

**PHASE II GEO-ENVIRONMENTAL SITE
INVESTIGATION - FINAL**

**Proposed Residential Development
Barrow Brook (Second Phase)
Clitheroe**

**REC Report: 43933p2r2
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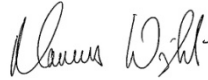
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QUALITY ASSURANCE

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EXECUTIVE SUMMARY

Background

Resource & Environmental Consultants (REC) have undertaken a comprehensive GeoEnvironmental assessment for the Second Phase of the Barrow Brook site located to the south of Clitheroe in Chorley, Lancashire. Prior to the completion of the Phase II intrusive site investigation (presented in detail within this report), REC completed a Phase I Desk Study, the salient features of which are summarised below:

- The site was historically occupied by the eastern sector of a large print works with in-filled reservoirs beneath the eastern sector;
- It was considered that significant buried obstructions will be present to depths of circa 4.0-5.0m bgl; and,
- Based on a proposed residential use the site is considered to represent a moderate risk in terms of contaminated land liabilities.

Exploratory Site Investigation

Exploratory site investigation works were completed between the 9th and 10th of March 2011 and comprised the excavation 24 trial pits, drilling of 12 window sample probeholes and 4 cable percussive boreholes. Dual purpose ground gas and groundwater monitoring well installations were placed in all probehole locations and one of the cable percussive boreholes.

Ground Conditions

Made Ground, comprising intermixed cohesive matrices, ash gravels and demolition materials with oversized cobbles and boulders has been identified within all exploratory locations with the thicknesses ranging from 0.10m to 4.50m bgl, generally increasing in depth from north to south.

Numerous large cobbles, boulders and relict foundations were observed within a number of exploratory locations, a preliminary observation suggested that the majority of the buried obstructions were concentrated in the south and western sectors of the site. Natural deposits consisting very soft to very stiff gravelly clay and occasional sands and gravels were recorded overlying an inferred bedrock horizon of grey mudstone.

Tier 1 Contaminated Land Risk Assessment

The Tier 1 Contaminated Land Risk Assessment has determined that the underlying made ground would pose a theoretical risk to chronic human health to the critical receptor (residential end use) when considering elevated concentrations of inorganic (arsenic & lead) and organic polycyclic aromatic hydrocarbon compounds (BaP) within the underlying Made Ground across the entire development site.

Asbestos (chrysotile) fibres were detected in three soil samples from depths ranging from 0.3m bgl to 2.0m bgl. It is recommended that suitable method statement and risk assessment be developed to mitigate the potential risk to construction workers during ground works.

Ground Gas Assessment

The ground gas monitoring has identified marginally elevated concentrations of carbon dioxide originating from the in-filled reservoir. It is therefore recommended that the site be zoned to reflect the requirements of individual units. Based on the data, this would suggest a classification of Amber 1 or Characteristic Situation 2 in the south eastern sector where low level ground gas protection measures comprising a ventilated sub-floor void and gas membrane may be required.

The remainder of the site would be currently classified as situation Green or Characteristic Situation 1.

Conceptual Site Model

The Tier 1 Contaminated Land Risk Assessment and revised Conceptual Site Model (CSM) identified potential pollutant linkages associated with dermal contact and ingestion of impacted Made Ground within residential gardens. It is therefore recommended that suitable remediation and mitigation measures, including the construction of a 600mm cover system within all gardens, be developed to ensure that the site can be safely developed for the proposed residential end use.

It is considered necessary to develop a suitable Remediation Strategy to facilitate the installation of a 600mm cover system within all residential garden areas to mitigate the identified exposure pathways to the critical receptors.

REC recommend that prior to any future redevelopment of the site, a suitably detailed site enabling works strategy and Materials Management Plan (MMP) should be developed to confirm the findings of this assessment and to document a strategy for the development of the site in a cost effective and regulatory compliant manner. It is likely that as part of any site enabling works, it would be possible to 'win' a proportion of clean sub-soils for use within the cover system to be placed in the residential gardens.

Any concrete / relict foundations could be recycled by crushing / grading for a construction aggregate.

Geotechnical

Strip foundations should be considered within the northern areas of the site where natural clay deposits have been encountered, however consideration should be given to the potential for localise buried obstructions.

The significant depth of Made Ground within the central, south-eastern and south western sectors of the site will require the implementation of a specialist foundation solution to support to proposed residential units; this could comprise one of the following options:

- A programme of site enabling works to excavate, screen and sort the underlying made ground to ensure all obstructions and oversized materials are removed prior to replacement and subsequent re-engineering using a specialist ground improvement technique such a vibro compaction;
- Utilisation of small diameter driven piled foundation to bear on the underlying weathered bedrock at a depth of circa 5.0-6.0m bgl. This option will be limited by the significant presence of buried obstructions which would necessitate the pre-boring of pile locations in some instances; and,

- It may be possible to extend the use of deep mass trench fill foundations within the central and western sectors of the site, however it is considered that this option would be limited by the significant presence of buried obstructions and abnormal volumes of concrete required to gain the NHBC approval for the foundation.

The viability of raft foundations would be limited by the potential for differential settlement of the Made Ground within the southern and western sectors; the NHBC would require that when constructing a raft foundation on non engineered Made Ground, that sufficient time be allowed for natural consolidation or 'self weight settlement' of the in-filled material, this would need to be proven by extensive geotechnical testing.

The use of a raft foundation would require the installation of flexible service infrastructure with exaggerated gradients to tolerate movement within the residential units.

When considering the options presented above, REC would recommend that consideration be given to the implementation a site wide programme of remediation / enabling works designed to deliver the following key objective:

- Remove all relict foundations / obstructions;
- Screen and sort all made ground;
- Remove all organic (potential gas source) deleterious content;
- Vibro-compaction of all replaced material beneath plots, driveways and access roads; and,
- 'Winning' of topsoil / subsoil for placement in residential gardens.

It is recommended that specialist contractors be contacted at the first available opportunity so that the client can obtain technical proposals and costing for the most appropriate solution.

All subsurface concrete should be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).

The NHBC will require suspended floors within all residential units to be constructed at this site.

A design CBR of less than 2% should be assumed for the Made Ground, although it may be possible to increase this following plate load tests.

All future ground works will require a detailed method statement and risk assessment to ensure that the potential risk to construction workers associated with exposure to asbestos fibres in the soils is adequately mitigated.

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A CD containing a complete PDF version of this report is attached to hard copy of the report.

1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Ltd have been commissioned by Rowland Homes Ltd to undertake a Phase II Intrusive Investigation at the site known as Barrow Brook (Second Phase), a plot situated within the Ribble Valley Enterprise Park to the south of Clitheroe in Lancashire.

A previous Environmental Risk Assessment report on the site by Owen Williams (OW) Consulting (March 2006) has been provided by Rowland Homes, the salient features of which are summarised below:

- *The OW Assessment has been developed for a commercial end use and as such the Contaminated Land Risk Assessment is not applicable within the context of the proposed residential end use; and,*
- *For a residential end use, the site is said to contain localised areas of contamination that will require further risk assessment and localised remediation to ensure that the landholding is suitable for the intended use.*

The OW investigation did not include any geotechnical appraisal of the site or address potential risks to future site developments posed by hazardous ground gases.

The scope of the REC works consisted of an intrusive ground investigation, comprising four cable percussive boreholes, twenty-one trial pits and twelve window sample probeholes. All of the window sample probeholes and one of the cable percussive boreholes were completed with gas and groundwater monitoring installations.

All acronyms used within this report are defined in the Glossary presented in Appendix I.

1.2 Proposed Development

REC understands that the client intends to acquire and redevelop the site as residential dwellings with front and rear gardens, driveways and access roads.

1.3 Objectives

The objectives of the geo-environmental investigation are to:

- Address the potential pollutant linkages identified by the initial conceptual site model (ICSM) presented in the REC Phase I report (43933p1r0) for the site;
- Undertake a preliminary stage of investigation and analysis to provide an overview of conditions identified;
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;
- Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and flood slabs;
- Provide recommendations regarding future works required.

1.4 Limitations

The limitations of this report are presented in Appendix II.

1.5 Confidentiality

REC has prepared this report solely for the use of Rowland Homes and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

1.6 Desk Study Information

Prior to the commencement of the Phase II GeoEnvironmental Investigation (detailed within this report), REC completed a Phase I Desk Study March 2011 (report no. 43933p1r0) and should be read in conjunction with this report. The desk study included a comprehensive review of the environmental setting, potentially contaminative land uses and the development of an ICSM.

The site is underlain by Devensian Till drift deposits which are underlain by the Clitheroe Limestone and Hodder Mudstone Formation, which is classed as a Secondary Aquifer.

