.

1.3.2 This report has been produced with this end use in mind and any alteration to the development plans may result in a requirement for additional assessment.

2 Summary of the Preliminary Conceptual Model

2.1 Introduction

2.1.1 The preliminary conceptual model and risk assessment included within the Arup Desk Study Report is summarised in Table 1.

Table 1: Summary of Preliminary Conceptual Model from Desk Study Report

Sources	Pathways	Receptors
Potentially impacted made ground soils	Ingestion of dust Dermal contact with soils Inhalation of vapour	Site workers during construction Future site users
	Inhalation of dust	Site workers and site neighbours during construction Future site users
	Contact with contaminated soils	Below ground building materials
Ground gases	Accumulation of gases in confined spaces producing an asphyxiation and explosion risk	Future site users
Leachable contaminants in made ground or free phase hydrocarbons in made ground.	Downward percolation and migration	Coal Measures aquifer
Coal deposits within Coal Measures strata	Risk of spontaneous combustion if Coal exposed at ground surface during/after construction	Site workers during construction Future site users

3 The Phase 2 Site Investigation

3.1 Preparatory Works

3.1.1 Statutory utilities undertakers' plans and information showing the locations of known buried services were procured and referred to when planning the site investigation. During the site investigation, borehole locations were cleared of live electrical cables and ferrous conducting services using a calibrated cable avoidance tool (CAT scanner).

3.1.2 Permission to enter Coal Authority interests was obtained in order to drill into suspected mine workings prior to the site investigation. Ecus originally applied to drill seven boreholes on the site to a depth of 20m each, but the Coal Authority determined that drilling should be to 30m. In order to avoid additional costs to the client, the number of boreholes drilled was reduced to five.

3.2 Intrusive Investigation Works

3.2.1 The site investigation used both windowless sampling and rotary drilling methods.

3.2.2 All borehole logs are included in Appendix B of this report. The locations of the exploratory holes are indicated on Figure A2, Appendix A.

3.2.3 All exploratory holes were supervised and logged on site by experienced geo-environmental engineers employed by Ecus to British Standard BS5930:1999, *Code of Practice for Site Investigations*.

Window Sampling

3.2.4 Twenty boreholes were drilled on the site using a tracked windowless sampling rig. Window sampler boreholes WS01 to WS09 were drilled on 13th February 2012. Subsequent to this phase of site investigation, the proposed site layout changed and additional window sampler boreholes (WS10 to WS20) were drilled on 7th March 2012.

3.2.5 The window sampler boreholes were drilled at locations based upon the proposed site layout, with particular focus on the footprint of the proposed building. The boreholes were drilled to depths ranging between 0.9m and 2.9m below ground level (bgl). These were the depths at which the strength of the strata prevented further progress.

3.2.6 Ground gas monitoring wells were installed in window sampler boreholes WS02, WS04 and WS08. The other boreholes were backfilled with surplus arisings.

Rotary Boreholes

3.2.7 Five boreholes (BH01 to BH05) were drilled on the site on 7th and 8th March 2012 to a depth of 30m bgl (29.5m in BH02) using a Soilmec 400 track-mounted drilling rig.

3.2.8 The boreholes were drilled within the footprint of the proposed building. The boreholes were drilled to 30m using water flush on the instruction of the Coal Authority.

3.2.9 The rotary boreholes were sealed with cement upon completion.

3.3 On-site Assessment, Sampling and Testing

3.3.1 Visual and olfactory examination of soils recovered from window sampler boreholes was carried out to identify any evidence of contamination. The soil materials encountered were characterised and logged on site.

3.3.2 Selected soil samples were collected by hand from recovered trial pit arisings and immediately packed into clean purpose-made containers supplied by the testing laboratory. Clean disposable nitrile gloves were worn for each sample collection to prevent cross contamination between samples. The relevant sample containers

were packed into cool boxes and transported by courier to the laboratory for analysis.

3.3.3 The soil samples were selected from soil horizons at depths relevant to the objectives of developing the preliminary conceptual model and in providing a geotechnical assessment for the site. The sampling locations were selected to provide an even, representative coverage across the site.

3.4 On-site Geotechnical Testing

3.4.1 Hand shear vane tests were undertaken within clay soil samples from the window sampler boreholes in order to measure the undrained shear strength. A 19mm diameter shear vane was used. The hand shear vane readings are shown on the window sampling logs, expressed as undrained shear strength in kilopascals (kPa).

3.5 Ground Gas and Groundwater Monitoring

3.5.1 Following completion of the site investigation a ground gas and groundwater monitoring programme was initiated. The gas monitoring was undertaken using a Gas Data GFM400 portable gas analyser. The gas analyser was used to measure the concentrations of carbon dioxide, methane, oxygen and hydrogen sulphide within the borehole atmosphere, as well as the borehole gas flow and atmospheric pressure.

3.5.2 The depth to groundwater within each monitoring well was measured using an electronic dipmeter following during each gas monitoring visit.

3.5.3 At the time of issue of this report, four of the planned six gas monitoring visits have been completed.

3.6 Chemical Analysis of Soil Samples

3.6.1 Chemical analyses were conducted by Scientific Analysis Laboratories (SAL), a UKAS accredited testing laboratory, on a total of 17no. soil samples collected from the window sampler boreholes.

3.6.2 The chemical analysis suite and the number and type of samples analysed were chosen to meet the objectives of the investigation, outlined in Section 1.2. The analytical methods used are presented in the laboratory reports in Appendix C.

3.6.3 Chemical analysis was carried out on soil samples as follows:

- Screening suite (arsenic, cadmium, chromium (total), chromium (hexavalent), copper, lead, mercury, nickel, selenium, zinc, pH, water soluble sulphate and speciated polycyclic aromatic hydrocarbons (PAH)) (8no. samples);
- BRE concrete classification suite (BRE) (pH, water soluble sulphate, total sulphate, total sulphur);
- Fraction of organic carbon (FOC) (3no. sample);
- Asbestos identification (4no. samples).

Table 2: Summary of Laboratory Chemical Soil Analysis

Exploratory Hole	Depth (m)	Material	Analysis
WS01	0.1	Topsoil (MADE GROUND)	Screen, FOC
WS01	0.3	Topsoil (MADE GROUND)	Asbestos
WS02	0.1	Topsoil (MADE GROUND)	Screen
WS02	0.9	MUDSTONE	BRE
WS03	0.1	Topsoil (MADE GROUND)	Screen
WS03	0.4	Limestone gravel (MADE GROUND)	Asbestos
WS03	0.9	CLAY	BRE
WS04	0.1	Topsoil (MADE GROUND)	Screen, FOC
WS04	0.9	CLAY	BRE
WS05	0.1	Topsoil (MADE GROUND)	Screen
WS06	0.1	Topsoil (MADE GROUND)	Screen
WS06	0.25	Topsoil (MADE GROUND)	Asbestos
WS07	0.9	CLAY	BRE
WS08	0.1	Topsoil (MADE GROUND)	FOC
WS08	0.5	Clay (MADE GROUND)	Asbestos
WS09	0.1	Topsoil (MADE GROUND)	Screen
WS09	0.9	CLAY	BRE

3.6.4 Details of the analytical methodologies used are detailed on the laboratory's Certificates of Analysis, reproduced in Appendix C.

3.7 Laboratory Geotechnical Analysis of Soil Samples

3.7.1 Three soil samples were analysed for Atterberg limits and moisture content in accordance with British Standard BS1377:1990, *Methods of Test for Soils for Civil Engineering Purposes. Part 2: Classification Tests* at the UKAS accredited laboratory of Professional Soils Laboratory (PSL) Ltd, Doncaster.

3.7.2 The geotechnical laboratory analysis undertaken is summarised in Table 3.

Table 3: Summary of Geotechnical Laboratory Analysis Undertaken

Borehole	Depth (m)	Material Type	Sample Type	Analysis
WS05	0.9	CLAY	Disturbed	Atterburg limits and moisture content
WS06	0.9	CLAY	Disturbed	Atterburg limits and moisture content
WS08	0.9	CLAY	Disturbed	Atterburg limits and moisture content

3.7.3 The geotechnical laboratory testing results are presented in Appendix D.

4 Findings of the Phase 2 Site Investigation

4.1 Ground Conditions

4.1.1 Ground conditions observed within the boreholes are detailed in the logs presented in Appendix B. A summary is given below; shallow ground conditions have been summarised based on the observations from window sampler boreholes, and deeper ground conditions have been summarised based on observations from rotary borehole drilling.

4.1.2 Made ground was observed in the majority of boreholes, to depths ranging between 0.1m and 0.8m. This mainly comprised topsoil with relatively small proportions of man made materials including brick, ceramic and slag.

4.1.3 Within boreholes WS02 and WS09, made ground comprising coarse red-brown sand was recorded to depths of 0.8m and 0.35m bgl respectively. In boreholes WS03 and WS04, made ground comprising limestone hardcore overlying a thin horizon of clinker gravel was identified between 0.3m and 0.65m and 0.2m and 0.35m bgl respectively.

4.1.4 In boreholes WS05, WS08 and WS12, made ground comprising stiff reworked natural clay was encountered to depth ranging between 0.45m and 0.8m. Fragments of tarmac were noted in the clay within WS12.

4.1.5 Apparently natural topsoil was identified within boreholes WS13, WS14, WS16 and WS19, from the surface to depths ranging between 0.25m and 0.35m bgl.

4.1.6 Below made ground, natural subsoil was encountered in all boreholes, to depths ranging between 0.55m and 1.95m bgl. This comprised stiff, locally very stiff clay, originating from weathering of the underlying Coal Measures rock strata.

4.1.7 Rockhead was encountered in the majority of boreholes, to the full depth of investigation. This generally comprised very weak to weak mudstone of the Pennine Middle Coal Measures strata that are shown to underlie the site on geological maps of the area.

4.1.8 A thin seam of coal (50mm to 250mm thick) was identified within window sampler boreholes toward the east of the site at depths ranging between 1.1m and 2.4m bgl.

Rotary Drilling

4.1.9 The rotary drilling encountered intact typical Coal Measures strata (mudstone, siltstone, sandstone and coal) to the full depth of drilling.

4.1.10 Intact coal seams were identified within the boreholes; no evidence of mine workings, e.g., loss of water flush or rapid downward penetration of drilling rods, was encountered during the drilling.

4.1.11 Borehole BH02 was terminated just short of the scheduled depth, at 29.5m bgl. This was due to the strength of the sandstone at the base of the hole preventing the water flush issuing from the drilling bit.

4.2 Groundwater Observations

4.2.1 The sand made ground between 0.2m and 0.35m bgl in window sampler borehole WS09 was observed to be wet. No other evidence of groundwater seepage was observed within the window sampler boreholes.

