

Report No. 1898/1A

July 2014

GEOENVIRONMENTAL APPRAISAL
of land at
LITTLEWORTH LANE, LUNDWORTH

Prepared for
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LITTLEWORTH LANE, LUNDWOOD - SUMMARY OF GEOENVIRONMENTAL ISSUES

The site is located off Littleworth Lane, approximately 1km east of Barnsley town centre (NGR SE 370 070), and occupies an area of 8 hectares. The site currently comprises an open area of generally rough grassland that is being grazed by horses. Sporadic trees are located in the northern section.

Lithos were commissioned by Harron Homes Limited to provide a geoenvironmental appraisal of the site. It is understood that consideration is being given to redevelopment of the site with around 198 traditional two to three storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; a proposed layout has been prepared. Lithos's investigation included a review of desk study information and a ground investigation comprising 35 trial pits and 12 rotary openhole boreholes.

A summary of salient geoenvironmental issues is provided in the Table below.

Issue	Remarks
Made Ground	Made ground typically around 1m in thickness, but locally up to 2.2m, was encountered only within the north of the site as a mixture of cohesive and granular soil along with ash and clinker.
Natural Ground	Natural ground was encountered in all of the exploratory holes, and typically comprised firm to stiff clay which becomes gravelly with depth. Underlying this in some exploratory hole locations medium dense clayey gravel of sandstone and siltstone.
Contamination	The ash and clinker and granular made ground have yielded elevated concentrations of a number of metals. Made ground in general has yielded sporadic elevated concentrations of benzo(a)pyrene. Therefore, where residual made ground remains beneath garden and landscaped areas (i.e. not beneath hardstanding) a 600mm thick surface cover of "clean" soil comprising 500mm subsoil and 100mm topsoil is recommended.
Hazardous Gas	There is an extensive area of landfill located immediately north of the site along with a thickness of made ground in the north. Gas monitoring is ongoing, and a risk assessment will be issued on completion in September 2014. No special precautions against radon gas are required.
Mining & Quarrying	Shallow coal workings will not affect the surface stability of the site. Movements in deeper worked seams resulted in a subsidence claim at the site in the early 1990's, but should now have ceased. Two 19th Century quarries existed within 250m of the site.
Foundations	All plots at the site can be founded on strip footings, or deeper trenchfill foundations. The founding strata will be stiff clay at a minimum depth of 900mm deepened near trees and where made ground exists in the northern section of the site.
Groundwater & Excavations	No significant inflows of groundwater were encountered during the investigation. Stability of excavations within both the made and natural ground was generally good.
Highways & Drainage	Soakaways will not provide a suitable drainage solution for surface water run-off at the site. Consequently, there is likely to be a need for surface water balancing. The natural weathered Oaks Rock deposits at shallow depth in the south of the site will have a CBR value of at least 3%. Where made ground is present the following options are considered suitable. Excavation of the full thickness (up to a maximum of 2m) of made ground and either replacement with suitable aggregate or screening, selection and replacement of suitable material in engineered layers.

Significant developer abnormalities relating to geoenvironmental issues at the site are:

- Excavation of up to a maximum depth of 2m beneath proposed adoptable road footprints in the north of the site and controlled re-engineering of selected materials in layers to approximately 650mm below final road levels.
- Provision of a minimum 600mm thick cover layer of 'clean' soils in all garden and landscaped areas within the northern section of the site (see Drawing No 1898/6).
- Locally deeper trenchfill footings in the north along with possible need to cut trenches through relict foundations.

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APPENDICES

Appendix A - General Notes

01	Environmental Setting
02	Ground Investigation Fieldwork
03	Geotechnical Testing
04	Contamination Laboratory Analysis & Interpretation
05	Hazardous Gas
06	Soakaways

Appendix B – Drawings

Drawing No.	Title
1898/1	Site Location Plan
1898/2	Proposed Site Layout
1898/3	Existing Site Features
1898/4	Site Photographs
1898/5	Preliminary Conceptual Site Model
1898/6	Exploratory Hole Location Plan

Appendix C - Commission

Appendix D - Historical OS Plans[#]

Appendix E - Search Responses[#]

From	Date	Content
Groundsure	10/06/2014	Environmental Report
Coal Authority	10/06/2014	Mining Report

Appendix F – Trial Pit Records

Appendix G – Borehole Records

Appendix H – Chemical Test Results

Appendix I – Geotechnical Test Results

Appendix J – Soakaway Results

Appendix K – Gas Monitoring Results

FOREWORD (Geoenvironmental Investigation Report)

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

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

The report should be read in its entirety, including all associated drawings and appendices. Lithos cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of sheets of paper in the hard copy to a minimum, some information (e.g. laboratory test certificates) is only included within the "electronic", PDF Report on the accompanying CD.

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

The report represents the findings and opinions of experienced geo-environmental consultants. Lithos does not provide legal advice and the advice of lawyers may also be required.

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

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

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

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

Lithos Consulting Limited cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

Lithos reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

GEOENVIRONMENTAL APPRAISAL
of land at
LITTLEWORTH LANE, LUNDWOOD

1 INTRODUCTION

1.1 The Commission and Brief

- 1.1.1 Lithos Consulting Limited (Lithos) was commissioned by Harron Homes Limited (Harron) to carry out a geoenvironmental appraisal of land at Littleworth Lane, Lundwood, in Barnsley.
- 1.1.2 Correspondence regarding Lithos's appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:
- a site walkover and inspection
 - an assessment of the land use history
 - determination of the site's environmental setting
 - an intrusive ground investigation comprising 35 trial pits and 12 boreholes
 - assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
 - a qualitative assessment of contamination risks
 - recommendations for the necessary site preparatory and remediation works
- 1.1.3 The primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to enable Harron to obtain budget costs for the necessary site preparatory and remediation works, and to support the submission of a planning application to the local authority.

1.2 The Proposed Development

- 1.2.1 It is understood that consideration is being given to redevelopment of the site with around 198 traditional two to three storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; a layout referenced 3623/10, dated June 2014 prepared by Downes Illingsworth Partnership has been supplied and is copied as Drawing No 1898/2 in Appendix B of this report.

1.3 Report Format and Limitations

- 1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:
- Assessment of the site's environmental setting
 - Ground investigation fieldwork
 - Geotechnical Testing
 - Contamination Testing
 - Hazardous Gas
 - Soakaways
- 1.3.2 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

2 SITE DESCRIPTION

2.1 General

- 2.1.1 The site's location is shown on Drawing No. 1898/1 presented in Appendix B to this report. Site details are summarised in the Table below.

Detail	Remarks
Location	1 km east of Barnsley city centre
NGR	SE 370 070
Approximate Area	8.0ha
Known services	Underground electric and sewer On site sub station

2.2 Site Features

- 2.2.1 A Lithos Engineer completed a walkover survey of the site on 11th June 2014.
- 2.2.2 The site currently comprises an open area of generally rough grassland that is being grazed by horses. Sporadic trees are located in the northern section.
- 2.2.3 There is a live electricity sub-station located in the east of the site.
- 2.2.4 The entire site is surrounded in steel palisade fencing.
- 2.2.5 At the time of Lithos's walkover it was noticed that an unknown party had moved horses onto the site to graze.
- 2.2.6 Existing salient features, at the time of the walkover are presented on Drawing No. 1898/3 in Appendix B to this report, and summarised in the Table below.

Feature	Remarks
Current Access	Off Littleworth Lane
Topography	Predominantly relatively flat, small terraces level the northern portion of the site. Steep slope in the southernmost portion of the site.
Approximate areas	7,000m ² tarmac hardstand 68,000m ² grass
Nature of boundaries	North, south, west & east – Metal palisade fencing.
Surrounding land uses	North – Open parkland South - Housing East – Housing West – Littleworth Grange Primary School. Housing beyond

- 2.2.7 A selection of site photographs are included on Drawing 1898/4.

3 SITE HISTORY

- 3.1.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1856 have been examined. Some of these plans are presented in Appendix D to this report.
- 3.1.2 The Table below provides a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in **bold** text for ease of reference.

Date	Site	Surrounding Land
1850	Open fields.	Littleworth Lane runs adjacent to northern boundary. Barnsley Canal adjacent to eastern boundary. ` <b>Bindstone</b> ` quarry 10m south. ` <b>Old quarry</b> ` 200m south. `Oaks quarry` 750m east.
1890	No significant changes	Sewage farm 700m south. Bindstone and Old quarries no longer shown. Railways developed 50m west and 440m east.
1892		No significant changes.
1904		Barnsley main colliery shown 700m southwest.
1906		No significant changes.
1929	School buildings developed in central north of site.	Housing developed 50m south and 100m east.
1938	No significant changes.	School buildings developed adjacent to north western boundary.
1948	Further school buildings developed central to site.	No significant changes.
1951	No significant changes.	
1960	Pavilion in central south of site. Slopes shown in east of site.	
1961	No significant changes.	
1966	Drain shown central to site running east west.	Canal marked as disused. Railways marked as dismantled.
1974	Tennis courts central to site.	No significant changes.
1982	Expansion of existing school buildings. Development of more school buildings in north and centre of site.	
1992	No significant changes.	
2002		
2012	School buildings no longer shown. (Small scale map only)	

4 ENVIRONMENTAL SETTING

4.1 General

- 4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. The responses received from Groundsure and the Coal Authority are presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet) 1:10,000 BGS map (Sheet SE 30 NE)	Drift – Till, (likely gravelly clay.) Solid – Oak Rock Sandstone across majority of site. Middle coal measures (likely mudstone) within northwest corner of site. Shallowest coal seam – Newhill Coal (0.61m to 1.37m thick) at about 22m depth. Strata Dip - 5° north east. Faults – Fault oriented north to south intersects centre of site..
Mining	Coal Authority BGS maps	The site is located within a Coal Mining standing advice area. Past and present workings - in 11 seams of coal at 160m to 580m depth, and last worked in 1991 . Opencast – None on or close to the site. Mine entries – none within the site or within 20 metres of its boundary. A mining subsidence damage claim was discharge on the school by the Coal Authority in 1995; however, the CA now state that ' <i>Any ground movement from these coal workings should have stopped by now</i> ', and therefore further subsidence would not be expected.
Quarrying	Historical OS Plans	Two 19 th Century quarries existed within 250m of the site.
Radon	BRE Report BR211	No protective measures required.
Hydrogeology	Groundsure Report	Source Protection Zone? None across site. Aquifer Unproductive strata within north east of site. Unclassified across majority of site. (Drift); Secondary A aquifer (Solid). Groundwater abstractions? None within 500m of site. Soil leaching potential - Low. Pollution incidents? None of significance to site. (only if relate or significant to site).
Hydrology	Environment Agency Groundsure Report	Nearest watercourse – 300m south west. Unnamed drain. Pollution incidents? None of significance to site. Abstractions? None within 500m of site boundary. Discharge consents? 180m north east. 402 Pontefract Road, Lundwood. Treated effluents. (Sewage discharge.)
Flood Risk	Environment Agency	The site area is greater than 1 hectare, therefore a Flood Risk Assessment, focused on the management of surface water run-off, will be required. Development that increases the amount of impermeable surfaces can result in an increase in surface water run-off, which in turn can result in increased flood risk both on site and elsewhere within the catchment.

4.2 Landfills

4.2.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Littleworth Lane, Monk Bretton, Barnsley.	SE 372 076 (15m north east)	Household waste.	Groundsure Report
Littleworth Lane Tip, Lundwood, Barnsley.	SE 371 072 (30m north east)	Inert, industrial, commercial waste and liquid sludge.	Groundsure Report

4.2.2 Historical mapping shows at least two areas of 19th Century quarrying within 250m of the site boundary.

5 GROUND INVESTIGATION DESIGN

5.1 Anticipated Ground Conditions & Potential Issues

5.1.1 Based on the data reviewed in Section 4 (Environmental Setting) anticipated ground conditions are expected to comprise:

Anticipated Condition	Remarks
Made Ground	Up to 1m demolition waste comprising brick fill. Possible relict foundations and/or basement structures.
Natural Soils	Cohesive glacial deposits within the north east of the site. Weathered sandstone in the west of the site.
Bedrock	Oak Rock sandstone and Middle Coal measures anticipated at relatively shallow depth.
Mineworkings	The Newhill Coal (0.61m to 1.37m thick) is the shallowest coal seam beneath the site located approximately 22m below the base of the Oaks Rock; therefore, any shallow coal workings would not affect the surface stability of the site.
Groundwater	Anticipated at depth within Oak Rock Sandstone.

5.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

Type of Issue	Specific Issue	Remarks
Potential on-site contamination sources	1. Made ground.	1. Made ground associated with demolition of former structures across site.
Potential off-site contamination sources	1. Adjacent landfill and filled quarries.	1. Possible migration of soil gasses onto site.
Potential geotechnical hazards	1. Relict buried obstructions 2. Deep MG	
Other potential constraints	1. On site electrical substation. 2. Underground drainage utilities.	1. May require relocation. 2. May require diverting.

5.2 Preliminary Conceptual Site Model

- 5.2.1 A preliminary conceptual site model, presented as Drawing No 1898/4 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 5.1 inclusive of this report.
- 5.2.2 The majority of the site is essentially greenfield, although land in the north has been a school; former usage is not considered likely to have given rise to significant contamination. Potential pollutant linkages are shown on the preliminary conceptual site model.

5.3 Ground Investigation Design & Strategy

- 5.3.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Exploratory Holes	Purpose
TPs 1 to 40	To determine the general nature of soils underlying the site, including the: • nature, distribution and thickness of made ground • nature, degree and extent of contamination • proportion of undesirable elements eg biodegradable matter, foundations etc • suitability of the ground for founding structures and highways
TPs 9, 14, 16, 21, 26, 27, 29, 31, 35 & 37	To determine whether soakaways could be utilised for storm water drainage.
BHs 1 to 8	To install monitoring wells across the site in order to monitor for hazardous gas.

- 5.3.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 4 above. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.
- 5.3.3 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most trial pits.

6 FIELDWORK

6.1 Objectives

- 6.1.1 The original investigation strategy is outlined in Section 6.3 above.
- 6.1.2 The additional exploratory holes listed below were advanced in light of ground conditions actually encountered.

Exploratory Holes	Purpose
BH's 7A and 8A	To allow for the placement of gas monitoring wells into deep made ground in order to monitor for the possibility of ground gas generation.

6.2 Exploratory Hole Location Constraints

- 6.2.1 No access was available in the southernmost portion of the site due to a steep slope.

6.3 Scope of Works

6.3.1 Fieldwork was supervised by Lithos between the 11th and the 13th June 2014 and comprised the exploratory holes listed below.

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 1 to 7, 9, 12 to 23 and 25 to 39.	1.7m to 3.6m	Vane tests in cohesive soils.
Soakaway Tests	Within TPs 9, 14, 16, 21, 26, 27, 29, 31, 35 and 37.		
Rotary open-hole probeholes	BH's 1 to 10 including BH's 7A and 8A	2.0m to 6.6m	Monitoring wells installed in all BHs excluding BH5

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

6.3.3 Exploratory hole logs are presented in Appendices F and G to this Report. These logs include details of the:

- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of the in-situ testing
- The monitoring wells installed

6.3.4 Exploratory hole locations are shown on Drawing No. 1898/6 presented in Appendix B.

7 GROUND CONDITIONS

7.1 General

7.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendices F to G. However, a summary of the ground conditions is provided below and in the table on page 10.

7.2 Made Ground

7.2.1 The made ground on site is a heterogeneous mixture of materials and it is unlikely, even with a huge amount of sampling, that it could be accurately characterised. Nonetheless, the bulk of the made ground can be categorised as one of 4 broad types:

Exploratory Locations	Material	Depth to base* (mbgl)	Nature of Made Ground & Typical depth (m)
TPs 2, 6, 9, 12 to 23 and 38	Made Ground Topsoil	0.15m to 1.8m (0.4m)	Typically silt with much sub-rounded gravel of mixed lithologies and occasionally glass, plastic and clinker
TPs 2, 6, 17, 18, 19, 20 and 23	Ash & Clinker	0.7m to 2.3m (1.3m)	Ash sand with gravel of clinker and coal.
TPs 12, 13, and 17 to 23	Cohesive Made Ground	0.5m to 2.2m (1.4m)	Typically comprising sand and gravel of limestone, or washed gravel of limestone
TPs 12, 16, 17, 20, 21 and 22	Granular Made Ground	0.2m to 1.3m (0.9m)	Typically comprising reworked clay with cobbles of brick, gravel of coal and clinker, or cobble sized fragments of rotting plant debris.

* Average depth to base in brackets

- 7.2.2 Whilst not encountered during this investigation, the possibility of asbestos sheeting (used as shuttering), and/or fragments of asbestos sheeting within the hardcore beneath concrete slabs cannot be entirely discounted.

7.3 Obstructions

- 7.3.1 It is apparent from a review of historical OS Plans (see Section 3) and the site visit that buildings have been present on about 25% of the site area. Drawing No. 1898/6 shows the footprints of the former structures.
- 7.3.2 Eight Trial pits have been excavated at locations where relict foundations were anticipated (based on superimposition of historical OS Plans).
- 7.3.3 Obstructions encountered in trial pits across the site are summarised below:

Hole ID	Former Feature	Depth (m)	Obstruction Encountered
TP6	Unknown feature	0.5	Frequent loose bricks excavated from south side of trial pit
TP9	School building. c. 1938 - 2012	0.4	Relict foundation comprising brick and mortar.
TP16	School building. c. 1929 - 2012	0.6	Boulder sized obstructions comprising brick and mortar.
TP17	School building. c.1982 - 2012	0.5 to 0.8	Relict foundation comprising brick, mortar and steel rebar.
TP18	School building. c.1982 - 2012	0.6	Relict foundations comprising brick and mortar.
TP19	Unknown feature	1.9	Tabular concrete slab in base of pit. Possible relict basement structure.

- 7.3.4 Given consideration of the above; whilst buildings have been cleared from the site, and significant foundations have not been encountered some obstructions remain beneath the surface. Hence it would be prudent to allow for excavations to encounter obstruction beneath at least a portion of the site within the footprints of former buildings.
- 7.3.5 The depth and distribution of the in-situ relics suggests that foundations/floor slabs etc from at least 2 "generations" are present.

7.4 Natural Ground

- 7.4.1 Natural ground was encountered in all of the exploratory holes, and typically comprised firm to stiff clay (Completely Weathered Oak Rock) which becomes gravelly with depth. Underlying this in some exploratory hole locations medium dense clayey gravel of sandstone and siltstone (Weathered Oaks Rock).
- 7.4.2 Bedrock comprising weak siltstone or mudstone was encountered locally below around 3m depth (Oaks Rock).

7.5 Visual & Olfactory Evidence of Organic Contamination

- 7.5.1 No visual or olfactory evidence of significant contamination was noted during Lithos's site investigation. Never the less selected samples of made ground and topsoil were selected for geochemical testing. Chemical test scheduling is surmised in Section 10.

7.6 Groundwater

- 7.6.1 No significant inflows of groundwater were encountered during the investigation.

7.7 Stability

7.7.1 Stability of excavations within both the made and natural ground was generally good.

7.8 Revised Conceptual Ground Model (Ground Conditions)

7.8.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:

- the nature and distribution of made ground, including the presence of buried obstructions
- the strength, nature and depth of underlying natural strata

7.8.2 Further refinement of the Conceptual Site Model is presented in Sections 10.1, where the results of laboratory testing for contaminants have been considered.

Summary of Ground Conditions

Hole ID	Final Depth	Depth to Base to Base (m)							
		Made Ground Topsoil	Granular Made Ground	Ash & Clinker	Cohesive Made Ground	Topsoil	Firm & Stiff Clay (Completely Weathered Oaks Rock)	Stiff Gravely CLAY (Weathered Oaks Rock)	Weak Mudstone or Siltstone (Oaks Rock)
TP01	1.7					0.3	>1.7		
TP02	2.9	0.3		0.9				>2.9	
TP03	2.6					0.3	2	2.4	>2.6
TP04	2.7					0.3	2.1	2.4	>2.7
TP05	2.1					0.3	1.4	1.7	>2.1
TP06	3	0.3		1			3	>2.5	
TP07	2.7					0.4	2.7	>1.8	
TP09	2.5	1.8					>2.5		
TP12	2.4	0.45	0.7		1.5		>2.4		
TP13	2.6	0.2			0.7		2.3		>2.6
TP14	2.1	0.5					>2.1		
TP15	3.6	0.5					2.7	2.9	>3.6
TP16	2.6	0.25	1.3				2.4		>2.6
TP17	2.7	0.6	1.3	1.8	2.1		>2.7		
TP18	2.8	0.2		2.3	0.9		>2.8		
TP19	2.6	0.25		0.7	2.2		>2.6		
TP20	2.9	0.25	0.2	1.9	2.2		>2.9		
TP21	2.4	0.5	1.2		0.5		>2.4		
TP22	3	0.5	0.8		1.2		2.6		>3
TP23	3.2			0.8	1.4		>3.2		
TP25	2					0.3	>2		
TP26	2.5					0.3	>2.2		
TP27	2.4					0.25	1.9		>2.5
TP28	2.5					0.3	1.9		>2.5
TP29	2.4					0.35	>2.4		
TP30	2.3					0.7	2.4		>2.6
TP31	2.3					0.3	>2.3		
TP32	2.2					0.3	>2.3		
TP33	2					0.3	1.5		>2
TP34	2.8					0.6	1.6	2.3	>2.8
TP35	2.1					0.4	1.2	1.8	>2.1
TP36	2.9	0.3					2.4		>2.9
TP37	2.6					0.6	2	2.3	>2.6
TP38	2.5	0.15			0.9		>2.5		
TP39	1.7					0.3	>1.7		

8 CONTAMINATION (ANALYSIS)

8.1 General

8.1.1 The site has been formerly used as: School buildings.

8.1.2 The site's former usage is unlikely to have given rise to significant ground contamination. However, in the north of the site significant thicknesses of made ground were encountered in many of the exploratory locations during the ground investigation. Consequently, for organic compounds, the Tier 1 Soil Screening Values used in this report have been derived with reference to a CSM that assumes a minimum 600mm of clean soil cover will be placed in gardens/landscaped areas (Lithos Scenario B). In the event that no determinands exceed these Tier 1 Values, the results will be reassessed with reference to values derived using a CSM with no soil cover (Lithos Scenario A).

8.2 Testing Scheduled

8.2.1 Based on the above assessment, a Lithos Engineer submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of Sample	No. of Samples	Determinands
Ash & Clinker	4	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Calorific Value (CV). Asbestos ID. TOC. Speciated Poly Aromatic Hydrocarbons (PAH).
	3	Leachable metals: arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc. Water soluble sulphate, chloride, nitrate and magnesium. Banded Total Petroleum Hydrocarbons (TPH).
Cohesive Made Ground	4	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Asbestos ID. TOC. Speciated Poly Aromatic Hydrocarbons (PAH).
	3	Leachable metals: arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc.
	2	Calorific Value (CV). Water soluble sulphate, chloride, nitrate and magnesium.
Granular Made Ground	2	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Asbestos ID. TOC. Speciated Poly Aromatic Hydrocarbons (PAH).
Made Ground Topsoil	5	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Asbestos ID. TOC. Speciated Poly Aromatic Hydrocarbons (PAH).
	1	Calorific Value (CV).
Topsoil	5	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Asbestos ID. TOC. Speciated Poly Aromatic Hydrocarbons (PAH).

8.3 Soil Contamination Results

8.3.1 The soil contamination test results are summarised in the Tables on pages 14 to 18.

8.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix H to this report.

Inorganic Determinands

8.3.3 Of the twenty samples of natural and made ground analysed for inorganic parameters five could be classified as contaminated.

8.3.4 These samples are classified by comparison with Lithos Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of the proposed end-uses).

8.3.5 The most common contaminants are arsenic, copper and zinc within the ash and clinker, and a single elevated concentration of arsenic within one sample of granular made ground.

8.3.6 Fewer than 6 samples of each made ground type were tested, consequently statistical analysis was not deemed appropriate.

Calorific Value

8.3.7 The calorific value of eight samples of made ground, have yielded CV's of:

- Ash and Clinker – 2.8MJ/kg to 9.2MJ/kg (ave 6.6MJ/kg)
- Cohesive Made Ground – 1.8MJ/kg
- Granular Made Ground – 0.2MJ/kg to 0.2MJ/kg
- Made Ground Topsoil – 2.4MJ/kg

8.3.8 Materials whose CVs exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn.

Asbestos

8.3.9 No asbestos fibres were identified in any of the samples screened.

Summary of Degree of Ground Contamination (Inorganics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.												
			pH	As 32	B~ 5	Cd 5	Cr x 3000	Cu♣\$ 200	Pb# 450	Hg* 169	Ni 127	Se 350	Zn\$ 200	CV 2	Asbestos
TP02	0.5	Ash and Clinker	6.6	170	<1	<1	41	490	440	<1	83	<3	420	9.2	N.D.
TP06	0.3	Ash and Clinker	6.1	130	<1	<1	34	300	400	2	63	<3	530	6.8	N.D.
TP17	0.8	Ash and Clinker	7.9	36	<1	<1	21	82	77	<1	26	<3	170	2.8	N.D.
TP19	0.4	Ash and Clinker	8.2	150	<1	<1	34	250	170	<1	63	<3	250	7.6	N.D.
TP18	0.5	Cohesive Made Ground	7.8	15	<1	<1	20	38	59	<1	21	<3	120		N.D.
TP19	2	Cohesive Made Ground	6.3	30	<1	<1	25	56	100	<1	25	<3	110	1.8	N.D.
TP12	0.6	Granular Made Ground	7.4	73	<1	<1	29	79	62	<1	40	<3	78	0.9	N.D.
TP17	0.6	Granular Made Ground	8.1	6	<1	<1	5	28	16	<1	5	<3	81		N.D.
TP21	0.7	Granular Made Ground	9.2	5	<1	<1	9	11	15	<1	7	<3	37	0.2	N.D.
TP22	0.1	Granular Made Ground	7.9	5	<1	<1	16	19	21	<1	10	<3	170		N.D.
TP06	0.1	Made Ground Topsoil	6.5	26	<1	<1	18	79	110	<1	19	<3	120	2.4	N.D.
TP15	0.1	Made Ground Topsoil	8	13	<1	<1	23	55	71	<1	21	<3	130		N.D.
TP19	0.1	Made Ground Topsoil	7.3	20	<1	<1	24	41	67	<1	26	<3	100		N.D.
TP22	0.1	Made Ground Topsoil	7.7	14	<1	<1	27	37	85	<1	23	<3	120		N.D.
TP36	0.1	Made Ground Topsoil	6.9	16	<1	<1	25	35	66	<1	20	<3	110		N.D.
TP01	0.1	Topsoil	6.2	21	<1	<1	21	44	71	<1	21	<3	91		N.D.
TP05	0.1	Topsoil	6.1	16	<1	<1	20	24	56	<1	20	<3	74		N.D.
TP32	0.1	Topsoil	5.7	17	<1	<1	22	25	60	<1	19	<3	82		N.D.
TP34	0.1	Topsoil	6.7	19	<1	<1	26	37	71	<1	27	<3	100		N.D.
TP37	0.1	Topsoil	6.4	21	<1	<1	28	42	74	<1	29	<3	110		N.D.

Key		Source of Guidance Trigger Level	
36	Parameter tested for and found to be in excess of Tier 1 concentration	With the exception of those annotated with one of the symbols below, all Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).	
179	Parameter tested for and found to be > 5 x Tier 1 concentration		
12	Parameter tested for but not found to be in excess of Tier 1 concentration	#	Former CLEA SGV value.
	Parameter not tested for	\$	Ministry of Agriculture, Fisheries & Food. Code of Practice for Agricultural Practice for the Protection of Soil. 1998
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI screen would be 4mg/kg	~	Engineering judgement (Lithos). Boron is a phytotoxic, although most phytotoxic compounds can pose a risk to human health if sufficient concentrations are present. However, plants represent the most sensitive receptor, and a Tier 1 value which is protective of flora is therefore also protective of human health.
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.		
♣	Tier 1 Value is pH dependent		

Summary of the Leachability Testing

Expl Hole	Depth (m)	Material	Concentration in µg/litre unless otherwise Shown. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Tier 1 Screening Concentrations are shown in BLUE .										
			pH	As*	B*	Cd*	Cr*	Cu*	Pb*	Hg*	Ni*	Se*	Zn*
				10	1000	5	50	2000	25	1	20	10	500
TP02	0.5	Ash and Clinker	6.6	2.2	<0.01	<0.02	68	0.7	2.2	<0.05	<1	0.6	17
TP06	0.3	Ash and Clinker	6.5	0.8	0.01	<0.02	<1	<0.5	0.3	<0.05	1	<0.5	20
TP17	0.8	Ash and Clinker	7.5	3.1	<0.01	<0.02	3	<0.5	<0.3	<0.05	2	0.9	<2
TP18	0.5	Cohesive Made Ground	7.8	5.1	0.01	<0.02	2	1	<0.3	<0.05	1	0.5	<2
TP21	0.7	Granular Made Ground	8.7	2.7	<0.01	<0.02	1	<0.5	<0.3	<0.05	2	0.8	<2

Key			Source of Guidance Trigger Level	
0.3	Parameter tested for but not found to be in excess of Tier 1 concentration		*	Water Supply (Water Quality) Regulations 1989, as amended in 2000
36	Parameter tested for and found to be in excess of Tier 1 concentration			Parameter not tested for

Summary of Degree of Ground Contamination (Organics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens (no cover) end use					
			% TOC	PAH		TPH - C6 to C40		
				B(a)P	Naphthalene	GRO~ C ₆ to C ₁₀	DRO◇ C ₁₀ to C ₂₀	LRO C ₂₀ to C ₄₀
				3	4	15	151	1000
TP02	0.5	Ash and Clinker	29	4.1	3.5	<10	20	46
TP06	0.3	Ash and Clinker	33	6.2	5			
TP17	0.8	Ash and Clinker	6.5	4.3	0.6	<10	8	45
TP19	0.4	Ash and Clinker	23	1.5	2			
TP18	0.5	Cohesive Made Ground	2.5	7	0.5			
TP19	2	Cohesive Made Ground	5.1	1	0.3			
TP12	0.6	Granular Made Ground	2.6	0.3	<0.1			
TP17	0.6	Granular Made Ground	8.7	0.2	0.2			
TP21	0.7	Granular Made Ground	0.7	0.5	<0.1			
TP22	0.1	Granular Made Ground	1.4	0.6	<0.1			
TP06	0.1	Made Ground Topsoil	6.2	0.9	1.1			
TP15	0.1	Made Ground Topsoil	2.9	4.5	0.6			
TP19	0.1	Made Ground Topsoil	8.6	0.9	0.5			
TP22	0.1	Made Ground Topsoil	2.2	3.9	0.4			
TP36	0.1	Made Ground Topsoil	5.6	0.7	0.5			
TP01	0.1	Topsoil (Three extracts were taken from the original sample and reanalysed following initially elevated result)	3.2	6.2	0.4			
				0.1				
				0.2				
				<0.1				
TP05	0.1	Topsoil	2.6	0.2	<0.1			
TP32	0.1	Topsoil	3.6	0.3	0.2			
TP34	0.1	Topsoil	7.3	0.9	0.4			
TP37	0.1	Topsoil	7.1	0.3	0.2			
Key			Source of Guidance Trigger Level					
0.3	Parameter tested for but not in excess of Tier 1 concentration		All Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).					
60	Parameter tested for and in excess of Tier 1 concentration		~	Assumes all GRO is aromatic fraction C7 to C8				
	Contaminant not tested for		◇	Assumes all DRO is aliphatic fraction C10 to C12				

Leachables

- 8.3.10 Of the leachability tests conducted on five samples of made ground, one had a concentration of leachable chromium above the maximum permissible concentrations as defined in the Water Supply (Water Quality) Regulations 1989, as amended in 2000.

Organic Determinands

- 8.3.11 Samples have been classified by comparison with Lithos risk-derived Tier 1 screening values (Lithos Scenario B, see Generic Notes 04 in Appendix A). These screening values assume a Soil Organic Matter (SOM) of 6% (equivalent to a TOC of 3.5%). Many organic contaminants are more mobile when the SOM is lower, and consequently lower screening values are then more appropriate for many organic contaminants.
- 8.3.12 In order to check the validity of Lithos Scenario B screening values, the average TOC for each common fill type (beyond any areas of obvious hydrocarbon impact) have been determined.

Fill Type	Typical TOC/%	Comparison with revised Screening Value necessary?
Ash & Clinker	>5%	No
Made Ground Topsoil	>5%	
Cohesive/Granular Made Ground	1% to 3%	Yes, but no significant organic contamination was recorded in this soil type. All determinands well below "6%" screening value; most below limit of detection.
Topsoil	3%	

Total Petroleum Hydrocarbons (TPH)

- 8.3.13 Lithos have used the CLEA model to derive risk based screening values for hydrocarbons, in accordance with the methodology detailed by the TPHCWG, and reviewed by a UK workshop of experts with respect to UK adoption of the method.
- 8.3.14 Assessment of TPH would normally be undertaken in accordance with a 3-step approach, (outlined in Generic Note 04 in Appendix A). However, given former uses and the absence of visual\olfactory evidence, only a simple banded TPH was scheduled here (cf full speciation).
- 8.3.15 None of the fractions exceed their respective Tier 1 criteria, even if it is conservatively assumed all of each fraction is either aliphatic or aromatic.