Barrow Brook (not classified by the EA) flows from east to west adjacent to the southern site boundary.

Potential contamination sources have been identified from the desk study and these are listed in Table 2.1 below:

Table 1.1 Summary of Potential Contaminant Sources

Potential Source	Potential Contaminants	Potential Impact
Former Print Works	Organic solvents, metals, hydrocarbons, asbestos	Groundwater, surface water and human health
Former Tanks	Hydrocarbons including solvents	Groundwater, surface water and human health
Former chimney and boiler house	Hydrocarbons, PAHs	Groundwater, surface water and human health
Backfilled reservoir	Landfill gas	Buildings
Made Ground across the site	Landfill gas, metals and hydrocarbons	Groundwater, surface water, and human health

REC identified future end users along with structures of the proposed residential development, controlled waters including the adjacent Barrow Brook and underlying Secondary A aquifer as potential receptors. Pathways identified include dermal contact and ingestion of soils, inhalation of contaminant vapours, ingress of gases via permeable strata and leaching and migration of mobile compounds in groundwater.

2.0 SITE INVESTIGATION

2.1 General

The intrusive Ground Investigation (GI) has been designed to consider the findings of the potential sources of contamination, abnormal development constraints and geotechnical issues highlighted within the Phase I desk study. Exploratory holes have been advanced to:

- Target specific potential contaminant sources summarised in Table 1.1 (previous section); and
- Provide information on baseline conditions across the site; and
- Collect geotechnical information to assist in the design and construction of the development.

Exploratory fieldwork was completed between the 7th and 11th March 2011. The works are summarised in Table 2.1 (below).

Table 2.1 Summary of Fieldwork

Investigation Method	Location references	No. of locations	Maximum Depth (m bgl)
Window Sample Probeholes	WS101 – WS112	12	4.45m
Cable Percussion Boreholes	CP101 – CP104	4	6.10m
Trial pitting	TP101 – TP121	21	4.00m

Notes

m bgl – metres below ground level.

The window sample probeholes, trial pits and cable percussive boreholes were designed to provide geotechnical information and collect environmental samples to confirm the findings of the Initial Conceptual Site Model (ICSM). Dual purpose gas and groundwater monitoring well installations were placed in all probehole locations and one of the cable percussive locations.

In addition to the above, the trial pitting was undertaken to investigate the extent and nature of any underground obstructions.

The sampling locations are illustrated in Figure 2 (Appendix III). The ground conditions encountered and details of monitoring well response zones are indicated on the logs which are provided in Appendix IV.

Return visits were made to monitor installations for groundwater level and gas concentrations.

Soil samples destined for chemical analysis were collected at regular intervals in appropriate sampling containers. In addition, a water sample was collected from the Brook. All samples were subsequently stored in cooled boxes prior to submission to Scientific Analysis Laboratories (SAL) for analysis in accordance with their UKAS accreditation where applicable. Results of the analysis are included in Appendix V. All samples were collected using appropriate PPE and sampling equipment that was cleaned at each sampling location. A detailed copy of REC Ltd sampling methodology, QA procedures and laboratory chain of custody forms can be provided upon request.

2.2 In-Situ Standard Penetration Testing (SPT)

In-situ geotechnical testing was carried out in all window sample probehole and cable percussive borehole locations to provide information on the geotechnical properties of the soils. The testing was conducted using the Standard Penetration Test (SPT). The results are shown in the exploratory hole logs in Appendix IV and presented in Table 3.3 and discussed in Section 3.

2.3 Laboratory Analysis

Selected soil samples were submitted for a range of chemical analysis comprising, metals, pH, total sulphate, water soluble sulphate (2:1 extract), sulphide, cyanide, phenols, total and speciated poly-aromatic hydrocarbons (PAHs), asbestos, organic carbon and banded total petroleum hydrocarbons (TPH).

Upstream and downstream water samples from the Brook were tested for inorganics, speciated PAH and Banded TPH.

Scientific Analysis Laboratories (SAL) Ltd of Manchester undertook the analytical work and the testing results are included in Appendix V and discussed in Section 4.

Selected samples were submitted to Professional Soils Laboratories (PSL) Ltd where the following geotechnical tests were undertaken:

- Atterberg Limits Determinations; and,
- Particle Size Distribution Tests;

PSL laboratory analysis sheets are included in Appendix VII and are summarised in Section 7.

3.0 GROUND AND GROUNDWATER CONDITIONS

3.1 Ground Conditions

3.1.1 Summary of Ground Conditions

The ground investigation generally confirms the published geology and identifies the strata set out in Table 3.1 below:

Table 3.1 Summary of Strata

Strata	Typical Description	Max Thickness (m)
Made Ground (Topsoil/gravel)	Grey clayey gravel. Gravel is medium to coarse, sub-angular to angular of limestone and mixed lithology.	0.50
Made Ground (Clay fill)	Brown gravelly clay. Gravel is fine to coarse, sub-rounded to angular of brick, mudstone, limestone, slate, clinker, concrete with cobbles and boulders of concrete and brick.	4.50
Drift Deposits (Clay)	Brown/grey/green gravelly clay. Gravel is fine to coarse, sub-rounded to sub-angular of limestone and mudstone.	3.30
Bedrock (Mudstone)	Dark grey fractured mudstone.	>1.10m

3.1.2 Made Ground

Made Ground was encountered in all exploratory locations with thicknesses ranging from 0.10m (several locations within northern sector) to 4.50m (CP101 and CP102, drilled within the in-filled reservoir). A stratum of Made Ground consisting grey clayey gravel was encountered across the site to a maximum depth of 0.50m in TP119.

The majority of the Made Ground encountered across the site comprised brown gravelly clay with gravel of brick, mudstone, limestone, slate, clinker; in addition occasional tile, metal, glass and rubber was encountered across the site; the coarser material was absent in TP113, TP116, WS105 and WS112, towards the northern extent of the site. The base of the clay fill was encountered at depths ranging from 0.40m bgl in TP112 to 4.50m bgl in CP101 and CP102.

The depths to the base of Made Ground, natural drift strata thicknesses and obstruction observations are illustrated in Figure 3, which shows that the depth of the Made Ground broadly increases from north to south reaching a maximum of 4.50m in the southeast sector.

Where obstructions were encountered within trial pits the stated depth of Made Ground is a minimum value.

Obstructions

Obstructions that could not be penetrated by the excavator bucket were encountered in a number of trial pits and the nature and locations of which are summarized in Table 3.2 and Figure 3. REC would note that further obstructions are expected to be present across the site.

The obstructions encountered appeared to be concentrated towards the south and western sectors of site at depths ranging between circa 1.0m and in excess of 3.0m bgl. The brick and concrete obstructions encountered in the south and west of the site are likely from remnant foundations of the former Print Works that occupied that area of the site.

Table 3.2 Summary of Depth of Made Ground and Obstructions

Location	Depth to base of Made Ground	Completion Depth	Obstruction
CP101	4.50	5.60	None
CP102	4.50	6.10	None
CP103	2.00	4.60	None
CP104	3.80	6.00	Chiselled through obstruction at 3.30
WS101	3.70*	3.70	Refusal within Made Ground
WS102	4.45	4.45	None
WS103	3.50	4.45	None
WS104	2.20	4.45	None
WS105	0.15*	2.50	Refusal within Made Ground
WS106	0.70*	2.45	Refusal within Made Ground
WS107	2.00*	2.00	Refusal within Made Ground
WS108	0.60	3.45	None
WS109	3.45	3.45	None
WS110	3.45	3.45	None
WS111	1.20	3.45	None
TP101	2.20	3.00	None
TP102	3.10*	3.10	Terminated on brick footing
TP103	2.60*	2.60	Terminated on hard obstruction
TP104	3.75	4.00	None
TP105	2.50*	2.50	Terminated on concrete footing
TP106	2.50	4.00	None
TP107	2.85	4.00	None
TP108	2.30*	2.30	Terminated due to concrete at 1.40m
TP109	1.20	2.90	None
TP110	0.80	2.00	None
TP111	2.00	2.50	None
TP112	0.40	1.95	None
TP113	0.15	2.30	None
TP114	1.50*	1.50	Terminated on brick structure
TP115	1.50*	1.50	Terminated on concrete obstruction
TP116	0.35	2.15	None
TP117	1.25*	1.25	Terminated on brick footing
TP118	2.35*	2.35	Terminated on brick footing
TP119	2.30*	2.30	Terminated on concrete/brick footing
TP120	2.30*	2.30	Terminated on concrete footing
TP121	0.45	2.30	None

*Depth is minimum value due to obstructions.