4.2.2 The use of water flush during rotary drilling masks groundwater seepages, and therefore no groundwater observations were made within the rotary boreholes.

4.2.3 During gas monitoring following the main phase of site investigation, groundwater levels were monitored. The depths to groundwater recorded are summarised in Table 4.

Table 4: Summary of Groundwater Levels within Monitoring Wells

Borehole	Depth to Groundwater (m bgl)			
	20/02/12	28/02/12	07/03/12	14/03/12
WS02	0.15	0.10	0.09	0.20
WS04	DRY	DRY	DRY	0.90
WS08	2.63	2.64	2.62	2.65

4.2.4 It should be noted that the groundwater monitoring visit undertaken on 14th March 2012 was subsequent to the rotary drilling with water flush, which is likely to have introduced large volumes of water into shallow strata.

4.2.5 The recorded groundwater level in WS02 is very high; this is considered likely to represent surface water running off the slope and the base of the slope becoming waterlogged due to the underlying clay subsoil.

4.3 Visual and Olfactory Observations of Contamination

4.3.1 The only potential indication of contamination observed during the site investigation was a cobble of slag observed within the topsoil in borehole WS01.

4.4 Gas and Groundwater Monitoring Results

4.4.1 The gas monitoring results available at the time of writing are presented in Tables 5 to 8. The site reading of atmospheric pressure is recorded, as well as the trend in atmospheric pressure at the time of monitoring, taken from the National Physical Laboratory's online records[1]. The recorded values for borehole gas flow rate and concentrations of methane, carbon dioxide and hydrogen sulphide are the maximums. The values recorded for oxygen are the minimums. The shallow groundwater level within the monitoring well in borehole WS02 prevented gas monitoring, as the pump on the gas monitor would introduce water into the machine, causing serious damage.

Table 5: Gas and Groundwater Monitoring Results: 20th February 2012 Air Pressure = 1007mb, steady.

Monitoring Point	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Hydrogen Sulphide (ppm)	Flow Rate (l/hr)
WS02	Groundwater at shallow depth – gas monitoring not attempted.				
WS04	0.0	4.6	14.7	1	0.0
WS08	0.0	0.6	20.0	0	0.0

Table 6: Gas and Groundwater Monitoring Results: 28th February 2012 Air Pressure = 1007mb, steady.

Monitoring Point	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Hydrogen Sulphide (ppm)	Flow Rate (l/hr)
WS02	Groundwater at shallow depth – gas monitoring not attempted.				
WS04	0.0	7.8	4.5	0	0.0
WS08	0.0	1.7	18.2	0	0.0

[1] http://resource.npl.co.uk/pressure/pressure.html

Table 7: Gas and Groundwater Monitoring Results: 7th March 2012 Air Pressure = 995mb, falling.

Monitoring Point	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Hydrogen Sulphide (ppm)	Flow Rate (l/hr)
WS02	Groundwater at shallow depth – gas monitoring not attempted.				
WS04	0.0	4.0	15.5	0	0.0
WS08	0.0	2.5	11.9	0	0.0

Table 8: Gas and Groundwater Monitoring Results: 14th March 2012 Air Pressure = 1013mb, falling.

Monitoring Point	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Hydrogen Sulphide (ppm)	Flow Rate (l/hr)
WS02	Groundwater at shallow depth – gas monitoring not attempted.				
WS04	0.0	1.1	19.3	0	0.0
WS08	0.0	1.9	17.4	0	0.0

4.5 Laboratory Soil Contamination Analysis Results

4.5.1 Table 9 provides a summary of the chemical analysis results for soil samples.

Table 9: Summary of Laboratory Soil Contamination Results

Analyte	No. Samples	Minimum Value	Maximum Value
Arsenic	8	9	15
Cadmium	8	<1	<1
Chromium (total)	8	14	22
Chromium (hexavalent)	8	<1	<1
Copper	8	18	42
Lead	8	30	61
Mercury	8	<1	<1
Nickel	8	16	21
Selenium	8	<3	<3
Zinc	8	63	110
pH (units)	13	4.9	7.6
Fraction organic carbon (no units)	3	0.029	0.064
Water soluble sulphate (g/l)	13	<0.1	<0.1
Total sulphur (%)	5	<0.05	<0.05
Total sulphate (%)	5	0.02	0.05
Asbestos (identification)	4	None detected	
PAH Compounds			
Acenaphthene	8	0.01	0.16
Acenaphthylene	8	<0.01	0.04
Anthracene	8	0.01	0.10
Benzo(a)Anthracene	8	0.04	0.40
Benzo(a)Pyrene	8	0.04	0.48
Benzo(b/k)Fluoranthene	8	0.07	0.77
Benzo(ghi)Perylene	8	0.02	0.17
Chrysene	8	0.04	0.39
Dibenzo(ah)Anthracene	8	0.01	0.08
Fluoranthene	8	0.06	0.72
Fluorene	8	<0.01	0.03
Indeno(123-cd)Pyrene	8	0.02	0.19
Naphthalene	8	0.01	0.16
Phenanthrene	8	0.04	0.31
Pyrene	8	0.05	0.68
PAH (total)	8	0.44	4.6

NB - All values are concentrations are in mg/kg unless otherwise stated.

4.6 Field Geotechnical Testing Results

Hand Shear Vane Tests

4.6.1 The results of hand shear vane tests undertaken on clay soils recovered from window sampler boreholes are shown on the logs included in Appendix B. The measured undrained shear strength results for natural clay at the site vary between 58kPa and 132kPa.

4.6.2 The undrained shear strength readings taken during the site investigation are normally distributed, with a mean value of 92kPa.

4.7 Laboratory Geotechnical Testing Results

4.7.1 Laboratory geotechnical testing results and certificates are presented in Appendix D. A summary of the results is presented in Table 10.

Table 10: Summary of Geotechnical Laboratory Analysis Results

Sample	Moisture Content	Plasticity Index	Material Passing 425µm sieve (%)
WS05, 0.9m	23	33	100
WS06, 0.9m	18	25	100
WS08, 0.9m	26	22	80

5 Revised Conceptual Model and Risk Assessment

5.1 Introduction

5.1.1 The preliminary conceptual model presented in Section 2 of this report identified potential receptors for contaminants that may be present at the site. The actual risks to each of these receptors have been assessed based on observed site data in the following sections.

5.2 Risks to Site End Users

5.2.1 This assessment of risk to human health associated with long-term exposure to contaminants in soil has been undertaken assuming that the critical receptors for contaminants will be workers on the site following redevelopment.

5.2.2 Defra and the Environment Agency are responsible for publishing guidance for the assessment of risks to human health associated with chronic (long-term) exposure to contaminated soils. In August 2008, the majority of the existing guidance (the CLR Series of reports) was withdrawn. In the CLR Series, for a number of contaminants, and a number of standard land uses, Defra and the Environment Agency had published soil guideline values (SGVs), for use in the assessment of risks associated with long-term exposure to contaminants in soil.

5.2.3 The SGVs and the associated technical algorithms and supporting documentation were all withdrawn in August 2008. They have now been replaced by new guidance[2,3,4] supported by a new software model (the Contaminated Land Exposure Assessment (CLEA) model, version 1.06) which was published in September 2009. Practitioners were advised to calculate new site-specific guideline values or Site Specific Assessment Criteria (SSAC) for assessing risks to human health and to cease use of the withdrawn SGVs.

5.2.4 At the time of writing, new SGVs and associated toxicity data have been published for arsenic, cadmium, mercury, nickel, selenium, benzene, toluene, ethylbenzene, xylene, phenol and dioxins only. Practitioners are advised by Defra and the Environment Agency to calculate new SSAC for assessing risks to human health from other contaminants, where sufficient toxicological data is available.

5.2.5 The calculation of SGVs or SSAC is reliant on toxicological data relating to the impact of contaminants on human health. Defra and the Environment Agency are also responsible for providing these toxicological data. According to the current guidance, the methods for calculating toxicity data have been altered, but as yet, only toxicity data for the contaminants listed above have been published.

5.2.6 In the absence of SGVs or toxicity data for a significant number of contaminants, including potential contaminants of concern for the site, alternative sources of toxicity and physicochemical data have been selected for use in the assessment.

5.2.7 The Chartered Institute of Environmental Health (CIEH) and LQM[5] have published toxicological and physicochemical data for a range of contaminants not currently

[2] Environment Agency, 2009. Science Report SC050021/SR2: *Human health toxicological assessment of contaminants in soil.*
[3] Environment Agency, 2009. Science Report SC050021/SR3: *Updated technical background to the CLEA model.*
[4] Environment Agency, 2009. Science Report SC050021/SR4: *CLEA Software (Version 1.05) Handbook.*
[5] Nathanail, P., et al., 2009. The LQM / CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition). Land Quality Press, Nottingham.

covered by the Environment Agency's published data, as well as generic assessment criteria (GAC) calculated using the data and the CLEA model.

5.2.8 Lead, which is a potential contaminant of concern at the site, is not covered either within the Environment Agency's publications, or within the LQM / CIEH documentation. Therefore, we have used the former SGVs[6] produced by Defra and the Environment Agency in this assessment, as lead is a contaminant of potential concern for the site, but no replacement authoritative soil toxicity data has been published to the public domain.

Conceptual Exposure Model

5.2.9 There are several potential exposure pathways by which site users may be exposed to concentrations of contaminants in soil. These exposure pathways, coupled with information about the current and feasible future use of the site (exposure frequency, age class of users etc.), combine to form a conceptual exposure model for each of the contaminants identified as potentially significant.

5.2.10 In the CLEA version 1.06 model, the commercial land use scenario is assumed to consist of a three-storey office building at which employees spend most time indoors and are involved in office-based or light physical work. The standard critical receptor is assumed to be a working female adult (aged 16-65 years old) with an exposure duration of 49 years.

5.2.11 It is considered that the proposed site use conforms satisfactorily to the commercial land use scenario described within SR3, and the SGVs for commercial use have therefore been used to assess this site.

5.2.12 An initial assessment of the risks to site end users has been carried out for determinants where no SGV exists using the relevant GAC (commercial / industrial).

5.2.13 The recorded fraction of organic carbon (FOC) values recorded in topsoil samples taken from the site range between 0.029 and 0.064, equivalent to a range of soil organic matter (SOM) values of 5.0% to 11.1%.

5.2.14 Therefore, SGVs and GAC based on a moderately conservative SOM concentration of 6% have been adopted for use within this risk assessment.