Poly Aromatic Hydrocarbons (PAH)

- 8.3.16 Speciated PAH analysis has been undertaken in order to determine concentrations of the key "marker" compounds: benzo(a)pyrene (considered the most toxic of the PAHs); and naphthalene (the most mobile and volatile of the PAHs).
- 8.3.17 Sporadic concentrations of benzo(a)pyrene in excess of Lithos' Tier 1 value (assuming no cover in garden and landscaped areas) of 3mg/kg were recorded in each made ground type with a single outlier concentration within the natural topsoil of TP1.
- 8.3.18 The sample of topsoil from TP1 was re-subsampled as three new extracts from the original sample and reanalysed. Each sub-sample yielded concentrations of less than 0.2mg/kg. The original outlier may have been the result of laboratory error or a very small fragment of benzo(a)pyrene rich material such as a grain of ash.
- 8.3.19 No concentrations of benzo(a)pyrene were recorded above Lithos' Tier 1 value of 15mg/kg (which assumes isolation beneath a minimum 600mm thick soil cover) in any of samples. A single elevated concentration of naphthalene was encountered within the ash and clinker.

9 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

9.1 Summary of Significant Contamination

- 9.1.1 Natural topsoil, covers the former playing field areas of the site to the west. Testing generally suggests this material is suitable for re-use.
- 9.1.2 Made ground is confined to the northern section (see Drawing No. 1898/6) of the site in the vicinity of the former school. This made ground contains elevated concentrations of a number of inorganic and organic determinands and contains materials (eg brick and ash), which would generally be considered undesirable as a near-surface material in garden areas.

9.2 Revised Conceptual Ground Model (Contamination)

- 9.2.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.
- 9.2.2 A revised Conceptual Site Model is presented as Drawing No. 1898/6 in Appendix B. The Model includes the contaminants described in Section 9.1 above, and potential pollutant linkages (summarised below in Section 9.3) to receptors.

9.3 Environmental Setting & End Use

- 9.3.1 As discussed in Section 9.1 above, contamination is limited to the made ground beneath the northern section of the site. In order to assess the significance of this contamination, consideration must be given to the site's environmental setting and the proposed end use.
- 9.3.2 The underlying coal measures are classified as both unproductive and secondary aquifers. The nearest surface watercourse is an un-named stream 300m from the site. Therefore, the site's environmental setting is considered to be moderate sensitivity.
- 9.3.3 With respect to human health, the proposed end use (residential) is also sensitive. Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 12.3.

9.4 Pollutant Linkages

- 9.4.1 In terms of a proposed redevelopment of this site, plausible pollutant linkages can be summarised as follows.

Contaminants

- 9.4.2 Contaminants have been summarised in Section 9.1 above.

Pathways

- 9.4.3 Potential contaminant pathways include:
- ingestion
 - dermal contact
 - inhalation of contaminated particulates
 - surface water run-off, including existing drainage infrastructure
 - downward infiltration of leachable/mobile contaminants to groundwater

Receptors

9.4.4 Potential contaminant receptors include:

- the environment – secondary aquifer
- end users of the site (residents)

9.4.5 It can be concluded that there are plausible pathways between actual contaminant and potential receptors. Consequently, some remediation action will be required, either treatment/removal of the contaminant, or “breakage” of the pathway.

9.5 Potential Remediation Options**General**

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

Combustibility

9.5.2 The ash and clinker is considered combustible and, in accordance with current guidance, the following remediation measures should be adopted if it is left on site:

- Garden areas: isolate beneath a minimum 1,000mm thickness of inert soil, comprising 850mm of “clean” subsoil plus 150mm topsoil.
- Services: utility trenches (especially those carrying potential heat sources e.g. electric cables) should be cut oversize and backfilled with clean, inert material. This applies to any utility trenches that run beneath estate roads or extend under houses. It is strongly recommended that further advice be sought from all statutory service bodies with respect to the ground conditions within which they will lay services.
- Estate roads: no action required (although generally less than 1,000mm thick, the road construction is considered to provide adequate isolation as there will be no heat source). Local Authority Highways approval should be sought.
- Houses: no action required (the floor slab will include insulation and therefore heat transfer into the ground will be negligible). Local Authority Building Control and Warranty Provider approval should be sought.

9.5.3 The made ground topsoil at this site yielded a maximum CV of 2.4MJ/kg. This is at the lower end of the range where the potential for combustion exists and it is not considered a significant hazard as it is also recommended to be isolated below 600mm of inert soil (see below).

Inorganic and PAH contamination

9.5.4 The ash and clinker and granular made ground has yielded elevated concentrations of a number of metals. Made ground in general has yielded sporadic elevated concentrations of benzo(a)pyrene. Therefore, where residual made ground remains beneath garden and landscaped areas (i.e. not beneath hardstanding) a 600mm thick surface cover of “clean” soil comprising 500mm subsoil and 100mm topsoil is recommended. This cover will break potential pollutant linkages between the contaminated made ground and future end-users.

9.5.5 Drawing No. 1898/6 details the area of the site underlain by made ground that will require soil cover.

9.5.6 Alternatively, the made ground types (except made ground topsoil) are considered suitable for redistribution beneath concrete oversite or areas of hardstanding, where they would be satisfactorily isolated from end users.

Waste Classification

- 9.5.7 Disposal of the made ground off site is not considered appropriate, economically viable, nor in line with current Government philosophy regarding sustainable development. However, some excess arisings may be generated by excavations for foundations, sewers etc.
- 9.5.8 Notes outlining the interpretation of analytical data with respect to waste classification are included in Appendix A to this report, together with notes about Waste Acceptance Criteria (WAC).
- 9.5.9 Non-hazardous soil waste can go to a non-hazardous landfill facility; no further testing (eg WAC) is required. Lithos typically only include WAC analysis if significant off-site disposal (of soil classified as hazardous waste) is anticipated. Characterisation of stockpiled materials generated during the construction phase is likely to be required if off-site disposal is proposed, and clearly this cannot be undertaken during a pre-development site investigation.
- 9.5.10 It should be noted that classification of soils as inert, non-hazardous or hazardous should be undertaken in accordance with the Environment Agency's Technical Guidance WM2 (*'Interpretation of the definition and classification of hazardous waste', 3rd edition, 2013*), and is quite a complex process. The comments below are preliminary only and are not based on the more rigorous data review required by WM2.
- 9.5.11 All soil arisings generated by excavations at this site are likely to be classified as non-hazardous waste; but it would be prudent to check with landfill operators.

9.6 Summary of Potential Pollutant Linkages & Mitigation

- 9.6.1 In terms of the proposed redevelopment plausible pollutant linkages, and feasible remediation options, can be summarised as follows:

Receptors	Pathways	Contaminants	Remediation Options
Human Health (Future residents) ◇	Consumption of contaminated vegetables	Metals, benzo(a)pyrene in the made ground	Isolation beneath at least 600mm clean soil cover in garden and landscaped areas.
	Ingestion		
	Dermal contact		
	Inhalation (dust and/or vapours)		
	Migration & accumulation of explosive gas	Methane, Hydrocarbons in the made ground	Gas monitoring ongoing.
Buildings	Migration & accumulation of explosive gas	Methane, Hydrocarbons in the made ground	To be assessed on completion of monitoring and gas risk assessment.
	Contact with "aggressive" soil and/or groundwater	Sulphate in the made ground	Design Sulphate Class DS-1, ACEC Classification of AC-1 for sub-surface concrete
Plants	Uptake of phytotoxic elements	Cu, Ni, Zn & B in the made ground	Placement of at least 600mm clean soil cover in garden and landscaped areas.

◇ transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and regulations made under the Act including for example the COSHH Regulations.

10 HAZARDOUS GAS

10.1 General

10.1.1 Consideration of the conceptual site model and potential linkages has enabled a preliminary qualitative assessment of risks associated with gas:-

Source	Receptors	Hazard	Pathway	Initial Risk
On-site made ground	Human Health	Asphyxiation & explosion.	Vertical migration, ingress & accumulation	Low: made ground essentially inert, with little degradable matter.
	Buildings	Explosion.		
Off-site landfill (Littleworth Lane Tip)	Human Health	Asphyxiation & explosion.	Lateral migration, ingress & accumulation	Moderate: landfill is located immediately north of the site and accepted mixed waste including household.
	Buildings	Explosion.		
	Buildings	Explosion.		

10.1.2 Therefore, eleven gas monitoring wells have been installed in boreholes across the site. Details of the installations are given on the borehole logs presented in Appendix K to this the report.

10.1.3 The generation potential of the gas source was initially considered to be moderate; however the monitoring results to date (two visits) would suggest that this may be reduced to low. Consequently, in accordance with CIRIA Report C665, given the proposed residential end use, six visits have been scheduled over a three month period.

10.2 Scope of Works

10.2.1 To date, the wells have been monitored on two occasions for groundwater levels and soils-gases.

10.2.2 A standard procedure was followed, in accordance with CIRIA guidance:

- Ambient oxygen concentration
- Atmospheric temperature & pressure
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data LMSx infra-red gas analyser
- Standing water level using a dipmeter
- Ambient oxygen concentration (check for instrument drift)

10.3 Monitoring Results

10.3.1 The results of the monitoring completed to date are summarised below.

Monitoring Well	Response Zone	Range of Methane Concentrations (% v/v)	Range of Carbon Dioxide Concentrations (% v/v)	Range of Steady Flow Rates (litre/hour)
BH01	1.5 – 4.3m (Oaks Rock Sandstone)	Not Detected	1.7	Not Detected
BH02	1.5 – 5.5m (Oaks Rock Sandstone)	Not Detected	0.2	Not Detected
BH03	1.5 – 4.3m (Oaks Rock Sandstone)	Not Detected	1.2	Not Detected
BH04	1.5 – 5.5m (Oaks Rock Sandstone)	Not Detected	Not Detected	Not Detected
BH06	2.0 – 5.0m (Oaks Rock Sandstone)	Not Detected	0.5	Not Detected

Monitoring Well	Response Zone	Range of Methane Concentrations (% v/v)	Range of Carbon Dioxide Concentrations (% v/v)	Range of Steady Flow Rates (litre/hour)
BH07	3.5 – 5.5m (Oaks Rock Sandstone)	Not Detected	3.3	Not Detected
BH07A	1.0 – 2.0m (Made Ground)	Not Detected	4.1	0.3
BH08	3.5 – 5.5m (Oaks Rock Sandstone)	Not Detected	Not Detected	Not Detected
BH08A	1.0 – 2.0m (Made Ground)	Not Detected	0.9	Not Detected
BH09	3.5 – 5.5m (Oaks Rock Sandstone)	Not Detected	0.1	Not Detected
BH10	1.0 – 2.0m (Oaks Rock Sandstone)	Not Detected	0.1	Not Detected

10.4 Discussion

- 10.4.1 Generic Notes outlining how monitoring results are included as Generic Note 05 in Appendix A.
- 10.4.2 An initial hazardous gas risk assessment incorporating all of the results will be issued on completion of monitoring in September 2014.

10.5 Radon

- 10.5.1 BRE Report BR211 (2007 Edition) indicates that radon protection measures are not required for new dwellings at the site. Information from Landmark confirms that the site is in an area where less than 1% of homes are estimated to be above the action level, and that radon protection measures are therefore not required.

11 GEOTECHNICAL TESTING

11.1 General

- 11.1.1 Sixteen samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.
- 11.1.2 The geotechnical laboratory test results are presented in Appendix I to this report.

11.2 Atterberg Limits

- 11.2.1 The plasticity index of eleven samples of cohesive soil have been determined; results are summarised below.

Soil type	Range of Plasticity Indices* (Average)	Shrinkability
Natural Clay Soils	14-32 (24)	Medium

* Modified where appropriate in accordance with revised Chapter 4.2 of the NHBC Standards (April 2003).

Note. The term Shrinkability is equivalent to the term Volume Change Potential used in Chapter 4.2.

- 11.2.2 For the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of medium shrinkability.

11.3 Soluble Sulphate and pH

- 11.3.1 In accordance with BRE Special Digest 1:2005, this site has been classified as brownfield with a mobile groundwater regime.
- 11.3.2 It is envisaged foundations will extend to depths of about 1m through made ground and natural strata and samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).
- 11.3.3 The concentrations of sulphate in the aqueous natural soil extracts of sixteen samples were determined. In addition, four samples of made ground were tested as part of the contamination suite. The pH value of each sample has also been determined.
- 11.3.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the Table below.

Soil type	Lowest pH values	Highest Soluble Sulphate Concentration (mg/l)
Made Ground	6.1	460
Natural Soils	5.3	310

- 11.3.5 pH values were all above 5.5 (with the exception of one sample at 5.3), therefore concentrations of chloride and nitrate are considered insignificant.
- 11.3.6 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1.

11.4 Soakaway Tests

- 11.4.1 General notes about soakaways, including their location, design, and Lithos's test methodology are presented in Appendix A.
- 11.4.2 Ten soakaway tests were carried out in accordance with BRE Digest 365 "Soakaway Design". The locations of the soakaways are shown on Drawing No. 1898/6 presented in Appendix B to this report.

Infiltration Rates

- 11.4.3 . BRE Digest 365 design takes into account the time of emptying the soakaway pit between 25% and 75% of its effective depth. The effective depth is calculated from the starting water level to the soakaway pit base.
- 11.4.4 However, none of the tests even reached the 75% effective depth and therefore infiltration rates could not be calculated.
- 11.4.5 Consequently, soakaways will not provide a suitable drainage solution for the discharge of surface water run-off at the site; there is likely to be a need for surface water balancing.

12 GEOTECHNICAL ISSUES

12.1 Conceptual site Model

- 12.1.1 It is understood that consideration is being given to redevelopment of the site with around 198 traditional two to three storey domestic dwellings with associated gardens, POS and adoptable roads and sewers.
- 12.1.2 Ground conditions at the site are relatively simple, with made ground in the north directly overlying weathered coal measures generally comprising stiff clay. In the south the weathered coal measures directly underlie topsoil.

12.2 Mining & Quarrying

- 12.2.1 This site is located within a Coal Mining Development Referral Area (an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc).
- 12.2.2 The Newhill Coal (0.61m to 1.37m thick) is the shallowest coal seam beneath the site located approximately 22m below the base of the Oaks Rock; therefore, any shallow coal workings should not affect surface stability, and an intrusive mining investigation will not be required.
- 12.2.3 A mining subsidence damage claim was discharge on the school by the Coal Authority in 1995; however, the CA now state that '*Any ground movement from these coal workings should have stopped by now*', and therefore further subsidence would not be expected.
- 12.2.4 Two 19th Century quarries existed within 250m of the site.

12.3 Foundation Recommendations

General

- 12.3.1 Foundation recommendations assume that development will be two or three storey construction and that line loads will not exceed 80kN/m run. If this is not the case significant alteration to these recommendations will be required.
- 12.3.2 We have also assumed that final development levels will not differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned by Harron should consider implications for the foundation recommendations outlined below.
- 12.3.3 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.
- 12.3.4 A suspended floor construction should be used wherever the depth of made ground or infill beneath a plot exceeds 600mm. This is likely to affect the all plots in the north of the site underlain by made ground (see Drawing No 1898/6).
- 12.3.5 Sub-surface concrete in contact with the made and natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification AC-1.

Strip/Trench Fill Footings

- 12.3.6 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for the majority of two or three storey houses constructed at the site. This solution is viable where the made ground is less than about 2.5m thick, and firm to stiff clay or competent rock is the founding material.

- 12.3.7 Natural soils (mostly firm or stiff clay) is generally considered to have a safe bearing capacity of at least 150kN/m².
- 12.3.8 Assuming a strip foundation of 10m length and 0.6m width, founding at 0.9m depth, and a maximum line load of 80kN/m run, minimal settlements would be anticipated.
- 12.3.9 Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata. One layer of B385 mesh placed 75mm above the base of the footing is likely to provide suitable reinforcement, but further advice should be sought from the Structural Engineer.
- 12.3.10 Where rock is encountered at shallow depth foundations should be placed entirely on rock and not partially on rock and partially on residual soil. This may, depending on surface gradient, necessitate significant overdeepening of foundations.
- 12.3.11 Clay classification tests suggest that natural cohesive soils at the site should be regarded as being of medium shrinkability. A minimum founding depth of 900mm is therefore recommended for all soils on the site where strip footings are proposed.
- 12.3.12 Founding depths are from original or finished ground level, whichever is the lower, to the underside of the footing.
- 12.3.13 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2.
- 12.3.14 Where existing buildings have been demolished in the north of the site relict foundations could probably be left in-situ and an allowance made for local breaking out where these conflict with new foundations.
- 12.3.15 Foundations of plots placed over relict foundations should be taken to greater depth than the relict foundations and into natural ground of adequate bearing capacity.
- 12.3.16 Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.
- 12.3.17 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.
- 12.3.18 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).
- 12.3.19 Harron or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

12.4 Floor Slabs

- 12.4.1 The natural ground beneath this site includes cohesive soils and is therefore subject to seasonal variation in moisture content. If ground slabs were constructed on desiccated soil, heave of the slab would occur on re-hydration of the ground. If any significantly desiccated soil is present, a block and beam floor construction should be adopted. In accordance with NHBC Standards Chapter 4.2, a minimum void height of 250mm should be adopted.

- 12.4.2 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems). This is likely to affect all plots in the north of the site.
- 12.4.3 Where foundations are within the influence of existing or proposed trees, and a trench fill foundation depth of 1.5m or greater is required, the ground floor should be constructed using block and beam, or another suitable voided construction. A suitable approved compressible void former, should be used on the internal face of all external walls.
- 12.4.4 It should be noted that NHBC have suffered a significant number of claims resulting from the use of ground bearing floor slabs. Consequently, if ground bearing slabs are proposed, care should be taken correct and careful construction. For example, if fill to the internal face of the foundation excavation is not properly compacted, subsequent settlement can result in cracking of the slab.

12.5 Designated Concrete Mixes

- 12.5.1 The following designated mixes in accordance with BRE Special Digest SD1 and BS 8500: Part 1: 2006 will be suitable for use on this site.

Application	DS-1 conditions (natural ground) ACEC Class AC-1
Unreinforced strip/trench fill footings	GEN1
Reinforced strip/ trench fill footings (mesh reinforcement)	RC25/30 ^{*1}
Unreinforced concrete floor slabs	GEN2
In situ reinforced concrete floor slabs	RC28/35

Note. ^{*1}Although RC25/30 is in line with BS8500, Lithos recommend the use of RC28/35 for concrete used in structurally sensitive works, to provide greater certainty of compliance with strength verification tests, enhanced durability and compliance with accepted NHBC practice.

12.6 Excavations

- 12.6.1 Based on the results of the investigation it is unlikely that major groundwater flows will be encountered in shallow excavations.
- 12.6.2 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in granular soils and made ground.
- 12.6.3 Mudstone or siltstone bedrock was encountered within the boreholes; excavation greater than 4m may prove difficult.

12.7 Drainage

- 12.7.1 Based on observations and in-situ testing made during the investigation, soakaways will not provide a suitable drainage solution for surface water run-off at the site. Consequently, there is likely to be a need for surface water balancing.
- 12.7.2 Any damage to the existing land drainage system caused by foundation or sewer excavations should be made good; this may require diversion and re-connection.
- 12.7.3 It is recommended that the developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

12.8 Highways

- 12.8.1 Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables (Interim Advice Note 73/06 Revision 1 (2009), Chapter 5. Characterisation of Materials Design Guidance For Road Pavement Foundations - Draft HD25) indicate that the weathered Oaks Rock deposits will have a CBR value of at least 3%.
- 12.8.2 Made ground is present across the site and it is strongly recommended that consultation regarding the specification of the highways should be made with the adopting authority. However, it is considered that the following options would be suitable to enable the construction of the highways.
- 12.8.3 Where made ground is present the following options are considered suitable. Excavation of the full thickness (up to a maximum of 2m) of made ground and either:
- a) replacement with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) "Specification for Highway Works" 1998, or
 - b) screening, selection and replacement (in accordance with Series 600) of suitable material in engineered layers. Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.
- 12.8.4 Any residual made ground materials in the base of the excavation (ie in areas where the thickness of made ground exceeds 2m) should be inspected and (where necessary) any soft spots removed and replaced with suitable engineered fill.
- 12.8.5 Where the made ground is re-engineered it is considered that a CBR value of 5% should be achievable, however, this should be verified by field trials.
- 12.8.6 Crushing of demolition/hardstand/foundation arisings will generate aggregate, which (subject to confirmatory testing) should be suitable for use as unbound pavement materials within the highways.

12.9 External Works

- 12.9.1 Any digital terrain modelling undertaken, or commissioned by Harron should be made available to their Engineering Designer prior to issue of an External Works Drawing.

13 REDEVELOPMENT ISSUES

13.1 General

- 13.1.1 This report has presented options with respect to foundation solutions, treatment of contamination etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.

13.2 Remediation Strategy

- 13.2.1 Redevelopment of this site will might be subject to planning conditions relating to remediation and validation. Once a specific, preferred development strategy has been decided, Lithos could liaise with local Planning Authority and Warranty Provider and prepare a detailed Remediation Strategy document for approval.

13.2.2 The Remediation Strategy document would include:

- General background information, including site location, site description and a summary of ground investigation data
- An overview of existing constraints on development and the aims of the proposed remediation works
- Specific details of the anticipated site remediation/preparatory works
- Details of site supervision and verification
- A summary of implications for redevelopment

13.2.3 The Remediation Strategy will describe what is required, but not how it is achieved; the appointed Contractor would normally be expected to undertake an Options Appraisal, and then prepare a Method Statement.

13.2.4 The anticipated remediation works are summarised below:

- General site clearance of surface materials and vegetation.
- Excavation of up to a maximum depth of 2m beneath proposed adoptable road footprints in the north of the site and controlled re-engineering of selected materials in layers to approximately 650mm below final road levels.
- Provision of a minimum 600mm thick cover layer of 'clean' soils in all garden and landscaped areas within the northern section of the site (see Drawing No 1898/6).

13.3 Health & Safety Issues - Construction Workers

13.3.1 The bulk of the made ground will be retained on site. This made ground contains contaminants at concentrations above the guidance threshold values for an end use that includes domestic gardens. Workers involved in excavations for foundations, drainage, utilities etc are likely to come into direct contact with the made ground.

13.3.2 Although workers will only be exposed to the contaminated soil for a relatively short time, the contaminants represent a risk, and simple precautionary measures are required, i.e. good personal hygiene and basic personnel protective equipment.

13.3.3 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document "*Protection of Workers and the General Public during the Redevelopment of Contaminated Land*".

13.3.4 Access into excavations etc. must be controlled and only undertaken in accordance with the Confined Spaces Regulations 1997. The atmosphere in shored trenches in excess of 1.2m should be monitored for oxygen and hazardous gas (methane & carbon dioxide), prior to personnel entering such excavations. Monitoring should continue whilst personnel are working in deep excavations.

13.3.5 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

13.4 Control of Excavation Arisings

13.4.1 Excavations into made ground are likely to yield contaminated arisings. The groundworker should carefully segregate (and stockpile separately) made ground arisings from arisings of "clean" natural soils, in order that an excessive volume of unsuitable material is not generated.

13.4.2 Made ground arisings could be:

- redistributed beneath concrete oversite, or areas of hardstanding, where they would be satisfactorily isolated from end users;
- isolated beneath the 600mm thick cover layer in garden or landscaped areas;
- exported from site to a suitably licensed landfill facility.

13.5 New Utilities

13.5.1 It is recommended that trenches for services in the north of the site, including site drainage and water supply, are cut over size in order to isolate pipe materials from potential contaminants and to enable maintenance to be conducted in "clean" material.

13.5.2 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.

13.5.3 Harron should consult Yorkshire Water at the earliest opportunity regarding the selection of pipes and fittings for the proposed water supply network. This site is brownfield, and previous usage of the site may have resulted in some ground contamination.

13.5.4 It is unlikely that the Water Company will request the use of Protectaline mains, with plastic coated copper house connections, given that residual organic contaminants will still be present post-remediation, albeit at acceptable concentrations.

14 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

14.1 General

14.1.1 It is understood that consideration is being given to redevelopment of the site with around 198 traditional two to three storey domestic dwellings with associated gardens, POS and adoptable roads and sewers.

14.1.2 Ground conditions at the site are relatively simple with made ground in the north directly overlying weathered coal measures generally comprising stiff clay. In the south the weathered coal measures directly underlie the topsoil.

14.2 Hazardous Gas

14.2.1 There is an extensive area of landfill located immediately north of the site along with a thickness of made ground in the north. Therefore, hazardous gas monitoring wells have been installed in a number of boreholes. A gas risk assessment will be issued on completion of the monitoring in September 2014.

14.2.2 The site is in an area where less than 1% of homes are estimated to be above the radon action level. As such, no special precautions against radon gas are required.

14.3 Mining

14.3.1 This site is located within a Coal Mining Development Referral Area (an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc).

- 14.3.2 The Newhill Coal (0.61m to 1.37m thick) is the shallowest coal seam beneath the site located approximately 22m below the base of the Oaks Rock; therefore, any shallow coal workings should not affect the surface stability, and an intrusive mining investigation will not be required.

14.4 Contamination & Remediation

- 14.4.1 The ash and clinker and granular made ground have yielded elevated concentrations of a number of metals. Made ground in general has yielded sporadic elevated concentrations of benzo(a)pyrene. Therefore, where residual made ground remains beneath garden and landscaped areas (i.e. not beneath hardstanding) a 600mm thick surface cover of "clean" soil comprising 500mm subsoil and 100mm topsoil is recommended.

14.5 Foundations

- 14.5.1 All plots at the site can be founded on shallow strip or deepened trench fill footings. The founding strata will be stiff clay at a minimum depth of 900mm deepened near trees and where made ground exists in the northern section of the site.

14.6 Flooding

- 14.6.1 The EA indicate that the site is/is not located within an indicative floodplain.

14.7 Drainage & Highways

- 14.7.1 Based on observations and in-situ testing made during the investigation, soakaways will not provide a suitable drainage solution for surface water run-off at the site. Consequently, there is likely to be a need for surface water balancing.
- 14.7.2 The natural weathered Oaks Rock deposits at shallow depth in the south of the site will have a CBR value of at least 3%.
- 14.7.3 Where made ground is present the following options are considered suitable. Excavation of the full thickness (up to a maximum of 2m) of made ground and either:
- replacement with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) "Specification for Highway Works" 1998, or
 - screening, selection and replacement (in accordance with Series 600) of suitable material in engineered layers. Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.

APPENDIX A
GENERAL NOTES

01	Environmental Setting
02	Ground Investigation Fieldwork
03	Geotechnical Testing
04	Contamination Laboratory Analysis & Interpretation
05	Hazardous Gas
06	Soakaways

01 - Environmental Setting

General

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

Geology, Mining & Quarrying

In order to establish the geological setting of a site, Lithos refer to BGS maps for the area, and the relevant geological memoir. Further information is sourced from the Local Authority and by reference to current and historical OS plans. A coal mining report is obtained from the Coal Authority (CA).

In July 2011, the CA formalised their requirements in relation to planning applications and introduced some new terminology. The CA, using its extensive records has prepared plans for all coalfield Local Planning Authorities, which effectively refines the defined coalfield areas into areas of higher risk (known as the Coal Mining Development **Referral Area**) and lower risk (known as the **Standing Advice Area**). The Coal Mining Development Referral Areas contain a range of specific mining legacy risks to the surface, including mine entries; shallow coal workings; workable coal seam outcrops; mine gas; geological features; and previous surface mining sites. The Standing Advice Area is the remainder of the defined coalfield. In this area no known defined risks have been recorded; although there may still be unrecorded issues.

Landfills

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

Radon

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

In order to assess potential risks associated with radon gas, Lithos refer to BRE Report BR211, 2007: "*Radon: guidance on protective measures for new buildings*". The level of protection needed is site-specific and is determined by reference to the maps contained in Annex A of BR211. These maps are derived from the Radon Atlas of England and Wales (2007), and indicate the highest radon potential within each 1km grid square.

If the site falls within a light grey square on the relevant map in Annex A then basic radon protection should be installed in new buildings; if the site falls within a dark grey square then full radon protection should be installed. **If the site is in an un-shaded square then no radon protection is needed.**

BR211 provides a preliminary indication of the measures required for a particular site, but it is also often beneficial to request a BR211 Radon Report from the BGS. The Annex A maps indicate the highest geological radon potential within each 1km grid square, but in many cases the radon potential varies considerably within the grid square. The BR211 Radon Report gives definitive guidance on the requirement for radon protective measures, and therefore may allow the adoption of a lower level of protection than that indicated in the Annex A maps.

Lithos typically obtain a BR211 Radon Report for all sites that fall within a shaded square on the relevant Annex A map. When requesting a BR211 Radon Report from the BGS Lithos select the search radius carefully, since too large a search radius may result in the inclusion of areas of higher geological radon potential, and therefore in the recommendation of too high a level of protection. Further details of the protective measures required are provided in the Hazardous Gas section of this Geoenvironmental Report.

Hydrogeology

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

- groundwater quality
- recorded pollution incidents
- licensed groundwater abstractions

From April 2010 the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are split into two different type of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- Bedrock -solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations:

Principal Aquifers: These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary Aquifers: These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:

Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;

Secondary B - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Undifferentiated - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata: These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Note: The maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the bedrock designation map will be unproductive strata. However, for uncoloured areas on the superficial (drift) designation map it is not possible to distinguish between areas of unproductive strata and areas where no drift is present. To do this, it is necessary to consult the published geological survey maps.

For the purposes of our Groundwater Protection Policy the following default position applies, unless there is site specific information to the contrary:

- if no superficial (drift) aquifers are shown, we will use the bedrock designation;
- in areas where the bedrock designation shows unproductive strata (the uncoloured areas) we will use the superficial (drift) designation;
- in all other areas, we will use the more sensitive of the two designations (e.g. if secondary drift overlies principal bedrock, we will adopt an overall designation of principal)

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

Hydrology

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

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

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

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

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

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

1. Dark blue areas could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

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

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

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

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

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

COMAH & Explosive Sites

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

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

Preliminary Conceptual Ground Model

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

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential targets.

Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this Geoenvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

02 - Ground Investigation Fieldwork

General

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

- BS5930:1999 "Code of practice for site investigation"
- BS10175:2011 "Code of practice for the identification of potentially contaminated sites".
- "Technical Aspects of Site Investigation" – EA R&D Technical Report P5-065/TR (2000)
- "Development of appropriate soil sampling strategies for land contamination" – EA R&D Technical Report P5-066/TR (2001)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "Sampling strategies for contaminated land"
- "Guidance on the protection of housing on contaminated land" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "Guide to the selection of Geotechnical Soil Laboratory Testing"

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

- Investigation technique adopted
- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of any in-situ testing
- Any gas\groundwater monitoring well installed

Exploratory Hole Locations

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

Investigation Techniques

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

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

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

In-situ Testing

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

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

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

Sampling

Typically Lithos collect at least three soil samples from each exploratory hole, although in practice a greater number are often taken. The collection of a sufficient number of samples provides a sound basis upon which to schedule laboratory analysis, ensuring:

- a sufficient number of samples from each (common) site material are tested;
- horizontal and vertical coverage of the site is adequate, thereby providing a robust data set for use in the conceptual ground model;
- any localised, significant, but non-pervasive conditions are considered.

Made ground and natural soils encountered in the field during a ground investigation often contain a significant proportion of coarse grained material (e.g. brick etc). Soil samples obtained during most investigations are often only truly representative of the in-situ soil mass where there is an absence of particles coarser than medium gravel; i.e the entire soil mass would pass a 20mm sieve.

Generic Notes – Geoenvironmental Investigations



Representative bulk samples of the **soil mass** are retrieved from coarse soils for specific geotechnical tests (most notably grading and compaction); this typically requires the collection of at least 10kg of soil, and occasionally >50kg. However, in the context of assessing land contamination, it is generally accepted that samples should be representative of the **soil matrix** of the stratum from which they are taken. Consequently, truly representative samples of coarse soils for subsequent contaminant analysis are not obtained - only the finer fraction is placed in sample containers. Coarse constituents not sampled would typically comprise any 'particles' with an average diameter greater than about 20mm (i.e. coarse gravel, cobble and boulder).

At present, neither ISO/IEC 17025 nor MCERTS specify sample pre-treatment with respect to stone removal. Unsurprisingly therefore UKAS accredited testing laboratories do not adopt the same approach to stones¹ – some crush and test the “as received” soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

In essence, samples taken from coarser soils for contaminant analysis are “screened” by the geoenvironmental engineer in the field, and often sieved again by the laboratory during sample preparation. Geoenvironmental engineers do not typically re-calculate soil mass contaminant concentrations by taking account of the unsampled coarse fraction. Likewise, laboratories that remove stones typically report contaminant concentrations based on the dry weight of soil passing the sieve. In the context of land contamination and human health risk assessment, this is considered reasonable, because it is the soil matrix which is of greatest concern. Stones are unlikely to:

- Provide a significant source for plant uptake (consumption of vegetables);
- Remain on vegetables after washing (consumption of vegetables);
- Be eaten (accidentally by an adult, or deliberately by a child);
- Be whipped-up by the wind for dust generation (inhalation);
- Stick to the skin for any length of time (dermal contact);
- Yield toxic vapour (inhalation).

Consequently, Lithos instruct labs to remove all stones >10mm, and to report the results as dry-weight based on the mass of matrix tested. However, the laboratory are given site-specific instruction where coarse stones are coated in say oil, or impregnated with mobile contaminants such as diesel. Where the stones are predominantly natural, or inert (e.g. brick, concrete etc), removal will clearly result in higher reported concentrations, than if the stones were crushed and added to the matrix.

Where the stones include a significant proportion of contaminant-rich material (e.g. slag, fragments of galvanised metal etc) an argument could be made for crushing and analysing. However, provided the stones are stable (i.e. unlikely to disintegrate or degrade) they should not pose a significant risk to human health for the reasons stated above.

Sometimes it is necessary to obtain samples that are not representative of the wider soil matrix, for example when investigating localised, significant, but non-pervasive conditions. Any such unrepresentative samples are annotated with the suffix ‘*’ (eg 2D*, or 4G*). Lithos’s site engineer describes both the unrepresentative sample, and the soil mass from which it was been taken.

Sample Containers (for contaminant analysis). Samples of soil for contaminant testing are placed into appropriate containers (see below). Soil samples for organic analysis are stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory.