3.1.3 Drift Deposits

Glacial Clay

Natural superficial deposits encountered beneath the Made Ground typically comprised brown or grey-green gravelly clay, with gravel of coal, sandstone, mudstone and limestone at depths ranging from 0.15m bgl in TP113, WS105 and WS112 to 5.20m bgl in CP102.

3.1.4 Solid Geology

Mudstone

Mudstone was encountered in several trial pits towards the north of the site between depths of 1.95m (TP112) and 2.90m (TP109) and in boreholes between depths of 4.10m (CP103) and 5.50m (CP104) and consisted grey to dark grey fractured mudstone.

Table 3.3 Standard Penetration Test Results

Boreholes	Depth (m bgl) (i)	Material Field Description	CPT/SPT "N" Value	Corrected "N" Value (N ₁) ₆₀	Terzaghi & Peck Relative Density (Sands)	Eurocode Soil strength	Consistency (BS5930)	Terzaghi & Peck Approximate Undrained Shear Strength (kN/m ²)
WS101	1.00	Gravelly CLAY	4	4.03	N/A	Low strength	Soft	20.16
	2.00	Gravelly CLAY	30	27.41	N/A	High strength	Stiff	137.03
	3.00	Gravelly CLAY	5	4.35	N/A	Low strength	Soft	21.74
	3.70	Gravelly CLAY	50	42.55	N/A	Very high strength	Very Stiff	212.75
WS102	1.00	Gravelly CLAY	7	7.06	N/A	Low strength	Soft	35.29
	2.00	Slightly gravelly CLAY	7	6.39	N/A	Low strength	Soft	31.97
	3.00	Slightly gravelly CLAY	18	15.65	N/A	High strength	Stiff	78.27
	4.00	Slightly gravelly CLAY	24	20.28	N/A	High strength	Stiff	101.38
WS103	1.00	Gravelly CLAY	8	8.07	N/A	Medium strength	Firm	40.33
	2.00	Sandy gravelly CLAY	9	8.22	N/A	Medium strength	Firm	41.11
	3.00	Gravelly CLAY	4	3.48	N/A	Very low strength	Very Soft	17.39
	4.00	Slightly sandy CLAY	4	3.38	N/A	Very low strength	Very Soft	16.90
WS104	1.00	Gravelly CLAY	7	7.06	N/A	Low strength	Soft	35.29
	2.00	Gravelly CLAY	4	3.65	N/A	Very low strength	Very Soft	18.27
	3.00	Gravelly CLAY	19	16.52	N/A	High strength	Stiff	82.62
	4.00	Gravelly CLAY	50	42.24	N/A	Very high strength	Very Stiff	211.21
WS105	1.00	Slightly gravelly CLAY	4	4.03	N/A	Low strength	Soft	20.16
	2.00	Slightly gravelly CLAY	35	31.97	N/A	Very high strength	Very Stiff	159.87
WS106	1.00	Gravelly CLAY	12	12.10	N/A	Medium strength	Firm	60.49
	2.00	Gravelly CLAY	50	45.68	N/A	Very high strength	Very Stiff	228.38
WS107	1.00	Very gravelly CLAY	47	47.38	N/A	Very high strength	Very Stiff	236.92
	2.00	Gravelly CLAY	50	45.68	N/A	Very high strength	Very Stiff	228.38
WS108	1.00	Gravelly CLAY	19	19.15	N/A	High strength	Stiff	95.77

Boreholes	Depth (m bgl) (i)	Material Field Description	CPT/SPT "N" Value	Corrected "N" Value (N ₁) ₆₀	Terzaghi & Peck Relative Density (Sands)	Eurocode Soil strength	Consistency (BS5930)	Terzaghi & Peck Approximate Undrained Shear Strength (kN/m ²)
	2.00	Gravelly CLAY	45	41.11	N/A	Very high strength	Very Stiff	205.55
	3.00	Gravelly CLAY	42	36.53	N/A	Very high strength	Very Stiff	182.63
WS109	1.00	Sandy gravelly CLAY	8	8.07	N/A	Medium strength	Firm	40.33
	2.00	Gravelly sandy CLAY	25	22.84	N/A	High strength	Stiff	114.19
	3.00	Gravelly sandy CLAY	44	38.26	N/A	Very high strength	Very Stiff	191.32
WS110	1.00	Gravelly CLAY	9	9.07	N/A	Medium strength	Firm	45.37
	2.00	Gravelly CLAY	22	20.10	N/A	High strength	Stiff	100.49
	3.00	Gravelly CLAY	50	43.48	N/A	Very high strength	Very Stiff	217.41
WS111	1.00	Gravelly CLAY	6	6.05	N/A	Low strength	Soft	30.24
	2.00	Gravelly CLAY	37	33.80	N/A	Very high strength	Very Stiff	169.00
	2.80	Gravelly CLAY	50	43.82	N/A	Very high strength	Very Stiff	219.10
WS112	1.00	Slightly gravelly CLAY	18	18.15	N/A	High strength	Stiff	90.73
	2.00	Gravelly CLAY	47	42.94	N/A	Very high strength	Very Stiff	214.68
	2.80	Gravelly CLAY	50	43.82	N/A	Very high strength	Very Stiff	219.10
CP101	1.00	Gravelly CLAY	50	50.41	N/A	Very high strength	Very Stiff	252.04
	2.00	Gravelly CLAY	9	8.22	N/A	Medium strength	Firm	41.11
	3.00	Gravelly CLAY	16	13.91	N/A	Medium strength	Firm	69.57
	4.00	Gravelly CLAY	9	7.60	N/A	Low strength	Soft	38.02
	5.00	MUDSTONE	50	41.48	N/A	Very high strength	Very Stiff	207.41
	5.50	MUDSTONE	50	41.21	N/A	Very high strength	Very Stiff	206.06
CP102	1.00	Gravelly CLAY	50	50.41	N/A	Very high strength	Very Stiff	252.04
	2.00	Sandy gravelly CLAY	6	5.48	N/A	Low strength	Soft	27.41
	3.00	Sandy gravelly CLAY	7	6.09	N/A	Low strength	Soft	30.44
	4.00	Sandy gravelly CLAY	7	5.91	N/A	Low strength	Soft	29.57
	5.00	SILT	50	41.48	N/A	Very high strength	Very Stiff	207.41

Boreholes	Depth (m bgl) (i)	Material Field Description	CPT/SPT "N" Value	Corrected "N" Value (N_1) ₆₀	Terzaghi & Peck Relative Density (Sands)	Eurocode Soil strength	Consistency (BS5930)	Terzaghi & Peck Approximate Undrained Shear Strength (kN/m ²)
	6.00	MUDSTONE	50	40.99	N/A	Very high strength	Very Stiff	204.97
CP103	1.00	Gravelly CLAY	7	7.06	N/A	Low strength	Soft	35.29
	2.00	Gravelly CLAY	15	13.70	N/A	Medium strength	Firm	68.52
	3.00	Gravelly CLAY	50	43.48	N/A	Very high strength	Very Stiff	217.41
	3.50	MUDSTONE	50	42.78	N/A	Very high strength	Very Stiff	213.92
	4.50	MUDSTONE	50	41.82	N/A	Very high strength	Very Stiff	209.09
CP104	1.00	Gravelly CLAY	11	11.09	N/A	Medium strength	Firm	55.45
	2.00	Gravelly CLAY	8	7.31	N/A	Low strength	Soft	36.54
	3.00	SILT	50	43.48	N/A	Very high strength	Very Stiff	217.41
	4.00	MUDSTONE	7	5.91	N/A	Low strength	Soft	29.57
	5.00	Gravelly CLAY	50	41.48	N/A	Very high strength	Very Stiff	207.41
	5.90	MUDSTONE	50	41.03	N/A	Very high strength	Very Stiff	205.17

3.1.5 pH and Sulphate

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised below in Table 3.4), shows that the soils at the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

Table 3.4 Summary of pH and Sulphate Data

Location	Depth (m bgl)	SO ₄ in 2:1 water / soil (g/l)	pH Value
TP102	0.50	0.1	8.1
TP104	0.20	0.3	7.7
TP105	0.30	0.1	7.9
TP108	2.00	0.1	8.0
TP111	0.50	0.1	8.2
TP112	1.50	0.1	8.3
TP113	0.30	0.1	8.2
TP117	0.30	0.1	8.1
TP121	1.50	0.1	8.2
WS103	0.50	0.1	7.9
WS104	2.30	0.1	7.9
WS106	1.50	0.1	8.0
WS109	2.00	0.1	8.6

3.2 Groundwater Conditions

Groundwater strikes were encountered as seepages and the depth of the seepages and the depth to which groundwater rose are shown on the exploratory hole records and summarised in Table 3.5 below:

Table 3.5 Summary Groundwater Strikes

Location	Depth to strike (m bgl)	Notes
TP106	3.00	Within thin granular strata in cohesive deposit
TP114	1.35	Standing water inside brick structure
TP116	0.60	Perched on top of cohesive strata
CP101	4.60	Perched on top of mudstone
CP102	4.20	Within thin granular strata in cohesive deposit
CP103	1.80	Within thin granular strata in cohesive deposit
CP104	3.50	Within thin granular strata in cohesive deposit

Subsequent to the fieldwork, twelve groundwater monitoring surveys have been scheduled; two of which have been completed to date. Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free phase hydrocarbon product, if present. The groundwater levels recorded are summarised in Tables 3.6.