Initial Screening of Risks to Future Site Users

5.2.15 An initial assessment of the risks to site end users has been carried out using the adopted assessment criteria and is presented in Table 11. In the first instance, maximum concentrations of contaminants which have the potential to affect human health have been compared to the adopted assessment criteria.

5.2.16 The maximum concentration of each contaminant is also stated in Table 11. Where the maximum concentration of a contaminant is less than the adopted assessment criteria, it can be stated with an appropriate degree of confidence that there is a low risk of active contaminant linkages between that contaminant within site soil and future site users, and that further assessment is not necessary.

5.2.17 Where the maximum concentration of a contaminant is below the laboratory detection limit as stated within Table 9, it is considered that, by inspection, this would be below the relevant screening criteria and not a potential risk to human health, and is not included within Table 11.

[6] Defra and the Environment Agency, 2002. Soil Guideline Values for Lead Contamination in Soils.

Table 11: Assessment of Risks to Human Health following Redevelopment

Analyte	SGV / GAC (mg/kg)	Max. conc. (mg/kg)	Is the Maximum Concentration Greater than the SSAC? Is Further Assessment Required?
Arsenic	640	15	No
Chromium (total)	30,400	22	
Copper	71,700	42	
Lead	750	61	
Nickel	1,800	21	
Zinc	665,000	110	
PAH Compounds			
Acenaphthene	100,000	0.16	No
Acenaphthylene	100,000	0.04	
Anthracene	540,000	0.10	
Benzo(a)anthracene	97	0.40	
Benzo(a)pyrene	14	0.48	
Benzo(b/k)fluoranthene	100*	0.77	
Benzo(ghi)perylene	660	0.17	
Chrysene	140	0.39	
Dibenzo(a)anthracene	13	0.08	
Fluoranthene	23,000	0.72	
Fluorene	71,000	0.03	
Indeno(123-cd)pyrene	62	0.19	
Naphthalene	432	0.16	
Phenanthrene	23,000	0.31	
Pyrene	54,000	0.68	

* SSAC for benzo(b)fluoranthene.

Summary

5.2.18 From Table 11, it can be seen that the maximum concentrations of all contaminants analysed for are less than the adopted screening values.

5.2.19 No asbestos fibres were identified within the samples analysed.

5.2.20 It is therefore concluded that there is a low risk to human health from soil contamination following redevelopment, and that no remediation measures are required.

5.3 Risks from Hazardous Ground Gases

5.3.1 Guidance produced by CIRIA[7] details good practice for the investigation, monitoring and assessment of the hazardous ground gas regime of a site. It advocates an approach that involves the calculation of Gas Screening Values (GSVs), which are calculated by multiplying the borehole flow rate of gas by the percentage concentration of gas recorded. The GSVs are calculated for both methane (CH_4) and carbon dioxide (CO_2). Where no flow has been measured, the guidance stipulates that the limit of detection for flow rate is used (in this case, 0.1 litre/hour).

5.3.2 The calculated GSVs for a given site can subsequently be compared against a series of comparative values. For proposed non-residential buildings, the 'Characteristic Situation' risk assessment system described within CIRIA Report C665 is the used.

5.3.3 Table 12 presents the maximum recorded methane, carbon dioxide and flow results from the gas monitoring undertaken to date, and calculates the GSVs for each

[7] Wilson, S., et al., 2007. CIRIA Report C665. *Assessing risks posed by hazardous ground gas to buildings.* CIRIA, London.

borehole during the gas monitoring programme. The worst case GSV is then compared with the limits in the 'Characteristic Situation' assessment system, in order to determine the appropriate risk classification.

Table 12: Calculation of Gas Screening Values (GSVs)

Monitoring Point	Maximum CH_4 Concentration (%)	Maximum CO_2 Concentration (%)	Maximum Flow (l/hr)	Maximum CH_4 GSV (l/h)	Maximum CO_2 GSV (l/h)
WS04	0.0	7.8	0.0	0.0	0.0078
WS08	0.0	2.5	0.0	0.0	0.0025

5.3.4 Based on the maximum concentration of carbon dioxide being greater than 5%, the ground gas regime on the site should be classified as Characteristic Situation 2.

5.3.5 Although there is no published guidance on assessing the risk from hydrogen sulphide ground gas emissions, the maximum concentration recorded was 1ppm, and this is considered unlikely to present any risk than those summarised above.

5.3.6 Basic ground gas protection measures will therefore be required for the new building. These are described in the Section 6.3 of this report.

5.3.7 The Desk Study report identified that although the site was in an area where between 1% and 3% of homes are above the radon action level, radon protection measures were not required for new buildings on the site.

5.3.8 The above calculations are based on three gas monitoring visits undertaken to date; they are subject to amendment upon completion of the gas monitoring programme.

5.4 Risks to Human Health from Contamination of Water Mains

5.4.1 Yorkshire Water require that new water mains be laid in proprietary barrier pipes (aluminium-skinned, e.g., Protectaline) where the concentration of either TPH or total PAH in soils is greater than 100mg/kg.

5.4.2 No soil samples had total concentrations of the specified PAH compounds greater than 100mg/kg.

5.4.3 Taking into consideration Yorkshire Water's rules, barrier pipes are not considered necessary at the site.

5.5 Risks to Controlled Waters

5.5.1 From a review of the data contained within the Desk Study report, it has been determined that there are no surface water courses within 250m of the site, and no surface water or groundwater abstraction activities within 500m of the site.

5.5.2 The Coal Measures strata underlying the site are classified as a minor aquifer.

5.5.3 Taking into account the low sensitivity of the site in relation to controlled waters receptors and the low level of contaminants recorded within site soils, it is considered that the risk to controlled waters from any contamination arising at the site is very low.

5.6 Risks to Future Site Buildings

5.6.1 Based on the guidance given in BRE Special Digest 1[8], the site has been classified as Brownfield, with Mobile groundwater conditions.

[8] BRE Special Digest 1– Concrete in Aggressive Ground. 2005.

5.6.2 Calculations using the recorded total sulphur and acid-soluble sulphate concentrations in soil indicate that pyritic ground is not present.

5.6.3 All water soluble sulphate results in soil were less than 100mg/l; the lowest pH value was 4.9. Based on these values, the site has been classified as being within Design Sulphate class DS-1 and Aggressive Chemical Environment for Concrete (ACEC) class AC-3z.

5.7 Revised Conceptual Model

5.7.1 The preliminary conceptual model produced within the Desk Study Report and summarised in Section 2 of this report has been refined based on the ground investigation data and risk assessments as detailed above to produce a revised conceptual model for the site following redevelopment. The revised conceptual model for potential contaminant linkages involving organic and inorganic contaminants is summarised in Tables 13 and 14 respectively.

5.7.2 The key to Tables 13 and 14 is as follows:

KEY: LOW – potential risks associated with the presence of the contaminant linkage are low and further assessment / remediation is not considered necessary.

MOD – potential risks associated with the presence of the contaminant linkage are moderate and further assessment / remediation should be considered.

HIGH – potential risks associated with the presence of the contaminant linkage are high and further assessment / remediation is considered necessary.

N/A – the contaminant has no potential to affect the receptor.

Table 13: Summary Revised Conceptual Model and Risk Assessment - Organic Contaminants

Receptors and pathways	PAH	Carbon Dioxide & Methane	Notes
Human Health			
Dermal contact with soil.	LOW	N/A	PAH compounds are present in concentrations lower than the adopted screening values.
Intake via direct ingestion of soil and contaminated dusts indoors and outdoors	LOW	N/A	
Intake via inhalation of soil vapours / gases indoors and outdoors.	LOW	MOD	Moderately elevated concentrations of carbon dioxide have been recorded during gas monitoring undertaken to date.
Buildings			
Ingestion of water from affected underground service pipes.	LOW	N/A	Organic contaminants have been recorded in concentrations less than Yorkshire Water's trigger values.
Concrete foundations.	LOW	N/A	No gross organic soil contamination is present.
Controlled Waters			
Migration to groundwater	LOW	N/A	Concentrations of contaminants at the site are low and there are no sensitive controlled waters receptors in vicinity to the site.
Migration to surface water	LOW	N/A	

Table 14: Summary Revised Conceptual Model and Risk Assessment - Inorganic Contaminants

Receptors and pathways	Heavy Metals	Sulphates	Asbestos	Acids	Notes
Human Health					
Dermal contact with soil.	LOW	LOW	LOW	LOW	The concentrations of heavy metals within site soils are below the adopted screening values.
Intake via direct ingestion of soil and contaminated dusts indoors and outdoors.	LOW	LOW	LOW	LOW	
Intake via inhalation of soil vapours / gases indoors and outdoors.	LOW	N/A	N/A	N/A	No asbestos was recorded within site soils.
Buildings					
Ingestion of water from affected underground service pipes.	N/A	N/A	N/A	LOW	Low sulphate concentrations but acidic ground conditions have been encountered.
Concrete foundations	N/A	LOW	N/A	MOD	
Controlled Waters					
Migration to groundwater	LOW	LOW	N/A	LOW	Concentrations of contaminants at the site are low and there are no sensitive controlled waters receptors in vicinity to the site.
Migration to surface water	LOW	LOW	N/A	LOW	

5.8 Summary Revised Risk Assessment

Human Health – Exposure to Contaminated Soils

5.8.1 The risk to human health from exposure to contaminated soils following redevelopment is low and remedial measures are not necessary.

Human Health – Ground Gases

5.8.2 Based on the results of the ground gas monitoring programme undertaken to date, the ground gas regime at the site is classified as Characteristic Situation 2, which is a low to moderate ground gas risk, and therefore basic ground gas protection measures are required.

Controlled Waters

5.8.3 The findings of the site investigation indicate that the risk of pollution from the site to groundwater and surface water is low.

6 Geotechnical Assessment

6.1 Mining and Mineral Extraction

6.1.1 A Coal Authority Mining Report was obtained for the site; a copy is included within Appendix E. The findings of the report are summarised as follows:

- The site is within the likely zone of influence from workings in 7 seams of coal from shallow depth (≤30m) to 330m bgl, last worked in 1970;
- The site is not within the likely zone of influence of any current or planned coal mine workings;
- There are no known mine entries within the site;
- There are no records of damage or subsidence at the site resulting from coal mining.

6.1.2 Due to there being potential recorded shallow coal mine workings below the site, rotary drilling was undertaken to identify any evidence of instability due to abandoned workings.

6.1.3 Several intact coal seams were identified within the boreholes. The rotary boreholes drilled did not encounter any evidence of coal mine workings or broken ground / voids.

6.1.4 It is therefore concluded that the risk of instability at the surface from abandoned coal mine workings is low, and that no specific mitigation measures are necessary.