Anticipated testing	Container(s)
pH & metals only	1 kg plastic tub
organics (TPH, PAH) etc only	500ml wide-necked glass jar. Vial required if TPH is to include GRO.
VOCs (incl. naphthalene and/or GRO) only	glass vial & 1kg plastic tub
pH & metals, and organics	1 litre wide-necked glass jar & 1kg plastic tub
pH & metals, and organics (incl. VOCs or GRO)	glass vial; 1 litre wide-necked glass jar; & 1kg plastic tub

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests is proposed.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork. Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

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

Description of Strata

Soils encountered during an Lithos investigation are described (logged) in general accordance with BS 5930. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text. The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to Exploratory Hole Logs

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

¹ Mark Perrin. *Stoned – Sample Preparation for Soils Analysis. Ground Engineering, April 2007.*

03 - Geotechnical Laboratory Tests

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Lithos. All tests are carried out in accordance with BS 1377:1990. The following laboratory testing are routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

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

- Grading.
- Compaction tests
- Particle density.

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

Atterberg Limits & Moisture Content

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

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Lithos typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%. PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I_p), defined as:

$$I_p = I_p * (\% < 425\mu\text{m} / 100)$$

ie if PI is 30%, but the soil contains 80% < 425µm, then: $I_p = 30 * 80/100 = 24\%$.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs. Lithos apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

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

Unless the judgment strongly indicates otherwise, Lithos typically adopt a conservative approach and recommend assumption of the higher classification.

Soluble Sulphate and pH

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

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

Lithos refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

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

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

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO₄ for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

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

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

04 - Contamination Analysis & Interpretation (including WAC)

Waste Classification & WAC

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

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

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

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

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, then WAC analysis should be scheduled at an early stage in the remediation programme. However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous, and these contaminants can often be dealt with by alternative technologies (eg by bioremediation or stabilisation) and consequently retention on site is often possible.

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

Contamination Laboratory Analysis & Interpretation

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

Current UK Guidance

The UK approach to contaminated land is set out in Contaminated Land Report No. 11 (2004) "*Model Procedures for the Management of Land Contamination*". The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source, (2) a receptor (eg controlled water or people) and (3) a pathway linking the (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

Lithos adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels, Lithos risk-derived screening values, or remedial targets. It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

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

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

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2006) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2007 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential **phytotoxic effects** of contaminants, Lithos refer to "*The Soil Code*" (MAFF, 1998) for copper and zinc. The CLEA SGV is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, 'Concrete in aggressive ground', 2005.

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

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

Soil Screening Values derived by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 and 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 and 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software (Version 1.05) Handbook Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

The approach set out in these documents represents current scientific knowledge and thinking; and includes the Contaminated Land Exposure Model (CLEAv1.06). The Environment Agency are in the process of using this updated approach to regenerate a selection of Soil Guideline Values (SGVs).

CLEA SGVs were derived for standard land use scenarios predominantly in the context of Part IIA, using a conceptual site model (CSM) defined in SR3. Lithos have incorporated amendments to the CSM used to derive SGVs, that more accurately reflect redevelopment within the planning regime; consequently, Lithos have not adopted any published SGV as a screening value.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). Lithos consider it reasonable to adopt the CLEA default TOC for made ground. However, where the average TOC value for a particular soil type is significantly lower than the 3.5%, evaluation of Lithos Screening Values should be undertaken and a site specific risk assessment will usually be required. Other CLEA default characteristics adopted by Lithos are:

Sandy loam characteristics (Source)	Default values adopted.
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for four different CSMs (Scenarios); these are:

- A - Residential with gardens, but no cover (or only up to 300mm)
- B - Residential with gardens and 600mm 'clean' cover
- C – Residential apartments with landscaping (i.e. no home grown produce)
- D - Commercial/industrial with landscaping.

The exposure pathways considered for each scenario are detailed in the Table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	• Direct ingestion of soil • Dermal contact • Consumption of vegetables and soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant
B	Residential with garden minimum 600mm cover	• Inhalation of indoor vapours • Inhalation of outdoor vapours	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.
D	Commercial/ industrial with landscaped areas no cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.

Lithos have assumed the source of contamination is directly below the building foundations i.e. a depth to source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default. This adjustment has been included to account for sites where made ground is re-engineered to enable new buildings to be established on raft foundations. In such situations contamination may lie directly beneath the foundation.

The Soil Screening Values referred to in this document are **not** intended to be used when considering potential risks associated with:

- existing land uses in the context of Part IIA of the Environment Protection Act 1990;
- end uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; and
- controlled waters.

Generic Notes –Geoenvironmental Investigations



With respect to **inorganic** determinands, Lithos derived Tier 1 values for the four Scenarios A to D are presented below:

Inorganic Contaminant	Source	Tier 1 Assessment Criteria (mg / kg) for Scenarios A to D					Comments / Notes
		SGV (Resi)	A	B	C	D	
As	CLEA	32	32	Use (A) in SI Report for initial "screen". If >5 x A, then consider increase of cover to 1,000mm	35	635	
Cd	CLEA	10	5		17	230	
Cr	CLEA		3,000		3,000	30,000	Assumes Cr is CrIII.
Pb	CLEA		450		450	750	Based on former SGV
Ni	CLEA	130	127		127	1,700	Assessment of health risk only
Se	CLEA	350	350		595	13,000	
Hg	CLEA	170	169		238	3,640	Assumes in an inorganic compound.
B	Lithos		5		5	5	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Cu	DoE		80-200		80-200	80-200	
Zn	DoE		200		200	200	
Cyanide	CLEA		527		530	14,000	

With respect to **organic** determinands, Lithos derived Tier 1 values for the four Scenarios A to D are presented below:

Organic Contaminant (all sourced via CLEA)	Tier 1 Assessment Criteria (mg / kg) for Scenarios A to D					Comments / Notes
	SGV (Resi)	A	B	C	D	
Benzene	0.33	0.3	0.5	0.6	100	
Toluene	610	497	1,440	1,690	4,360	
Ethyl Benzene	350	240	416	498	2,840	
Xylenes	240	127	146	183	2,620	
Phenol	420	412	2,360	557	38,700	
PCBs		1.7	1.8	1.8	1.8	Based on toxicity of EC7.
Benzo(a)pyrene		3	15	3	15	Where source is not a coal tar
Naphthalene		4	4	5	430	
Gasoline Range Organics		15	16	21	1,000	See 3-step assessment of TPH below.
Diesel Range Organics		151	153	232	5,000	
Lubricating Range Org		1,000	5,000	1,000	5,000	

Note: **PAH** cannot be assessed as a single "total" value, as each individual PAH compound has different toxicity and mobility in the environment. Speciated analysis is required to determine the concentrations of the various compounds, most notably the key PAHs: Benzo(a)Pyrene (considered the most toxic of the PAHs); and Naphthalene (the most mobile and volatile of the PAHs).

Similarly, **TPH** cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into thirteen representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the thirteen bandings. The significance of speciated TPH results can be assessed by following the 3 steps outlined in Table 3 below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, Naphthalene, Benzo(a)pyrene (and the other toxic PAHs) above their respective Tier 1 screening values?	Yes	DQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	DQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	DQRA required
	No	TPH compounds pose no significant risk

Step 1 - Assessing indicator compounds

TPH fraction Indicator compound	End use specific screening value (mg / kg)			
	A: Residential no cover	B: Residential with 600mm cover	C: Residential no gardens	D: Commercial / Industrial
Benzene	0.3	0.5	0.6	100
Toluene	497	1,400	1,690	4,360
Ethylbenzene	240	416	498	2,840
Xylene	127	146	183	2,620
Naphthalene	4	4	5	430
Benzo(a)pyrene	5	25	5	25

Step 2 - Assessing individual TPH fractions

TPH fraction		End use specific screening value (mg / kg)			
		A: Residential no cover	B: Residential with 600mm cover	C: Residential with no gardens	D: Commercial / industrial
Aliphatic 5-6	GRO	41	41	63	5,000 ^
Aliphatic 6-8	GRO	123	123	191	
Aliphatic 8-10	GRO	30	31	48	
Aliphatic 10-12	DRO	151	153	232	
Aliphatic 12-16	DRO	500 ^	500 ^	500 ^	
Aliphatic 16-21	DRO	1,000 ^	5,000 #	1,000 ^	
Aliphatic 21-35	LRO	1,000 ^	5,000 #	1,000 ^	
Aromatic 5-7	GRO	52	56	72	1,000 ^
Aromatic 7-8	GRO	15	16	21	
Aromatic 8-10	GRO	47	50	77	5,000 ^
Aromatic 10-12	DRO	212	282	390	
Aromatic 12-16	DRO	683	1,000 *	1,000 *	
Aromatic 16-21	DRO	1,000 ^	5,000 #	1,000 ^	
Aromatic 21-35	LRO	1,000 ^	5,000 #	1,000 ^	

* Calculated Screening Value exceeded soil saturation limit and could indicate free product, therefore calculated soil saturation limit adopted as a target

^ Calculated Screening Value close to soil saturation limit, screening value selected by Lithos considering visual and olfactory impacts.

#. Five times the screening value for Scenario A.

Step 3 - Assessing Cumulative Effects

$$HI = \sum_{F_i=1}^{16} HQ F_i = \frac{\text{Measured concentration } F_i \text{ (mg kg}^{-1}\text{)}}{SGV F_i \text{ (mg kg}^{-1}\text{)}}$$

where HI = Hazard Index
 HQ = Hazard Quotient
 F_i = Fraction i
 SGV = Soil Guideline Value

Possible Action in event of Tier 1 exceedance

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

- Undertake further statistical analysis following the approach set out in "Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008" in order to determine whether contaminant concentrations of inorganic contaminants within soil/fill actually present a risk (only applicable to assessing the risk to human health).
- Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
- Based on a qualitative risk assessment, advocate an appropriate level of remediation to "break" the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the **averaging area** requires further consideration. The CL:AIRE\CIEH still refers to CLR 7, which suggests averaging area should reflect receptor behaviour and therefore might be a single garden, or an open area used by the local community as a play area. This approach to averaging areas is considered applicable within the context of Part IIA of the Environmental Protection Act (EPA) 1990, in terms of an existing residential development.

However, Lithos consider the concept of a single garden as an averaging area to be inappropriate with respect to brownfield redevelopment, which is regulated by the planning regime. In this context, contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and/or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage/leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

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

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

05 - Hazardous Gas

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency). In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 1. – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group, the Environment Agency and the Local Authority and the British Geological Survey. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

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

Sources

Potential sources of hazardous gas are:

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

Generation

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

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

Migration

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

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

Gas Monitoring Procedure

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

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

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism. Where samples of gas are required for laboratory analysis, Gresham Tubes are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Current Guidance

CIRIA Report 151 (1995)ⁱ identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2006)ⁱⁱ advocates two methodologies for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999ⁱⁱⁱ.

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006^{iv} for NHBC

Both methodologies refer to Gas Screening Values (GSV); previously referred to as limiting borehole gas volume flow.

A – All developments except low rise housing.

(Wilson & Card, 1999)^v revised Table 28 of CIRIA 149^v in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Table 1 – Site Classification (Wilson & Card)

Characteristic Situation (W&C, 1999)	Gas Screening Value, CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworking flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworking – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	<70		Mineworking unflooded, inactive
6	>70		Recent landfill site

Notes:

Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr). Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr). To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.

B – Low rise housing.

NHBC have developed a characterisation system similar to that of Wilson & Card above, but specific to low-rise housing development (Boyle and Witherington^{xii}) (Table 8.7). This approach compares measured gas emission rates with generic "Traffic Lights". The Traffic Lights include "Typical Maximum Concentrations" for initial screening, and risk-based Gas Screening Values (GSVs) for consideration of situations where the Typical Maximum Concentrations are exceeded. Calculations are carried out for both methane and carbon dioxide and the worse case adopted in order to establish the appropriate protection measures.

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic light		Methane ¹		Carbon dioxide ¹	
		Typical maximum concentration ⁵ (% v/v)	Gas screening value (GSV) ^{2,4,6} (litres per hour	Typical maximum concentration ⁵ (% v/v)	Gas screening value (GSV) ^{2,3,4,5} (litres per hour
Green	{	1	0.16	5	0.78
Amber 1		5	0.63	10	1.56
Amber 2		20	1.56	30	3.13
Red					

Notes:

- The **worst gas-regime** identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which Traffic Light and GSV is allocated.
- Generic GSVs are based on guidance contained within "The Building Regulations: Approved Document C" (2004) and assume a **sub-floor void** of 150 mm thickness.
- The **small room** is considered to be a downstairs toilet, with dimensions of 1.50 × 1.50 × 2.50 m, with a soil pipe passing into the sub-floor void.
- The **GSV**, in litres per hour, is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
- The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional **judgment** will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
- The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

i Harries CR, Witherington PJ and McEntee JM (1995). Interpreting measurements of gas in the ground. CIRIA Report 151

ii CIRIA (2006) – Assessing risks posed by hazardous ground gases to buildings.

iii Wilson SA and Card GB (February 1999). Reliability and Risk in Gas Protection Design. Ground Engineering.

iv Boyle & Witherington (2006) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC

v Wilson SA and Card GB (February 1999). Reliability and Risk in Gas Protection Design. Ground Engineering.

06 - Soakaways

Background

Soakaways have been the traditional way to dispose of stormwater from buildings and paved areas remote from a public sewer or watercourse. In recent years, soakaways have been used within urban, fully-sewered areas to limit the impact on discharge of new upstream building works and to avoid costs of sewer up-grading outside a development.

Soakaways are seen increasingly as a more widely applicable option alongside other means of stormwater control and disposal. Soakaways must store the immediate stormwater run-off and allow for its efficient infiltration into the adjacent soil. They must discharge their stored water sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics. Soakaways can be constructed in many different forms and from a range of materials.

BRE Digest 365, DG365: 1991 describes design and construction procedures, explains how to calculate rainfall design values and soil infiltration rates, and gives design examples. Further advice is provided in **NHBC Standards Chapter 5.3** (Section 9 & Appendix F). Soakaways should generally be built on land lower than or sloping away from buildings and be sited **at least 5m** from the foundations of a building.

Made ground (and ground within 5m of deep fill) is not generally regarded as suitable for soakaways, due to the potential for inundation settlement and the leaching of contaminants. It should be noted that due to possible structural instability and modification to **Chalk** when wetted, CIRIA Report 11 'Foundations in Chalk' states that "Soakaways should be avoided if at all possible but, if unavoidable, should be sited **at least 20m** away from any structure".

Test Methodology

Lithos undertake soakaway tests in general accordance with BRE Digest 365 "Soakaway Design". The BRE Digest recommends that each soakaway pit is filled and allowed to drain three times to near empty; the three fillings to be on the same or consecutive days. However, each test can take over 2 hours to complete and therefore pits are often only filled and allowed to drain on one occasion, due to the time constraints imposed on the investigation

Three filling\drainage cycles are more important where drainage is primarily via fissures, most notably within a rock mass. Initial drainage within the rock mass may be high, as the fissures fill with water, giving the impression (if only one cycle is undertaken) that soakaways would be a suitable drainage solution. If infiltration through the matrix of the rock is low, then drainage from the test pit becomes slow as the fissures become saturated.

For non-fissile, granular soils infiltration is via the matrix, and consequently one filling\drainage cycle is generally considered sufficient. Soakaway pits are typically excavated to a depth of about 2.5m using a mechanical excavator equipped with a 0.3m wide bucket. The soakaway test pits are rapidly filled with water to the top of the test section. The fall in water level is then monitored at regular intervals.

Infiltration Rates

Infiltration rates for each soakaway test are calculated (where possible) in accordance with BRE Digest 365. This design takes into account the time of emptying the soakaway pit between 25% and 75% of its effective depth. The effective depth is calculated from the starting water level to the soakaway pit base. Where the water level did not fall to 25% effective depth, the data was interpolated in order to obtain a representative infiltration rate.

Soakaway Design

Soakaway design is carried out in accordance with BRE Digest 365 using the infiltration rates calculated above; assuming a rainfall ratio of 0.39; and that each soakaway will have the capacity to handle storm water from an impermeable area of 100m².

Two soakaway types can be designed using BRE Digest 365:

- perforated concrete ring in a square pit with granular backfill (chamber type)
- trench with granular backfill (trench type)

The design for the perforated ring type soakaway assumes that the chamber comprises a permeable 900mm internal diameter "hollow" chamber set in a square pit with granular material around the chamber. It is assumed that the granular material will have 30% void space. The design for the trench type soakaway assumes that the trench is 600mm wide filled with granular material, having a void space of 30%.

It is generally assumed that soakaways become impracticable on residential developments when:-

- the chamber type design requires a square pit with side length in excess of 1.8m, or an effective depth greater than 1.5m.
- the trench type design requires a length greater than about 10m, or an effective depth greater than 1.5m.

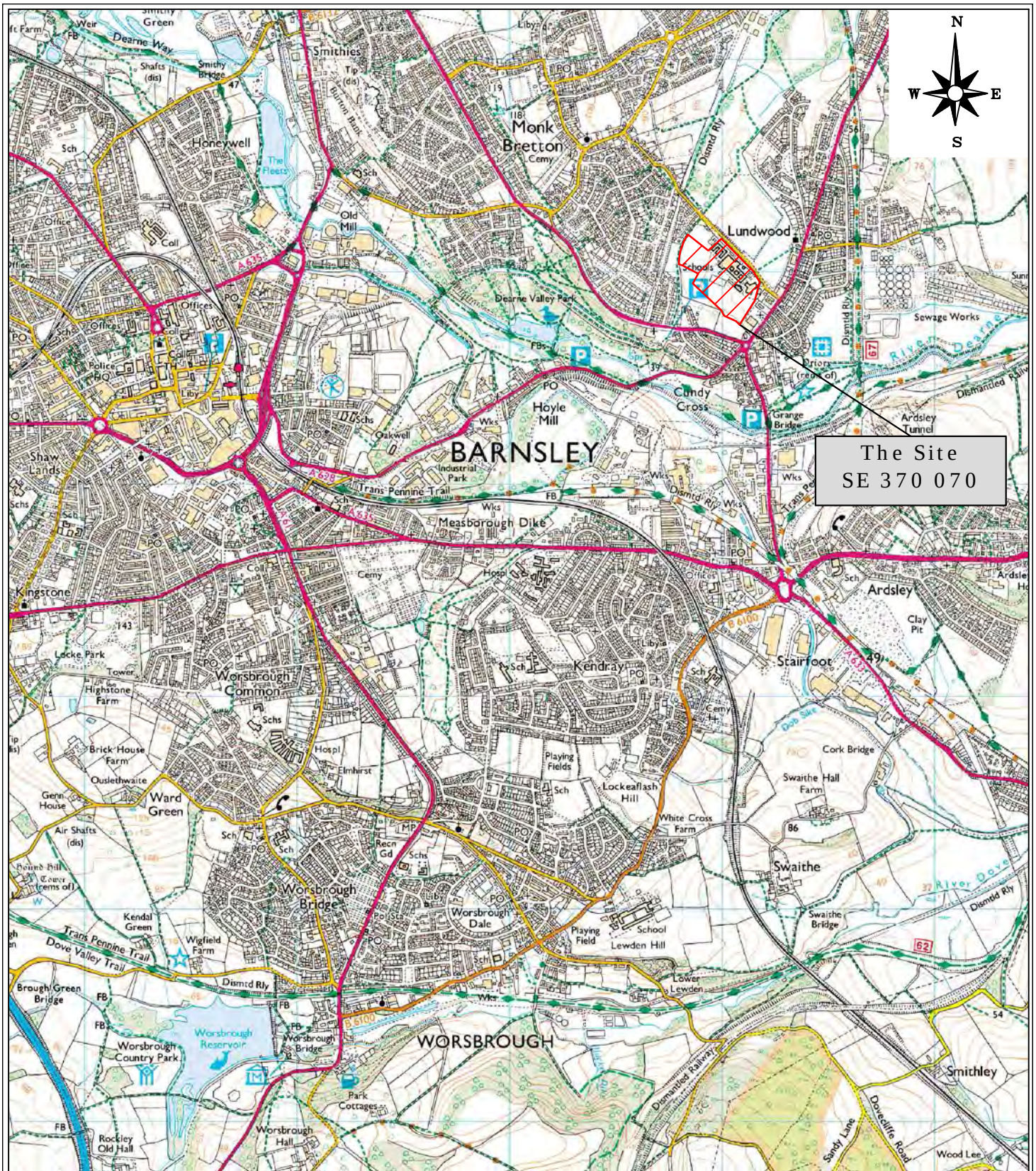
Increasing the soakaway effective depth might offer a solution, but consideration should be given to:

- standing groundwater level
- depth to base of permeable strata
- cost of excavation.

Soakaway percolation in some rock types is predominately via the vertical joints within the rock mass. The relatively small-scale soakaway test pits may not intercept such joints and this can result in variable test results. However, it is likely that the larger surface area of a completed soakaway within the development will intercept such joints.

APPENDIX B
DRAWINGS

Drawing No.	Title
1898/1	Site Location Plan
1898/2	Proposed Site Layout
1898/3	Existing Site Features
1898/4	Site Photographs
1898/5	Preliminary Conceptual Site Model
1898/6	Exploratory Hole Location Plan



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Tel 0845 680 9781

CLIENT

HARRON HOMES

JOB TITLE

LITTLEWORTH LANE,
LUNDWOOD

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

GLM

DATE

02/07/2014

CHECKED

RJH

DATE

02/07/2014

STATUS

FOR COMMENT ☐

DRAFT ☐

FOR APPROVAL ☐

FINAL ☒

SCALE

1:25,000

SHEET

A4

DRAWING NO.

1898/1

REVISION



NOTES

REV

DATE

AMENDMENT

01

01845 524758

01

02

01845 524278

02

03

diparchitects@btconnect.com

03

04

www.diparchitects.co.uk

04

CHARTERED ARCHITECTS

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Thirsk, North Yorkshire Y07 1EY

downes

illingsworth

partnership

CLIENT :

Harron Homes Limited

Colton House

Temple Point

Bullerthorpe Lane

Leeds

LS19 9JL

Tel: 0113 2044670



HARRON
HOMES

PROJECT :

Proposed Residential Development at

Littleworth Lane, Lundwood

DRAWING TITLE :

Proposed Site Layout Plan

SCALE:

1:500 @ A0

DATE:

June 2014

DRAWN:

KLW

CHECKED:

-

DWG NO.

3623/10

REVISION:

REV.	DESCRIPTION	DATE
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Tel 0845 680 9781

CLIENT

HARRON HOMES

JOB TITLE

LITTLEWORTH LANE
LUNDWOOD

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN

GLM

DATE

10/07/2014

STATUS

FOR COMMENT

☐

CHECKED

RJH

DATE

10/07/2014

FOR APPROVAL

☐

DRAFT

☐

FINAL

☒

SCALE

1:2000

SHEET

A3

DRAWING NO.

1898/2

REVISION



- NOTES
- GRASS & OVERGROWN AREAS
 - HISTORICAL BUILDING
 - EXISTING BUILDING
 - CONCRETE OR TARMAC HARDSTAND
 - CONCRETE HARDSTAND
 - APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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CLIENT

HARRON HOMES

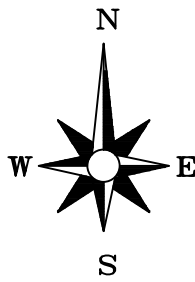
JOB TITLE

LITTLEWORTH LANE,
LUNDWOOD

DRAWING TITLE

SITE FEATURES

DRAWN	GLM	DATE	02/07/2014	STATUS	FOR COMMENT	☐
CHECKED	RJH	DATE	02/07/2014	FOR APPROVAL	DRAFT	☐
				FINAL		☒
SCALE	1:2000	SHEET	A3	DRAWING NO.	1898/3	REVISION



- NOTES
- GRASS & OVERGROWN AREAS
 - HISTORICAL BUILDING
 - GRAVEL OR HARDCORE SURFACING
 - EXISTING BUILDING
 - APPROXIMATE SITE BOUNDARY
 - LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE



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Tel 0845 680 9781

CLIENT

HARRON HOMES

JOB TITLE

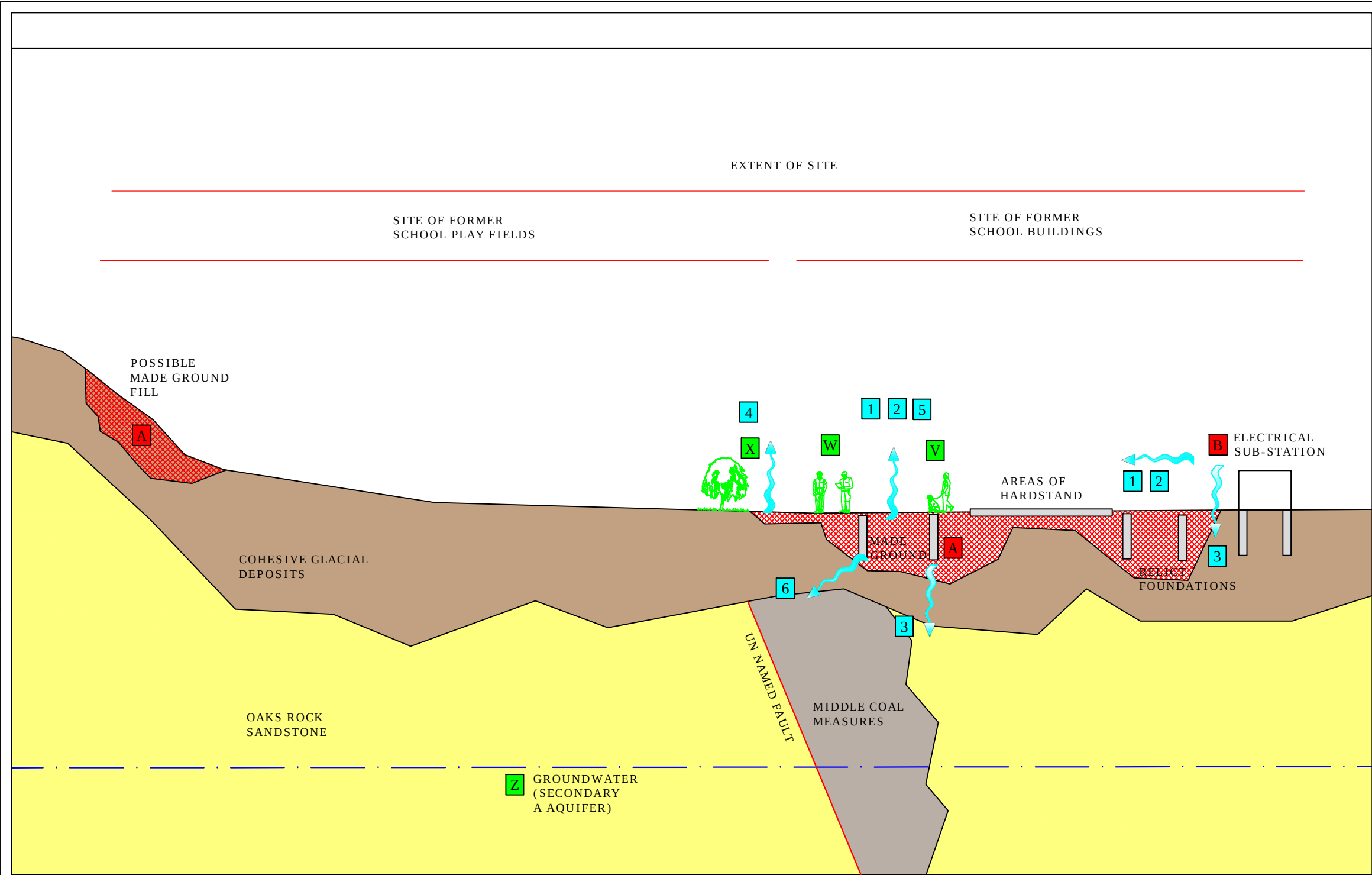
LITTLEWORTH LANE,
LUNDWOOD

DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	DATE	STATUS FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☒
CHECKED	DATE	
GLM	02/07/2014	
RJH	02/07/2014	

SCALE	SHEET	DRAWING NO.	REVISION
NOT TO SCALE	A3	1898/4	



SOURCES	
A	MADE GROUND (INORGANICS)
B	LEAKAGE\SPILLAGE (ORGANICS)

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION\INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	VOLATILISATION
6	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	SURFACE WATERS
Z	GROUNDWATER

NOTES		
REV.	DESCRIPTION	DATE



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CLIENT

HARRON HOMES

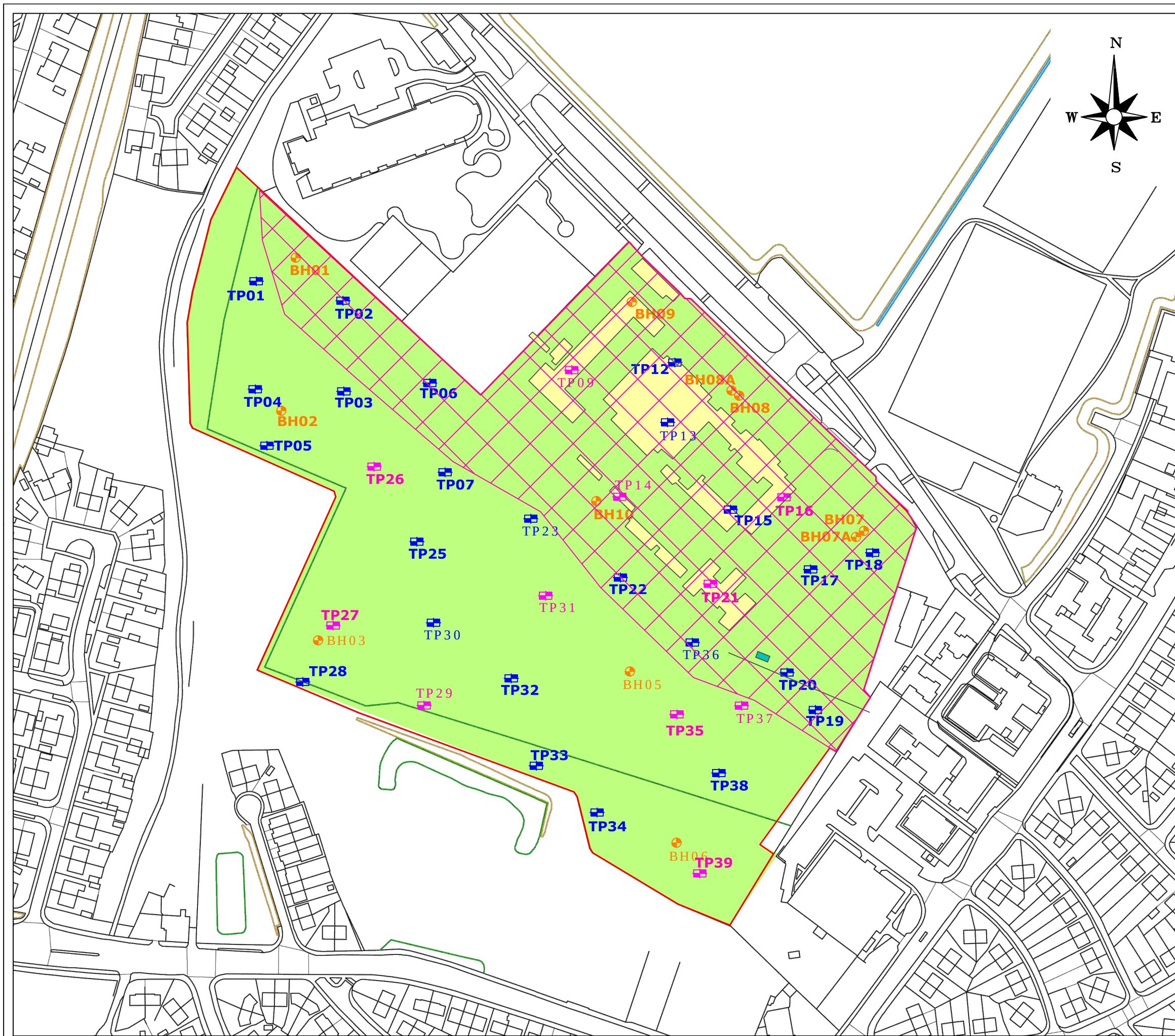
JOB TITLE

LITTLEWORTH LANE,
LUNDWOOD

DRAWING TITLE

PRELIMINARY CONCEPTUAL SITE
MODEL

DRAWN	GLM	DATE	02/07/2014	STATUS	FOR COMMENT	☐
CHECKED	RJH	DATE	02/07/2014	FOR APPROVAL	DRAFT	☐
SCALE				SHEET	DRAWING NO.	REVISION
Not to scale				A3	1898/5	



NOTES

- TRIAL PIT LOCATION
- SOAKAWAY PIT LOCATION
- BOREHOLE LOCATION
- APPROXIMATE EXTENT OF MADE GROUND THAT REQUIRES SOIL COVER IN GARDEN AND LANDSCAPED AREAS
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

info@lithos.co.uk
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Tel 0845 680 9781

CLIENT

HARRON HOMES

JOB TITLE

**LITTLEWORTH LANE,
LUNDWOOD**

DRAWING TITLE

**PROPOSED
EXPLORATORY HOLE LOCATIONS**

DRAWN	GLM	DATE	10/06/2014	STATUS	FOR COMMENT	☐
CHECKED	REG	DATE	10/06/2014	FOR APPROVAL	DRAFT	☐
				FINAL	☒	

SCALE	1:2,000	SHEET	A3	DRAWING NO.	1898/6	REVISION	
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APPENDIX C
COMMISSION

Richard

From: Daniel Starkey <danielstarkey@harronhomes.co.uk>
Sent: 02 June 2014 11:49
To: Richard
Subject: RE: Littleworth Lane, Lundwood (Quote)

Good Morning Richard,

We would like you to proceed on this basis.

Costs up to £f f f f f f f f f - AOR to quote when invoicing for this work is 2873.

Please could you let me know exactly when you expect to undertake the works?