3.3 Ground Gas

Twelve ground gas monitoring visits have been completed. Concentrations of methane (CH_4), carbon dioxide (CO_2) and Oxygen (O_2) were measured using an infra red gas analyser (GA2000) calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an attached flow pod.

Gas measurements were recorded for a minimum of sixty seconds at each location, at which point the maximum concentration of CH_4 and CO_2 together with the lowest concentration of O_2 were recorded. The results of the ground gas monitoring are presented in Table 3.6 overleaf.

Table 3.6 Summary of Ground Gas and Groundwater Monitoring Results

Well	Date	CH ₄ Initial %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Initial %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow (l/hr)	Response Zone (mbgl)	Depth to Water (mbgl)
WS101	17/03/2011	Gas bung missing										0.60 – 3.60	Dry
	05/04/2011	0.40	0.40	-0.0008	1.10	1.10	-0.0022	11.90	1005	Falling	-0.20		Dry
	12/04/2011	0.10	0.10	0.0001	1.40	1.40	0.0014	20.50	1030	falling	0.10		Dry
	05/05/2011	0.10	0.10	0.0001	1.00	0.90	0.001	19.90	1007	Falling	0.10		Dry
	09/05/2011	0.10	0.10	0.0001	0.80	0.80	0.0008	19.50	1008	Raising	0.10		Dry
	02/06/2011	0.10	0.10	0	0.10	0.00	0	21.00	1025	Falling	0.00		Dry
	05/09/2011	0.00	0.00	0	0.20	0.20	0	16.40	996	Steady	0.00		Dry
	26/09/2012	0.00	0.00	0	0.70	0.70	0	15.80	1010	Steady	0.00		Dry
	02/10/2011	0.00	0.00	0	1.90	1.90	0.0019	16.20	1001	Steady	0.10		Dry
	10/10/2011	0.00	0.00	0	0.30	0.30	0.0003	15.10	1001	Falling	0.10		Dry
	21/10/2011	0.10	0.10	0.0001	1.60	1.60	0.0016	15.80	1017	Steady	0.10		Dry
WS102	17/03/2011	Gas bung missing										0.65 – 3.65	3.45
	25/03/2011	0.10	0.10	0.0001	0.80	0.80	0.0008	16.70	1013	Steady	0.10		3.46
	05/04/2011	0.20	0.20	0.0002	3.40	3.40	0.0034	3.80	1005	Falling	0.10		3.46
	12/04/2011	0.10	0.10	0.0001	2.00	2.00	0.002	4.40	1030	Falling	0.10		3.75
	05/05/2011	0.10	0.10	0.0001	11.60	11.60	0.0116	7.80	1007	Falling	0.10		dry
	09/05/2011	0.10	0.10	0.0001	1.50	1.50	0.0015	13.00	1008	Raising	0.10		3.76
	02/06/2011	0.10	0.10	0	0.00	0.00	0	20.90	1025	Falling	0.00		3.76
	05/09/2011	0.00	0.00	0	11.50	11.40	0	2.80	996	Steady	0.00		3.71
	26/09/2011	0.00	0.00	0	12.00	12.00	0	5.10	1010	Steady	0.00		3.70
	02/10/2011	0.00	0.00	0.0001	0.00	0.00	0.0001	20.00	1001	Steady	0.10		3.78
	10/10/2011	0.00	0.00	0.0001	0.00	0.00	0.0001	21.00	1001	Falling	0.00		3.79
	21/10/2011	0.10	0.10	0.0001	4.50	4.50	0.0045	5.90	1017	Steady	0.10		3.78
WS103	17/03/2011	Gas bung missing										0.60 – 3.60	3.36
	25/03/2011	0.10	0.10	0.0001	7.80	7.80	0.0078	10.20	1013	Steady	0.10		3.38
	05/04/2011	0.20	0.20	-0.0004	9.90	9.90	-0.0198	7.70	1005	Falling	-0.20		3.38
	12/04/2011	0.10	0.10	0.0001	0.80	0.80	0.0008	20.20	1030	Falling	0.10		3.70

Well	Date	CH ₄ Initial %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Initial %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow (l/hr)	Response Zone (mbgl)	Depth to Water (mbgl)
WS103	05/05/2011	0.10	0.10	0.0001	10.90	10.50	0.0109	8.80	1007	Falling	0.10		3.73
	09/05/2011	0.10	0.10	0.0001	12.20	12.20	0.0122	6.90	1008	Raising	0.10		3.72
	02/06/2011	0.10	0.10	0.0001	0.10	0.10	0.0001	20.80	1025	Falling	0.10		3.68
	20/06/2011	0.20	0.20	0.0002	0.00	0.00	0	21.00	1000	Steady	0.10		3.68
	05/09/2011	0.00	0.00	0	0.00	0.00	0	20.80	996	Steady	0.00		3.68
	26/09/2011	0.00	0.00	0	1.00	1.00	0	16.80	1010	Steady	0.00		1.04
	02/10/2011	0.00	0.00	0	12.50	12.50	0	4.00	1001	Steady	0.00		3.72
	10/10/2011	0.00	0.00	0	6.40	6.40	0	3.70	1001	Falling	0.00		3.60
	21/10/2011	0.10	0.10	0.0001	9.00	9.00	0.009	3.50	1017	Steady	0.10		2.66
WS104	17/03/2011	Gas bung missing										0.55 – 3.55	2.60
	25/03/2011	0.00	0.00	0	0.80	0.80	0.0008	19.50	1013	Steady	0.10		2.73
	05/04/2011	0.20	0.20	-0.0002	4.10	4.10	-0.0041	4.10	1005	Falling	-0.10		2.71
	12/04/2011	0.10	0.10	0.0001	3.00	3.00	0.003	12.20	1030	Falling	0.10		3.12
	05/05/2011	0.10	0.10	0.0001	6.00	6.00	0.006	1.50	1007	Falling	0.10		3.30
	09/05/2011	0.10	0.10	0.0001	4.60	4.60	0.0046	7.00	1008	Raising	0.10		3.31
	02/06/2011	0.10	0.10	0	1.00	0.80	0	17.90	1025	Falling	0.00		3.10
	20/06/2011	0.20	0.10	0	0.00	0.00	0	20.80	1000	Steady	0.00		3.18
	05/09/2011	0.00	0.00	0	3.90	3.60	0	6.50	996	Steady	0.00		2.73
	26/09/2011	0.00	0.00	0	5.50	5.50	0	2.20	1010	Steady	0.00		2.97
	02/10/2011	0.00	0.00	0	5.60	5.60	0	6.00	1001	Steady	0.00		3.12
	10/10/2011	0.00	0.00	0	2.00	2.00	0	7.00	1001	Falling	0.00		2.18
	21/10/2011	0.10	0.10	-0.0003	3.50	3.50	-0.0105	4.00	1017	Steady	-0.30		2.77
WS105	17/03/2011	Gas bung missing										0.65 – 2.65	1.95
	05/04/2011	0.10	0.10	0.0001	0.30	0.30	0.0003	20.60	1005	Falling	0.10		3.51
	12/04/2011	0.10	0.10	0.0001	0.40	0.40	0.0004	20.90	1030	Falling	0.10		2.59
	05/05/2011	0.10	0.10	0.0001	1.80	1.80	0.0018	19.90	1007	Falling	0.10		2.82
	09/05/2011	0.10	0.10	0.0001	2.10	2.10	0.0021	18.30	1008	Raising	0.10		2.82
	02/06/2011	0.10	0.10	0	0.00	0.00	0	20.80	1025	Falling	0.00		2.58
	20/06/2011	0.10	0.10	0.0002	0.00	0.00	0	20.70	1000	steady	0.20		dry
	05/09/2011	0.00	0.00	0	2.70	2.70	0.0054	16.70	996	steady	0.20		2.19
	26/09/2011	0.00	0.00	0	3.50	3.50	0.0035	15.50	1010	Steady	0.10		2.02