6.1.5 The shallowest depth at which coal was encountered was 1.1m, within borehole WS04. Within the window sampler boreholes drilled in the footprint of the proposed building, the shallowest depth that coal is found is 1.5m bgl. The shallow coal seam below the proposed building is thin, being a maximum of 200mm. It is therefore considered that the risk from spontaneous combustion of the shallow coal seam is low.

6.1.6 The Desk Study report does not indicate that the site stability may be affected by extraction of any other minerals.

6.2 Foundation Design

6.2.1 Strip / trench-fill foundations will be suitable for the proposed building. The foundations should penetrate through made ground and found wholly within undisturbed natural stiff clay or mudstone. If coal is encountered within a foundation excavation, it should be deepened to found within clay or mudstone.

6.2.2 Assuming a clay soil undrained shear strength of 85kN/m^2, a foundation width of 500mm and depth of 900mm, an allowable bearing pressure of 200kN/m^2 may be assumed.

6.2.3 Plasticity index testing of clay soil samples from the site has identified that this material may change in volume in response to variations in soil water content caused by both seasonal effects and the actions of existing and future trees and shrubs.

6.2.4 In the absence of prescriptive guidance for non-residential buildings, for the purposes of assessing the potential volume change effects on clay soils from trees, the guidance within NHBC Standards Chapter 4.2, *Building near Trees* has been used in this instance, as it is the most comprehensive and widely used assessment system available.

6.2.5 Based on the laboratory plasticity index testing, the clay soils have had their volume change potential classified in accordance with the NHBC Standards, as summarised within Table 15.

Table 15: Assessment of Plasticity Index Analysis Results

Sample	Plasticity Index	Retained on 425µm sieve (%)	Modified Plasticity Index	NHBC Volume Change Potential
WS05, 0.9m	33	100	33	Medium
WS06, 0.9m	25	100	25	Medium
WS08, 0.9m	22	80	18	Low

6.2.6 Clay soils on the site have therefore been classified as having Medium volume change potential. From the NHBC standards, the minimum founding depth within clay soils would be 0.9m.

6.2.7 There are trees on the site boundary in proximity to the proposed building and a tree that will require removal within the footprint of the building. Therefore, deepening of foundations will be required in accordance with the guidance given in the NHBC Standards or other assessment systems.

6.2.8 The mudstone rock below the site is not susceptible to volume change, and where foundations are deepened due to the effects of previous or future tree or shrub planting, the depth should be no more than 150mm into the rock.

6.3 Ground Floor Slab Design

6.3.1 Along the south-eastern face of the proposed building, where the requirement for deepening due to existing trees or hedges is likely to be greatest, mudstone is present at depths of 1.5m or less. Therefore, heave protection is not required for ground floors and a ground-bearing floor slab may be used following stripping of topsoil.

6.3.2 Basic ground gas protection measures are required within the ground floor slab construction. Based on the findings of the ground gas monitoring undertaken to date, ground gas protection measures should comprise either a reinforced concrete cast in situ floor slab with at least 1200g damp-proof membrane (DPM) or a beam and block or pre-cast concrete slab and minimum 2000g DPM or reinforced gas membrane (resistant to carbon dioxide).

6.3.3 For either option, all joints and penetrations in the floor slab should be sealed with proprietary tape and 'top-hat' units to prevent gas ingress. Wall cavities should be sealed with cavity trays.

6.3.4 The membrane manufacturer's installation instructions should be followed in all cases.

6.3.5 These are interim recommendations that are subject to completion of the gas monitoring programme at the end of March 2012.

6.4 Surface Water Drainage

6.4.1 The site is underlain by low permeability clay. It is therefore considered that soakaways are not suitable for surface water disposal on the site.

7 Conclusions and Recommendations

7.1 Conclusions

Ground Conditions

- Made ground (primarily topsoil) was recorded to a maximum depth of 0.65m bgl.
- Natural subsoil comprising stiff clay was encountered in all exploratory holes, to depths ranging between 0.55m and 1.95m bgl.
- Rockhead comprising mudstone was encountered in the majority of boreholes.
- Rotary drilling proved intact Coal Measures strata (mudstone, siltstone, sandstone and coal) to a depth of 30m bgl.
- Groundwater was not encountered during the intrusive site investigation; groundwater monitoring indicates that there is not a continuous shallow groundwater table below the site.

Abandoned Coal Mine Workings

- No evidence of abandoned mine workings was encountered within rotary boreholes drilled to 30m below ground level, and therefore the risk of instability from coal mining features is considered to be low.

Soil, Groundwater and Ground Gas Contamination

- The risk to human health from exposure to contaminated soils following redevelopment is low; remediation is not required in this respect.
- Moderately elevated concentrations of carbon dioxide have been recorded during ground gas monitoring and basic ground gas protection measures are required.
- The risk of pollution from the site to groundwater and surface water is low.

Geotechnical Assessment

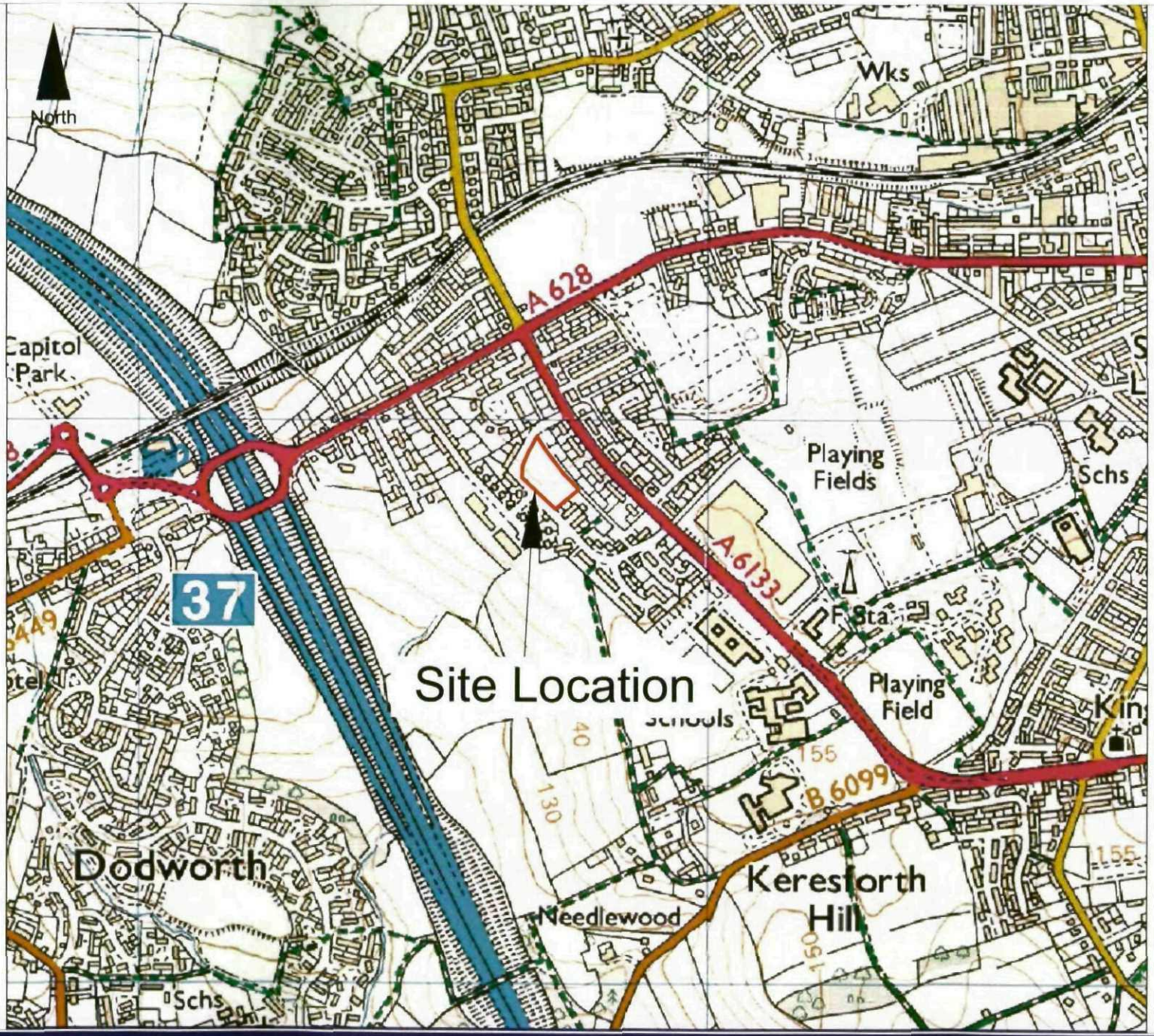
- No stabilisation measures are required with respect to abandoned coal mine workings.
- Strip / trench-fill foundations should be suitable for the low-rise building proposed for the site.
- The minimum foundation depth should be 0.9m below ground level. Additional deepening of foundations due to the potential effects of trees and shrubs on clay soils may be required.
- A ground-bearing floor slab may be used following stripping of topsoil.
- Soakaways are not suitable on the site, due to the presence of clay soils across the site.

7.2 Recommendations

7.2.1 The only remediation that is required is provision of ground gas protection measures, as described within Section 6.3 of this report. These recommendations are subject to review upon completion of the ongoing gas monitoring programme at the end of March 2012.

Appendix A: Figures

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ecus
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Phase1 & 2 Site Investigation

Dodworth, Barnsley

Job No. 2957

Site Location Plan

Brook Holt ■ Blackburn Road ■ Sheffield ■ S61 2DW
■tel: 0114 266 9292 ■ www.ecusltd.co.uk

Ordnance Survey © Crown Copyright (2012). All rights reserved. License number 100018619

Date: March 2012 | Not to Scale | Figure: A1



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ENVIRONMENTAL CONSULTANTS

KEY

WS01 — Window sampling location

WS01 — Window sampling location with gas monitoring installation

BH01 — Rotary borehole location

Phase1 & 2 Site Investigation

Dodworth, Barnsley

Job No. 2957

Exploratory Hole Location Plan

Brook Holt ■ Blackburn Road ■ Sheffield ■ S61 2DW
■tel: 0114 266 9292 ■ www.ecusltd.co.uk

Date: March 2012 | Scale: 1:500 @ A3 | Figure: A2

Appendix B: Borehole Logs

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ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS01
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	13-02-12 13-02-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.40)	MADE GROUND: Grass over sandy slightly gravelly topsoil with occasional lime fragments and an angular slag cobble. Gravel is medium to coarse subangular sandstone and fine coal.		
0.30	D					0.40			
							Stiff light orange-brown and light grey CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
						(1.30)			
1.10	HSV	105kPa							
1.30	HSV	110kPa							
1.50	HSV	100kPa							
						1.70			
							Very weak grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.50)			
						2.20			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS02
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	13-02-12 13-02-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.20) 0.20	MADE GROUND: Grass over clayey slightly gravelly topsoil with occasional lime fragments. Gravel is fine angular coal and coarse angular brick. Wet.		
0.25	D					(0.20) 0.40	MADE GROUND: Coarse red-brown sand.		
						(0.15) 0.55	Stiff orange-brown and grey CLAY with mudstone lithorelicts. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.90	D					(0.85)	Very weak to weak grey-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						1.40			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Ground gas monitoring well installed (50mm diameter).