I will aim to provide a details of the access arrangements asap.

Thanks

Best Regards

Daniel Starkey
Planner
Harron Homes Ltd.
Tel: (0113) 204 4843
Fax: (0113) 204 4677
Email: danielstarkey@harronhomes.co.uk
Web: www.harronhomes.co.uk



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Harron Homes Ltd. is registered in England and Wales no. 03012678, Registered Office: Colton House, Temple Point, Bullerthorpe Lane, Leeds, LS15 9JL.

For more information about Harron Homes and the locations of our current developments please see www.harronhomes.co.uk.

1898/002/RJH/rjh

14th April 2014



Mr D Starkey
Harron Homes Limited
Colton House
Temple Point
Bullerthorpe Lane
Leeds
LS15 9JL

Please reply to
Parkhill
Walton Road
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
E info@lithos.co.uk

Dear Daniel

Littleworth Lane, Lundwood

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that your proposed development will include around 196 traditional two storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; a draft layout referenced SK02, dated 24th January 2014 prepared by JRP has been supplied.

Review of the drawing supplied suggests that the site consists of a single parcel of land of approximately 7.5 hectares off Littleworth Lane.

The site currently comprises an open area of generally rough grassland that is being grazed by horses. There is an electricity sub-station located on site. The entire site is surrounded by a 2.4m high steel palisade fence with locked gates at two locations onto Littleworth Lane.

Brief review of historical OS plans indicates that the site was open fields until around 1931 when schools first appear in the centre north of the site adjacent to Littleworth Lane. By 1966 two schools (Priory School and Sports College and Littleworth Junior School) occupied the area adjacent to Littleworth lane with playing fields extending to the south. The schools appear to have only relatively recently been demolished.

Brief examination of the relevant geological map suggests the site is underlain predominately by Oaks Rock (sandstone) although a wedge of undivided coal measures (likely mudstone) is faulted into the north-central area of the site. A fault crosses the centre of the site from south-west to north-east.

Till (likely gravelly clay) underlies the eastern half of the site; no drift deposits are shown in the west. Two small areas of made ground are noted on site and likely relate to material used to make flat sports fields. A further area is noted in the north-east under the former buildings.

This site is located within a Standing Advice Area (within the defined coalfield, but no known defined risks have been recorded by the Coal Authority; there may still be unrecorded issues), therefore a mining report will be obtained. The Newhill Coal (0.61m to 1.37m thick) is the shallowest coal seam beneath the site located approximately 22m below the base of the Oaks Rock; therefore, shallow coal workings are highly unlikely to affect the surface stability of the site.

The land immediately to the north is understood to have comprised the very extensive 'Littleworth Lane Tip'. This is believed to comprise colliery waste from Monk Bretton Colliery to the north; however, the EA records suggest that it accepted inert, industrial, commercial and sludge wastes.

Our site investigation proposal allows for the following works:

Desk Study: Environmental search data and historical maps (obtained from Landmark or Groundsure), will be reviewed in order to determine whether any past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined. We will also visit site to undertake a walkover survey.

Fieldwork: We have allowed for three day's trial pitting (around 40 trial pits) and the drilling of ten boreholes. Soakaway testing will also be carried out in at least ten pits in order to assess suitability of the ground for house and highway surface water drainage. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We will make every effort to compact arisings and 'sweep' them over each pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings, replacement of turf.

This investigation should yield sufficient data to enable a foundation zoning plan, and possibly a detailed Foundation Schedule. However, if ground conditions are found to be more variable than anticipated, a 'tighter' grid of pits will be necessary prior to preparation of a detailed Foundation Schedule. This proposal does not allow for the preparation of a detailed Foundation Schedule, but we will provide a quote on completion of the site investigation if requested.

Given the likely presence of an extensive area of adjacent landfill, we have allowed for the installation of wells in ten boreholes and monitoring for hazardous gas (and any shallow groundwater). As rockhead is likely to be at shallow depth we have allowed for rotary openhole drilling in order to install wells. Window sampling would be highly unlikely to be capable of installing wells at sufficient depth to be effective.

The generation potential of this gas source is considered likely to be Low. Therefore, in general accordance with CIRIA Report C665, we have initially allowed for six visits over a three month period. A hazardous gas risk assessment will be issued on completion of monitoring.

This proposal has been put together assuming that access is available for a JCB-type excavator along with a tractor towed water bowser and a track mounted drilling rig and associated tele-handler.

The desk study may highlight other potential problems with the site such as landfill gas, quarrying, shallow mining or soil contamination. It may therefore be necessary to carry out additional works, but we will inform you prior to undertaking any such work and provide revised a cost estimate.

Soils Testing: This will comprise routine geotechnical soils analysis, typical of that normally required for greenfield sites. Although no allowance has been made for in-situ or laboratory CBR testing, CBR values will be estimated from the strata descriptions and classification test results, where appropriate (i.e. if no significant regrading or reworking of made ground is proposed).

At this stage, we have no reason to expect wide areas of the site to be underlain by significant thicknesses of made ground. Consequently, we have only allowed for contaminant testing of up to twenty samples of made ground samples, plus a further eight samples of topsoil to confirm its suitability for re-use.

Reporting & Timescales: In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within five days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive, factual and interpretative report will be issued. This will contain detailed engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health.

The report will also provide technically feasible options for redevelopment of the site with housing, including consideration of foundation types and treatment\removal of contamination.

Fieldwork could be commenced within two weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within four weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

This site lies within an area for which Barnsley Council is the Local Authority; this Authority require submission of a Remediation Strategy in support of all planning applications for brownfield sites. Consequently a Remediation Strategy report will be required by the Local Authority at an early stage in the planning approval process, and our proposal allows for this.

Copies of the final reports will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of £[REDACTED] plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

Our proposal allows for submission of the report to the Local Authority and NHBC, and for submission of a single piece of subsequent correspondence with each regulator to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project at the milestones defined below:

- 1st milestone invoice (Items A to E) within five days of fieldwork completion, with exploratory hole logs and an interim letter report outlining our initial findings and preliminary recommendations report
- 2nd milestone invoice (Items F to H) on issue of the final report.
- 3rd milestone invoice (Item I) on issue of the Remediation Strategy.
- 4th and final invoice (Item J) after completion of the gas monitoring/issue of the supplementary letter report.

Health, Safety & Welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of welfare will be included within the Method Statements, however, this investigation is expected to be completed within three working days and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing.

Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector).

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks. However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

Terms & Conditions: This work will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

You will note that in the last two columns of our costed proposal we have included an estimate of the proportion of the total cost of the works that could be eligible for Land Remediation Tax Relief (LRR).

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely

A handwritten signature in black ink, appearing to read 'R. Hey'.

Richard Hey
Director
for and on behalf of
LITHOS CONSULTING LIMITED

enc

Terms and Conditions for the Appointment of Lithos Consulting Limited

V002.10

1 DEFINITIONS AND INTERPRETATION

- 1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" shall mean these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;

"Client" shall mean the party for whom the Services are being provided by Lithos;

"Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Lithos, and whether in paper form or stored electronically or on disk, or otherwise;

"Lithos" shall mean Lithos Consulting Limited whose registered office is at 45 High Street, South Milford, North Yorkshire, LS25 5AF.

"Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;

"Parties" shall mean the Client and Lithos

"Project" shall mean the project described in the Proposal and any enquiry from the Client on which Lithos has based its Proposal;

"Proposal" means the offer document prepared by Lithos in response to an enquiry or otherwise, in connection with the proposed provision of the Services;

"Services" means the work and services relating to the Project to be provided by Lithos pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;

"Terms" means these terms entitled "Lithos Consulting Terms of Appointment";

- 1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.
- 1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.
- 1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.
- 1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.
- 1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT

- 2.1 The Client agrees to engage Lithos and Lithos agrees to provide the Services in accordance with the provisions of the Agreement.

3 OBLIGATIONS OF LITHOS

- 3.1 Lithos shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional Environmental firms in performing similar services under similar conditions.
- 3.2 Lithos shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.

4 OBLIGATIONS OF THE CLIENT

- 4.1 Throughout the period of this Agreement the Client shall afford to Lithos or procure the affording to Lithos of access to any site where access is required for the performance of the Services.
- 4.2 The Client accepts responsibility for ensuring that Lithos is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to Lithos prior to the commencement of the Services. The Client shall also inform Lithos in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. The Client shall indemnify Lithos against all costs, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.
- 4.3 If the Client discovers any conflict, defect or other fault in the information or designs provided by Lithos pursuant to the Agreement, he will advise Lithos in writing of such defect, conflict or other fault and Lithos shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant the conflicting, defective or in any other way faulty information or designs.

5 INTELLECTUAL PROPERTY

- 5.1 The copyright in all Intellectual Property prepared by or on behalf of Lithos in connection with the Project for delivery to the Client shall remain vested in Lithos.
- 5.2 The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any licence to amend any drawing, design or other Intellectual Property produced by Lithos.
- 5.3 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and shall be upon such terms as may be required by Lithos. Lithos shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of Lithos.
- 5.4 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with Lithos and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.
- 5.5 In the event of the Client being in default of payment of any fees or other amounts due, Lithos may suspend further use of the licence on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts

6 TITLE

- 6.1 Lithos shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third party Lithos shall transfer only such title or rights as that party had and has transferred to Lithos.
- 6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.
- 6.3 Until title passes, the Client shall hold the Documents as bailee for Lithos and shall store or mark them so that they can at all times be identified as the property of Lithos.
- 6.4 At any time before title passes (save and except where payment is not due), but only after prior consultation with the Client, Lithos may without any liability to the Client repossess and use or sell all or any of part of the Documents and by doing so terminate the right of the Client to use, sell or otherwise deal in the Documents.
- 6.5 Lithos may maintain an action for the price of the Documents notwithstanding that title in them has not passed to the Client.

7 CONFIDENTIALITY

- 7.1 Lithos undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.

- 7.2 Subject to the above, Lithos shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

8 THIRD PARTIES

- 8.1 The Agreement or any part thereof or any benefit or interest thereunder may not be assigned by the Client without the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and Lithos will only agree to an assignment on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos's legal and other costs associated with any assignment.
- 8.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.
- 8.3 Lithos will consider and may consent to any request from the Client for Lithos to enter a collateral warranty with a third party with regard to the Services provided under the Agreement. The giving of such consent shall be at the discretion of Lithos and Lithos will only enter a collateral warranty on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos's legal and other costs associated with any collateral warranty.

9 INSURANCE

- 9.1 Lithos warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one Single Claim, Defence Costs in addition. This policy is annually renewable and whilst renewal is not automatic, Lithos agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.
- 9.2 If for any period such insurance is not available at commercially reasonable rates, Lithos shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Lithos to obtain.

10 LIMITATIONS ON LIABILITY

- 10.1 Unless otherwise agreed in writing, Lithos's liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either five million pounds in the aggregate or 10 times the total value of invoices issued to the Client for consultancy work instructed under the Agreement.
- 10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against Lithos after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.
- 10.3 Whilst Lithos will scan all potential exploratory locations with a Cable Avoidance Tool, Lithos shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.
- 10.4 Lithos shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Lithos or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless Lithos has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 PAYMENT

- 11.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.
- 11.2 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.
- 11.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Lithos by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.
- 11.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Lithos will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.

12 DELAY

- 12.1 Lithos will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising Lithos undertakes to complete the Services within a reasonable period, but will not be liable to the Client for any delay as a result.

13 TERMINATION

- 13.1 The Agreement may be determined by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of determination must be given to the party which is insolvent by the other party.
- 13.2 If for any reason the performance of the Services by Lithos is suspended for a period in excess of three calendar months then Lithos shall be entitled to determine its appointment in respect of the Services by seven days written notice to the Client.
- 13.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Lithos may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Lithos shall be entitled to terminate its employment under the Agreement forthwith.
- 13.4 Any determination of the appointment of Lithos howsoever caused shall be without prejudice to the right of Lithos to require payment for all services performed up to the date of such determination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.

14 NOTICES

- 14.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Lithos set out above or to the registered address of the Client.
- 14.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.

15 ENTIRE AGREEMENT

- 15.1 The Agreement constitutes the complete and entire agreement between the Client and Lithos with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against Lithos in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.
- 15.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Lithos; such agreement must be recorded in writing by at least one of the Parties.
- 15.3 Lithos will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Lithos specifically states in writing separately from such documents that it intends such terms and conditions to apply.

16 DISPUTES AND GOVERNING LAW

- 16.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.
- 16.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

APPENDIX D
HISTORICAL OS PLANS

Site Details:

Littleworth
LaneLundwoodBarnsley, S71
5RG

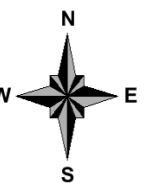
Client Ref: PO8294
Report Ref: GS-1496600
Grid Ref: 437011, 406961

Map Name: County Series

Map date: 1850

Scale: 1:10,560

Printed at: 1:10,560



Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

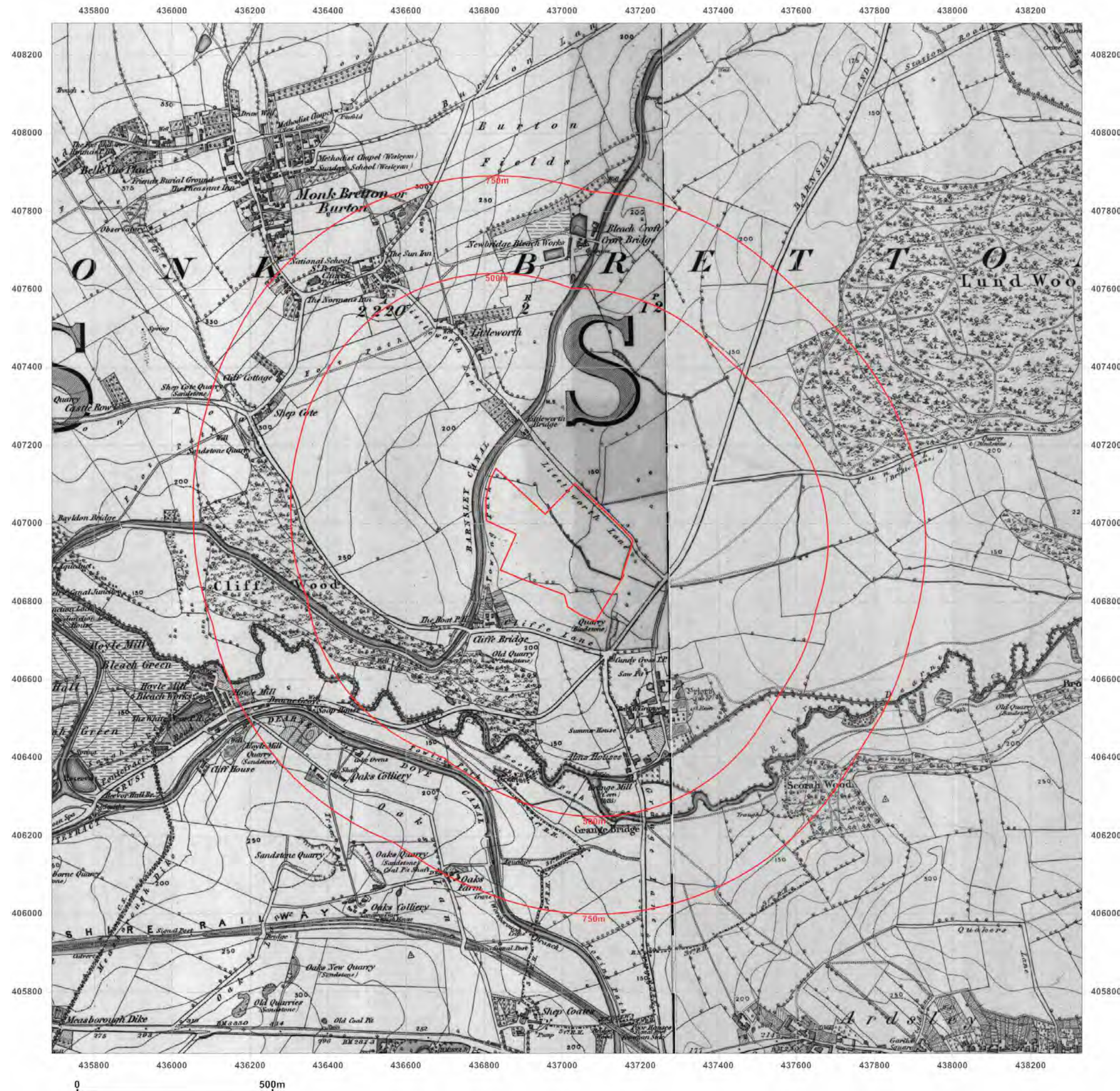


Produced by
GroundSure Environmental Insight
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E: info@groundsure.com
W: www.groundsure.com

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Production date: 10 June 2014

To view map legend click here [Legend](#)



Site Details:

Littleworth
LaneLundwoodBarnsley, S71
5RG

Client Ref: PO8294
Report Ref: GS-1496600
Grid Ref: 437011, 406961

Map Name: County Series

Map date: 1892-1893

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1892
Revised 1892
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1893
Revised 1893
Edition N/A
Copyright N/A
Levelled N/A

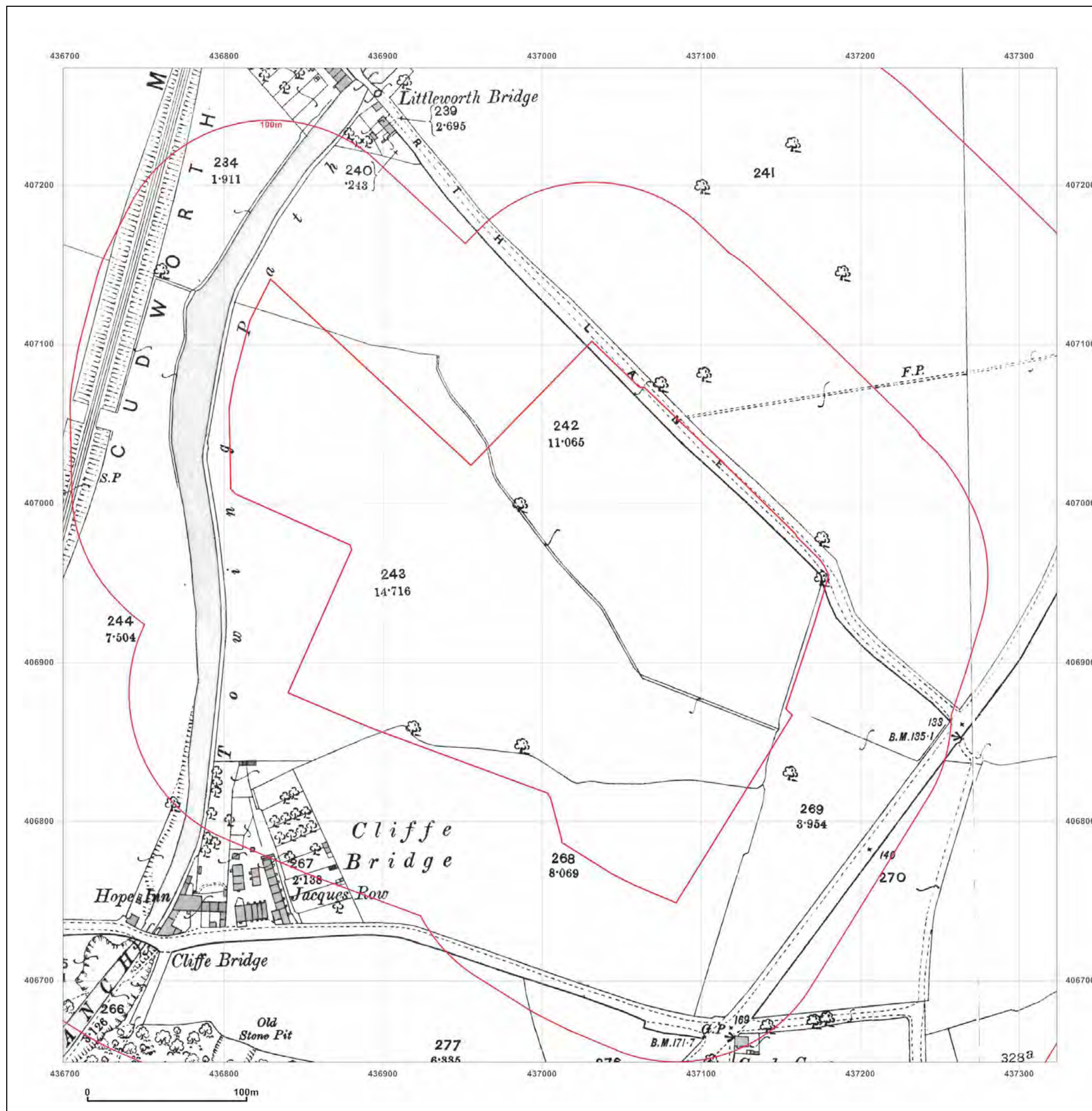


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Site Details:

Littleworth
LaneLundwoodBarnsley, S71
5RG

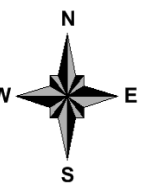
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Report Ref: GS-1496600
Grid Ref: 437011, 406961

Map Name: County Series

Map date: 1929-1932

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1851
Revised 1929
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1850
Revised 1930
Edition 1932
Copyright N/A
Levelled N/A

Surveyed 1851
Revised 1929
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1851
Revised 1929
Edition 1931
Copyright N/A
Levelled N/A

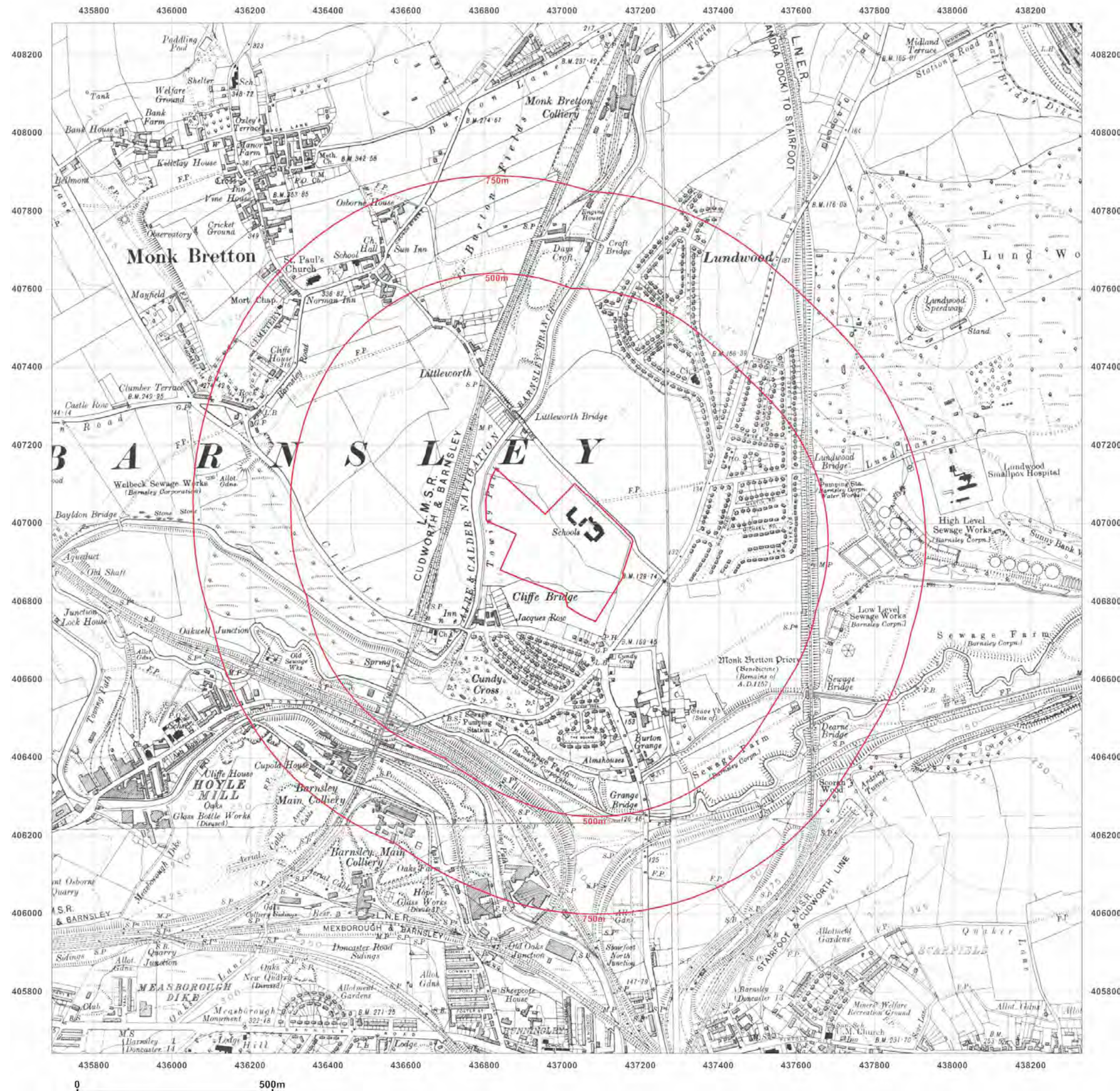


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Site Details:

Littleworth
LaneLundwoodBarnsley, S71
5RG

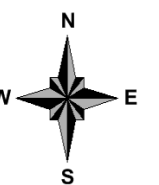
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Report Ref: GS-1496600
Grid Ref: 437011, 406961

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1851
Revised 1938
Edition 1938
Copyright N/A
Levelled N/A

Surveyed 1850
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1851
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1851
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

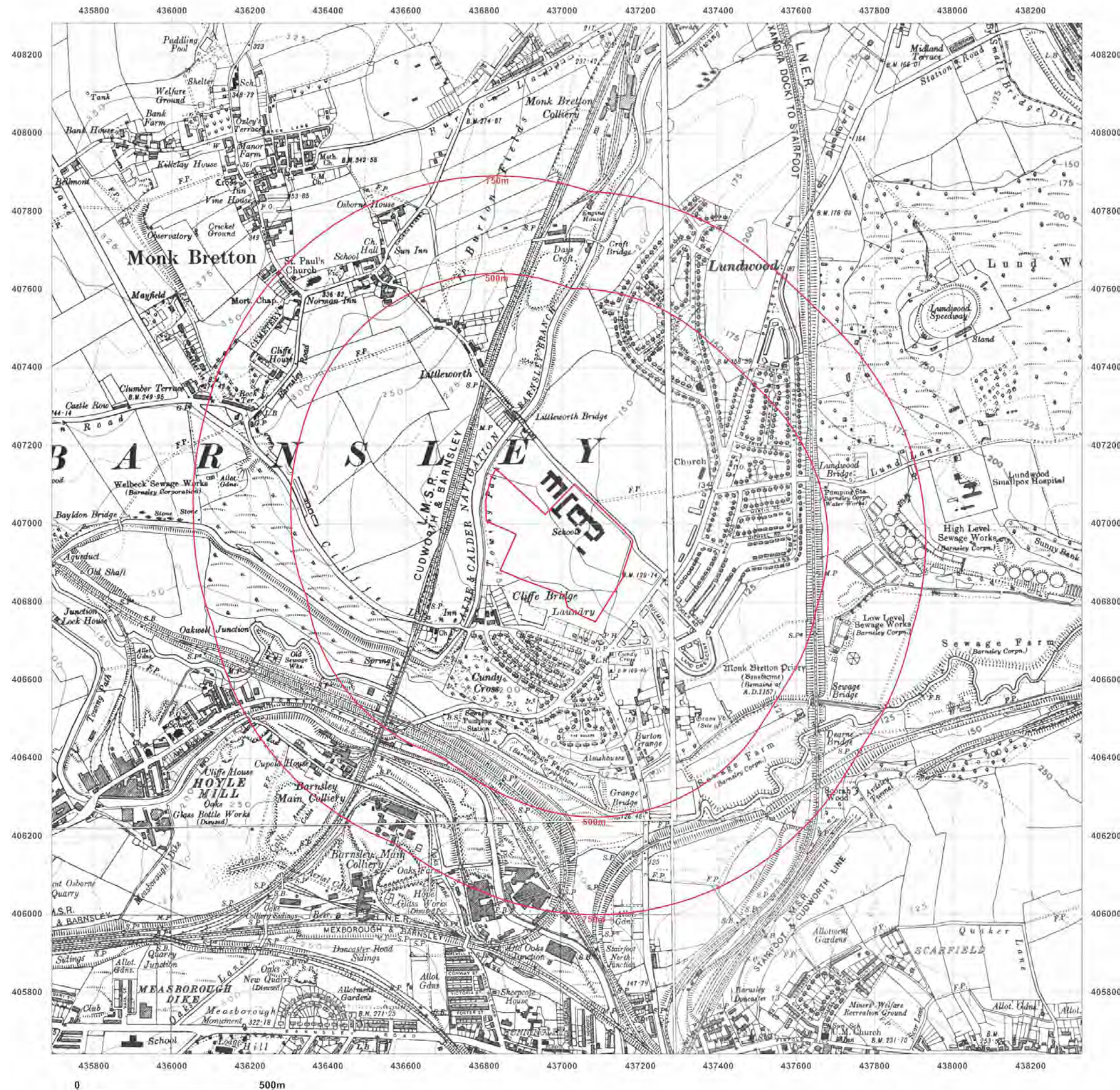


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Site Details:

Littleworth
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5RG

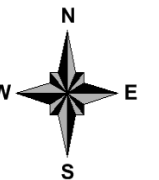
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Report Ref: GS-1496600
Grid Ref: 437011, 406961

Map Name: National Grid

Map date: 1960

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1960
Revised 1960
Edition 1962
Copyright 1962
Levelled 1960

Surveyed 1960
Revised 1960
Edition 1962
Copyright 1962
Levelled 1959

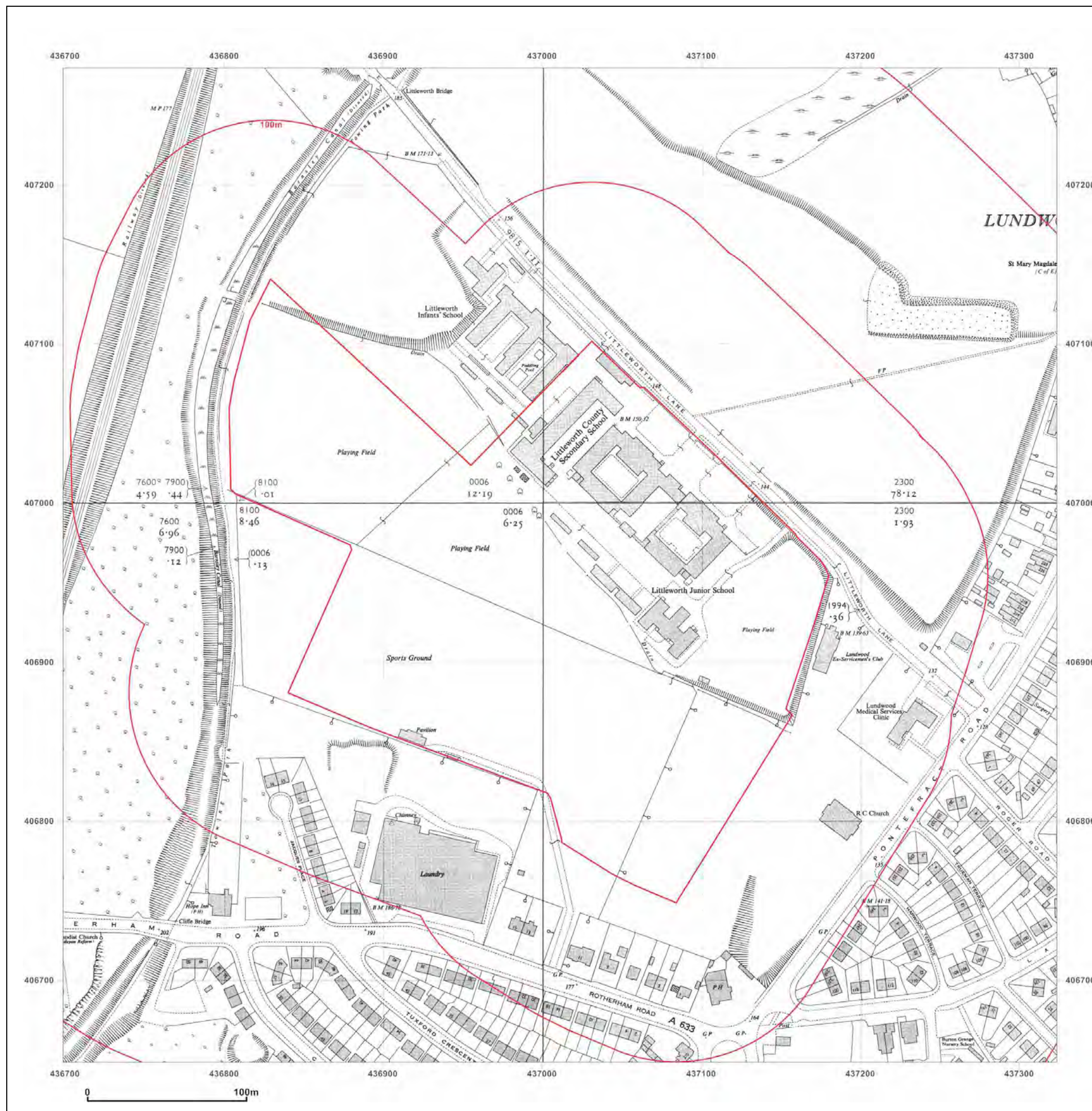


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Production date: 10 June 2014

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APPENDIX E
SEARCH RESPONSES

From	Date	Content
Groundsure	10/06/2014	Environmental Report



GroundSure EnvirolInsight

Address: Littleworth Lane Lundwood Barnsley, S71 5RG

Date: 10 Jun 2014

Reference: GS-1496601

Client: Lithos Consulting Ltd

NW

N

NE

W

E



SW

S

SE

Aerial Photograph Capture date: 26-Mar-2012
Grid Reference: 437011,406961
Site Size: 7.97ha