Well	Date	CH ₄ Initial %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Initial %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow (l/hr)	Response Zone (mbgl)	Depth to Water (mbgl)
WS105	02/10/2011	0.00	0.00	0	3.60	3.60	0.0036	14.60	1001	Steady	0.10		2.80
	10/10/2011	0.00	0.00	0	4.20	4.20	0.0042	12.00	1001	Steady	0.10		1.79
	21/10/2011	0.10	0.10	-0.0003	3.70	3.70	-0.0111	13.80	1017	Falling	-0.30		2.18
WS106	17/03/2011	Gas bung missing										0.55 – 2.05	0.97
	05/04/2011	0.10	0.10	-0.0002	0.50	0.50	-0.001	20.50	1005	Falling	-0.20		0.95
	12/04/2011	0.10	0.10	0.0001	1.80	1.80	0.0018	17.90	1030	Falling	0.10		2.41
	05/05/2011	0.10	0.10	0.0001	0.40	0.40	0.0004	20.50	1007	Falling	0.10		1.73
	09/05/2011	0.10	0.10	0.0001	1.20	1.20	0.0012	19.20	1008	Raising	0.10		1.78
	02/06/2011	0.10	0.10	-0.0001	1.70	1.70	-0.0017	18.00		Falling	-0.10		1.38
	05/09/2011	0.00	0.00	0	2.60	2.60	0.0026	18.90	996	Steady	0.10		1.37
	26/09/2011	0.00	0.00	0	3.10	3.10	0.0031	18.40	1010	Steady	0.10		1.38
	02/10/2011	0.00	0.00	0	2.90	2.90	0.0029	12.00	1001	Steady	0.10		1.39
	10/10/2011	0.00	0.00	0	2.80	2.80	0.0028	17.10	1001	Steady	0.10		1.35
	21/10/2011	0.10	0.10	0.0001	2.20	2.20	0.0022	18.40	1017	Falling	0.10		1.40
WS107	17/03/2011	Gas bung missing										0.65 – 2.15	Dry
	05/04/2011	0.10	0.10	-0.0001	2.30	2.30	-0.0023	13.90	1005	Falling	-0.10		Dry
	12/04/2011	0.10	0.10	0.0001	2.90	2.90	0.0029	11.30	1030	Falling	0.10		Dry
	05/05/2011	0.10	0.10	0.0001	0.50	0.50	0.0005	19.50	1007	Falling	0.10		Dry
	09/05/2011	0.10	0.10	0.0001	1.60	1.60	0.0016	16.00	1008	Raising	0.10		Dry
	02/06/2011	0.10	0.10	0	0.40	0.40	0	20.00	1025	Falling	0.00		Dry
	05/09/2011	Destroyed											
WS108	17/03/2011	Gas bung missing										0.60 – 3.60	Dry
	05/04/2011	0.10	0.10	-0.0002	1.00	1.00	-0.002	20.20	1005	Falling	-0.20		2.45
	12/04/2011	0.10	0.10	0.0001	0.30	0.30	0.0003	21.20	1030	Falling	0.10		2.50
	05/05/2011	0.10	0.10	0.0001	0.10	0.10	0.0001	20.80	1007	Falling	0.10		2.71
	09/05/2011	0.10	0.10	0.0001	1.30	1.20	0.0013	19.10	1008	Raising	0.10		2.75
	02/06/2011	0.10	0.10	0	0.20	0.20	0	20.70	1025	Falling	0.00		1.32
	05/09/2011	0.00	0.00	0	0.10	0.10	0.0005	20.90	996	Steady	0.50		0.50
	26/09/2011	0.00	0.00	0	0.20	0.20	0	20.70	1010	Steady	0.00		0.98
	02/10/2011	0.00	0.00	0	1.60	1.60	0	18.60	1001	Steady	0.00		1.17

Well	Date	CH ₄ Initial %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Initial %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow (l/hr)	Response Zone (mbgl)	Depth to Water (mbgl)
	10/10/2011	0.00	0.00	0	0.20	0.20	0	20.80	1001	Steady	0.00		0.43
	21/10/2011	0.10	0.10	0.0001	1.60	1.60	0.0016	15.80	1017	Falling	0.10		Dry
WS109	17/03/2011	Gas bung missing										0.55 – 2.55	2.41
	05/04/2011	0.10	0.10	-0.0002	0.30	0.30	-0.0006	20.00	1005	Falling	-0.20		2.37
	12/04/2011	0.10	0.10	0.0001	0.40	0.40	0.0004	19.60	1030	Falling	0.10		2.50
	05/05/2011	0.10	0.10	0.0001	1.00	1.00	0.001	14.20	1007	Falling	0.10		2.75
	09/05/2011	0.10	0.10	0.0001	1.00	1.00	0.001	14.60	1008	Raising	0.10		2.75
	02/05/2011	0.10	0.10	0	1.00	1.00	0	6.40	1025	Falling	0.00		2.75
	26/09/2012	destroyed											
WS110	17/03/2011	Gas bung missing										0.65 – 2.15	Dry
	05/04/2011	0.10	0.10	-0.0001	1.80	1.80	-0.0018	16.90	1005	Falling	-0.10		Dry
	12/04/2011	0.10	0.10	0.0001	0.10	0.10	0.0001	21.30	1030	Falling	0.10		2.91
	05/05/2011	0.10	0.10	0.0001	7.70	7.70	0.0077	7.70	1007	Falling	0.10		Dry
	09/05/2011	0.10	0.10	0.0001	7.30	7.20	0.0073	6.80	1008	Raising	0.10		Dry
	02/05/2011	0.10	0.10	0.0001	1.10	1.00	0.0011	10.80	1025	Falling	0.10		Dry
	05/09/2011	0.00	0.00	0	0.30	0.30	0.0003	6.00	996	Steady	0.10		Dry
	26/09/2011	0.00	0.00	0	1.20	1.20	0	2.50	1010	Steady	0.00		Dry
	02/10/2011	0.00	0.00	0	3.10	3.10	0	1.70	1001	Steady	0.00		Dry
	10/10/2011	0.00	0.00	0	0.30	0.30	0	9.40	1001	Steady	0.00		Dry
	21/10/2011	0.10	0.10	0.0001	0.90	0.90	0.0009	7.40	1017	Falling	0.10		Dry
WS111	17/03/2011	Gas bung missing										0.55 – 2.55	1.90
	25/03/2011	0.10	0.10	0.0001	0.10	0.10	0.0001	20.30	1013	Steady	0.10		2.02
	05/04/2011	0.10	0.10	0	0.00	0.00	0	20.30	1005	Falling	0.00		1.93
	12/04/2011	0.10	0.10	0.0001	0.40	0.30	0.0004	20.40	1030	Falling	0.10		2.45
	05/05/2011	0.10	0.10	0.0001	0.10	0.10	0.0001	20.80	1007	Falling	0.10		2.65
	09/05/2011	0.10	0.10	0.0001	0.10	0.10	0.0001	20.40	1008	Raising	0.10		2.67
	02/06/2011	0.10	0.10	0	0.20	0.20	0	21.50	1025	Falling	0.00		2.41
	20/06/2011	0.20	0.20	0.0002	0.00	0.00	0	20.90	1000	Steady	0.10		2.47
	05/09/2011	0.00	0.00	0	0.10	0.10	0	20.40	996	Steady	0.00		2.22
	26/09/2011	0.00	0.00	0	0.50	0.50	0	20.40	1010	Steady	0.00		2.30