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS03
Job No: 2957	Date: 13-02-12 13-02-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.30)	MADE GROUND: Grass over clayey slightly gravelly topsoil. Gravel is subangular fine coal and medium to coarse angular limestone.		
						0.30			
0.40	D					(0.30)	MADE GROUND: Sandy light pinkish-white subangular and angular fine to medium linestone gravel.		
						0.60			
						0.65	MADE GROUND: Black sandy subrounded to subangular fine to medium clinker gravel.		
0.80	HSV	62kPa					Stiff light grey and light orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.90	D								
						(0.95)			
1.20	HSV	95kPa							
1.40	HSV	114kPa							
						1.60			
						(0.30)	Very weak blue-grey and orange-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						1.90			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS04
Job No: 2957	Date: 13-02-12 13-02-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.20) 0.20	MADE GROUND: Grass over clayey slightly gravelly topsoil. Gravel is fine angular brick, fine subangular coal and medium angular limestone.		
0.25	D					0.30	MADE GROUND: Sandy light pinkish-white subangular and angular fine to medium linestone gravel.		
						0.35	MADE GROUND: Black sandy subrounded to subangular fine to medium clinker gravel.		
0.55	HSV	88kPa					Stiff orange-brown and dark brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
0.65	HSV	118kPa				(0.75)			
0.80	HSV	132kPa							
0.90	D								
0.95	HSV	118kPa				1.10			
						(0.25) 1.35	COAL. Shaley but bright in places. [POSSIBLY DUNSIL COAL]		
						1.45	Very stiff light grey CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
						(0.55) 2.00	Very weak light grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES STRATA]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Gas monitoring well installed in borehole (50mm diamater).

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS05
Job No: 2957	Date: 13-02-12 13-02-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.20) 0.20	MADE GROUND: Clayey slightly gravelly topsoil. Gravel is coarse subangular sandstone, fine subangular coal and fine angular brick.		
0.25	D					(0.25) 0.45	MADE GROUND: Stiff slightly sandy slightly gravelly dark orange-brown clay. Gravel is coarse subangular sandstone, fine subangular coal and fine angular brick.		
0.70	HSV	76kPa				(1.30) 1.75	Stiff light grey and light orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
0.85	HSV	87kPa							
0.90	D								
0.95	HSV	87kPa							
						(0.25) 2.00	Very weak to weak dark brown and dark grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES STRATA]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS06
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	13-02-12 13-02-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.25) 0.25	MADE GROUND: Grass over clayey slightly gravelly topsoil. Gravel is coarse subrounded quartz.		
0.30	D					0.35	... gravelly and damp at 0.25m. Gravel is fine subangular and angular brick and medium angular limestone.		
0.50	HSV	68kPa				(0.65)	Stiff light grey and light orange-brown CLAY with mudstone lithorelics. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
0.90	D					1.00			
						(0.20) 1.20	... with some medium subangular sandstone gravel below 1.0m.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS07
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	13-02-12 13-02-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.30)	MADE GROUND: Grass over slightly clayey slightly gravelly topsoil with one angular sandstone cobble. Gravel is medium angular coal.		
0.20	D					0.30			
0.40	HSV	80kPa					Stiff light orange-brown and light grey CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
0.55	HSV	78kPa				(0.50)			
0.70	HSV	62kPa				0.80			
0.80	HSV	85kPa					... with mudstone lithorelics below 0.8m.		
0.90	D					(0.40)			
						1.20			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS08
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	13-02-12 13-02-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.45) 0.45	MADE GROUND: Grass over slightly clayey slightly gravelly topsoil. Gravel is fine rounded quartz and fine subangular coal.		
0.50	D					(0.35) 0.80	MADE GROUND: Firm slightly gravelly brown clay with plastic bag fragments. Gravel is coarse subangular clinker and brick.		
0.90	D					(0.20) 1.00	Stiff dark reddish-grey CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
1.20	HSV	95kPa				(0.90) 1.90	Stiff to very stiff grey-brown and orange-brown CLAY with mudstone lithorelics and fine gravel coal particles. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
1.45	HSV	98kPa							
1.65	HSV	112kPa							
						(0.90) 2.80	Weak to very weak grey and grey-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES STRATA]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater encountered during drilling.
3. Ground gas monitoring well installed in borehole (50mm diamater).

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS09
Job No: 2957	Date: 13-02-12 13-02-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.20) 0.20	MADE GROUND: Grass over slightly clayey slightly gravelly topsoil. Gravel is fine subangular coal and brick.		
						(0.15) 0.35	MADE GROUND: Fine to medium red-brown sand (builder's sand).		
0.45	HSV	85kPa				(0.45) 0.80	Stiff to very stiff light grey-brown and light orange-brown CLAY with occasional coal gravel. [WEATHERED PENNINE MIDDLE COAL MEASURES STRATA]		
0.65	HSV	105kPa							
0.80	HSV	108kPa				(0.50) 1.30	... with mudstone lithorelics from 0.8m.		
0.90	D								
						(0.40) 1.70	Very weak light grey-brown and dark brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES STRATA]		

Boring Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater seepage encountered (made ground wet between 0.2m and 0.35m.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS10
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	07-03-12 07-03-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.30) 0.30	MADE GROUND: Claeyey slightly gravelly topsoil. Gravel is fine to medium subangular coal and mudstone.		
0.75	HSV	72kPa				(0.60)	Stiff pale grey and orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.80	HSV	82kPa				0.90			
0.90	HSV	110kPa				(0.60) 1.50	Stiff dark grey-brown CLAY with mudstone lithorelics. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.70) 2.20	Very weak to weak weathered dark grey-brown MUDSTONE with ironstone nodules. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.20) 2.40	Very weak light grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.20) 2.60	COAL - shaley, bright in places. [POSSIBLY DUNSIL COAL]		
						(0.30) 2.90	Very weak light grey-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS11
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	07-03-12 07-03-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.20) 0.20	Possibly MADE GROUND: Clayey slightly gravelly topsoil. Gravel is fine subrounded coal with rare medium subrounded ironstone.		
0.65	HSV	82kPa					Stiff light grey and light orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.80	HSV	92kPa				(1.40)			
0.95	HSV	77kPa							
1.15	HSV	72kPa							
						1.60			
						(0.35)	Very weak weathered grey-brown MUDSTONE with occasional partings of weak black shale / mudstone. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						1.95			
						2.00	Shaley COAL. [POSSIBLY DUNSIL COAL]		
						(0.50)	Very weak light grey MUDSTONE. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
						2.50			
						2.60	... becoming weak at 2.5m.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS12
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.40) 0.40	MADE GROUND: Slightly clayey slightly gravelly topsoil. Gravel is fine subangular brick and coal.		
						(0.20) 0.60	MADE GROUND: Stiff light grey-brown and orange-brown clay with tarmac fragments at 0.5m.		
0.75	HSV	88kPa					Stiff light grey-brown and orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.85	HSV	72kPa							
0.95	HSV	68kPa				(0.80)			
1.20	HSV	75kPa							
						1.40			
						1.50	Very weak dark grey-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						1.57	Shaley COAL. [POSSIBLY DUNSIL COAL]		
						(0.23) 1.80	Stiff light grey and yellow-grey CLAY with mudstone lithorelics. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.50) 2.30	Very weak light grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.20) 2.50	Weak bluish-grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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3 Blackburn Road
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BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS13
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA					
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(0.25) 0.25	Clayey TOPSOIL.		
0.60	HSV	95kPa				(0.75) 1.00	Stiff grey-brown and orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.75	HSV	112kPa							
0.90	HSV	112kPa							
						(1.00) 2.00	Very weak light grey-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS14
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.25) 0.25	Clayey slightly gravelly TOPSOIL. Gravel is fine subangular coal.		
0.50	HSV	120kPa				(0.65) 0.90	Stiff grey-brown and orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.60	HSV	108kPa							
0.70	HSV	95kPa							
0.90	HSV	88kPa				(0.30) 1.20	... with mudstone lithorelics from 1.2m.		
						(0.50) 1.70	Very weak dark orange-brown and grey-brown MUDSTONE with occasional partings of weak black shale / mudstone. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						1.77	COAL - shaley and dusty, bright in places. [POSSIBLY DUNSIL COAL]		
						(0.23) 2.00	Weak light bluish-grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS15
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.23) 0.23	MADE GROUND: Clayey topsoil with one ceramic fragment.		
0.50	HSV	124kPa					Stiff orange-brown and orange-grey CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.60	HSV	88kPa							
0.70	HSV	88kPa				(1.27)			
1.20	HSV	105kPa				1.50			
						(0.20) 1.70	Very weak light-grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						1.80	... becoming weak at 1.7m.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS16
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.30) 0.30	Slightly sandy slightly gravelly TOPSOIL. Gravel is medium subangular sandstone and subrounded ironstone.		
						(0.20) 0.50	Stiff dark grey-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.70	HSV	94kPa					Stiff light grey and orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.80	HSV	80kPa				(0.70)			
0.95	HSV	95kPa				1.20			
						(0.35) 1.55	... with mudstone lithorelics from 1.2m.		
						1.62	COAL - bright, slightly shaley. [POSSIBLY DUNSIL COAL]		
						(0.33) 1.95	Stiff dark grey CLAY with mudstone lithorelics. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
						2.00	Weak bluish-grey and yellow-grey MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS17
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.30) 0.30	MADE GROUND: Clayey topsoil with occasional angular brick gravel.		
0.50	HSV	94kPa				(0.80) 1.10	Stiff grey and light orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.65	HSV	89kPa							
						(0.90) 2.00	Very weak grey-brown and dark brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS18
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	07-03-12 07-03-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	D					(0.30) 0.30	MADE GROUND: Clayey topsoil with one brick cobble and occasional medium rounded quartz gravel.		
						(0.15) 0.45	Stiff grey-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.60	HSV	83kPa				(0.45) 0.90	Stiff grey-brown and light grey CLAY with mudstone lithorelics. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.90	HSV	109kPa				(0.30)	... with partings of coal between 0.9m and 1.2m.		
1.15	HSV	89kPa				1.20 1.30			
						(0.40) 1.70	... with mudstone lithorelics from 1.2m.		
						(0.30) 2.00	Very weak grey-brown and dark brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS19
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	07-03-12 07-03-12			
Method/Plant Used				Sheet
Archway Competitor Dart windowless sampling rig				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(0.35) 0.35	Clayey slightly sandy TOPSOIL.		
						0.40	Stiff light grey-brown and orange-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
						0.50	... with subangular sandstone cobbles between 0.4m and 0.5m.		
						(0.20) 0.70			
0.70	HSV	88kPa				0.80	... with coal partings between 0.7m and 0.8m.		
0.80	HSV	92kPa				(0.15) 0.95			
						(0.60) 1.55	Very weak pale blue-grey and dark brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						(0.20) 1.75	COAL - dusty, bright in places. [POSSIBLY DUNSIL COAL]		
						(0.25) 2.00	Stiff pale grey and yell-brown CLAY with mudstone lithorelics.		