Overview of Findings

The GroundSure GeoInsight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Shallow Mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and GroundSure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1:Geology

1.1 Artificial Ground	1.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	Yes
	1.1.2 Are there any records relating to permeability of artificial ground within the study site* boundary?	Yes
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?	Yes
	1.2.2 Are there any records relating to permeability of superficial geology within the study site boundary?	Yes
	1.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	1.2.4 Are there any records relating to permeability of landslips within the study site boundary?	No
1.3 Bedrock, Solid Geology & Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records relating to permeability of bedrock within the study site boundary?	Yes
	1.3.3 Are there any records of faults within 500m of the study site boundary?	Yes
1.4 Radon data	1.4.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level
	1.4.2 Is the property in an area where Radon Protection Measures are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary

Section 2:Ground Workings

	On-site	0-50m	51-250	251-500	501-1000
2.1 Historical Surface Ground Working Features from Small Scale Mapping	0	8	22	Not Searched	Not Searched
2.2 Historical Underground Workings from Small Scale Mapping	0	0	2	5	16
2.3 Current Ground Workings	0	1	1	0	10

Section 3: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
3.1 Historical Mining	0	0	2	5	9
3.2 Coal Mining	1	0	0	0	0
3.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
3.4 Non-Coal Mining	1	0	1	2	1
3.5 Non-Coal Mining Cavities	0	0	0	0	0
3.6 Natural Cavities	0	0	0	0	0
3.7 Brine Extraction	0	0	0	0	0
3.8 Gypsum Extraction	0	0	0	0	0
3.9 Tin Mining	0	0	0	0	0
3.10 Clay Mining	0	0	0	0	0

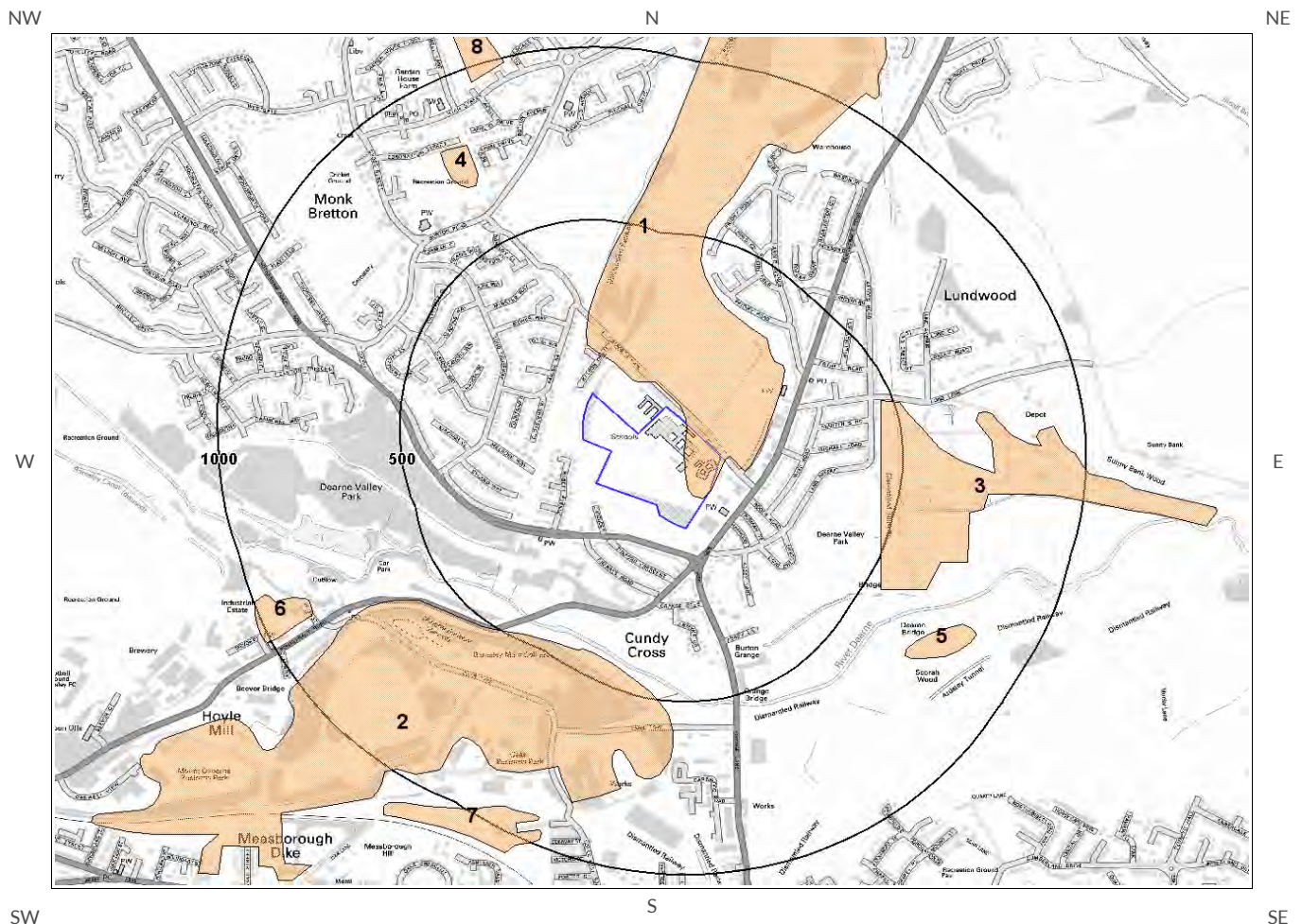
Section 4: Natural Ground Subsidence	On-site
4.1 Shrink Swell Clay	Low
4.2 Landslides	Very Low
4.3 Ground Dissolution of Soluble Rocks	Null
4.4 Compressible Deposits	Very Low
4.5 Collapsible Deposits	Very Low
4.6 Running Sand	Very Low

Section 5: Borehole Records	On-site	0-50m	51-250
5 BGS Recorded Boreholes	0	1	6

Section 6: Estimated Background Soil Chemistry	On-site	0-50m	51-250
6 Records of Background Soil Chemistry	6	0	5

1 Geology

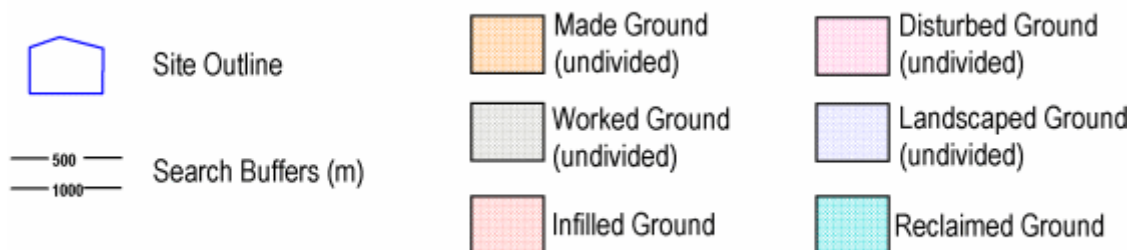
1.1 Artificial Ground Map



Artificial Ground Legend



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Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Environmental Permits, Incidents and Registers		On-site	0-50m	51-250	251-500		
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations							
1.1.1	Records of historic IPC Authorisations	0	0	0	0		
1.1.2	Records of Part A(1) and IPPC Authorised Activities	0	0	0	0		
1.1.3	Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0		
1.1.4	Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0		
1.1.5	Records of List 1 Dangerous Substances Inventory sites	0	0	0	0		
1.1.6	Records of List 2 Dangerous Substances Inventory sites	0	0	0	0		
1.1.7	Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0		
1.1.8	Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0		
1.1.9	Records of Licensed Discharge Consents	0	0	1	3		
1.1.10	Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0		
1.2	Records of COMAH and NIHHS sites	0	0	0	0		
1.3 Environment Agency Recorded Pollution Incidents							
1.3.1	National Incidents Recording System, List 2	0	0	0	0		
1.3.2	National Incidents Recording System, List 1	0	0	0	0		
1.4	Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0		
Section 2: Landfill and Other Waste Sites		On-site	0-50m	51-250	251-500	501-1000	1000-5000
2.1 Landfill Sites							
2.1.1	Environment Agency Registered Landfill Sites	0	0	0	0	0	Not searched
2.1.2	Environment Agency Historic Landfill Sites	0	2	0	2	5	14
2.1.3	BGS/DoE Landfill Site Survey	0	0	1	0	0	3
2.1.4	GroundSure Local Authority Landfill Sites Data	0	0	2	1	1	4
2.2 Landfill and Other Waste Sites Findings							
2.2.1	Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	3	Not searched	Not searched
2.2.2	Environment Agency Licensed Waste Sites	0	0	0	0	6	4

Section 3: Current Land Use	On-site	0-50m	51-250	251-500
3.1 Current Industrial Sites Data	2	0	12	Not searched
3.2 Records of Petrol and Fuel Sites	0	0	1	0
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0

Section 4: Geology	
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	Yes
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 5: Hydrogeology and Hydrology	0-500m					
5.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes					
5.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes					
	On-site	0-50m	51-250	251-500	501-1000	1000-2000
5.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	2	0
5.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	3
5.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
5.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
5.7 Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	No	Yes
5.8 Detailed River Network entries within 500m of the site	0	0	0	16	Not searched	Not searched
5.9 Surface water features within 250m of the study site	No	No	No	Not searched	Not searched	Not searched

Section 6: Flooding	
6.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	Yes
6.2 Are there any Environment Agency Zone 3 floodplains within 250m of the study site?	No
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderate

Section 7: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
7.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
7.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
7.5 Records of Ramsar sites	0	0	0	0	0	0
7.6 Records of Ancient Woodlands	0	0	0	0	1	3
7.7 Records of Local Nature Reserves (LNR)	0	0	1	0	0	0
7.8 Records of World Heritage Sites	0	0	0	0	0	0
7.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0
7.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
7.11 Records of National Parks	0	0	0	0	0	0
7.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
7.13 Records of Nitrate Vulnerable Zones	1	0	0	0	0	0

Section 8: Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?

Low

Section 9: Mining

9.1 Are there any coal mining areas within 75m of the study site?

Yes

9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site?

Low-Moderate

9.3 Are there any brine affected areas within 75m of the study site?

No



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

**GROUNDSURE LIMITED
SOVEREIGN HOUSE
CHURCH STREET
BRIGHTON
BN1 3UJ**

Our reference: **51000561883001**
Your reference: **GS-1496616, PO:**
Date of your enquiry: **10 June 2014**
Date we received your enquiry: **10 June 2014**
Date of issue: **10 June 2014**

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

Non-Residential Coal Authority Mining Report

LITTLEWORTH LANE, LUNDWOOD, BARNSELY, SOUTH YORKSHIRE, S71 5RG

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 11 seams of coal at 160m to 580m depth, and last worked in 1991.

Any ground movement from these coal workings should have stopped by now.

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.

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

A damage notice or claim for alleged subsidence damage was made in October 1995 for PRIORY COMPREHENSIVE SCHOOL LITTLEWORTH LANE, BARNSLEY, SOUTH YORKSHIRE, S71 5RG. The claim was discharged by repairs to the value of £13,908.01.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

There are a further 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 in an area for which a notice of entitlement to withdraw support was published in 1982.

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.

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. The Coal Authority owns the copyright in this report. The information we have used to write this report is protected by our database right. All rights are reserved and unauthorised use is prohibited. If we provide a report for you, this does not mean that copyright and any other rights will pass to you. However, you can use the report for your own purposes.

Location map



Approximate position of property



Enquiry boundary

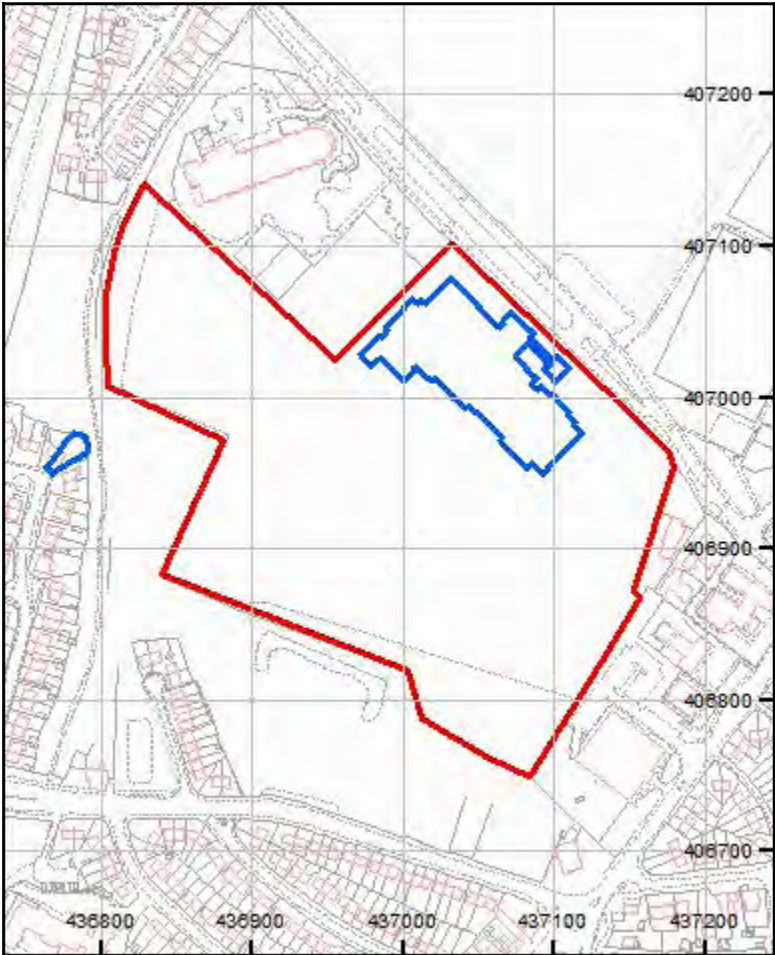
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Key

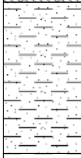
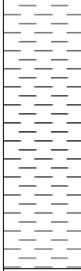
Approximate position of enquiry boundary shown



Coal Claims

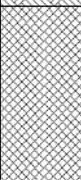


APPENDIX F
TRIAL PIT RECORDS

				Trial Pit Log				Trialpit No TP01 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436836.12 - 407092.43 Level: 51.20		Date 11/06/2014		
Location: Lundwood						Dimensions (m): Depth 1.70		Scale 1:25 Logged GLM		
Client: Harron Homes Limited										
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	0.10	J,K&T	HVP=60	0.30	50.90		TOPSOIL: Grey brown slightly sandy silt. Occasional rootlets. TOPSOIL			1
	1.00	D		0.80	50.40		Firm light brown sandy CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE			
									Stiff brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
					1.70	49.50		1.3m Becomes fissile.		
								End of pit at 1.70 m		2
										3
										4
										5
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.										
Stability:										

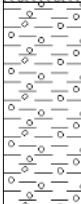
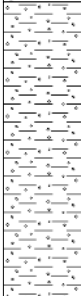
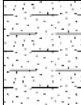


				Trial Pit Log				Trialpit No TP02 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436881.46 - 407082.24 Level: 50.25		Date 11/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.90		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	J,K&T	HVP=58	0.30	49.95		MADE GROUND: Grey brown slightly sandy silt. Occasional rootlets. MADE GROUND TOPSOIL	1
							MADE GROUND: Purple brown ash sand with much subrounded to angular fine to coarse gravel of clinker, glass, coal and pottery and occasional subangular cobbles of brick. ASH & CLINKER	
	1.10	D		0.90	49.35		Firm light brown mottled grey sandy CLAY. WEATHERED OAKS ROCK SANDSTONE	
							1.3m Becomes fissile.	
							1.7m Becomes orange brown.	2
				2.90	47.35		End of pit at 2.90 m	3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP03 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436881.91 - 407034.95 Level: 50.05		Date 11/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.60					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T		0.30	49.75		TOPSOIL: Grey brown slightly sandy clay. Occasional rootlets. TOPSOIL	1 2 3 4 5
	0.80	D		1.00	49.05		Stiff orange brown mottled grey sandy CLAY with occasional subangular cobbles of mudstone. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
	1.50	D				Stiff brown mottled grey CLAY with some subrounded to subangular medium to coarse gravel of mudstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
			2.00	48.05		?Medium dense grey clayey angular tabular medium to coarse gravel of mudstone. WEATHERED OAKS ROCK SANDSTONE		
			2.40	47.65		Moderately weak thickly laminated grey brown MUDSTONE. Recovered as angular tabular medium to coarse gravel of mudstone.		
			2.60	47.45		OAKS ROCK SANDSTONE End of pit at 2.60 m		

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

Stability:



				Trial Pit Log				Trialpit No TP04 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436835.60 - 407036.05 Level: 50.85		Date 11/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.70		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	50.55		TOPSOIL: Grey brown slightly sandy silt. Occasional medium gravel sized peaty fragments. Occasional rootlets. TOPSOIL	
	0.70	D		0.60	50.25		Firm light brown CLAY. Occasional subangular tabular fine to coarse gravel of sandstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
			HVP=114				Stiff brown mottled grey fissured CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	1
							1.5m Becomes increasingly gravelly with siltstone lithorelics.	
	2.00	D		2.10	48.75		?Medium dense grey angular tabular medium to coarse GRAVEL of mudstone. WEATHERED OAKS ROCK SANDSTONE	2
				2.40	48.45		2.3m Lens of black siltstone. Moderately weak dark grey thickly laminated MUDSTONE. Recovered as angular tabular medium to coarse gravel with many angular tabular cobbles. All mudstone.	
				2.70	48.15		OAKS ROCK SANDSTONE End of pit at 2.70 m	3
								4
								5

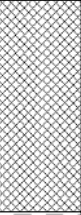
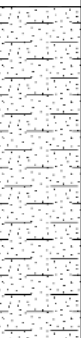
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP05 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436841.73 - 407006.60 Level: 50.55		Date 11/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.10			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T		0.30	50.25		TOPSOIL: Grey brown slightly sandy silt. Occasional medium gravel sized peaty fragments. Occasional rootlets. TOPSOIL	
	1.00	D	HVP=92				Firm light brown mottled grey CLAY. Occasional cobble sized sand lenses. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <i>0.5m Land drain intercepted.</i> <i>0.6m Lens of red brown fine sand with some gravel of ironstone.</i>	1
	1.60	D	HVP=110	1.40	49.15		?Medium dense yellow brown clayey slightly sandy angular medium to coarse GRAVEL of siltstone. WEATHERED OAKS ROCK SANDSTONE <i>1.6m Occasional cobbles of ironstone.</i>	
				1.70	48.85		Moderately weak thickly laminated grey brown MUDSTONE. Recovered as angular tabular medium to coarse gravel of mudstone. OAKS ROCK SANDSTONE	2
				2.10	48.45		End of pit at 2.10 m	5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP06 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436926.85 - 407039.30 Level: 49.05		Date 11/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 3.00					

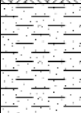
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T	HVP=52	0.30	48.75		MADE GROUND: Grey brown slightly sandy clay with rare angular medium gravel of pottery. Occasional rootlets.	1 2 3 4 5
	0.30	J,K&T					MADE GROUND TOPSOIL	
	1.30	D		48.05		MADE GROUND: Purple brown ash sand with much subangular fine to medium gravel of coal, clinker, brick, glass, and pottery. Occasional subangular cobbles of brick.		
						ASH & CLINKER <i>0.5m Frequent bricks excavated in south side of trial pit.</i>		
	1.50	D	47.65		Firm light brown mottled grey slightly sandy CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE			
	2.50	46.55				?Medium dense orange grey very clayey SAND with occasional subrounded medium gravel of sandstone. WEATHERED OAKS ROCK SANDSTONE <i>1.7. Occasional cobble sized lenses of light grey sandy clay.</i>		
			3.00	46.05			Firm light brown very sandy CLAY with occasional subangular to subrounded medium gravel of sandstone. Occasional root traces. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
	End of pit at 3.00 m							

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

Stability:

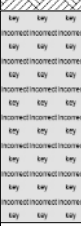


				Trial Pit Log			Trialpit No TP07 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436934.79 - 406992.67 Level: 48.50		Date 11/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.70		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.40	48.10		TOPSOIL: Grey brown silt. Occasional rootlets. Rare subangular cobbles of brick. TOPSOIL	
	0.90	D	HVP=60				Firm orange brown sandy CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <u>0.4m Land drain intercepted.</u> <u>0.7m Seepage of groundwater.</u>	1
			HVP=82					
	1.70	D		1.50	47.00		?Medium dense yellow brown very clayey fine to medium SAND. WEATHERED OAKS ROCK SANDSTONE	
	2.00	D		1.80	46.70		Very stiff grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	2
				2.70	45.80		----- End of pit at 2.70 m	3
								4
								5

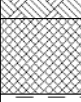
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage at 0.7m during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

Stability:


				Trial Pit Log			Trialpit No TP09 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437000.96 - 407046.07 Level: 46.75		Date 13/06/2014	
Location: Lundwood				Dimensions (m): Depth 2.50			Scale 1:25		
Client: Harron Homes Limited							Logged GLM		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.50	J,K&T	HVP=64	1.80	44.95		MADE GROUND: Grey brown slightly sandy silt with some subrounded fine to medium gravel of mixed lithologies. Rare subangular cobbles of brick. Rare cobble sized metal and plastic fragments. MADE GROUND TOPSOIL <i>0.4m Relict foundations comprising brick and concrete excavated.</i>		
	2.00	D					Firm brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				2.50	44.25		End of pit at 2.50 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage at 1.7m during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									



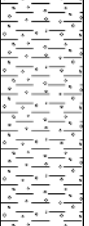
				Trial Pit Log			Trialpit No TP12 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437054.82 - 407050.00 Level: 45.55		Date 13/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.40		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.10	J,K&T					MADE GROUND: Grey brown slightly sandy silt with some subangular medium gravel of mixed lithologies and clinker. MADE GROUND TOPSOIL	1 2 3 4 5
							0.4m Layer of medium gravel of clinker at base.	
	0.60	J,K&T		0.45	45.10		MADE GROUND: Red brown sandy angular fine to medium angular gravel of burnt shale. GRANULAR MADE GROUND	
				0.70	44.85		Firm brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE 0.7m to 1.2m Discoloured green.	
								
			2.40	43.15	End of pit at 2.40 m			

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.
Stability:	



				Trial Pit Log			Trialpit No TP13 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437052.61 - 407003.22 Level: 45.45		Date 13/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.60			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.40	J,K&T	HVP=66	0.20	45.25	        	MADE GROUND: Grey brown silt with much subangular medium to coarse gravel of mixed lithologies, mortar, tarmac and brick. Occasional rootlets. MADE GROUND TOPSOIL MADE GROUND: Black brown silt with much subangular medium to coarse gravel of mixed lithologies, mortar, tarmac and brick, and occasional subangular cobbles of brick and mortar. COHESIVE MADE GROUND 0.2m Concrete boulder excavated (>1m) 1.3m Frequent cobbles of brick excavated 1.4m Seepage of groundwater. Firm light brown sandy CLAY with some angular tabular medium to coarse gravel of sandstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE Moderately weak brown grey thickly laminated SILTSTONE. Recovered as silty angular tabular medium to coarse gravel of siltstone. OAKS ROCK SANDSTONE	1	
				1.50	43.95				2
				2.30	43.15				3
				2.60	42.85				4
									5

End of pit at 2.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage at 1.4m during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

 Stability:



				Trial Pit Log			Trialpit No TP14 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437023.21 - 406980.96 Level: 46.00		Date 13/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.10					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	2.00	D		0.50	45.50		MADE GROUND: Grey brown sandy silt with some subrounded fine to medium gravel of mixed lithologies. Rare subangular cobbles of brick. MADE GROUND TOPSOIL	1
				0.70	45.30		MADE GROUND: Black silt. Rare subangular to subrounded fine to medium gravel of clinker and coal. COHESIVE MADE GROUND	
							Firm light brown mottled grey slightly sandy CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <i>0.8m Gravel filled land drain intercepted. Much inflow of groundwater.</i>	
				2.10	43.90		End of pit at 2.10 m	2
								3
								4
								5

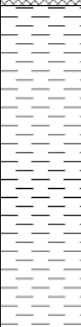
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP15 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437083.87 - 406973.18 Level: 44.75		Date 12/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 3.60			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T					MADE GROUND: Grey brown silt with some subrounded fine to medium gravel of mixed lithologies, brick and coal. MADE GROUND TOPSOIL	
				0.50	44.25		Firm grey slightly sandy CLAY. Occasional rootlets. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
				0.80	43.95		Firm light brown orange CLAY with occasional angular fine to medium gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	1
	1.10	D	HVP=72					
			HVP=68					
				2.70	42.05		?Medium dense grey clayey fine to medium angular tabular GRAVEL of siltstone. WEATHERED OAKS ROCK SANDSTONE	
				2.90	41.85		Moderately weak brown grey thickly laminated SILTSTONE. Recovered as silty angular tabular medium to coarse gravel of siltstone. OAKS ROCK SANDSTONE	3
				3.60	41.15		End of pit at 3.60 m	4
								5

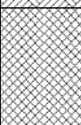
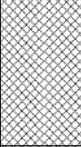
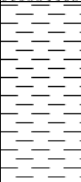
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP16 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437111.86 - 406979.65 Level: 44.20		Date 13/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.60			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40	J,K&T		0.25	43.95		MADE GROUND: Grey brown slightly sandy silt with some subangular medium gravel of mixed lithologies and clinker. Occasional subangular cobbles of brick. MADE GROUND TOPSOIL MADE GROUND: Yellow sand and subangular coarse gravel of sandstone. GRANULAR MADE GROUND
				1.30	42.90		Stiff light brown mottled grey CLAY with some subangular medium to coarse gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE
				2.40	41.80		Moderately weak brown grey thickly laminated SILTSTONE. Recovered as silty angular tabular medium to coarse gravel of siltstone.
				2.60	41.60		OAKS ROCK SANDSTONE End of pit at 2.60 m

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.
Stability:	

				Trial Pit Log			Trialpit No TP17 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437125.74 - 406942.01 Level: 44.45		Date 12/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.70					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T	HVP=62				MADE GROUND: Grey brown silt with much subangular fine to medium gravel of mixed lithologies, brick, clinker and coal. MADE GROUND TOPSOIL	1 2 3 4 5
				0.60	43.85			
	0.80	J,K&T		1.00	43.45		MADE GROUND: Cream silty subangular medium gravel of limestone GRANULAR MADE GROUND	
	1.20	T		1.30	43.15		MADE GROUND: Black brown ash sand with much subrounded to subangular medium to coarse gravel of clinker, coal, brick and sandstone. ASH & CLINKER	
				1.80	42.65		MADE GROUND: Green grey CLAY with occasional cobble sized lens of rotting plant debris. COHESIVE MADE GROUND	
				2.10	42.35		Firm light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
				2.70	41.75		End of pit at 2.70 m	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP18 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437158.13 - 406950.66 Level: 44.40		Date 12/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.80		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	J,K&T		0.20	44.20	    		
	1.20	J,K&T		0.90	43.50		  	1
	2.70	D	HVP=64	2.30	42.10	 	2	
				2.60	41.80	 		
				2.80	41.60		3	
							4	
							5	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP19 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437128.22 - 406868.60 Level: 43.45		Date 12/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.60			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T					MADE GROUND: Grey brown silt. Occasional rootlets. MADE GROUND TOPSOIL	
	0.40	J,K&T		0.25	43.20		MADE GROUND: Purple brown ash sand with much subangular to subrounded fine to medium gravel of clinker, coal, siltstone and pottery and rare subangular cobbles of brick and sandstone. ASH & CLINKER	
				0.70	42.75		MADE GROUND: Firm brown clay with subangular fine to medium gravel of sandstone. COHESIVE MADE GROUND	1
	2.00	J,K&T					1.9m Obstruction comprising strong concrete encountered in base of pit.	2
				2.20	41.25		Firm brown mottled grey CLAY with much subangular fine to medium gravel of sandstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
				2.60	40.85		End of pit at 2.60 m	3
								4
								5

Remarks: Stability:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
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				Trial Pit Log			Trialpit No TP20 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437113.41 - 406888.12 Level: 43.90		Date 12/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.90			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.50	J,K&T		0.20	43.70		MADE GROUND: Buff silty subangular to subrounded gravel of limestone GRANULAR MADE GROUND	1	
							MADE GROUND: Purple brown ash sand with much angular to subrounded fine to coarse gravel of clinker, coal, sandstone, brick, pottery and glass. Rare cobble sized glass bottles. Rare cobble sized tabular fragment of ?asbestos? ASH & CLINKER		
				1.90	42.00		MADE GROUND: Green grey CLAY with occasional cobble sized lens of rotting plant debris. COHESIVE MADE GROUND	2	
	2.30	D		2.20	41.70		Firm light brown mottled grey CLAY with some subangular tabular fine to medium gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				2.90	41.00		----- End of pit at 2.90 m -----	3	
									4
								5	

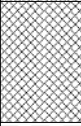
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP21 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437073.44 - 406934.41 Level: 45.00		Date 13/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.40			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.70	J,K&T	HVP=84	0.25	44.75	 MADE GROUND: Grey brown silt with much subangular medium to coarse gravel of mixed lithologies, mortar, and brick. MADE GROUND TOPSOIL  MADE GROUND: Brown sandy CLAY with some subangular coarse gravel of predominantly sandstone. COHESIVE MADE GROUND <i>0.3m cobble sized tarmac fragments excavated.</i>  MADE GROUND: Buff sand and subrounded medium to coarse gravel of sandstone. GRANULAR MADE GROUND	1	
				0.50	44.50			
				1.20	43.80			
				2.40	42.60	 Stiff brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <i>1.2m to 1.4m Discoloured green.</i>	2	
End of pit at 2.40 m								3
								4
								5

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.
Stability:	

				Trial Pit Log			Trialpit No TP22 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437026.41 - 406937.72 Level: 45.00		Date 13/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 3.00			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T				 MADE GROUND: Grey brown slightly sandy silt with some subrounded fine to medium gravel of mixed lithologies and occasional subangular cobbles of brick and paving slabs. MADE GROUND TOPSOIL	1	
	0.60	T		0.50	44.50	 MADE GROUND: Buff silty sand and subrounded to subangular fine to coarse gravel of limestone. GRANULAR MADE GROUND		
				0.80	44.20	 MADE GROUND: Firm green grey clay with occasional cobble sized rotting plant debris. COHESIVE MADE GROUND		
	1.30	D		1.20	43.80	 Stiff brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	2	
				2.60	42.40	 Moderately weak brown grey thinly laminated SILTSTONE. Recovered as silty sandy angular tabular medium to coarse gravel of siltstone. OAKS ROCK SANDSTONE	3	
			3.00	42.00	End of pit at 3.00 m			
							4	
							5	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

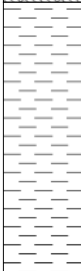
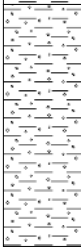
				Trial Pit Log			Trialpit No TP23 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436981.01 - 406967.25 Level: 47.45		Date 13/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 3.20		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.60	J,K&T		0.50	46.95		TOPSOIL: Grey brown silt with much subangular fine to medium gravel of sandstone, coal and clinker. Occasional rootlets. MADE GROUND TOPSOIL	1
				0.80	46.65		MADE GROUND: Black brown ash sand with much subrounded to subangular medium to coarse gravel of clinker, coal, brick and sandstone. ASH & CLINKER MADE GROUND: Light brown clay with rare cobbles of brick. COHESIVE MADE GROUND	
				1.40	46.05		1.2m Becomes dark grey. Firm light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
				3.20	44.25		2m Becomes fissile. End of pit at 3.20 m	2
					3			
								4
								5

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.
Stability:	

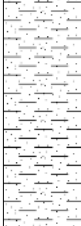
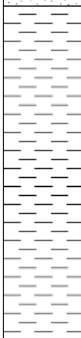


				Trial Pit Log			Trialpit No TP25 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436920.07 - 406956.44 Level: 48.30		Date 11/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.00		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	48.00		TOPSOIL: Black brown silt. Occasional rootlets. TOPSOIL	
			HVP=70	1.20	47.10		Firm orange brown mottled grey slightly sandy CLAY with rare subrounded cobbles of sandstone. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	1
	2.00	D		2.00	46.30		Stiff brown mottled grey CLAY with much subangular fine to medium gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <i>1.4m Becomes fissile.</i>	2
							End of pit at 2.00 m	3
								4
								5

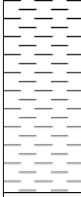
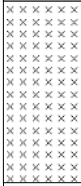
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP26 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436897.73 - 406995.62 Level: 49.40		Date 12/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.50					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	49.10		TOPSOIL: Grey brown silt. Occasional rootlets. TOPSOIL	
			HVP=64				Firm orange brown sandy CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	1
			HVP=68	1.10	48.30		Firm brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
	1.30	D		2.20	47.20			2
							End of pit at 2.50 m	3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP27 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436876.31 - 406912.66 Level: 50.45		Date 12/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.40		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.30	D	HVP=40	0.25	50.20		TOPSOIL: Grey brown silt. Occasional rootlets. TOPSOIL	1
			HVP=120	0.90	49.55		Firm light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
							Stiff brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
							1.7m Becomes sandy.	
						1.90	48.55	
				2.50	47.95		End of pit at 2.40 m	3
								4
								5

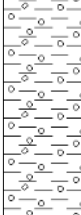
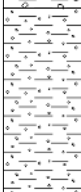
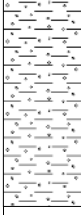
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP28 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436860.45 - 406883.24 Level: 51.40		Date 11/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.50			Logged GLM		

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T	HVP=80	0.30	51.10		TOPSOIL: Grey brown silt. Occasional rootlets. TOPSOIL	1
				0.60	50.80		Stiff light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
							Very stiff brown mottled grey CLAY with occasional subangular medium to coarse gravel of mudstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
	1.40	D				 1.6m Frequent gravel of mudstone lithorelics.		
				1.90	49.50		Moderately weak grey thickly laminated MUDSTONE. Recovered as clayey angular tabular medium to coarse gravel of mudstone. OAKS ROCK SANDSTONE	2
				2.50	48.90	End of pit at 2.50 m		3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP29 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436922.99 - 406872.58 Level: 49.15		Date 12/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.40					

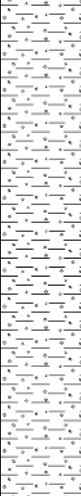
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.35	48.80		TOPSOIL: Grey brown silt. Occasional rootlets. TOPSOIL	1
							Firm light brown mottled grey CLAY with occasional subangular to subrounded cobbles of sandstone. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
				1.10	48.05		Stiff brown mottled grey fissured CLAY with much angular tabular fine to medium gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
	2.10	D		2.40	46.75		End of pit at 2.40 m	2
								3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

Stability:

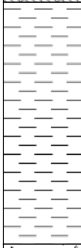
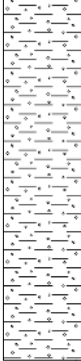


				Trial Pit Log			Trialpit No TP30 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436923.82 - 406903.53 Level: 48.95		Date 11/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.30					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.70	48.25		TOPSOIL: Brown silt. Occasional rootlets. TOPSOIL	
	1.40	D	HVP=68				Firm brown mottled grey CLAY with occasional subangular coarse gravel of mudstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	1
				2.40	46.55		Moderately weak grey thickly laminated MUDSTONE.	
				2.60	46.35		Recovered as clayey angular tabular medium to coarse gravel of mudstone. OAKS ROCK SANDSTONE	
							End of pit at 2.30 m	3
								4
								5

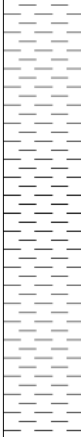
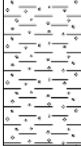
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP31 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436975.20 - 406917.55 Level: 46.75		Date 13/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.30		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.00	D	HVP=48	0.30	46.45		TOPSOIL: Grey brown silt. Occasional rootlets. TOPSOIL	1
			HVP=70	1.10	45.65		Firm light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
				2.30	44.45		Stiff brown mottled grey CLAY with some subangular medium to coarse gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
							End of pit at 2.30 m	2
								3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

				Trial Pit Log			Trialpit No TP32 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436969.36 - 406885.06 Level: 47.05		Date 11/06/2014	
Location: Lundwood				Dimensions (m): Depth 2.20				Scale 1:25	
Client: Harron Homes Limited								Logged GLM	

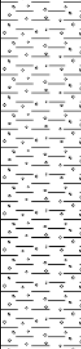
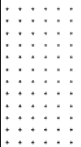
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T					TOPSOIL: Brown silt. Occasional rootlets. TOPSOIL	
				0.30	46.75		Stiff light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <u>0.4m Land drain intercepted.</u>	1
	1.00	D	HVP=102					
				1.80	45.25		Stiff brown mottled grey CLAY with some angular fine to coarse gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	2
				2.30	44.75		End of pit at 2.20 m	3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

Stability:



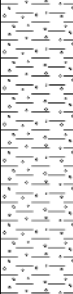
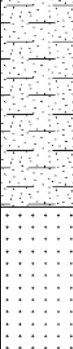
				Trial Pit Log			Trialpit No TP33 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 436982.43 - 406839.48 Level: 47.25		Date 13/06/2014	
Location: Lundwood				Dimensions (m):		Scale 1:25		Logged GLM	
Client: Harron Homes Limited				Depth 2.00					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.60	J,K&T		0.30	46.95		TOPSOIL: Black brown silt with occasional subangular fine to medium gravel of mixed lithologies. Occasional rootlets. TOPSOIL	1	
				1.50	45.75		Firm brown sandy CLAY with much angular tabular medium to coarse gravel of sandstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				2.00	45.25		Moderately weak brown thickly laminated fine SANDSTONE. Recovered as angular tabular medium to coarse gravel of sandstone. OAKS ROCK SANDSTONE		
						1.9m Becomes difficult to excavate. End of pit at 2.00 m			2
							3		
								4	

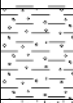
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.