Well	Date	CH ₄ Initial %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Initial %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow (l/hr)	Response Zone (mbgl)	Depth to Water (mbgl)
	02/10/2011	0.00	0.00	0	1.20	1.20	0	18.10	1001	Steady	0.10		2.42
	10/10/2011	0.00	0.00	0	0.40	0.40	0	18.80	1001	Falling	0.20		2.01
	21/10/2011	0.10	0.10	-0.0001	1.10	1.10	-0.0011	15.20	1017	Steady	-0.10		2.20
WS112	17/03/2011	Gas bung missing										0.60 – 2.60	1.98
	05/04/2011	0.10	0.10	0.0001	0.70	0.70	0.0007	19.70	1005	Falling	0.10		2.03
	12/04/2011	0.10	0.10	0.0001	1.70	1.70	0.0017	19.70	1030	Falling	0.10		2.38
	05/05/2011	0.10	0.10	0.0001	2.30	2.30	0.0023	20.80	1007	Falling	0.10		dry
	09/05/2011	0.10	0.10	0.0001	2.80	2.80	0.0028	18.90	1008	Raising	0.10		2.48
	02/06/2011	0.10	0.10	0	0.40	0.40	0	20.00	1025	Falling	0.00		2.37
	05/09/2011	0.00	0.00	0	3.50	3.50	0.0525	17.80	996	Steady	1.50		2.20
	26/09/2011	0.00	0.00	0	4.70	4.70	0	9.10	1010	Steady	0.00		2.32
	02/10/2011	0.00	0.00	0	3.90	3.90	0	11.30	1001	Steady	0.00		2.35
	10/10/2011	0.00	0.00	0	2.50	1.80	0	14.30	1001	Steady	0.00		1.81
	21/10/2011	0.10	0.10	0.0001	2.20	2.20	0.0022	18.40	1017	Falling	0.10		1.40
CP101	17/03/2011	0.00	0.00	0	0.70	0.60	0.0007	20.10	1006	Steady	0.10	0.50 – 4.50	3.18
	25/03/2011	0.40	0.40	0.0004	4.00	4.00	0.004	6.10	1013	Steady	0.10		3.21
	05/04/2011	0.10	0.10	0	4.40	4.40	0	13.30	1005	Falling	0.00		3.29
	12/04/2011	0.10	0.10	-0.0001	1.30	1.30	-0.0013	10.60	1030	Falling	-0.10		3.29
	05/05/2011	0.10	0.10	0.0001	2.90	2.90	0.0029	15.00	1007	Falling	0.10		3.24
	09/05/2011	0.10	0.10	0.0001	10.60	10.60	0.0106	6.00	1008	Raising	0.10		3.27
	02/06/2011	0.00	0.00	0	0.30	0.30	0	20.40	1025	Falling	0.00		3.25
	26/06/2011	0.20	0.20	0.0002	0.00	0.00	0	21.00	1000	Steady	0.10		3.22
	05/09/2011	0.40	0.40	0	4.20	4.10	0	0.30	996	Steady	0.00		3.25
	26/09/2011	0.50	0.50	-0.0005	3.70	3.70	-0.0037	1.20	1010	Falling	-0.10		3.16
	02/10/2011	0.00	0.00	0	4.40	4.40	0	0.60	1001	Steady	0.00		3.21
	10/10/2011	0.30	0.30	0	3.20	3.20	0	0.50	1001	Steady	0.00		3.16
	21/10/2011	0.10	0.10	-0.0003	3.50	3.50	-0.0105	0.10	1017	Falling	-0.30		3.21

4.0 TIER 1 QUALITATIVE RISK ASSESSMENT

REC has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils pose an unacceptable level of risk to the identified receptors.

4.1 Human Health Risk Assessment

At a Tier 1 stage the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published by the EA (Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values (SGV)) and where absent, General Acceptance Criteria (GACs) published by LQM/CIEH (2nd edition).

The results of this comparison have been summarised within Table 4.1 (overleaf).

Table 4.1 Summary of Inorganic and Hydrocarbon Toxicity Assessment in Made Ground Residential (Medium Terrace) With Plant Uptake End Use

Determinand	Units	GAC ^(vi)	n	ME	Loc. of Ex	Pathway	Assessment
Arsenic	mg/kg	32	10	76	TP104, TP108	1	Further Assessment
Cadmium	mg/kg	10	10	N/A	N/A	1	No Further Assessment
Chromium (Hexavalent)	mg/kg	4.3	13	N/A	N/A	1	No Further Assessment
Lead ⁽ⁱ⁾	mg/kg	225	10	620	TP108, TP104	1	Further Assessment
Mercury	mg/kg	11	10	N/A	N/A	2	No Further Assessment
Nickel	mg/kg	130	10	N/A	N/A	1	No Further Assessment
Selenium (New SGV)	mg/kg	350	10	N/A	N/A	1	No Further Assessment
Copper	mg/kg	2330	10	N/A	N/A	1	No Further Assessment
Zinc	mg/kg	3750	10	N/A	N/A	1	No Further Assessment
Cyanide	mg/kg	791	13	N/A	N/A	1	No Further Assessment
Phenol	mg/kg	210	13	N/A	N/A		No Further Assessment
Naphthalene	mg/kg	1.5	13	N/A	N/A	2	No Further Assessment
Acenaphthylene	mg/kg	170	13	N/A	N/A	3	No Further Assessment
Acenaphthene	mg/kg	210	13	N/A	N/A	1	No Further Assessment
Fluorene	mg/kg	160	13	N/A	N/A	1	No Further Assessment
Phenanthrene	mg/kg	92	13	N/A	N/A	3	No Further Assessment
Anthracene	mg/kg	2300	13	N/A	N/A	3	No Further Assessment
Fluoranthene	mg/kg	260	13	N/A	N/A	3	No Further Assessment
Pyrene	mg/kg	560	13	N/A	N/A	3	No Further Assessment
Benzo(a)Anthracene ^(c)	mg/kg	3.1	13	N/A	N/A	3	No Further Assessment
Chrysene	mg/kg	6	13	N/A	N/A	3	No Further Assessment
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	mg/kg	5.6	13	N/A	N/A	3	No Further Assessment
Benzo(a)Pyrene	mg/kg	0.83	13	0.88	WS109	3	Further Assessment
Indeno(123-cd)Pyrene	mg/kg	3.2	13	N/A	N/A	3	No Further Assessment
Dibenzo(a,h)Anthracene	mg/kg	0.76	13	N/A	N/A	3	No Further Assessment
Benzo(ghi)Perylene	mg/kg	44	13	N/A	N/A	3	No Further Assessment
TPH C ₅ -C ₆ (aliphatic) ^(iv)	mg/kg	30	13	N/A	N/A	2	No Further Assessment
TPH C ₆ -C ₈ (aliphatic) ^(iv)	mg/kg	73	13	N/A	N/A	2	No Further Assessment
TPH C ₈ -C ₁₀ (aliphatic) ^(iv)	mg/kg	19	13	N/A	N/A	2	No Further Assessment
TPH C ₁₀ -C ₁₂ (aromatic) ^(iv)	mg/kg	69	13	N/A	N/A	2	No Further Assessment
TPH C ₁₂ -C ₁₆ (aromatic) ^(iv)	mg/kg	140	13	N/A	N/A	1	No Further Assessment
TPH C ₁₆ -C ₂₁ (aromatic) ^(iv)	mg/kg	250	13	N/A	N/A	1	No Further Assessment
TPH C ₂₁ -C ₃₅ (aromatic) ^(iv)	mg/kg	890	13	N/A	N/A	1	No Further Assessment

Notes

Main Exposure Pathways: 1 = Soil Ingestion, 2 = Vapour Inhalation (indoor), 3 = Dermal Contact & Ingestion, 4 = Dust Inhalation.

Abbreviations: GAC = General Assessment Criteria, n = number of samples, ME = Maximum Exceedance concentration; NA – Not Applicable (no exceedance of assessment criteria); Loc of Ex = Location of Exceedances

*

(i) Lead – Based on 50% SOM 2003 SGV because of proposed decrease in DWS and acceptable lead blood levels from 10µg/l to 5µg/l

(ii) Mercury – Based on elemental Mercury

(iii) Benzo (b) Fluoranthene (100mg/kg) Benzo (k) Fluoranthene (140mg/kg)

(iv). BTEX is not SOM related due to inhalation pathway

(v) Xylenes based on p-xylene (o-xylene 2600mg/kg, m-xylene 3500mg/kg) and is capped by its solubility

(vi) * The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. REC has utilised the Tier 1 values for aliphatic compounds for the volatile and semi volatile fractions (C₅-C₁₂) and the Tier 1 values for aromatic compound for the non volatile fractions (C₁₂-C₃₅). The comparison of a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

Referring to Table 4.1, the results of the direct comparison show that screening values have been exceeded for the following determinands:

- Arsenic, at 76mg/kg in TP104 (2.0m bgl);
- Arsenic, at 33mg/kg in TP104 (2.0m bgl);
- Lead, at 520mg/kg in TP104 (2.0m bgl);
- Lead, at 640mg/kg in TP108 (2.0m bgl);and
- Benzo(a)Pyrene (BaP), at 0.88mg/kg in TP109 (2.0m bgl).

In the case of all identified organic and inorganic contaminants, the primary exposure pathway is soil ingestion, dermal contact and consumption of home grown vegetables. However, the elevated concentrations were all detected at depth, removing the relevant pathways. For the shallow soils REC accepts there is insufficient data to classify them as chemically suitable, they are physically unsuitable for use in gardens. Further classification of the shallow soils will be completed to determine whether they are suitable for re-use on site in less sensitive areas.