Boring Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client J F Finnegan	Contractor Exploration Ltd	Logged By AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

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Brook Holt
3 Blackburn Road
Sheffield S61 2DW

BOREHOLE LOG

Project				HOLE No
Land off Woodland Drive, Dodworth, Barnsley				WS20
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Archway Competitor Dart windowless sampling rig				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						0.10	Possibly MADE GROUND: Clayey topsoil with occasional fine coal gravel.		
							Firm grey-brown CLAY. [WEATHERED PENNINE MIDDLE COAL MEASURES FORMATION]		
0.40	HSV	65kPa				(0.60)			
0.50	HSV	58kPa				0.70			
						(0.20)	Weak grey-brown MUDSTONE. [PENNINE MIDDLE COAL MEASURES FORMATION]		
						0.90			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

GENERAL REMARKS

1. Borehole terminated due to strength of strata.
2. No groundwater observed during drilling.
3. Borehole backfilled with arisings.

All dimensions in metres Scale 1:18.75	Client: J F Finnegan	Contractor: Exploration Ltd	Logged By: AMG

ECUS WINDOW SAMPLE LOG AG WORKING 2957.GPJ NEW.GDT 7/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

OPENHOLE LOG

ecus ENVIRONMENTAL CONSULTANTS

Project				OPENHOLE No
Land off Woodland Drive, Dodworth, Barnsley				BH01
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Soilmec 400 rotary drilling rig				Sheet: 1 of 1

RUN DETAILS			STRATA						
Depth / Date	Time Min/m	Flush %	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION Flush	Detail	Main	Geology / Instrument/ Backfill
					0.30			Clayey TOPSOIL.	
					(1.90)			Brown CLAY.	
					2.20				
					2.40			Black COAL.	
								Interbedded MUDSTONE & SANDSTONE.	
					(9.20)				
					11.60				
					11.90			Dark grey MUDSTONE with traces of coal.	
					13.20			MUDSTONE.	
					13.60			Black COAL.	
								Interbedded MUDSTONE & SANDSTONE.	
					(15.20)				
					28.80				
					29.10			Dark grey MUDSTONE.	
					30.00			MUDSTONE.	

Drilling Progress and Water Observations

Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing

GENERAL REMARKS

1. Borehole drilled using water flush.
2. Stable during drilling.
3. Terminated at scheduled depth.
4. Backfilled with cement.

All dimensions in metres Scale 1:200	Client: J F Finnegan	Contractor: Sirius Drilling Services	Logged By: AL

OPENHOLE 2957.GPJ NEW.GDT 12/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

OPENHOLE LOG

ecus ENVIRONMENTAL CONSULTANTS

Project				OPENHOLE No
Land off Woodland Drive, Dodworth, Barnsley				BH02
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Soilmec 400 rotary drilling rig				Sheet: 1 of 1

RUN DETAILS			STRATA						
Depth Date	Time Min/m	Flush %	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION Flush	Detail	Main	Geology / Instrument/ Backfill
					0.30			Clayey TOPSOIL.	
					(1.70) 2.00			Brown CLAY.	
					2.50			MUDSTONE.	
					2.80			Black COAL.	
					(9.90)			MUDSTONE.	
					12.70				
					13.30			Black COAL.	
					(15.20)			Interbedded MUDSTONE & SANDSTONE.	
					28.50				
					29.50			SANDSTONE with trace of coal.	

Drilling Progress and Water Observations						
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Standing

GENERAL REMARKS

1. Borehole drilled using water flush.
2. Stable during drilling.
3. Terminated due to loss of flush due to hard strata.
4. Backfilled with cement.

All dimensions in metres Scale 1:200	Client: J F Finnegan	Contractor: Sirius Drilling Services	Logged By: AL

OPENHOLE 2957.GPJ NEW.GDT 12/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

OPENHOLE LOG

ecus ENVIRONMENTAL CONSULTANTS

Project				OPENHOLE No
Land off Woodland Drive, Dodworth, Barnsley				BH03
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Soilmec 400 rotary drilling rig				Sheet: 1 of 1

RUN DETAILS			STRATA						
Depth Date	Time Min/m	Flush %	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION Flush	Detail	Main	Geology / Instrument/ Backfill
					0.20			Clayey TOPSOIL.	
					(2.30)			Brown CLAY.	
					2.50				
					2.90			Black COAL.	
					(9.40)			Interbedded MUDSTONE & SANDSTONE.	
					12.30				
					13.30			Black COAL.	
					(14.30)			MUDSTONE.	
					27.60				
					28.40			Dark MUDSTONE with trace of coal.	
					(1.60)			MUDSTONE.	
					30.00				

Drilling Progress and Water Observations

Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing

GENERAL REMARKS

1. Borehole drilled using water flush.
2. Stable during drilling.
3. Terminated at scheduled depth.
4. Backfilled with cement.

All dimensions in metres Scale 1:200	Client: J F Finnegan	Contractor: Sirius Drilling Services	Logged By: AL

OPENHOLE 2957.GPJ NEW.GDT 12/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

OPENHOLE LOG

ecus ENVIRONMENTAL CONSULTANTS

Project				OPENHOLE No
Land off Woodland Drive, Dodworth, Barnsley				BH04
Job No: 2957	Date: 07-03-12 07-03-12	Ground level (m):	Co-Ordinates ():	
Method/Plant Used: Soilmec 400 rotary drilling rig				Sheet: 1 of 1

RUN DETAILS			STRATA						
Depth / Date	Time Min/m	Flush %	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION Flush	Detail	Main	Geology / Instrument/ Backfill
					0.20			Clayey TOPSOIL.	
					1.20			Brown CLAY.	
					2.70			Interbedded MUDSTONE & SANDSTONE.	
					3.00			Black COAL.	
					4.10			Interbedded MUDSTONE & SANDSTONE.	
					4.30			Black COAL.	
					(8.50)			Interbedded MUDSTONE & SANDSTONE.	
					12.80			Black COAL.	
					13.60			Interbedded MUDSTONE & SANDSTONE.	
					(8.80)				
					22.40			Black COAL.	
					22.90			MUDSTONE.	
					(5.90)				
					28.80			Dark grey MUDSTONE with trace of coal.	
					29.10			MUDSTONE.	
					30.00				

Drilling Progress and Water Observations

Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing

GENERAL REMARKS

1. Borehole drilled using water flush.
2. Stable during drilling.
3. Terminated at scheduled depth.
4. Backfilled with cement.

All dimensions in metres Scale 1:200	Client: J F Finnegan	Contractor: Sirius Drilling Services	Logged By: AL

OPENHOLE 2957.GPJ NEW.GDT 12/3/12

ECUS Ltd
Brook Holt
3 Blackburn Road
Sheffield S61 2DW

OPENHOLE LOG

ecus ENVIRONMENTAL CONSULTANTS

Project				OPENHOLE No
Land off Woodland Drive, Dodworth, Barnsley				BH05
Job No	Date	Ground level (m)	Co-Ordinates ()	
2957	07-03-12 07-03-12			
Method/Plant Used				Sheet
Soilmec 400 rotary drilling rig				1 of 1

RUN DETAILS			STRATA						
Depth Date	Time Min/m	Flush %	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION Flush	Detail	Main	Geology	Instrument/ Backfill
					0.20			Clayey TOPSOIL.		
					1.40			Brown CLAY.		
					1.50			Black COAL.		
					3.00			SANDSTONE.		
					3.40			Black COAL.		
					(8.60)			Interbedded MUDSTONE & SANDSTONE.		
					12.00					
					13.00			Black COAL.		
					(8.40)			Interbedded MUDSTONE & SANDSTONE.		
					21.40					
					22.40			Black COAL.		
					(5.60)			Interbedded MUDSTONE & SANDSTONE.		
					28.00					
					28.50			Black COAL.		
					30.00			MUDSTONE.		

Drilling Progress and Water Observations						
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Standing

GENERAL REMARKS
1. Borehole drilled using water flush. 2. Stable during drilling. 3. Terminated at scheduled depth. 4. Backfilled with cement.

All dimensions in metres Scale 1:200	Client J F Finnegan	Contractor Sirius Drilling Services	Logged By AL

OPENHOLE 2957.GPJ NEW.GDT 12/3/12

Appendix C: Laboratory Chemical Analysis Results

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Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 267637-1

Date of Report: 27-Feb-2012

Customer: ECUS
Brook Holt
3 Blackburn Road
Sheffield
S61 2DW

Customer Contact: Mr Adrian Grant

Customer Job Reference: 2957
Customer Purchase Order: 5588-2957
Customer Site Reference: Woodland Drive, Dodworth, Barnsley
Date Job Received at SAL: 14-Feb-2012
Date Analysis Started: 16-Feb-2012
Date Analysis Completed: 24-Feb-2012

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

UKAS TESTING
1549

Report checked and authorised by :
Caroline Haworth
Assistant Customer Service Manager

Issued by :
Caroline Haworth
Assistant Customer Service Manager

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SAL Reference: 267637
Project Site: Woodland Drive, Dodworth, Barnsley
Customer Reference: 2957