Stability:



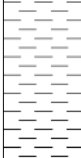
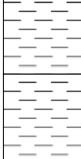
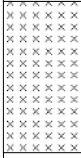
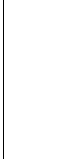
				Trial Pit Log				Trialpit No TP34 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437014.19 - 406815.04 Level: 47.45		Date 13/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.80		Logged GLM	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.10	J,K&T	HVP=50	0.60	46.85		TOPSOIL: Black brown slightly sandy silt with occasional subrounded to subangular fine to medium gravel of mixed lithologies. TOPSOIL		
	1.00	D		1.60	45.85		Firm brown CLAY with much angular fine to medium gravel of sandstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				2.30	45.15		Moderately weak thickly laminated fine SANDSTONE. Recovered as angular tabular coarse gravel with some angular cobbles. All sandstone. OAKS ROCK SANDSTONE		
				2.80	44.65	End of pit at 2.80 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									



				Trial Pit Log				Trialpit No TP35 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437020.78 - 406840.36 Level: 46.00		Date 12/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.10		Logged GLM	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	2.10	D	HVP=64	0.40	45.60		TOPSOIL: Grey brown silt. Occasional rootlets. TOPSOIL		
			HVP=72	0.90	45.10		Firm light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				1.20	44.80		Stiff brown mottled grey fissured CLAY with much angular tabular medium to coarse gravel of siltstone lithorelics. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				1.80	44.20		?Medium dense grey brown angular medium to coarse GRAVEL of sandstone. WEATHERED OAKS ROCK SANDSTONE		
			2.10	43.90		Moderately weak grey brown thinly laminated fine SANDSTONE. Recovered as grey brown angular medium to coarse gravel of sandstone. OAKS ROCK SANDSTONE			
End of pit at 2.10 m									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									



				Trial Pit Log				Trialpit No TP36 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437055.90 - 406866.31 Level: 44.90		Date 12/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 2.90		Logged GLM	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J,K&T					TOPSOIL: Black brown silt. Occasional rootlets. MADE GROUND TOPSOIL	
				0.30	44.60		Stiff light brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	
	1.00	D	HVP=86	1.10	43.80		Stiff brown mottled grey CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE	1
			HVP=90					
				2.40	42.50		Moderately weak brown grey thickly laminated SILTSTONE. Recovered as silty angular tabular medium to coarse gravel of siltstone. OAKS ROCK SANDSTONE	2
				2.90	42.00		End of pit at 2.90 m	3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

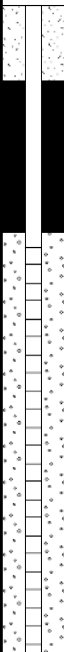
				Trial Pit Log			Trialpit No TP37 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437077.83 - 406835.65 Level: 44.75		Date 12/06/2014	
Location: Lundwood				Dimensions (m):			Scale 1:25		
Client: Harron Homes Limited				Depth 2.60			Logged GLM		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J,K&T	HVP=78	0.60	44.15		TOPSOIL: Grey brown silt with occasional subangular fine to medium gravel of mixed lithologies. Occasional rootlets. TOPSOIL		
							0.5m Band of dark silt.		
							Stiff light brown mottled grey slightly sandy CLAY. COMPLETELY WEATHERED OAKS ROCK SANDSTONE		
				2.00	42.75		?Medium dense light grey very clayey angular tabular medium to coarse GRAVEL of sandstone lithorelics. WEATHERED OAKS ROCK SANDSTONE		
				2.30	42.45		Moderately weak brown thickly laminated fine SANDSTONE. Recovered as coarse angular tabular gravel of sandstone. OAKS ROCK SANDSTONE		
				2.60	42.15		End of pit at 2.60 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									

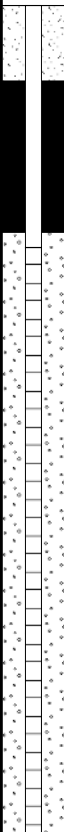
				Trial Pit Log			Trialpit No TP39 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437067.85 - 406783.21 Level: 45.50		Date 12/06/2014	
Location: Lundwood						Dimensions (m):		Scale 1:25	
Client: Harron Homes Limited						Depth 1.70		Logged GLM	

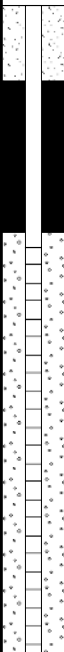
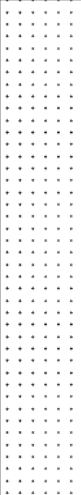
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.30	45.20		TOPSOIL: Grey brown silt with occasional subangular fine to medium gravel of predominantly sandstone. Occasional rootlets. TOPSOIL	1
				0.80	44.70		?Medium dense clayey angular coarse gravel of sandstone with much angular tabular cobbles of sandstone. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <u>0.5m Land drain excavated.</u>	
				1.70	43.80		Moderately weak grey brown thinly laminated fine SANDSTONE. Recovered as grey brown angular medium to coarse gravel of sandstone. COMPLETELY WEATHERED OAKS ROCK SANDSTONE <u>1.6m Seepage of groundwater.</u>	
	2.10	D					End of pit at 1.70 m	2
								3
								4
								5

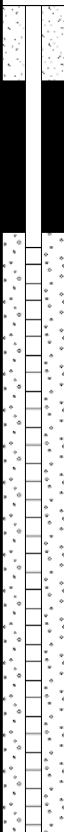
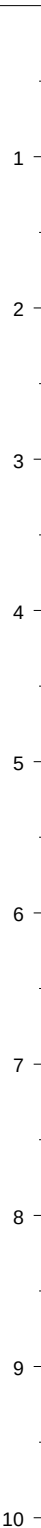
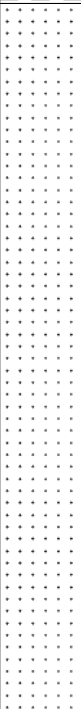
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage at 1.6m] during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:	

APPENDIX G
BOREHOLE RECORDS

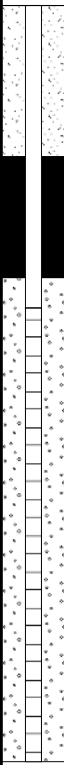
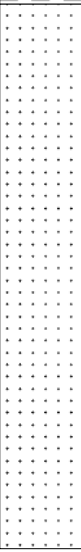
					Borehole Log			Borehole No. BH01 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 436856.85 - 407104.71		Hole Type PH	
Location: Lundwood					Level: 50.85		Scale 1:50		Logged By GLM	
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.30	49.55		Overburden WEATHERED OAKS ROCK SANDSTONE	1	
					4.30	46.55		Sandstone OAKS ROCK SANDSTONE	2	
									3	
									4	
									5	
									6	
									7	
									8	
									9	
									10	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										

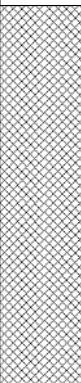
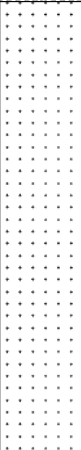
					Borehole Log			Borehole No. BH02 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 436849.26 - 407024.81		Hole Type PH
Location: Lundwood					Level: 50.55		Scale 1:50		Logged By GLM
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	49.55		Overburden WEATHERED OAKS ROCK SANDSTONE	
								Sandstone OAKS ROCK SANDSTONE	1
									2
									3
									4
									5
					5.50	45.05		End of borehole at 5.50 m	6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

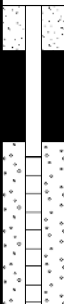
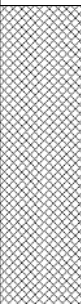
					Borehole Log			Borehole No. BH03 Sheet 1 of 1			
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 436868.50 - 406904.92		Hole Type PH		
Location: Lundwood					Level: 50.90		Scale 1:50		Logged By GLM		
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					1.00	49.90		Overburden WEATHERED OAKS ROCK SANDSTONE			
								Sandstone OAKS ROCK SANDSTONE	1		
									2		
									3		
									4		
					4.30	46.60		End of borehole at 4.30 m			
									5		
									6		
									7		
									8		
									9		
									10		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.											

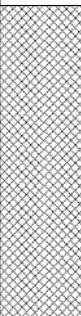
					Borehole Log			Borehole No. BH04 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: -		Hole Type PH	
Location: Lundwood					Level:		Scale 1:50			
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014		Logged By GLM			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.80			Overburden		
								WEATHERED OAKS ROCK SANDSTONE		
								Sandstone		
								OAKS ROCK SANDSTONE		
					5.50			End of borehole at 5.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										
										

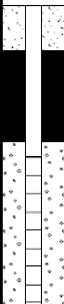
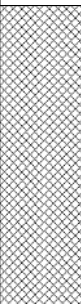
					Borehole Log			Borehole No. BH05 Sheet 1 of 1		
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437021.61 - 406843.70		Hole Type PH	
Location: Lundwood					Level: 45.90		Scale 1:50		Logged By GLM	
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	44.90		Overburden WEATHERED OAKS ROCK SANDSTONE		
								Sandstone OAKS ROCK SANDSTONE		1
										2
										3
										4
					5.00	40.90		End of borehole at 5.00 m		5
										6
										7
										8
										9
										10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 3.5m and rose to ground level after 30 minutes.										

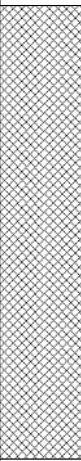
					Borehole Log			Borehole No. BH06 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437050.12 - 406794.14		Hole Type PH
Location: Lundwood					Level: 45.85		Scale 1:50		Logged By GLM
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.40	44.45		Overburden WEATHERED OAKS ROCK SANDSTONE	1
								Sandstone OAKS ROCK SANDSTONE	2
					5.00	40.85			3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. BH07 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437153.66 - 406962.08		Hole Type PH
Location: Lundwood					Level: 44.35		Scale 1:50		Logged By GLM
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	41.85		Made Ground ASH & CLINKER	1
									Sandstone OAKS ROCK SANDSTONE
					5.50	38.85		End of borehole at 5.50 m	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

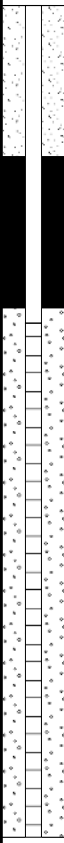
					Borehole Log			Borehole No. BH07A Sheet 1 of 1			
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437149.53 - 406958.91		Hole Type PH		
Location: Lundwood					Level: 44.45		Scale 1:50		Logged By GLM		
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					2.00	42.45		Made Ground ASH & CLINKER			
									1		
									2		
									3		
									4		
									5		
									6		
									7		
									8		
									9		
									10		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.											

					Borehole Log			Borehole No. BH08 Sheet 1 of 1			
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437088.49 - 407032.62		Hole Type PH		
Location: Lundwood					Level: 44.95		Scale 1:50		Logged By GLM		
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					2.10	42.85		Made Ground ASH & CLINKER		1	
								Sandstone OAKS ROCK SANDSTONE		2	
					5.50	39.45		End of borehole at 5.50 m		3	
										4	
										5	
										6	
										7	
										8	
										9	
										10	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.											

					Borehole Log			Borehole No. BH08A Sheet 1 of 1			
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437084.36 - 407035.33		Hole Type PH		
Location: Lundwood					Level: 45.10		Scale 1:50		Logged By GLM		
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					2.00	43.10		Made Ground ASH & CLINKER			
									1		
									2		
									3		
									4		
									5		
									6		
									7		
									8		
									9		
									10		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.											

				Borehole Log				Borehole No. BH09 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood				Project No. 1898		Co-ords: 437032.43 - 407081.60		Hole Type PH	
Location: Lundwood				Level: 45.95		Scale 1:50			
Client: Harron Homes Limited				Dates: 13/06/2014 - 13/06/2014		Logged By GLM			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					3.00	42.95		Made Ground ASH & CLINKER	1
									Sandstone OAKS ROCK SANDSTONE
					5.50	40.45	End of borehole at 5.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 3m and rose to 0.5m after 30 minutes.									



					Borehole Log			Borehole No. BH10 Sheet 1 of 1	
Project Name: Littleworth Lane, Lundwood					Project No. 1898		Co-ords: 437013.85 - 406977.65		Hole Type PH
Location: Lundwood					Level: 46.30		Scale 1:50		
Client: Harron Homes Limited					Dates: 13/06/2014 - 13/06/2014		Logged By GLM		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.60	44.70		Overburden WEATHERED OAKS ROCK SANDSTONE	1
					5.50	40.80		Sandstone OAKS ROCK SANDSTONE	2
									3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

APPENDIX H
CHEMICAL TEST RESULTS



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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
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Report Number: 403852-1

Date of Report: 30-Jun-2014

Customer: Lithos Consulting Ltd.
Parkhill
Walton Road
Wetherby
West Yorkshire
LS22 5DZ

Customer Contact: Mr George Morton

Customer Job Reference: PO8337/1898/RJH
Customer Purchase Order: PO8337/1898/RJH
Customer Site Reference: Littleworth Lane, Lundwood
Date Job Received at SAL: 16-Jun-2014
Date Analysis Started: 26-Jun-2014
Date Analysis Completed: 30-Jun-2014

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
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Chris Murphy
Project Manager

Issued by :
Chris Murphy
Project Manager

Page 3 of 6
403852-1

SAL Reference: 403852							
Project Site: Littleworth Lane, Lundwood							
Customer Reference: PO8337/1898/RJH							
Soil		Analysed as Soil					
Miscellaneous							
SAL Reference					403852 030	403852 031	403852 032
Customer Sample Reference					TP37	TP22	TP17
Date Sampled					13-JUN-2014	12-JUN-2014	12-JUN-2014
Depth					0.1	0.1	0.6
Sample Description					TOPSOIL	GRANULAR MADE GROUND	GRANULAR MADE GROUND
Type					Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units			
Moisture	T277	AR	0.1	%	27	5.1	6.4
Moisture @ 105 C	T162	AR	0.1	%	28	4.8	5.1
pH	T7	AR			6.4	7.9	8.1
Arsenic	T6	M40	2	mg/kg	21	5	6
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1
Chromium	T6	M40	1	mg/kg	28	16	5
Chromium (trivalent)	T85	AR	2	mg/kg	28	16	5
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1
Copper	T6	M40	1	mg/kg	42	19	28
Lead	T6	M40	1	mg/kg	74	21	16
Mercury	T6	M40	1	mg/kg	<1	<1	<1
Nickel	T6	M40	1	mg/kg	29	10	5
Selenium	T6	M40	3	mg/kg	<3	<3	<3
Zinc	T6	M40	1	mg/kg	110	170	81
Asbestos ID	T27	AR			N.D.	N.D.	N.D.
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1
Naphthalene	T207	M105	0.1	mg/kg	0.2	<0.1	0.2
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	0.4	0.2	0.3
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	1.0	1.3	0.5
Pyrene	T207	M105	0.1	mg/kg	0.9	1.8	0.5
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	0.6	0.8	0.3
Chrysene	T207	M105	0.1	mg/kg	0.5	0.7	0.3
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	0.5	0.8	0.3
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	0.3	0.5	0.2
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	0.3	0.6	0.2
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	0.2	0.3	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.2	0.3	<0.1
PAH(total)	T207	M105	0.1	mg/kg	5.1	7.3	2.8
Total Organic Carbon	T21	M40	0.1	%	7.1	1.4	8.7

SAL Reference: 403852
Project Site: Littleworth Lane, Lundwood
Customer Reference: PO8337/1898/RJH

Leachate to BS EN 12457-2 (10:1) Analysed as Water
Lithos pH and metals

SAL Reference					403852 001	403852 003	403852 006	403852 009	403852 014
Customer Sample Reference					TP02	TP06	TP17	TP18	TP21
Date Sampled					11-JUN-2014	11-JUN-2014	12-JUN-2014	12-JUN-2014	13-JUN-2014
Depth					0.5	0.3	0.8	0.5	0.7
Sample Description					ASH AND CLINKER	ASH AND CLINKER	ASH AND CLINKER	COHESIVE MADE GROUND	GRANULAR MADE GROUND
Type					Sandy Soil	Sandy Soil	Sandy Soil	Clay	Sandy Soil
Determinand	Method	Test Sample	LOD	Units					
As (Dissolved)	T281	10:1	0.2	µg/l	2.2	0.8	3.1	5.1	2.7
Boron	T6	10:1	0.01	mg/l	<0.01	0.01	<0.01	0.01	<0.01
Cd (Dissolved)	T281	10:1	0.02	µg/l	<0.02	<0.02	<0.02	<0.02	<0.02
Cr (Dissolved)	T281	10:1	1	µg/l	68	<1	3	2	1
Cu (Dissolved)	T281	10:1	0.5	µg/l	0.7	<0.5	<0.5	1.0	<0.5
Pb (Dissolved)	T281	10:1	0.3	µg/l	2.2	0.3	<0.3	<0.3	<0.3
Hg (Dissolved)	T281	10:1	0.05	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	10:1	1	µg/l	<1	1	2	1	2
pH	T7	10:1			6.6	6.5	7.5	7.8	8.7
Se (Dissolved)	T281	10:1	0.5	µg/l	0.6	<0.5	0.9	0.5	0.8
Zn (Dissolved)	T281	10:1	2	µg/l	17	20	<2	<2	<2

Index to symbols used in 403852-1

Value	Description
10:1	Leachate to BS EN 12457-2 (10:1)
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
AR	As Received
N.D.	Not Detected
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos

Method Index

Value	Description
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T277	Grav (1 Dec) (40 C)
T7	Probe
T162	Grav (1 Dec) (105 C)
T40	Bomb calorimetry
T206	GC/FID (MCERTS)
T251	2:1 Extraction/ICP/OES
T281	ICP/MS (Filtered)
T27	PLM
T21	OX/IR
T2	Grav
T207	GC/MS (MCERTS)
T426	2:1 Extraction / IC
T6	ICP/OES
T42	PID
T85	Calc

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Moisture	T277	AR	0.1	%	N	001,003,006,009,014,016,018,020-022,024,026,028-032
Moisture @ 105 C	T162	AR	0.1	%	N	001,003,006,009,014,016,018,020-022,024,026,028-032
pH	T7	AR			M	001,003,006,009,014,016,018,020-022,024,026,028-032
Arsenic	T6	M40	2	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Boron (water-soluble)	T6	AR	1	mg/kg	N	001,003,006,009,014,016,018,020-022,024,026,028-032
Cadmium	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Chromium	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Chromium (trivalent)	T85	AR	2	mg/kg	N	001,003,006,009,014,016,018,020-022,024,026,028-032
Chromium VI	T6	AR	1	mg/kg	N	001,003,006,009,014,016,018,020-022,024,026,028-032
Copper	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Lead	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Mercury	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Nickel	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Selenium	T6	M40	3	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Zinc	T6	M40	1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
(Water soluble) Cl-	T426	AR	0.01	g/l	N	001,003,006,009
(Water soluble) Mg	T251	AR	1	mg/l	N	001,003,006,009
(Water soluble) NO3	T426	AR	0.01	g/l	N	001,003,006,009
(Water Soluble) SO4 expressed as SO4	T242	AR	0.01	g/l	N	001,003,006,009
Asbestos ID	T27	AR			SU	001,003,006,009,014,016,018,020-022,024,026,028-032
Retained on 10mm sieve	T2	M40	0.1	%	N	001,003,006,009,014,016,018,020-022,024,026,028-032
Gasoline Range Organics	T42	M105	10	mg/kg	N	001,006
TPH (C10-C12)	T206	M105	1	mg/kg	M	001,006
TPH (C12-C16)	T206	M105	1	mg/kg	M	001,006
TPH (C16-C21)	T206	M105	1	mg/kg	M	001,006
TPH (C21-C35)	T206	M105	1	mg/kg	M	001,006
TPH (Sum of Bands)	T85	M105			N	001,006
Naphthalene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Acenaphthylene	T207	M105	0.1	mg/kg	U	001,003,006,009,014,016,018,020-022,024,026,028-032
Acenaphthene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Fluorene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Phenanthrene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Anthracene	T207	M105	0.1	mg/kg	U	001,003,006,009,014,016,018,020-022,024,026,028-032
Fluoranthene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Pyrene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Chrysene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001,003,006,009,014,016,018,020-022,024,026,028-032
PAH(total)	T207	M105	0.1	mg/kg	U	001,003,006,009,014,016,018,020-022,024,026,028-032
Total Organic Carbon	T21	M40	0.1	%	N	001,003,006,009,014,016,018,020-022,024,026,028-032
Gross Calorific Value (MF)	T40	M40	0.1	MJ/kg	N	001,003,006,014,016
As (Dissolved)	T281	10:1	0.2	µg/l	U	001,003,006,009,014
Boron	T6	10:1	0.01	mg/l	N	001,003,006,009,014
Cd (Dissolved)	T281	10:1	0.02	µg/l	U	001,003,006,009,014
Cr (Dissolved)	T281	10:1	1	µg/l	U	001,003,006,009,014
Cu (Dissolved)	T281	10:1	0.5	µg/l	U	001,003,006,009,014
Pb (Dissolved)	T281	10:1	0.3	µg/l	U	001,003,006,009,014
Hg (Dissolved)	T281	10:1	0.05	µg/l	U	001,003,006,009,014
Ni (Dissolved)	T281	10:1	1	µg/l	U	001,003,006,009,014
pH	T7	10:1			U	001,003,006,009,014
Se (Dissolved)	T281	10:1	0.5	µg/l	U	001,003,006,009,014
Zn (Dissolved)	T281	10:1	2	µg/l	U	001,003,006,009,014



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Certificate of Analysis

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Report Number: 405675-1

Date of Report: 09-Jul-2014

Customer: Lithos Consulting Ltd.
Parkhill
Walton Road
Wetherby
West Yorkshire
LS22 5DZ

Customer Contact: Mr George Morton

Customer Job Reference: PO8337/1898/RJH
Customer Purchase Order: PO8337/1898/RJH
Customer Site Reference: Littleworth Lane, Lundwood
Date Job Received at SAL: 16-Jun-2014
Date Analysis Started: 03-Jul-2014
Date Analysis Completed: 09-Jul-2014

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
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Chris Murphy
Project Manager

Issued by :
Chris Murphy
Project Manager

SAL Reference: 405675							
Project Site: Littleworth Lane, Lundwood							
Customer Reference: PO8337/1898/RJH							
Soil				Analysed as Soil			
MCERTS Preparation							
SAL Reference					405675 001	405675 002	405675 003
Customer Sample Reference					TP19 (403852/004)	TP19 (403852/011)	TP12 (403852/015)
Sample Description					ASH AND CLINKER	COHESIVE MADE GROUND	GRANULAR MADE GROUND
Date Sampled					12-JUN-2014	12-JUN-2014	13-JUN-2014
Depth					0.4	2.0	0.6
Type					Sandy Soil	Clay	Sandy Soil
Determinand	Method	Test Sample	LOD	Units			
Moisture	T277	AR	0.1	%	20	27	5.5
Moisture @ 105 C	T162	AR	0.1	%	42	25	4.4
pH	T7	AR			8.2	6.3	7.4
Arsenic	T6	M40	2	mg/kg	150	30	73
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1
Chromium	T6	M40	1	mg/kg	34	25	29
Chromium (trivalent)	T85	AR	2	mg/kg	34	25	29
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1
Copper	T6	M40	1	mg/kg	250	56	79
Lead	T6	M40	1	mg/kg	170	100	62
Mercury	T6	M40	1	mg/kg	<1	<1	<1
Nickel	T6	M40	1	mg/kg	63	25	40
Selenium	T6	M40	3	mg/kg	<3	<3	<3
Zinc	T6	M40	1	mg/kg	250	110	78
Asbestos ID	T27	AR			N.D.	N.D.	N.D.
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1
(Water soluble) Cl-	T426	AR	0.01	g/l	<0.01	<0.01	-
(Water soluble) Mg	T251	AR	1	mg/l	4	16	-
(Water soluble) NO3	T426	AR	0.01	g/l	<0.01	<0.01	-
(Water Soluble) SO4 expressed as SO4	T242	AR	0.01	g/l	0.02	0.31	-
Naphthalene	T207	M105	0.1	mg/kg	2.0	0.3	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	3.1	1.7	0.3
Anthracene	T207	M105	0.1	mg/kg	0.7	0.5	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	5.1	3.6	0.8
Pyrene	T207	M105	0.1	mg/kg	4.4	2.9	0.7
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	2.5	1.6	0.4
Chrysene	T207	M105	0.1	mg/kg	2.4	1.5	0.5
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	1.7	0.9	0.3
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	1.0	0.9	0.3
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	1.5	1.0	0.3
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	0.7	0.4	0.2
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	0.3	0.2	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.9	0.5	0.2
PAH(total)	T207	M105	0.1	mg/kg	26	16	4.0
Gross Calorific Value (MF)	T40	M40	0.1	MJ/kg	7.6	1.8	0.9
Total Organic Carbon	T21	M40	0.1	%	23	5.1	2.6

SAL Reference: 405675 Project Site: Littleworth Lane, Lundwood Customer Reference: PO8337/1898/RJH Leachate to BS EN 12457-2 (10:1) Analysed as Water Lithos pH and metals						
SAL Reference			405675 001		405675 002	
Customer Sample Reference			TP19 (403852/004)		TP19 (403852/011)	
Sample Description			ASH AND CLINKER		COHESIVE MADE GROUND	
Date Sampled			12-JUN-2014		12-JUN-2014	
Depth			0.4		2.0	
Type			Sandy Soil		Clay	
Determinand	Method	Test Sample	LOD	Units		
As (Dissolved)	T281	10:1	0.2	µg/l	2.1	1.2
Boron	T6	10:1	0.01	mg/l	0.02	0.09
Cd (Dissolved)	T281	10:1	0.02	µg/l	0.02	0.64
Cr (Dissolved)	T281	10:1	1	µg/l	2	<1
Cu (Dissolved)	T281	10:1	0.5	µg/l	1.2	1.4
Pb (Dissolved)	T281	10:1	0.3	µg/l	<0.3	<0.3
Hg (Dissolved)	T281	10:1	0.05	µg/l	<0.05	<0.05
Ni (Dissolved)	T281	10:1	1	µg/l	<1	10
pH	T7	10:1			7.6	5.7
Se (Dissolved)	T281	10:1	0.5	µg/l	<0.5	<0.5
Zn (Dissolved)	T281	10:1	2	µg/l	<2	110

Index to symbols used in 405675-1

Value	Description
10:1	Leachate to BS EN 12457-2 (10:1)
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
N.D.	Not Detected
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos

Method Index

Value	Description
T7	Probe
T85	Calc
T426	2:1 Extraction / IC
T277	Grav (1 Dec) (40 C)
T6	ICP/OES
T162	Grav (1 Dec) (105 C)
T27	PLM
T251	2:1 Extraction/ICP/OES
T281	ICP/MS (Filtered)
T2	Grav
T21	OX/IR
T40	Bomb calorimetry
T207	GC/MS (MCERTS)
T242	2:1 Extraction/ICP/OES (TRL 447 T1)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Moisture	T277	AR	0.1	%	N	001-003
Moisture @ 105 C	T162	AR	0.1	%	N	001-003
pH	T7	AR			M	001-003
Arsenic	T6	M40	2	mg/kg	M	001-003
Boron (water-soluble)	T6	AR	1	mg/kg	N	001-003
Cadmium	T6	M40	1	mg/kg	M	001-003
Chromium	T6	M40	1	mg/kg	M	001-003
Chromium (trivalent)	T85	AR	2	mg/kg	N	001-003
Chromium VI	T6	AR	1	mg/kg	N	001-003
Copper	T6	M40	1	mg/kg	M	001-003
Lead	T6	M40	1	mg/kg	M	001-003
Mercury	T6	M40	1	mg/kg	M	001-003
Nickel	T6	M40	1	mg/kg	M	001-003
Selenium	T6	M40	3	mg/kg	M	001-003
Zinc	T6	M40	1	mg/kg	M	001-003
Asbestos ID	T27	AR			SU	001-003
Retained on 10mm sieve	T2	M40	0.1	%	N	001-003
(Water soluble) Cl-	T426	AR	0.01	g/l	N	001-002
(Water soluble) Mg	T251	AR	1	mg/l	N	001-002
(Water soluble) NO3	T426	AR	0.01	g/l	N	001-002
(Water Soluble) SO4 expressed as SO4	T242	AR	0.01	g/l	N	001-002
Naphthalene	T207	M105	0.1	mg/kg	M	001-003
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-003
Acenaphthene	T207	M105	0.1	mg/kg	M	001-003
Fluorene	T207	M105	0.1	mg/kg	M	001-003
Phenanthrene	T207	M105	0.1	mg/kg	M	001-003
Anthracene	T207	M105	0.1	mg/kg	U	001-003
Fluoranthene	T207	M105	0.1	mg/kg	M	001-003
Pyrene	T207	M105	0.1	mg/kg	M	001-003
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-003
Chrysene	T207	M105	0.1	mg/kg	M	001-003
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001-003
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001-003
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-003
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-003
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-003
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-003
PAH(total)	T207	M105	0.1	mg/kg	U	001-003
Gross Calorific Value (MF)	T40	M40	0.1	MJ/kg	N	001-003
Total Organic Carbon	T21	M40	0.1	%	N	001-003
As (Dissolved)	T281	10:1	0.2	µg/l	U	001-002
Boron	T6	10:1	0.01	mg/l	N	001-002
Cd (Dissolved)	T281	10:1	0.02	µg/l	U	001-002
Cr (Dissolved)	T281	10:1	1	µg/l	U	001-002
Cu (Dissolved)	T281	10:1	0.5	µg/l	U	001-002
Pb (Dissolved)	T281	10:1	0.3	µg/l	U	001-002
Hg (Dissolved)	T281	10:1	0.05	µg/l	U	001-002
Ni (Dissolved)	T281	10:1	1	µg/l	U	001-002
pH	T7	10:1			U	001-002
Se (Dissolved)	T281	10:1	0.5	µg/l	U	001-002
Zn (Dissolved)	T281	10:1	2	µg/l	U	001-002



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Scientific Analysis Laboratories Ltd

Certificate of Analysis

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

Report Number: 407288-1

Date of Report: 15-Jul-2014

Customer: Lithos Consulting Ltd.
Parkhill
Walton Road
Wetherby
West Yorkshire
LS22 5DZ

Customer Contact: Mr George Morton

Customer Job Reference: PO8337/1898/RJH
Customer Purchase Order: PO8337/1898/RJH
Customer Site Reference: Littleworth Lane, Lundwood
Date Job Received at SAL: 16-Jun-2014
Date Analysis Started: 10-Jul-2014
Date Analysis Completed: 15-Jul-2014

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
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Chris Murphy
Project Manager

Issued by :
Chris Murphy
Project Manager

SAL Reference: 407288 Project Site: Littleworth Lane, Lundwood Customer Reference: PO8337/1898/RJH									
Soil		Analysed as Soil							
MCERTS Preparation									
SAL Reference				407288 001		407288 002		407288 003	
Customer Sample Reference				TP01 0.1 (403852/024) A		TP01 0.1 (403852/024) B		TP01 0.1 (403852/024) C	
Depth				0.1		0.1		0.1	
Date Sampled				11-JUN-2014		11-JUN-2014		11-JUN-2014	
Type				Topsoil		Topsoil		Topsoil	
Determinand		Method	Test Sample	LOD	Units				
Moisture		T277	AR	0.1	%	-	-	-	
Moisture @ 105 C		T162	AR	0.1	%	24	24	24	

SAL Reference: 407288 Project Site: Littleworth Lane, Lundwood Customer Reference: PO8337/1898/RJH									
Soil		Analysed as Soil							
Benzo(a)Pyrene									
SAL Reference				407288 001		407288 002		407288 003	
Customer Sample Reference				TP01 0.1 (403852/024) A		TP01 0.1 (403852/024) B		TP01 0.1 (403852/024) C	
Depth				0.1		0.1		0.1	
Date Sampled				11-JUN-2014		11-JUN-2014		11-JUN-2014	
Type				Topsoil		Topsoil		Topsoil	
Determinand		Method	Test Sample	LOD	Units				
Benzo(a)Pyrene		T16	M105	0.1	mg/kg	0.1	0.2	<0.1	

Index to symbols used in 407288-1

Value	Description
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
AR	As Received
M	Analysis is MCERTS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T162	Grav (1 Dec) (105 C)
T277	Grav (1 Dec) (40 C)
T16	GC/MS

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Benzo(a)Pyrene	T16	M105	0.1	mg/kg	M	001-003
Moisture	T277	AR	0.1	%	N	001-003
Moisture @ 105 C	T162	AR	0.1	%	N	001-003

APPENDIX I
GEOTECHNICAL TEST RESULTS



LABORATORY REPORT



4043

Contract Number: PSL14/3115

Client's Reference:

Report Date: 07 July 2014

Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: Richard Hey

Contract Title: Littleworth Lane, Lundwood

Date Received: 24/6/2014

Date Commenced: 24/6/2014

Date Completed: 7/7/2014

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

M Beastall
(Laboratory Manager)

D Lambe
(Senior Technician)

S Royle
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
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e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
TP01	2	D	1.00	Brown mottled grey slightly gravelly sandy CLAY.
TP03	2	D	0.80	Brown mottled grey slightly sandy CLAY.
TP04	1	D	0.70	Brown mottled grey sandy CLAY.
TP07	2	D	1.70	Brown mottled grey slightly gravelly very sandy CLAY.
TP07	3	D	2.00	Brown mottled grey slightly sandy CLAY.
TP09	2	D	2.00	Brown mottled grey slightly sandy CLAY.
TP18	3	D	2.70	Brown mottled grey gravelly sandy CLAY.
TP20	2	D	2.30	Brown mottled grey slightly gravelly very sandy CLAY.
TP27	1	D	1.30	Brown mottled grey CLAY.
TP31	1	D	1.00	Brown mottled grey slightly gravelly slightly sandy CLAY.
TP35	1	D	2.10	Brown mottled grey slightly gravelly very sandy CLAY.
TP36	2	D	1.00	Brown mottled grey sandy CLAY.
TP38	2	D	1.30	Brown mottled grey sandy CLAY.

 Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		02/07/14		07/07/14		07/07/14
	LITTLEWORTH LANE, LUNDWOOD.				Contract No:	PSL14/3115
					Client Ref:	1898

SUMMARY OF SOIL CLASSIFICATION TESTS

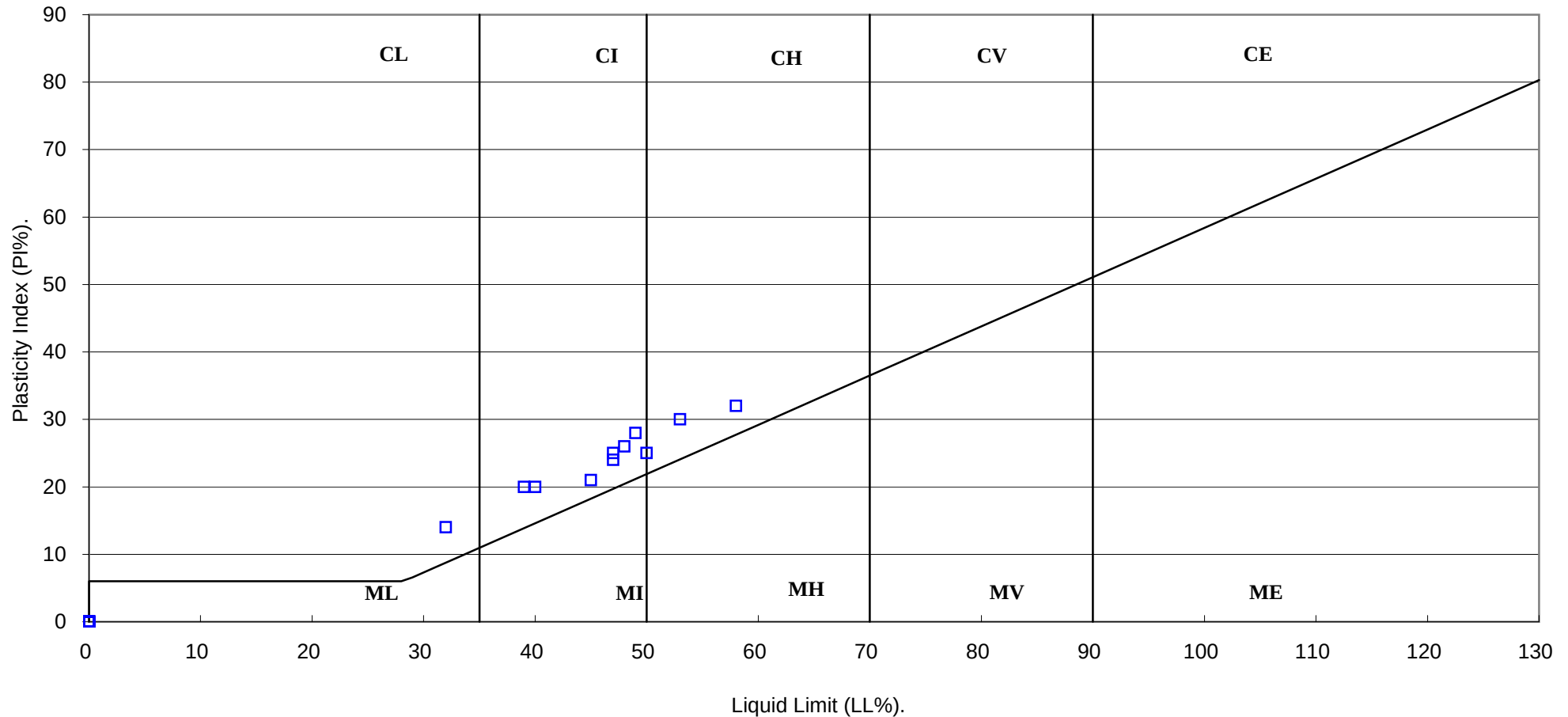
(B.S. 1377 : PART 2 : 1990)

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 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
TP01	2	D	1.00	20				39	19	20	98	Intermediate plasticity CI.
TP03	2	D	0.80	28				53	23	30	100	High plasticity CH.
TP04	1	D	0.70	16				40	20	20	100	Intermediate plasticity CI.
TP07	3	D	2.00	20				50	25	25	100	Intermediate plasticity CI.
TP09	2	D	2.00	21				47	23	24	100	Intermediate plasticity CI.
TP18	3	D	2.70	27				47	22	25	99	Intermediate plasticity CI.
TP20	2	D	2.30	17				32	18	14	98	Low plasticity CL.
TP27	1	D	1.30	30				58	26	32	100	High plasticity CH.
TP31	1	D	1.00	20				45	24	21	100	Intermediate plasticity CI.
TP36	2	D	1.00	22				49	21	28	100	Intermediate plasticity CI.
TP38	2	D	1.30	22				48	22	26	100	Intermediate plasticity CI.

 Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date	
		02/07/14		07/07/14		07/07/14	
	LITTLEWORTH LANE, LUNDWOOD.					Contract No:	PSL14/3115
						Client Ref:	1898

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL

Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	02/07/14		07/07/14		07/07/14
LITTLEWORTH LANE, LUNDWOOD.				Contract No:	PSL14/3115
				Client Ref:	1898

Particle Size Distribution Test

BS1377 : Part 2 : 1990

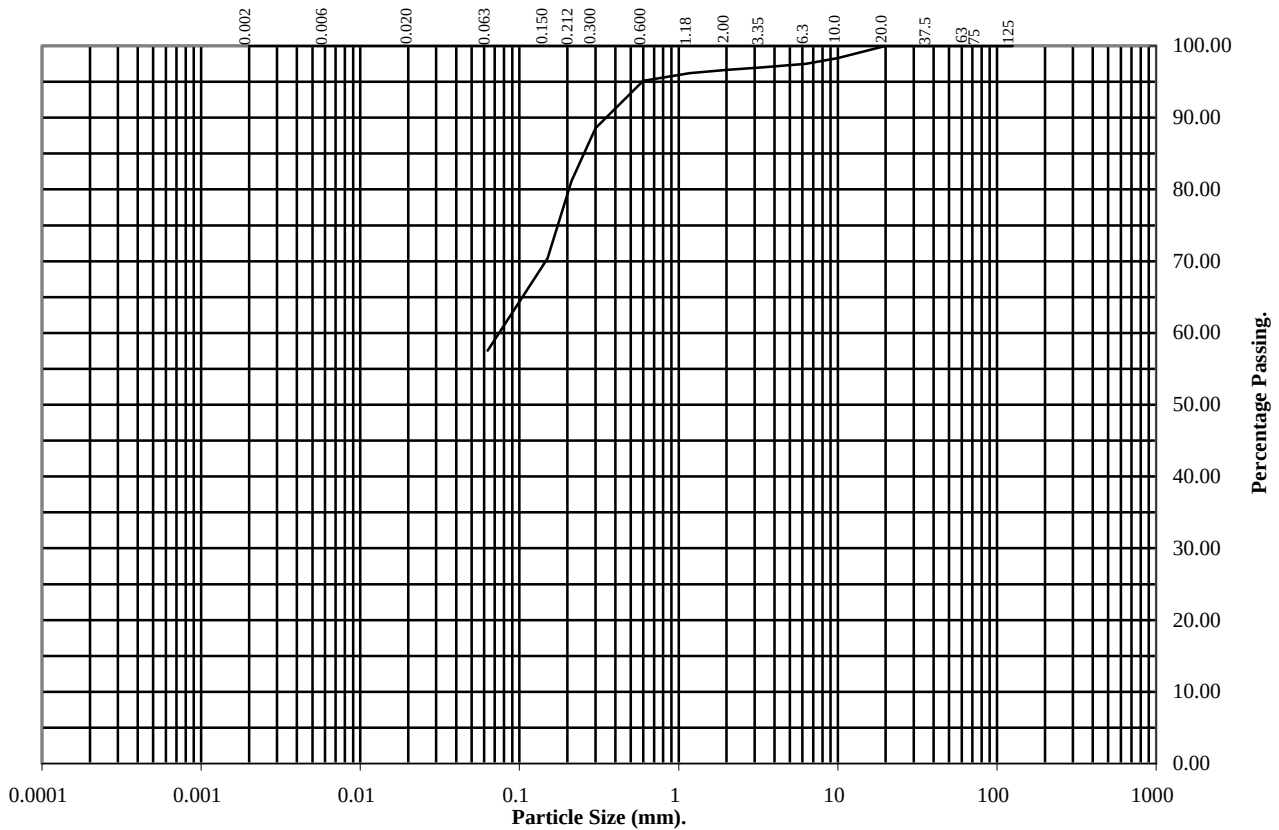
Wet Sieve, Clause 9.2

Hole Number: TP07

Depth (m): 1.70

Sample Number: 2

Sample Type: D



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	98
6.3	97
3.35	97
2	97
1.18	96
0.6	95
0.3	89
0.212	81
0.15	70
0.063	58

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	39
Silt / Clay	58

Remarks:

See summary of soils descriptions.

Checked By	Date	Approved By	Date
<i>H. S. D.</i>	07/07/14	<i>H. S. D.</i>	07/07/14

PSL

Professional Soils Laboratory

LITTLEWORTH LANE, LUNDWOOD.

Contract No.:
PSL14/3115

Particle Size Distribution Test

BS1377 : Part 2 : 1990

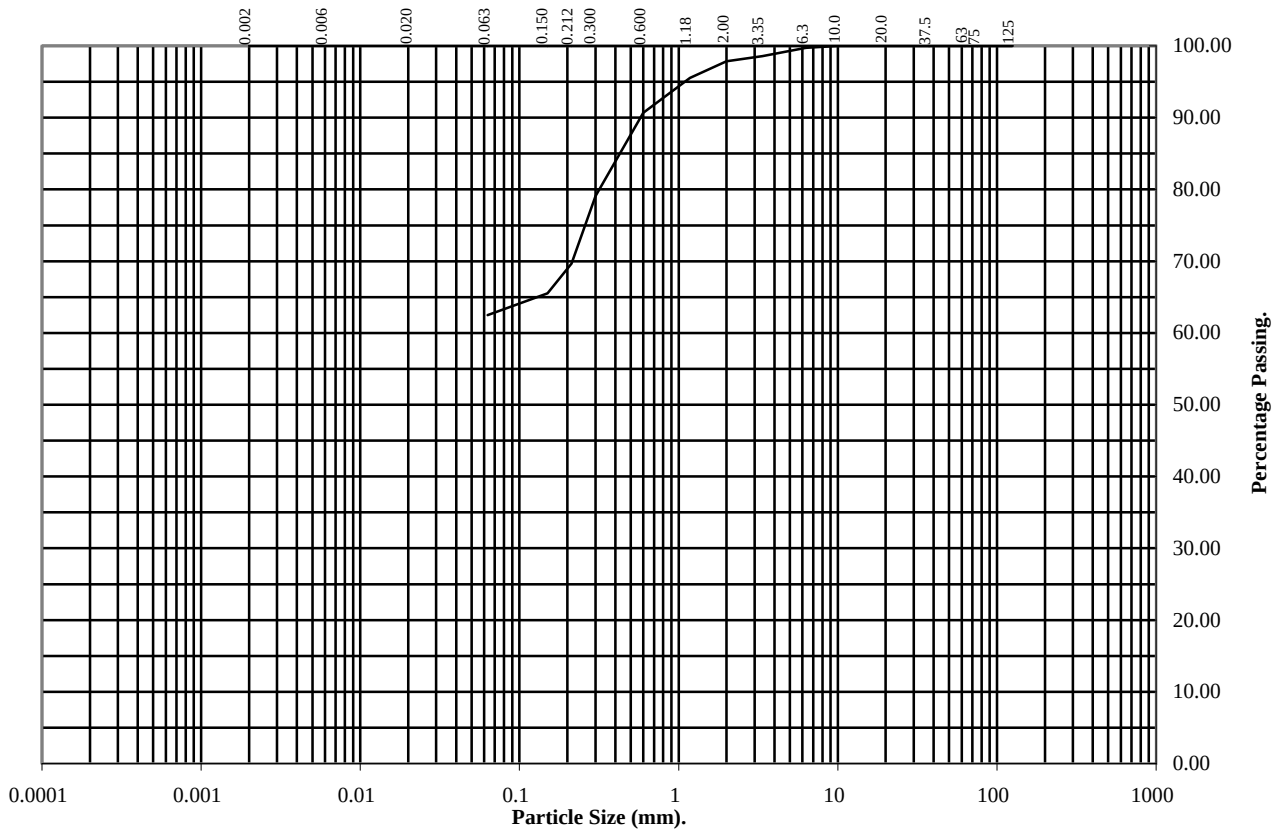
Wet Sieve, Clause 9.2

Hole Number: TP35

Depth (m): 2.10

Sample Number: 1

Sample Type: D



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	98
1.18	96
0.6	91
0.3	79
0.212	70
0.15	66
0.063	62

Soil Fraction	Total Percentage
Cobbles	0
Gravel	2
Sand	36
Silt / Clay	62

Remarks:

See summary of soils descriptions.

Checked By	Date	Approved By	Date
<i>H. S. S.</i>	07/07/14	<i>H. S. S.</i>	07/07/14

PSL

Professional Soils Laboratory

LITTLEWORTH LANE, LUNDWOOD.

Contract No.:
PSL14/3115



Certificate of Analysis

Certificate Number 14-09535

04-Jul-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 14-09535

Client Reference PSL14/3115

Contract Title Littleworth Lane, Lundwood

Description 16 Soil samples.

Date Received 01-Jul-14

Date Started 01-Jul-14

Date Completed 04-Jul-14

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown
Business Manager



Summary of Chemical Analysis Soil Samples

Our Ref 14-09535

Client Ref PSL14/3115

Contract Title Littleworth Lane, Lundwood

Lab No	665927	665928	665929	665930	665931	665932	665933	665934	665935	665936	665937	665938	665939	665940	665941
Sample ID	TP04	TP31	TP27	TP39	TP32	TP01	TP36	TP38	TP28	TP09	TP20	TP22	TP07	TP18	TP02
Depth	0.70	1.00	1.30	2.10	1.00	1.00	1.00	1.30	1.40	2.00	2.30	1.30	2.00	2.70	1.10
Other ID															
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units															
Inorganics																		
pH	DETSC 2008#			7.6	5.5	7.0	6.3	7.0	7.0	5.8	5.7	5.3	6.7	7.1	6.2	6.0	6.7	6.1
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	62	120	120	79	78	80	310	170	43	38	160	150	82	200	190

Summary of Chemical Analysis

Soil Samples

Our Ref 14-09535

Client Ref PSL14/3115

Contract Title Littleworth Lane, Lundwood

Lab No	665942
Sample ID	TP05
Depth	1.60
Other ID	
Sample Type	SOIL
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units
Inorganics			
pH	DETSC 2008#		7.4
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l 26

Information in Support of the Analytical Results

Our Ref 14-09535
Client Ref PSL14/3115
Contract Littleworth Lane, Lundwood

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
665927	TP04 0.70 SOIL		PT 500ml	Sample date not supplied	
665928	TP31 1.00 SOIL		PT 500ml	Sample date not supplied	
665929	TP27 1.30 SOIL		PT 500ml	Sample date not supplied	
665930	TP39 2.10 SOIL		PT 1L	Sample date not supplied	
665931	TP32 1.00 SOIL		PT 1L	Sample date not supplied	
665932	TP01 1.00 SOIL		PT 500ml	Sample date not supplied	
665933	TP36 1.00 SOIL		PT 500ml	Sample date not supplied	
665934	TP38 1.30 SOIL		PT 500ml	Sample date not supplied	
665935	TP28 1.40 SOIL		PT 1L	Sample date not supplied	
665936	TP09 2.00 SOIL		PT 500ml	Sample date not supplied	
665937	TP20 2.30 SOIL		PT 500ml	Sample date not supplied	
665938	TP22 1.30 SOIL		PT 1L	Sample date not supplied	
665939	TP07 2.00 SOIL		PT 500ml	Sample date not supplied	
665940	TP18 2.70 SOIL		PT 500ml	Sample date not supplied	
665941	TP02 1.10 SOIL		PT 1L	Sample date not supplied	
665942	TP05 1.60 SOIL		PT 1L	Sample date not supplied	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

APPENDIX J
SOAKAWAY RESULTS

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client:	Harron Homes
Job Name:	Littleworth Lane, Lundwood
Job No.:	1898



Trial Pit No.	TP09
Test No.	1

Time	Elapsed Time (min)	Depth to water from ground level	
		(m)	(mm)
	0	1.71	1710
	1	1.71	1710
	2	1.70	1700
	3	1.69	1690
	4	1.69	1690
	5	1.68	1680
	19	1.66	1660
	42	1.64	1640
	58	1.61	1610
	183	1.59	1590
	271	1.59	1590

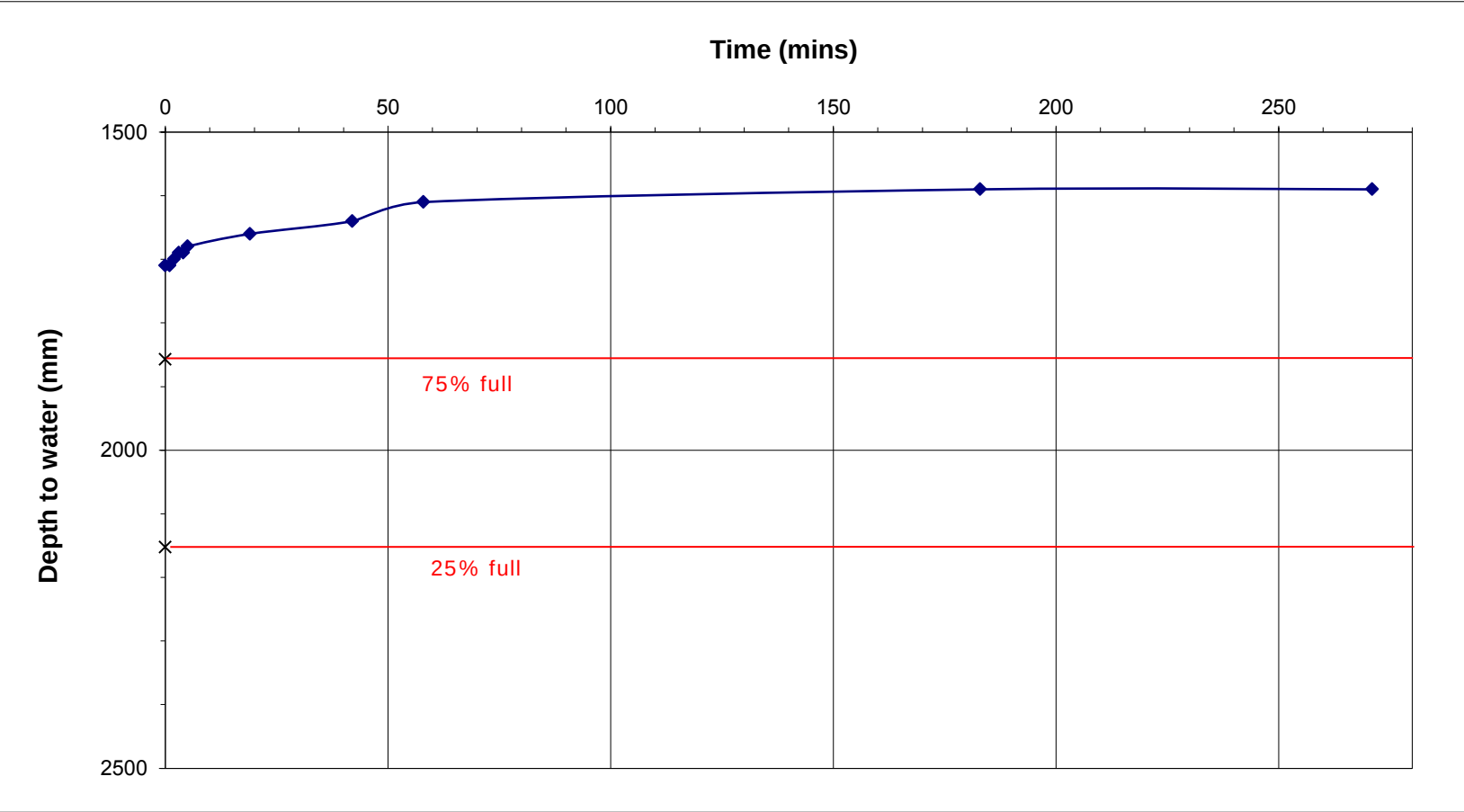
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	3.20	3200
Width	=	0.70	700
Depth	=	2.30	2300

Effective Depth (% full)		mm	m
25%	=	2152.5	2.15
50%	=	2005.0	2.01
75%	=	1857.5	1.86

Depth at start of test (mm)	=	1710
Depth at end of test (mm)	=	1710

Base area of pit	=	2.24
a _{p50} - 50% internal surface area inc. base	=	4.541
V _{p75-25} - Volume 75 - 25%	=	0.6608

Read from the graph:		
t _{p 75} (min)	=	N/A
t _{p 25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP14
Test No.	1

Time	Elpsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	1.48	1480
	1	1.48	1480
	2	1.48	1480
	3	1.48	1480
	4	1.48	1480
	5	1.48	1480
	11	1.48	1480
	30	1.48	1480
	71	1.48	1480
	136	1.48	1480
	226	1.48	1480
	278	1.49	1490

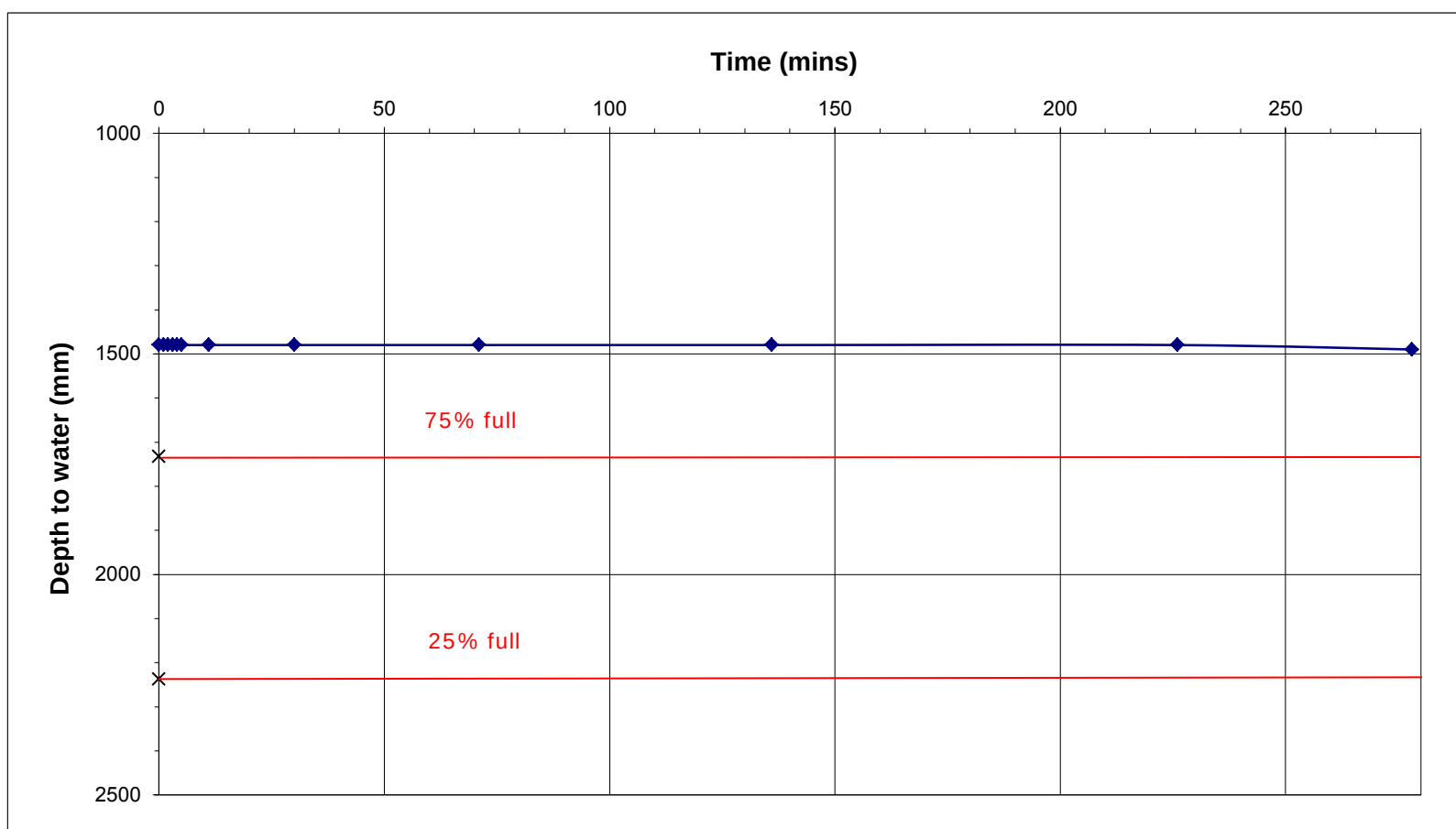
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	2.60	2600
Width	=	0.80	800
Depth	=	2.49	2490

Effective Depth (% full)	mm	m
25% =	2237.5	2.24
50% =	1985.0	1.99
75% =	1732.5	1.73

Depth at start of test (mm)	=	1480
Depth at end of test (mm)	=	1490

Base area of pit	=	2.08
a_{p50} - 50% internal surface area inc. base	=	5.514
V_{p75-25} - Volume 75 - 25%	=	1.0504

Read from the graph:		
t _{p 75} (min)	=	N/A
t _{p 25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate



**LITHOS
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SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP26
Test No.	1

Time	Elpsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	1.60	1600
	1	1.59	1590
	2	1.59	1590
	3	1.59	1590
	4	1.59	1590
	5	1.59	1590
	10	1.59	1590
	20	1.60	1600
	54	1.56	1560
	97	1.57	1570
	123	1.57	1570
	146	1.57	1570
	203	1.57	1570
	274	1.57	1570
	316	1.57	1570

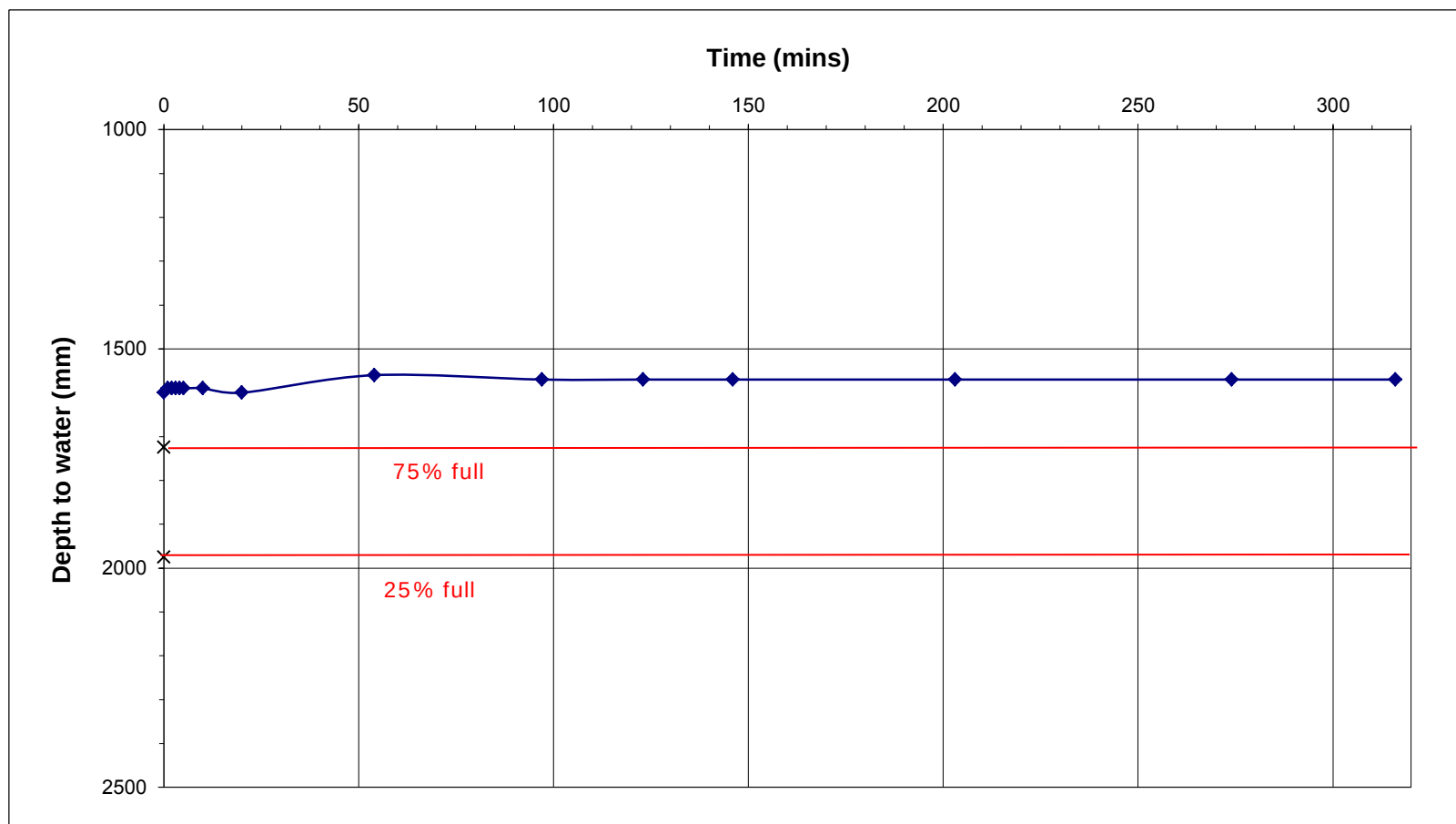
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	1.90	1900
Width	=	0.70	700
Depth	=	2.10	2100