For the gardens, REC recommends that a suitable cover system comprising 450mm subsoil and 150mm topsoil be placed within all residential gardens to ensure that the site is developed in a manner that would pose no unacceptable level of risk to future residential site occupants and provides a suitable growing medium.

Asbestos Assessment

Asbestos was identified in three out of the thirteen soil samples submitted for screening analysis:

- TP105 (0.3m bgl) – Chrysotile detected;
- WS103 (0.5m bgl).- Chrysotile detected; and,
- WS109 (2.0m bgl) – Chrysotile detected.

It is recommended that further assessment is carried out at the site to delineate the extent of the asbestos impact to site soils and the risk posed to site end users and construction workers.

The main risk associated with asbestos is through inhalation of airborne dust fibres and as such the primary risk is to construction workers during the earthworks phase of the proposed development. It is therefore recommended that suitable method statements, risk assessments and validation air monitoring be completed during the construction phase to ensure that the perceived risk is mitigated in full.

REC can confirm that the risk to future residential receptors will be mitigated through the installation of a suitable cover system within the residential gardens.

4.2 Controlled Waters

When considering the potential risk to controlled waters and the wider environment, the ICSM has identified Barrow Brook flowing through the centre of the site as the critical controlled waters receptor with the underlying Secondary A aquifer also being identified as a viable receptor. The ICSM has no identified any potable drinking water extractions within influencing distance of the site.

Analysis of the Brook samples did not detect any hydrocarbons above the lower method reporting limits.

4.2.1 Risk to Potable Water Supplies

The UK DWS have been specifically developed for the protection of human health for potable drinking water supplies; therefore for a potential risk to exist a viable exposure pathway must exist between the identified impact and a potable water supply. Within the context of the developed CSM for the site, the risk to groundwater quality is not considered significant due to the following mitigating factors:

- No significant concentrations of either organic or inorganic contaminants have been identified at levels which would normally be expected to generate a dissolved phase plume capable of leaching at concentrations capable of impacting the identified receptors; and
- The nearest potable groundwater abstraction is located in excess of 500m from the proposed development site;

4.2.2 Risk to the Environment

Within the context of the developed CSM for the site, the risk to surface water quality from the marginal low level inorganic and organic concentrations are not considered significant due to the following mitigating factor:

- The site is underlain in its entirety by low permeability glacial boulder clay, which is likely to impede the vertical migration of any dissolved phase contaminants towards the underlying aquifer (identified as a receptor);
- The glacial clay will also act as a sorption mechanism which will significantly reduce the potential for lateral migration of potential contaminants which will bond with the clay minerals;
- REC has completed a programme of water quality monitoring within Barrow Brook over the past 12 months which has demonstrated that there is no impact to the watercourse (REC letter report 03c43709); and,
- No significant concentrations of either organic or inorganic contaminants have been identified at levels which would normally be expected to generate a dissolved phase plume capable of leaching towards the identified receptors.

Based on the data obtained to date, it is considered that the recorded concentrations of potential contaminants within the underlying soil would pose no unacceptable level of potential risk to controlled waters.

4.3 Ground Gas

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 (*Assessing risks posed by hazardous ground gases to buildings*, 2007).

Prior to the development of a representative ground gas assessment it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on-site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

The Phase I report has identified backfilled reservoirs in the southwest of the site and off-site adjacent to the east as potential sources of hazardous ground gas.

During the monitoring visits completed, no significantly elevated concentrations of methane were recorded within any of the monitoring wells. Elevated levels of carbon dioxide (up to 12.5% v/v) were recorded in WS103 though this was also associated with low flow rates of than 0.1litres/hr

The ground gas monitoring has identified marginally elevated concentrations of carbon dioxide originating from the in-filled reservoir. It is therefore recommended that the site be zoned to reflect the requirements of individual units. Based on the data, this would suggest a classification of Amber 1 or Characteristic Situation 2 in the south eastern sector where low level ground gas protection measures comprising a ventilated sub-floor void and gas membrane may be required.

The remainder of the site would be currently classified as situation Green or Characteristic Situation 1.

4.4 Revised Conceptual Site Model

Following the completion of the intrusive site investigation, chemical analysis and risk assessment the conceptual model shown in Table 4.3 (below) has been prepared for the site.

Table 4.3 Revised Conceptual Site Model

Source	Exposure Pathway	Potential Receptor	Probability of Exposure	Discussion of Pollutant Linkage
Human Health				
Elevated arsenic and lead in soils in TP104 (2.0m) and TP106 (2.0m)	Soil Ingestion	Future site users and construction workers	Unlikely	The risk of exposure to soils can be mitigated through the use of a 600mm cover system of chemically suitable topsoil and sub-base would break this pathway. The correct use of PPE during construction works would mitigate against the risk to site workers.
Elevated Benzo(a)Pyrene in soils in TP109 (2.0m)	Soil ingestion and dermal contact	Future site users and construction workers	Unlikely	The correct use of PPE during construction works would mitigate against the risk to site workers.
Ground Gas	Lateral Migration	Future site users	Unlikely	The installation of appropriate ground gas protection measures will mitigate against this source.
Asbestos (Chrysotile fibres) in TP105 (0.3m), WS103 (0.5m) and WS109 (2.0m)	Dust inhalation	Future site users and construction workers	Likely	The risk of exposure to soils can be mitigated through the use of a 600mm cover system of chemically suitable topsoil and sub-base would break this pathway. The correct use of PPE during construction works would mitigate against the risk to site workers.
Controlled Water				
Elevated inorganic compounds in site soils	Ingestion	Secondary A aquifer / Human Health	Unlikely	The pH of site soils is not sufficiently acidic or alkaline to enhance leaching of inorganic compounds and there are no potable water abstractions within 500m of the site.
	Lateral migration, run-off	Barrow Brook	Unlikely	The presence of low permeability cohesive deposits across the site should impede the vertical and lateral migration of any dissolved phase contaminants.

The assessment and conceptual model has identified one potentially significant pollutant linkage (asbestos fibres) with one as yet unconfirmed linkage via shallow soils which will be removed by the placement of a cover system in the gardens. It is therefore recommended that a detailed Remediation Strategy be developed to ensure that the site can be safely developed for the proposed residential end use.

5.0 GEOTECHNICAL ASSESSMENT

5.1 Proposed Development

It is understood that the proposed development will comprise the construction of low rise residential housing units with gardens to the front and rear, private driveways, adoptable estate roads and drainage infrastructure.

Given the nature of the proposed development it is considered that the structure meets the criteria of Geotechnical Category 1 of Euro Code 7.

Given the nature of the development it is considered that acceptable risk from settlement is a total settlement value of 25mm for a masonry structure.

5.2 Summary of Ground Conditions

Ground conditions identified at the site are summarised in Table 5.1 below:

Table 5.1 Summary of Ground Conditions

Strata	Typical Description	Max Thickness (m)
Made Ground (Topsoil/gravel)	Grey clayey gravel. Gravel is medium to coarse, sub-angular to angular of limestone and mixed lithology.	0.50
Made Ground (Clay fill)	Brown gravelly clay. Gravel is fine to coarse, sub-rounded to angular of brick, mudstone, limestone, slate, clinker, concrete with cobbles and boulders of concrete and brick.	4.50
Drift Deposits (Clay)	Brown/grey/green gravelly clay. Gravel is fine to coarse, sub-rounded to sub-angular of limestone and mudstone.	3.30
Bedrock (Mudstone)	Dark grey fractured mudstone.	>1.10

5.3 Site Preparation

Numerous large cobbles, boulders and relict foundations were observed within a number of exploratory locations. A preliminary observation suggested that the majority of the buried obstructions were concentrated in the south and western sectors of the site.

When considering the above, REC would recommend that consideration be given to the implementation of a site wide programme of remediation / enabling works designed to deliver the following key objectives:

- Remove all relict foundations / obstructions;
- Screen and sort all made ground;
- Remove all organic (potential gas source) deleterious content;
- Vibro-compaction of all replaced material beneath plots, driveways and access roads; and,
- 'Win' topsoil / subsoil for placement in residential gardens.

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the Specification for Highway Works. This should include:

- Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void in-filled with suitable compacted engineered fill;
- Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill; and,
- Buried structures and old foundations have been encountered on site. These should be excavated from below the proposed development foot print with the resulting void backfilled.