Soil Analysed as Soil
Asbestos

					SAL Reference	267637 001	267637 002	267637 003	267637 004	267637 005	267637 006
					Customer Sample Reference	WS01 0.1	WS01 0.3	WS02 0.1	WS02 0.9	WS03 0.1	WS03 0.4
					Date Sampled	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012
Determinand	Method	Test Sample	LOD	Units							
Asbestos ID	T27	AR			-	N.D.	-	-	-	N.D.
Naphthalene	T149	AR	0.01	mg/kg	0.05	-	0.02	-	0.02	-
Acenaphthylene	T149	AR	0.01	mg/kg	<0.01	-	<0.01	-	0.01	-
Acenaphthene	T149	AR	0.01	mg/kg	0.01	-	0.01	-	0.01	-
Fluorene	T149	AR	0.01	mg/kg	0.01	-	0.01	-	0.01	-
Phenanthrene	T149	AR	0.01	mg/kg	0.08	-	0.04	-	0.06	-
Anthracene	T149	AR	0.01	mg/kg	0.02	-	0.01	-	0.02	-
Fluoranthene	T149	AR	0.01	mg/kg	0.12	-	0.06	-	0.10	-
Pyrene	T149	AR	0.01	mg/kg	0.10	-	0.05	-	0.09	-
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	0.06	-	0.04	-	0.06	-
Chrysene	T149	AR	0.01	mg/kg	0.07	-	0.04	-	0.08	-
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	0.11	-	0.07	-	0.11	-
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	0.06	-	0.04	-	0.06	-
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	0.02	-	0.02	-	0.03	-
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	0.02	-	0.01	-	0.01	-
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	0.02	-	0.02	-	0.02	-
PAH(total)	T149	AR	0.01	mg/kg	0.75	-	0.44	-	0.69	-
Arsenic	T6	AR	1	mg/kg	12	-	15	-	14	-
Cadmium	T6	AR	1	mg/kg	<1	-	<1	-	<1	-
Chromium	T6	AR	1	mg/kg	14	-	20	-	20	-
Copper	T6	AR	1	mg/kg	28	-	42	-	36	-
Lead	T6	AR	1	mg/kg	36	-	56	-	59	-
Mercury	T6	AR	1	mg/kg	<1	-	<1	-	<1	-
Nickel	T6	AR	1	mg/kg	17	-	21	-	21	-
Selenium	T6	AR	3	mg/kg	<3	-	<3	-	<3	-
Zinc	T6	AR	1	mg/kg	63	-	81	-	97	-
pH	T7	AR			5.9	-	7.6	5.5	7.5	-
Chromium VI	T6	AR	1	mg/kg	<1	-	<1	-	<1	-
Mass Fraction of organic carbon	T286	AR			0.047	-	-	-	-	-
SO4(Total)	T102	AR	0.01	%	-	-	-	0.02	-	-
SO4(2:1)	T6	AR	0.1	g/l	<0.1	-	<0.1	<0.1	<0.1	-
Sulphur (total)	T21	AR	0.05	%	-	-	-	<0.05	-	-

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SAL Reference: 267637
Project Site: Woodland Drive, Dodworth, Barnsley
Customer Reference: 2957

Soil Analysed as Soil
Asbestos

					SAL Reference	267637 007	267637 008	267637 009	267637 010	267637 011	267637 012
					Customer Sample Reference	WS03 0.9	WS04 0.1	WS04 0.9	WS05 0.1	WS06 0.1	WS06 0.25
					Date Sampled	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012
Determinand	Method	Test Sample	LOD	Units							
Asbestos ID	T27	AR			-	-	-	-	-	N.D.
Naphthalene	T149	AR	0.01	mg/kg	-	0.03	-	0.01	0.01	-
Acenaphthylene	T149	AR	0.01	mg/kg	-	0.01	-	<0.01	<0.01	-
Acenaphthene	T149	AR	0.01	mg/kg	-	0.01	-	0.07	<0.01	-
Fluorene	T149	AR	0.01	mg/kg	-	0.02	-	0.02	<0.01	-
Phenanthrene	T149	AR	0.01	mg/kg	-	0.15	-	0.13	0.04	-
Anthracene	T149	AR	0.01	mg/kg	-	0.04	-	0.03	0.01	-
Fluoranthene	T149	AR	0.01	mg/kg	-	0.16	-	0.24	0.08	-
Pyrene	T149	AR	0.01	mg/kg	-	0.14	-	0.20	0.06	-
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	-	0.07	-	0.15	0.05	-
Chrysene	T149	AR	0.01	mg/kg	-	0.08	-	0.17	0.06	-
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	-	0.13	-	0.38	0.12	-
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	-	0.07	-	0.19	0.06	-
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	-	0.03	-	0.09	0.03	-
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	-	0.02	-	0.05	0.02	-
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	-	0.02	-	0.08	0.03	-
PAH(total)	T149	AR	0.01	mg/kg	-	0.98	-	1.8	0.57	-
Arsenic	T6	AR	1	mg/kg	-	13	-	9	12	-
Cadmium	T6	AR	1	mg/kg	-	<1	-	<1	<1	-
Chromium	T6	AR	1	mg/kg	-	16	-	18	19	-
Copper	T6	AR	1	mg/kg	-	33	-	18	25	-
Lead	T6	AR	1	mg/kg	-	57	-	30	45	-
Mercury	T6	AR	1	mg/kg	-	<1	-	<1	<1	-
Nickel	T6	AR	1	mg/kg	-	17	-	16	19	-
Selenium	T6	AR	3	mg/kg	-	<3	-	<3	<3	-
Zinc	T6	AR	1	mg/kg	-	82	-	71	72	-
pH	T7	AR			6.6	7.6	5.0	7.7	7.7	-
Chromium VI	T6	AR	1	mg/kg	-	<1	-	<1	<1	-
Mass Fraction of organic carbon	T286	AR			-	0.029	-	-	-	-
SO4(Total)	T102	AR	0.01	%	0.04	-	0.04	-	-	-
SO4(2:1)	T6	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1	<0.1	-
Sulphur (total)	T21	AR	0.05	%	<0.05	-	<0.05	-	-	-

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SAL Reference: 267637
Project Site: Woodland Drive, Dodworth, Barnsley
Customer Reference: 2957

Soil Analysed as Soil
Asbestos

				SAL Reference	267637 013	267637 014	267637 015	267637 016	267637 017
				Customer Sample Reference	WS07 0.9	WS08 0.1	WS08 0.5	WS09 0.1	WS09 0.9
				Date Sampled	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012	13-FEB-2012
Determinand	Method	Test Sample	LOD	Units					
Asbestos ID	T27	AR			-	-	N.D.	-	-
Naphthalene	T149	AR	0.01	mg/kg	-	0.16	-	0.03	-
Acenaphthylene	T149	AR	0.01	mg/kg	-	0.04	-	<0.01	-
Acenaphthene	T149	AR	0.01	mg/kg	-	0.02	-	0.03	-
Fluorene	T149	AR	0.01	mg/kg	-	0.03	-	0.02	-
Phenanthrene	T149	AR	0.01	mg/kg	-	0.31	-	0.23	-
Anthracene	T149	AR	0.01	mg/kg	-	0.10	-	0.06	-
Fluoranthene	T149	AR	0.01	mg/kg	-	0.79	-	0.32	-
Pyrene	T149	AR	0.01	mg/kg	-	0.68	-	0.27	-
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	-	0.40	-	0.14	-
Chrysene	T149	AR	0.01	mg/kg	-	0.39	-	0.16	-
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	-	0.77	-	0.29	-
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	-	0.48	-	0.17	-
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	-	0.19	-	0.07	-
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	-	0.08	-	0.04	-
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	-	0.17	-	0.07	-
PAH(total)	T149	AR	0.01	mg/kg	-	4.6	-	1.9	-
Arsenic	T6	AR	1	mg/kg	-	15	-	11	-
Cadmium	T6	AR	1	mg/kg	-	<1	-	<1	-
Chromium	T6	AR	1	mg/kg	-	17	-	22	-
Copper	T6	AR	1	mg/kg	-	34	-	27	-
Lead	T6	AR	1	mg/kg	-	61	-	48	-
Mercury	T6	AR	1	mg/kg	-	<1	-	<1	-
Nickel	T6	AR	1	mg/kg	-	17	-	18	-
Selenium	T6	AR	3	mg/kg	-	<3	-	<3	-
Zinc	T6	AR	1	mg/kg	-	110	-	78	-
pH	T7	AR			4.9	6.8	-	7.5	4.9
Chromium VI	T6	AR	1	mg/kg	-	<1	-	<1	-
Mass Fraction of organic carbon	T286	AR			-	0.064	-	-	-
SO4(Total)	T102	AR	0.01	%	0.05	-	-	-	0.04
SO4(2:1)	T6	AR	0.1	g/l	<0.1	<0.1	-	<0.1	<0.1
Sulphur (total)	T21	AR	0.05	%	<0.05	-	-	-	<0.05

Index to symbols used in 267637-1

Value	Description
AR	As Received
N.D.	Not Detected
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T149	GC/MS (SIR)
T27	PLM
T6	ICP/OES
T21	OX/IR
T7	Probe
T286	Calc TOC/100
T102	ICP/OES (HCl extract)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Asbestos ID	T27	AR			SU	002,006,012,015
Naphthalene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Acenaphthylene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Acenaphthene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Fluorene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Phenanthrene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Anthracene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Fluoranthene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Pyrene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Chrysene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
PAH(total)	T149	AR	0.01	mg/kg	U	001,003,005,008,010-011,014,016
Arsenic	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Cadmium	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Chromium	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Copper	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Lead	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Mercury	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Nickel	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
Selenium	T6	AR	3	mg/kg	U	001,003,005,008,010-011,014,016
Zinc	T6	AR	1	mg/kg	U	001,003,005,008,010-011,014,016
pH	T7	AR			U	001,003-005,007-011,013-014,016-017
Chromium VI	T6	AR	1	mg/kg	N	001,003,005,008,010-011,014,016
Mass Fraction of organic carbon	T286	AR			N	001,008,014
SO4(Total)	T102	AR	0.01	%	N	004,007,009,013,017
SO4(2:1)	T6	AR	0.1	g/l	N	001,003-005,007-011,013-014,016-017
Sulphur (total)	T21	AR	0.05	%	N	004,007,009,013,017

Appendix D: Laboratory Geotechnical Analysis Results

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PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL12/0721

Client's Reference: Report Date: 16 February 2012

Client Name: Ecus
Endcliffe Holt
343 Fulwood Road
Sheffield

S10 3BQ

For the attention of: Adrian Grant

Contract Title: Woodland Drive, Dodworth, Barnsley

Date Received: 14-Feb-12
Date Commenced: 14-Feb-12
Date Completed: 16-Feb-12

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

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

Checked and Approved Signatories:

R Gunson	A Watkins	M Beastall
(Director)	(Director)	(Laboratory Manager)

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Doncaster DN4 0AR
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fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
WS05		D	0.90	Grey mottled brown CLAY.
WS06		D	0.90	Brown mottled grey sandy CLAY.
WS08		D	0.90	Dark brown gravelly sandy CLAY.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	16/02/12		16/02/12		16/02/12

WOODLAND DRIVE, DODWORTH, BARNSLEY.