Effective Depth (% full)	mm	m
25% =	1975.0	1.98
50% =	1850.0	1.85
75% =	1725.0	1.73

Depth at start of test (mm)	=	1600
Depth at end of test (mm)	=	1600

Base area of pit	=	1.33
a_{p50} - 50% internal surface area inc. base	=	2.63
V_{p75-25} - Volume 75 - 25%	=	0.3325

Read from the graph:		
t_{p75} (min)	=	N/A
t_{p25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP27
Test No.	1

Time	Elpsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	1.42	1420
	1	1.43	1430
	2	1.44	1440
	3	1.44	1440
	4	1.44	1440
	5	1.45	1450
	19	1.50	1500
	55	1.48	1480
	83	1.45	1450
	109	1.44	1440
	167	1.44	1440
	238	1.46	1460
	280	1.46	1460

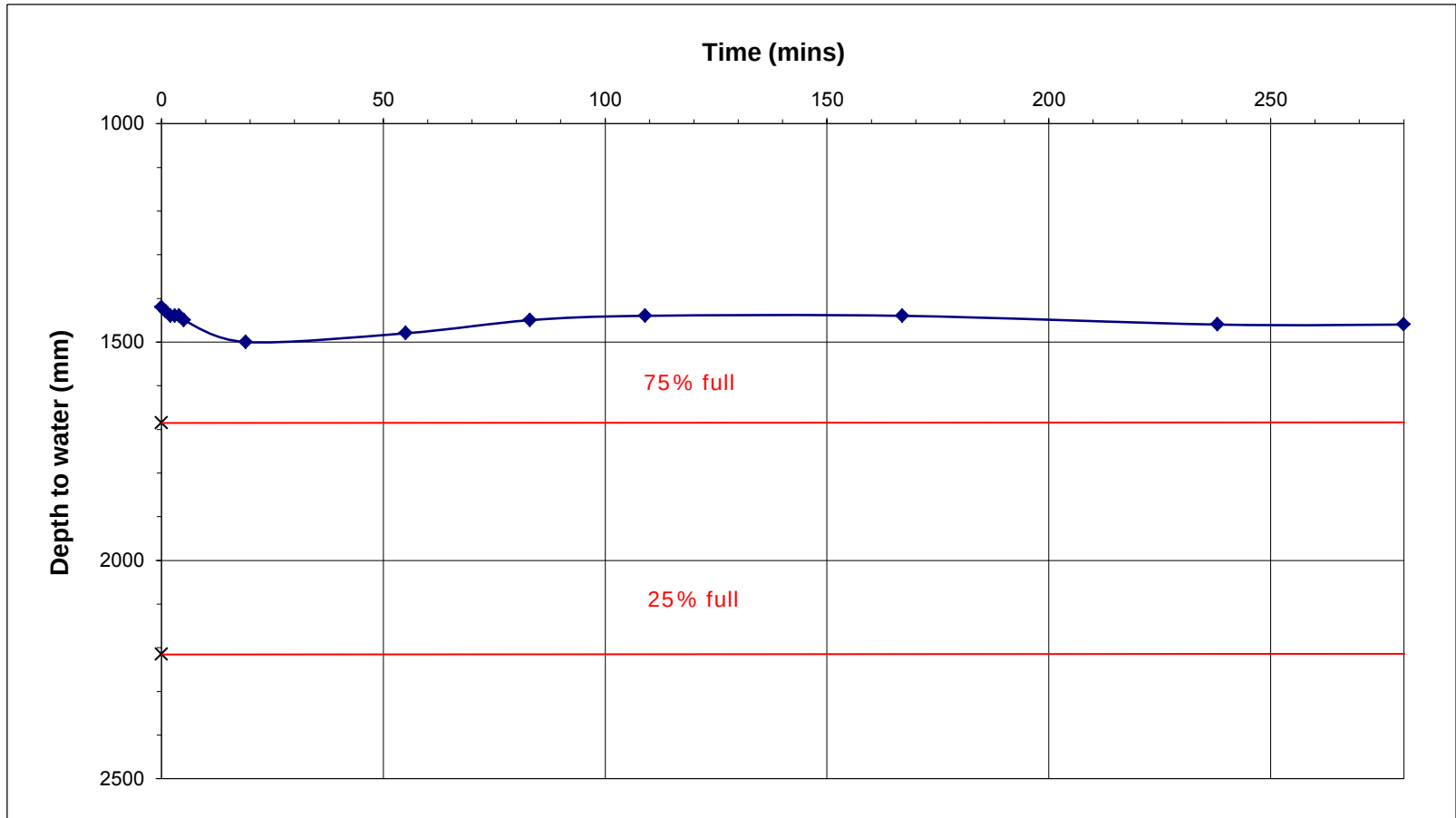
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	2.40	2400
Width	=	0.65	650
Depth	=	2.48	2480

Effective Depth (% full)	mm	m
25% =	2215.0	2.22
50% =	1950.0	1.95
75% =	1685.0	1.69

Depth at start of test (mm)	=	1420
Depth at end of test (mm)	=	1500

Base area of pit	=	1.56
a_{p50} - 50% internal surface area inc. base	=	4.793
V_{p75-25} - Volume 75 - 25%	=	0.8268

Read from the graph:		
t_{p75} (min)	=	N/A
t_{p25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP29
Test No.	1

Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	1.30	1300
	1	1.31	1310
	2	1.32	1320
	3	1.32	1320
	4	1.32	1320
	5	1.32	1320
	12	1.32	1320
	47	1.32	1320
	73	1.33	1330
	102	1.32	1320
	159	1.32	1320
	230	1.32	1320
	272	1.32	1320

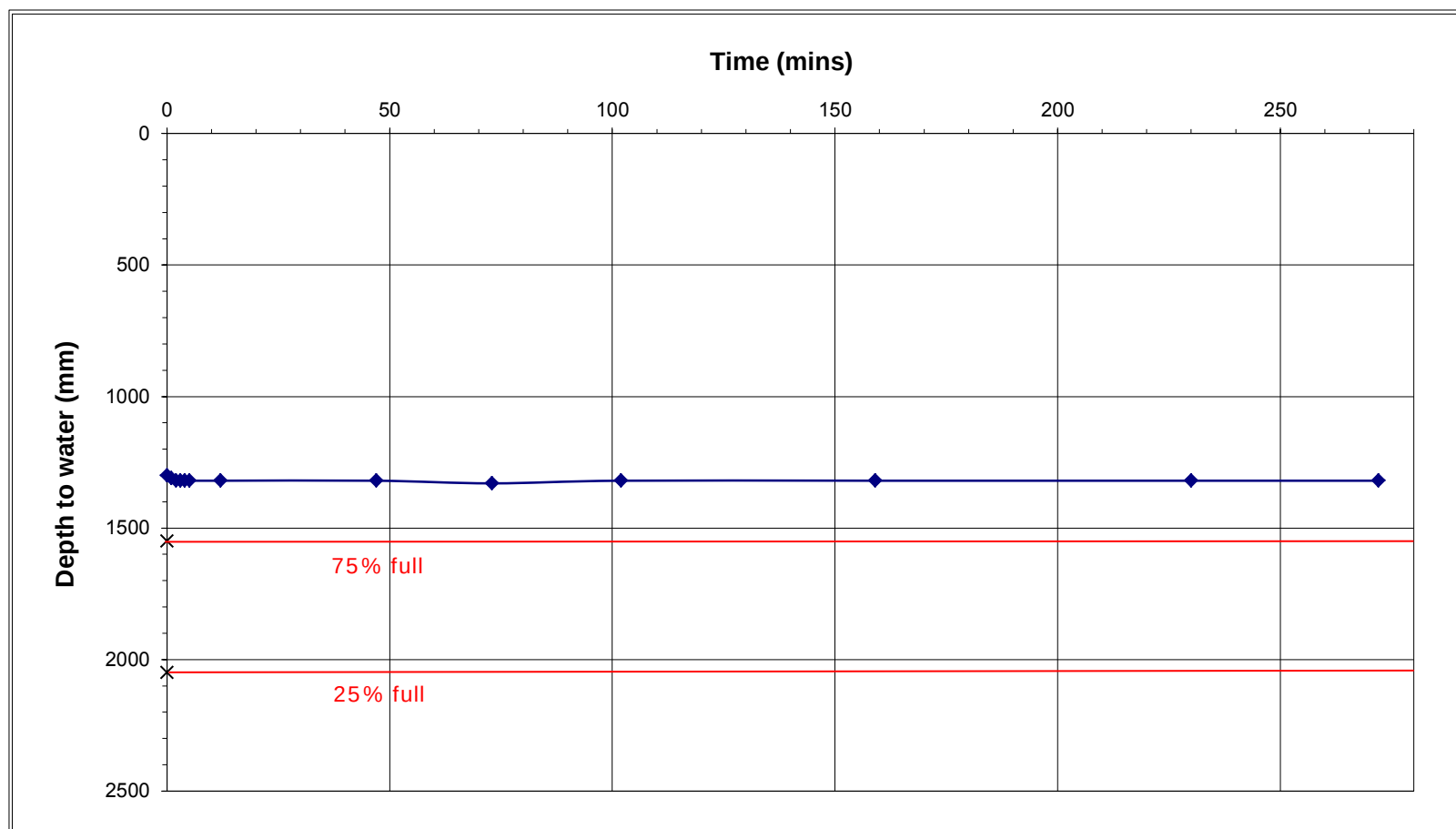
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	2.40	2400
Width	=	0.65	650
Depth	=	2.30	2300

Effective Depth (% full)	mm	m
25% =	2050.0	2.05
50% =	1800.0	1.80
75% =	1550.0	1.55

Depth at start of test (mm)	=	1300
Depth at end of test (mm)	=	1330

Base area of pit	=	1.56
a_{p50} - 50% internal surface area inc. base	=	4.61
V_{p75-25} - Volume 75 - 25%	=	0.78

Read from the graph:		
t_{p75} (min)	=	N/A
t_{p25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP31
Test No.	1

Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	0.85	850
	1	0.86	860
	2	0.86	860
	3	0.86	860
	4	0.86	860
	5	0.86	860
	15	0.86	860
	49	0.86	860
	64	0.86	860
	159	0.86	860
	244	0.86	860
	308	0.86	860

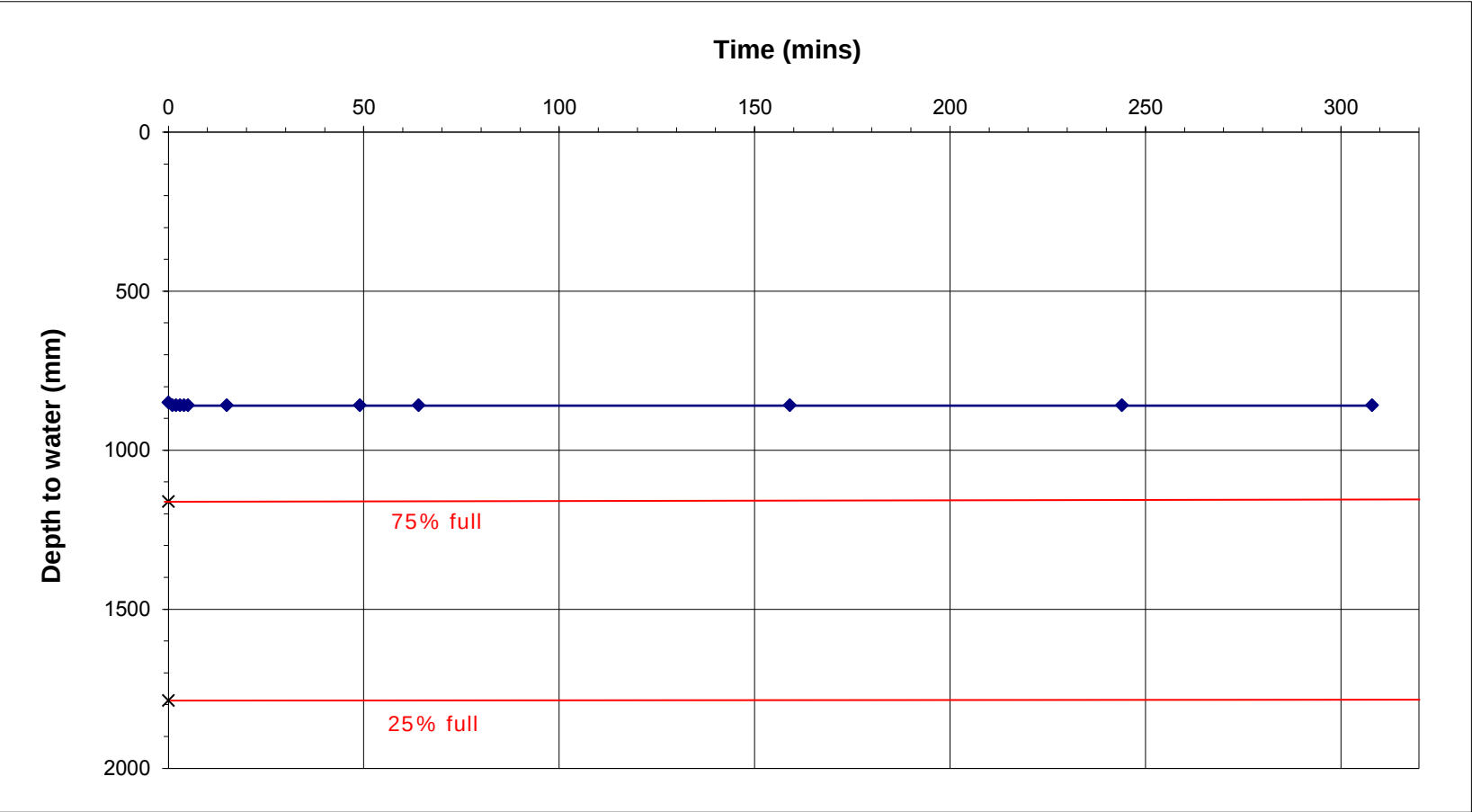
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	2.60	2600
Width	=	0.70	700
Depth	=	2.10	2100

Effective Depth (% full)		mm	m
25%	=	1787.5	1.79
50%	=	1475.0	1.48
75%	=	1162.5	1.16

Depth at start of test (mm)	=	850
Depth at end of test (mm)	=	860

Base area of pit	=	1.82
a _{p50} - 50% internal surface area inc. base	=	5.945
V _{p75-25} - Volume 75 - 25%	=	1.1375

Read from the graph:		
t _{p 75} (min)	=	N/A
t _{p 25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP35
Test No.	1

Time	Elpsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	1.07	1070
	1	1.07	1070
	2	1.07	1070
	3	1.08	1080
	4	1.08	1080
	5	1.08	1080
	13	1.08	1080
	31	1.08	1080
	57	1.08	1080
	89	1.07	1070
	146	1.08	1080
	218	1.08	1080
	262	1.07	1070

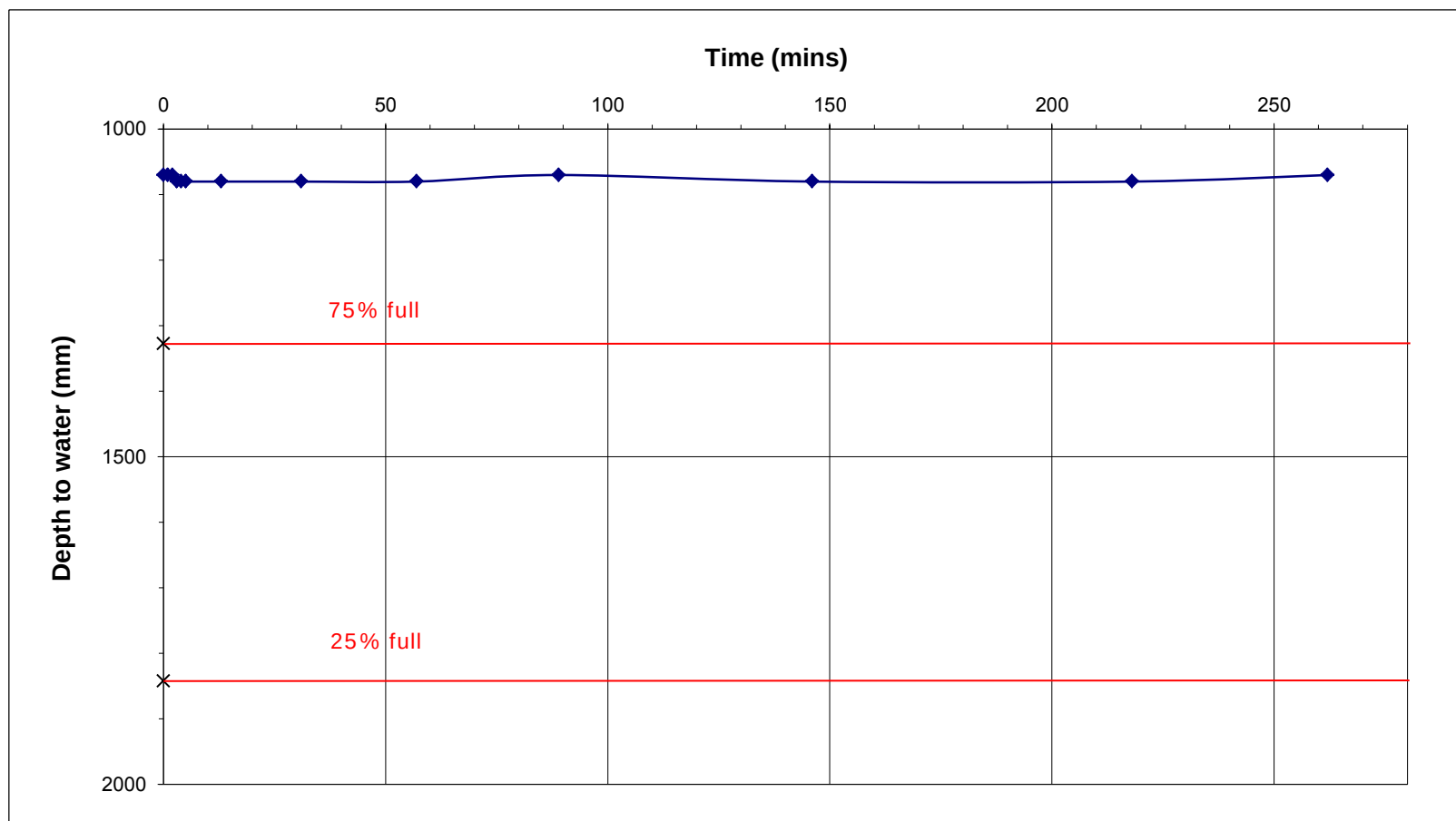
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	2.80	2800
Width	=	0.70	700
Depth	=	2.10	2100

Effective Depth (% full)	mm	m
25% =	1842.5	1.84
50% =	1585.0	1.59
75% =	1327.5	1.33

Depth at start of test (mm)	=	1070
Depth at end of test (mm)	=	1080

Base area of pit	=	1.96
a_{p50} - 50% internal surface area inc. base	=	5.565
V_{p75-25} - Volume 75 - 25%	=	1.0094

Read from the graph:		
t_{p75} (min)	=	N/A
t_{p25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP37
Test No.	1

Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
	0	1.43	1430
	1	1.43	1430
	2	1.43	1430
	3	1.43	1430
	4	1.43	1430
	5	1.43	1430
	13	1.43	1430
	22	1.43	1430
	50	1.44	1440
	117	1.45	1450
	188	1.45	1450
	234	1.45	1450
	250	1.46	1460

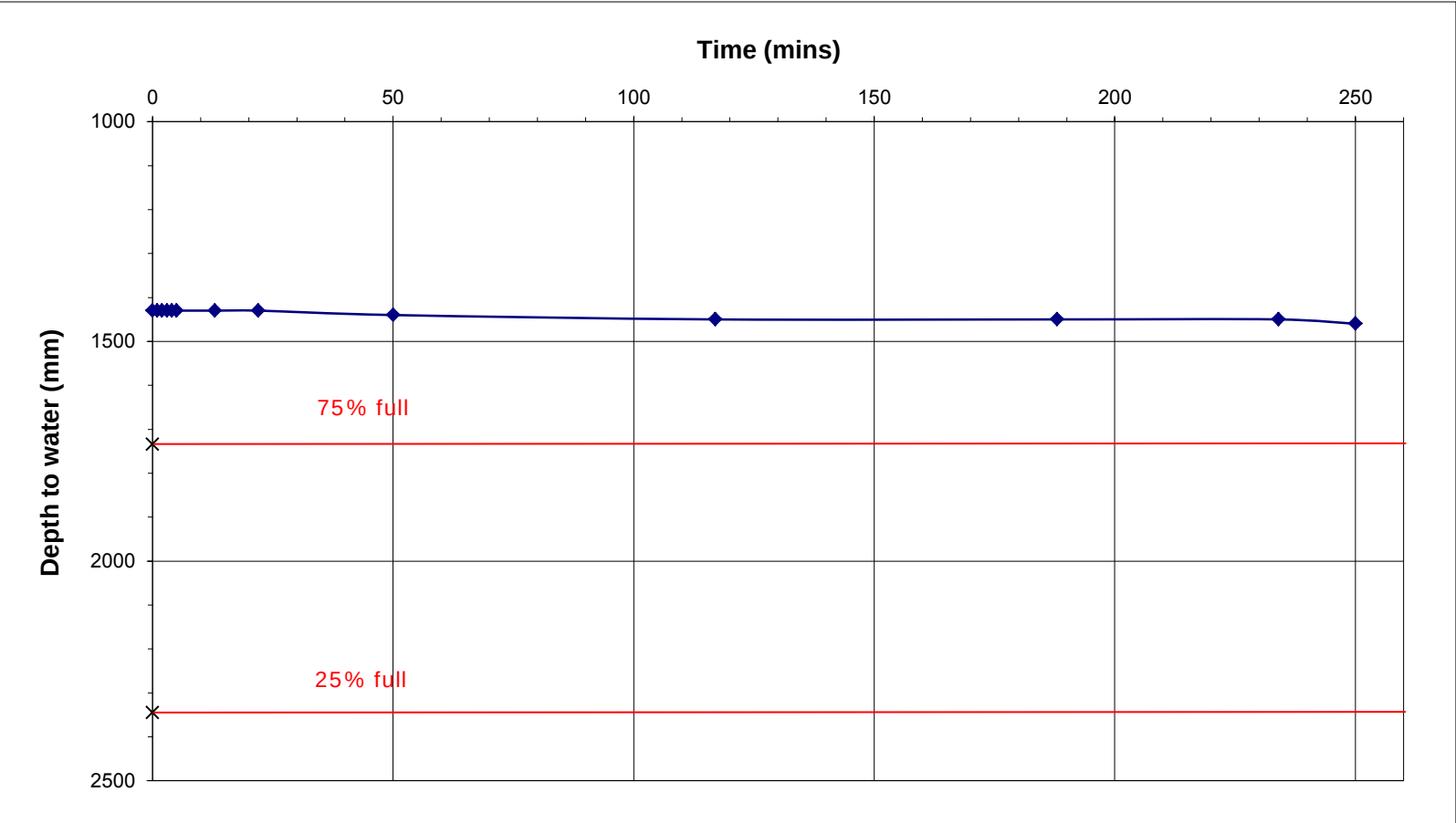
SOAKAWAY TRIAL PIT			
Dimensions		(m)	(mm)
Length	=	2.80	2800
Width	=	0.70	700
Depth	=	2.65	2650

Effective Depth (% full)		mm	m
25%	=	2345.0	2.35
50%	=	2040.0	2.04
75%	=	1735.0	1.74

Depth at start of test (mm)	=	1430
Depth at end of test (mm)	=	1460

Base area of pit	=	1.96
a_{p50} - 50% internal surface area inc. base	=	6.23
V_{p75-25} - Volume 75 - 25%	=	1.1956

Read from the graph:		
t_{p75} (min)	=	N/A
t_{p25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client: Harron Homes
Job Name: Littleworth Lane, Lundwood
Job No.: 1898



Trial Pit No.	TP39
Test No.	1

Time	Elpsed Time (min)	Depth to water from ground level	
		(m)	(mm)
	0	0.67	670
	1	0.68	680
	2	0.68	680
	3	0.68	680
	4	0.68	680
	5	0.68	680
	12	0.68	680
	39	0.66	660
	74	0.64	640
	131	0.60	600
	202	0.56	560
	247	0.55	550

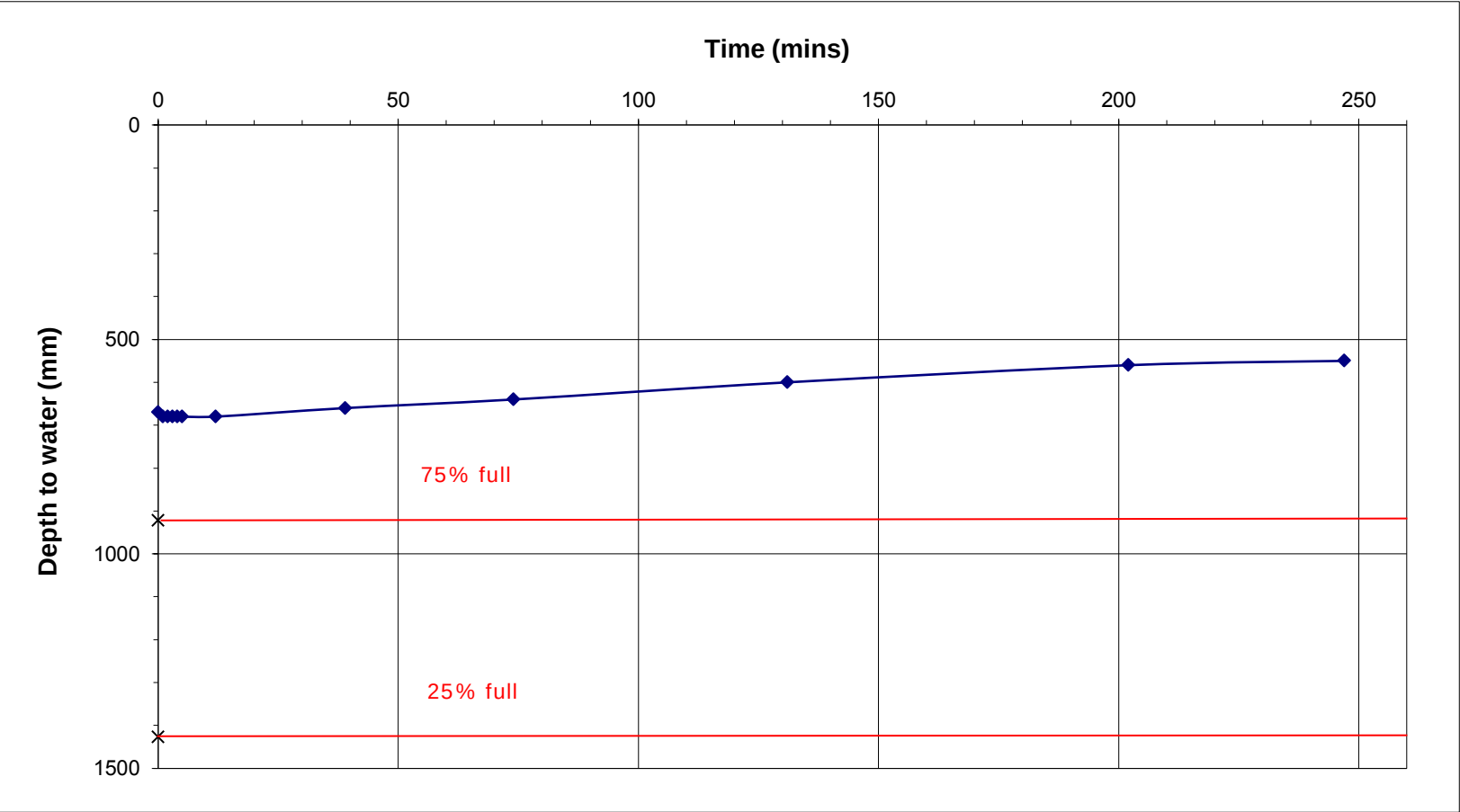
SOAKAWAY TRIAL PIT		
Dimensions		(m) (mm)
Length	=	2.90 2900
Width	=	0.80 800
Depth	=	1.68 1680

Effective Depth (% full)	mm	m
25%	= 1427.5	1.43
50%	= 1175.0	1.18
75%	= 922.5	0.92

Depth at start of test (mm)	=	670
Depth at end of test (mm)	=	680

Base area of pit	=	2.32
a _{p50} - 50% internal surface area inc. base	=	6.057
V _{p75-25} - Volume 75 - 25%	=	1.1716

Read from the graph:		
t _{p 75} (min)	=	N/A
t _{p 25} (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

APPENDIX K
GAS MONITORING RESULTS

Job Title:								Job No:		LITHOS CONSULTING				
Littleworth Lane, Lundwood								1898						
Client:								Sheet :						
Harron Homes								1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:								
19/06/2014		15:00		16:50		Martin Thompson								
Gas Monitoring Results:														
Ambient Concentration (% Volume):				CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	21.9					
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks			
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady					
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂								
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m				
BH01	2.88	ND	1.5	ND	1.5	18.5	ND	ND	ND	4.45				
BH02	1.35	ND	ND	ND	ND	21.6	ND	ND	ND	3.82				
BH03	2.11	ND	1.2	ND	1.2	20.4	ND	ND	ND	5.25				
BH04	1.30	ND	0.4	ND	0.4	21.0	ND	ND	ND	5.30	7L bailed from well taking dip to 2.50m @ 16:13. Water level rose to 1.70m @ 16:36.			
BH06	0.45	ND	ND	ND	ND	22.0	-1.3	0.0	17.0	4.36	10L bailed from well taking dip to 0.50m @ 16:18. Water level rose to 0.45m @ 16:40.			
BH07	ND	ND	0.3	ND	0.3	21.7	ND	ND	ND	1.40				
BH07A	2.38	ND	4.1	ND	4.1	16.0	0.3	0.3	30.0	5.52				
BH08	1.68	ND	ND	ND	ND	21.9	ND	ND	ND	5.24	6L bailed from well taking dip to 2.06m @ 16:25. Water level rose to 1.73m @ 16:44.			
BH08A	1.30	ND	ND	ND	ND	21.9	ND	ND	ND	2.30				
BH09	1.90	ND	ND	ND	ND	21.6	-1.4	0.0	5.0	4.40				
BH10	1.78	ND	ND	ND	ND	21.2	ND	ND	ND	5.38	6L bailed from well taking dip to 2.80m @ 16:06. Water level rose to 2.79m @ 16:29.			
Notes														
Equipment Used:						Next Calibration Date			Key					
Gas Data GFM430 Infrared Gas Analyser Geotechnical Instruments Dipmeter						24/07/2014			ND			None Detected		
									NR			Not Recorded		
									1.0			Recorded value does not breach trigger levels		
									5.0			Recorded value breaches trigger level 1		
									10.0			Recorded value breaches trigger level 2		
	Site Data:			Weather Station Data (Brierley Station)										
	Temp (°C):			Barometric Pressure Trend:			Steady							
Time:	15:05	15:34	15:54	00:12	05:30	09:00	12:00	15:44	19:30	Trigger level 1	1.0	5.0	16.0	
Pressure (mb):	1020	1020	1018	1023	1023	1024	1024	1023	1023	Trigger level 2	5.0	10.0	10.0	
	Weather Conditions:		Sunny, light breeze											
	Surface Ground Conditions:		Dry											
Remarks:														

Job Title:										Job No:	
Littleworth Lane, Lundwood										1898	
Client:										Sheet :	
Harron Homes										1 of 1	
Date:		Arrival Time:		Depart Time:		Operator:					
16/07/2014		12:40		14:00		Martin Thompson					



Gas Monitoring Results:											
Ambient Concentration (% Volume):				CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	21.3		

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
BH01	3.21	ND	1.7	ND	1.7	18.9	ND	ND	ND	4.45	
BH02	1.02	ND	0.2	ND	0.2	21.2	ND	ND	ND	3.80	
BH03	2.77	ND	1.2	ND	1.2	18.9	ND	ND	ND	5.17	
BH04	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Lost in vegetation
BH06	0.81	ND	0.5	ND	0.5	20.8	ND	ND	ND	4.10	
BH07	ND	ND	3.3	ND	3.3	17.8	-3.9	0.0	2.0	1.43	
BH07A	2.47	ND	0.7	ND	0.7	20.5	ND	ND	ND	5.49	
BH08	1.84	ND	ND	ND	ND	21.2	ND	ND	ND	5.13	
BH08A	1.97	ND	0.9	ND	0.9	8.9	ND	ND	ND	2.31	
BH09	2.08	ND	0.1	ND	0.1	20.9	ND	ND	ND	4.27	
BH10	1.91	ND	0.1	ND	0.1	21.4	-4.1	0.0	9.0	5.20	

Notes

Equipment Used:						Next Calibration Date				Key			
Gas Data GFM430 Infrared Gas Analyser Geotechnical Instruments Dipmeter						24/07/2014				ND	None Detected		
										NR	Not Recorded		
										1.0	Recorded value does not breach trigger levels		
										5.0	Recorded value breaches trigger level 1		
				10.0	Recorded value breaches trigger level 2								

	Site Data:			Weather Station Data (Worsbrough Station)							CH ₄	CO ₂	O ₂	
	Temp (°C):	21		Barometric Pressure Trend:			Decrasing							
Time:	12:48	13:18	13:53	00:20	03:24	07:31	10:15	13:31	17:39	Trigger level 1	1.0	5.0	16.0	
Pressure (mb):	1014	1013	1012	1018	1018	1017	1016	1016	1016	Trigger level 2	5.0	10.0	10.0	
	Weather Conditions:		Sunny, light wind											
	Surface Ground Conditions:		Dry											
Remarks:														