Contract No:	PSL12/0721
Client Ref:	2957

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.	Plasticity Index % Clause 6.	% Passing .425mm	Remarks
WS05		D	0.90	23				57	24	33	100	High plasticity CH.
WS06		D	0.90	18				44	19	25	100	Intermediate plasticity CI.
WS08		D	0.90	26				47	25	22	80	Intermediate plasticity CI.

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

PSL Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	16/02/12		16/02/12		16/02/12

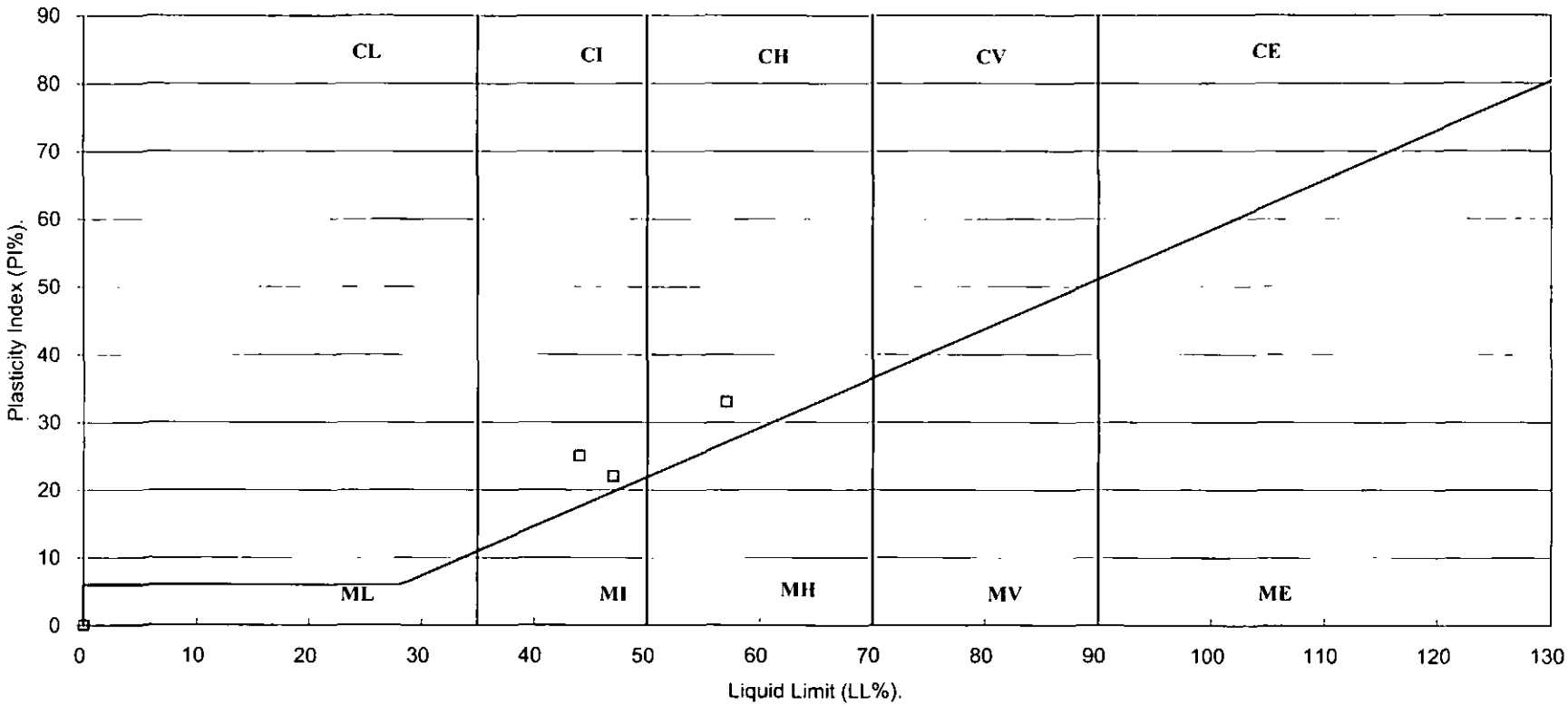
WOODLAND DRIVE, DODWORTH, BARNSLEY.

Contract No: PSL12/0721

Client Ref: 2957

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		16/02/12		16/02/12		16/02/12
	WOODLAND DRIVE, DODWORTH, BARNSLEY.				Contract No:	PSL12/0721
					Client Ref:	2957

Appendix E: Coal Authority Mining Report

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The COAL AUTHORITY

Issued by:
The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0845 762 6848 DX 716176 MANSFIELD 5

LANDMARK INFORMATION GROUP LIMITED
SOWTON INDUSTRIAL ESTATE
ABBEY COURT
UNIT 5/7 EAGLE WAY
EXETER
DEVON
EX2 7HY

Our reference:	**51000021029001**
Your reference:	**37369982**
Date of your enquiry:	**26 January 2012**
Date we received your enquiry:	**26 January 2012**
Date of issue:	**28 January 2012**

This report is for the property described in the address below and the attached plan.

Non-Residential Coal Authority Mining Report

SITE AT WOODLAND DRIVE, DODWORTH, BARNSLEY, SOUTH YORKSHIRE,

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	See comments below
Brine Compensation District	No

Information from the Coal Authority

Underground coal mining

Past

The property is in the likely zone of influence from workings in 7 seams of coal at shallow to 330m depth, and last worked in 1970.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area that is likely to be affected at the surface from any planned future workings.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

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Records may be incomplete. Consequently, there may exist in the local area mine entries of which the Coal Authority has no knowledge.

Coal mining geology

The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.

Opencast coal mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal mining subsidence

There are 1 claim(s) within 50 metres of the property boundary that do not match the property address. These are shown on the attached plan.

The Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

If further subsidence damage claims information is required in addition to that provided in this report, the Authority need to manually search their records. For further advice on how to order this additional information visit www.groundstability.com or telephone 0845 7626 848.

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

The property is not in an area for which a notice has been given under section 41 of the Coal Industry Act 1994, revoking the entitlement to withdraw support.

Working facilities orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to owners of former copyhold land

The property is not in an area for which a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

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Comments on Coal Authority information

In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

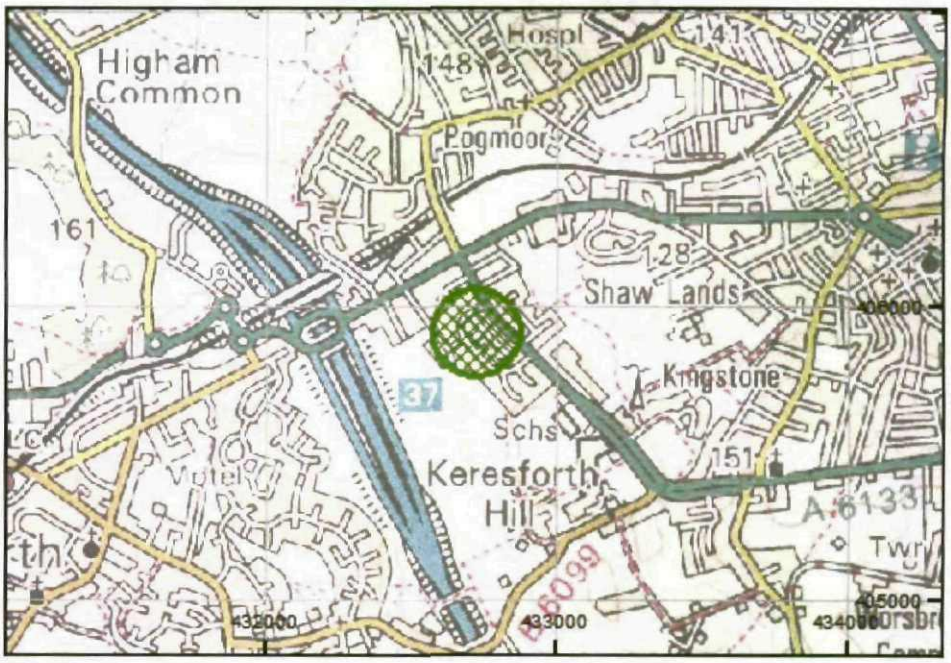
Additional Remarks

This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2006.

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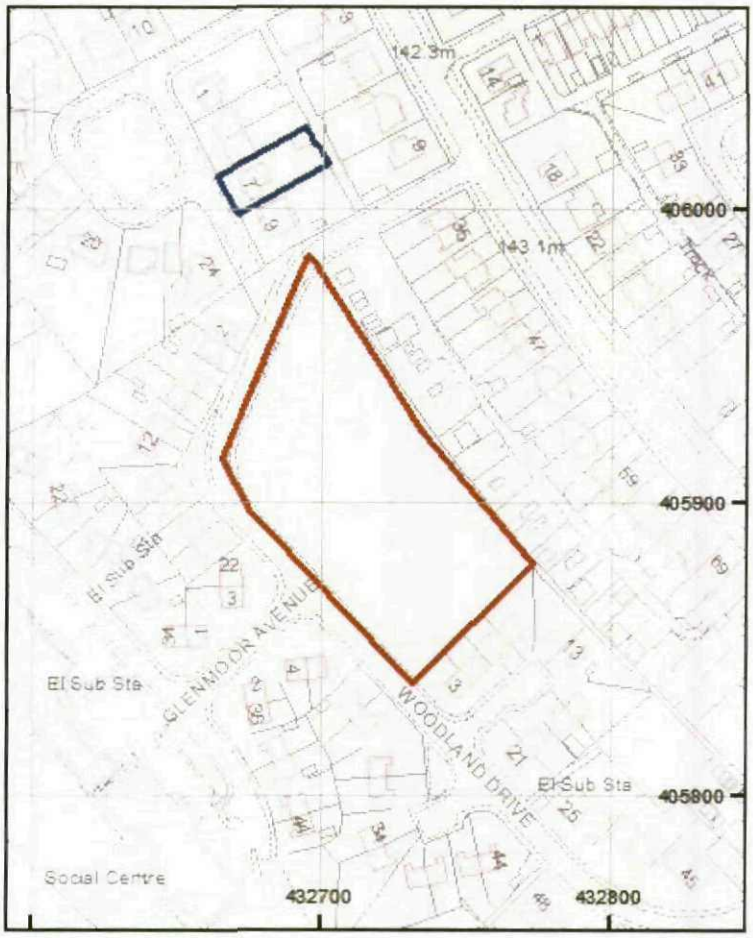
Location map

Approximate position of property



Enquiry boundary

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Key

Approximate position of enquiry boundary shown

Coal Claims

Mapping sourced from Ordnance Survey