5.4 Foundation Conditions and Bearing Capacity

General

It is considered that the Made Ground is not suitable for a founding material due to the inherent variability of the material. Foundation options are therefore:

- Traditional strip foundations into the underlying Clay;
- Raft foundation;
- Programme of site enabling works to facilitate the construction of shallow strip footings bearing on re-engineered made ground using vibro granular columns / dynamic compaction;
- Deeper pile foundations; and,

These options are discussed below:

Strip Foundations

Traditional strip foundations could be constructed at least 150mm in to the underlying natural stiff clay within the northerly sector of the site where limited made ground and few obstructions were encountered. However consideration will need to be given to where the footprint of the proposed development extends from the stiff clay into the Made Ground deposits within the central sectors of the site.

Within the stiff clay deposits, bearing capacities in the order of 100kN/m² should be achieved at depths of 1.00m bgl; however consideration should be given to the moderate potential for volumetric instability of clays underlying this site and NHBC's requirement to extend foundations to a greater depth.

It may be possible to extend the use of deep mass trench fill foundations within the central and western sectors of the site, however it is considered that this option would be limited by the significant presence of buried obstructions and abnormal volumes of concrete required to gain the NHBC approval for footing.

Raft Foundation

The viability of a raft foundations would be limited by the potential for differential settlement of the Made Ground within the southern and western sectors; the NHBC require that when constructing a raft foundation on non engineered Made Ground, that sufficient time be allowed for natural consolidation or 'self weight settlement' of the in-filled material.

As the material has been placed within the last five years, an extensive programme of geotechnical testing would be required to model the settlement characteristics.

The use of a raft foundation would require the installation of flexible service infrastructure with exaggerated gradients to tolerate movement within the residential units.

Ground Improvement

The significant depth of Made Ground within the central, south-eastern and south western sectors of the site will require the implementation of a specialist foundation solution to support to proposed residential units.

Consideration should be given to the implementation of a programme of site enabling works to excavate, screen and sort the underlying made ground to ensure all obstructions and oversized materials are removed prior to replacement and subsequent re-engineering using a specialist ground improvement technique such as vibro compaction using stone columns;

Piled Foundations

Consideration should be given to the utilisation of small diameter driven pile bearing on the underlying weathered bedrock at a depth of circa 5.0-6.0m bgl. This option will be limited by the significant presence of buried obstructions which would necessitate the pre-boring of pile locations in some instances.

Consideration would also need to be given to the potential for negative skin friction which could be introduced from the deeper deposits of Made Ground encountered within the southern areas of the site.

Recommendation

Traditional strip foundations should be considered within the northern areas of the site where natural clay deposits are encountered coupled with programme of site enabling works and subsequent vibro granular column ground improvement across the remainder of the site which will provide the most reliable and cost effective option for the site.

5.5 Ground Floor Slabs

The NHBC will require suspended floors within all residential units to be constructed at this site.

5.6 Concrete Durability

Based upon the results of the chemical analyses summarised in Table 3.4 it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).

5.7 Pavement Design

A design CBR of less than 2% should be assumed for the Made Ground, although it may be possible to increase this following plate load tests.

5.8 Excavations

Site observations indicated that excavations should be feasible in the near surface with normal plant. It is anticipated that any obstructions will be grubbed out during the reduced level dig for the sub structure works.

Groundwater seepage was recorded in a number of the Trial Holes, evident of isolated perched water in the Made Ground. Generally trial pits were stable in.

Due to the variability of the Made Ground it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA RR97. Groundwater seepages were noted in several exploratory holes, however, these were minor and it is considered that conventional sump pumping should be adequate.

5.9 Minerals

Historically there has been opencast quarrying of sands and gravels almost 1km west of the site and opencast coal mining almost 1km east of the site. There are no known minerals of economic value underlying the Sites at shallow depth and mining is considered to be very unlikely. There are no mine entries recorded or likely at this site however the previously obtained Envirocheck data has listed this site at being of moderate risk of shallow mining hazards.

5.10 Further Works

To assist in the safe and economic design and construction of the development it is recommended that consideration is given to the following further activities:

- Materials management plans;
- CBR assessment for design and construction of roads and hard standing; and,
- BRE 365 Soakaway to assist in the design of drainage at this location.

5.11 Construction Activity and Inspection

It is considered that the following considerations and recommendations be incorporated in to the site works:

- Due to the variability of the soils at the site it is recommended that sufficient allowance is made for the inspection of formation and sub formations to foundations and pavement construction;
- Excavations where access is required should be subject to a risk assessment from a competent person and where appropriate mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA 97 utilised;
- It is considered that de-watering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond;
- Based on the groundwater monitoring results it is possible that groundwater pumped

from trenches may require treatment using a water/oil interceptor. Discharge limits and treatment should be agreed as part of the trade effluent discharge;

- Where access to confined spaces is required appropriate mitigation measures should be addressed within the Construction Stage Health and Safety Plan. Particular account should be taken of the gas results;
- The presence of potential contamination and mitigation measures should be addressed as part of the Construction Stage Health and Safety Plan and should include measures to design out the risks, reduce their impact and finally the use of Personnel Protective Equipment (PPE).

6.0 CONCLUSIONS & RECOMMENDATIONS

Environmental

The Tier 1 Contaminated Land Risk Assessment and developed Conceptual Site Model (CSM) identified potential pollutant linkages associated with dermal contact and ingestion of impacted Made Ground within residential gardens. It is therefore recommended that suitable remediation and mitigation measures, including the construction of a 600mm cover system within all gardens, be developed to ensure that the site can be safely developed for the proposed residential end use. Testing of the shallow soils to confirm its suitability for other uses should be considered.

It is considered necessary to develop a suitable Remediation Strategy to facilitate the installation of a 600mm cover system within all residential garden areas to mitigate the identified exposure pathways to the critical receptors.

Asbestos (chrysotile) fibres were detected in three soil samples from depths ranging from 0.3m bgl to 2.0m bgl. It is recommended that suitable method statement and risk assessment be developed to mitigate the potential risk to construction workers during ground works.

Geotechnical

Traditional strip foundations should be considered within the northern areas of the site where natural clay deposits have been encountered, however consideration should be given to the potential for localise buried obstructions.

The significant depth of Made Ground within the central, south-eastern and south western sectors of the site will require the implementation of a specialist foundation solution to support to proposed residential units; this could comprise:

- Implementation of a programme of site enabling works to excavate, screen and sort the underlying made ground to ensure all obstructions and oversized materials are remove prior to replacement and subsequent re-engineering using a specialist ground improvement technique such a vibro compaction using stone columns; and / or;
- Utilisation of small diameter driven piled foundation to bear on the underlying weathered bedrock: this option will be limited by the significant presence of buried obstructions which would necessitate the pre-boring of pile locations in some instances.

It is recommended that specialist contractors be contacted at the first available opportunity so that the client can obtain technical proposals and costs for the various options.

Subsurface concrete should be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s.

The NHBC will require suspended floors within all residential units to be constructed at this site.

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. REC can not be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
13. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II
GLOSSARY

TERMS

AST	Above Ground Storage Tank
BGS	British Geological Survey
BSI	British Standards Institute
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research Association
CLEA	Contaminated Land Exposure Assessment
CSM	Conceptual Site Model
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	General Assessment Criteria
GL	Ground Level
GSV	Gas Screening Value
HCV	Health Criteria Value
ICSM	Initial Conceptual Site Model
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)
ND	Not Detected
LMRL	Lower Method Reporting Limit
NR	Not Recorded
PAH	Poly Aromatic Hydrocarbon
PCB	Poly-Chlorinated Biphenyl
PID	Photo Ionisation Detector
QA	Quality Assurance
SGV	Soil Guideline Value
SPH	Separate Phase Hydrocarbon
Sp.TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)
SPT	Standard Penetration Test
SVOC	Semi Volatile Organic Compound
UST	Underground Storage Tank
VCCs	Vibro Concrete Columns
VOC	Volatile Organic Compound
WTE	Water Table Elevation

UNITS

m	Metres
km	Kilometres
%	Percent
%v/v	Percent volume in air
mb	Milli Bars (atmospheric pressure)
l/hr	Litres per hour
µg/l	Micrograms per Litre (parts per billion)
ppb	Parts Per Billion
mg/kg	Milligrams per kilogram (parts per million)
ppm	Parts Per Million
mg/m ³	Milligram per metre cubed

m bgl	Metres Below Ground Level
m bcl	Metre Below Cover Level
mAOD	Metres Above Ordnance Datum (sea level)
kN/m ²	Kilo Newtons per metre squared
µm	Micro metre

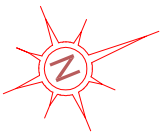
APPENDIX III
FIGURES



EC 
Environmental Consultants

1

at Site Location
erial Photo

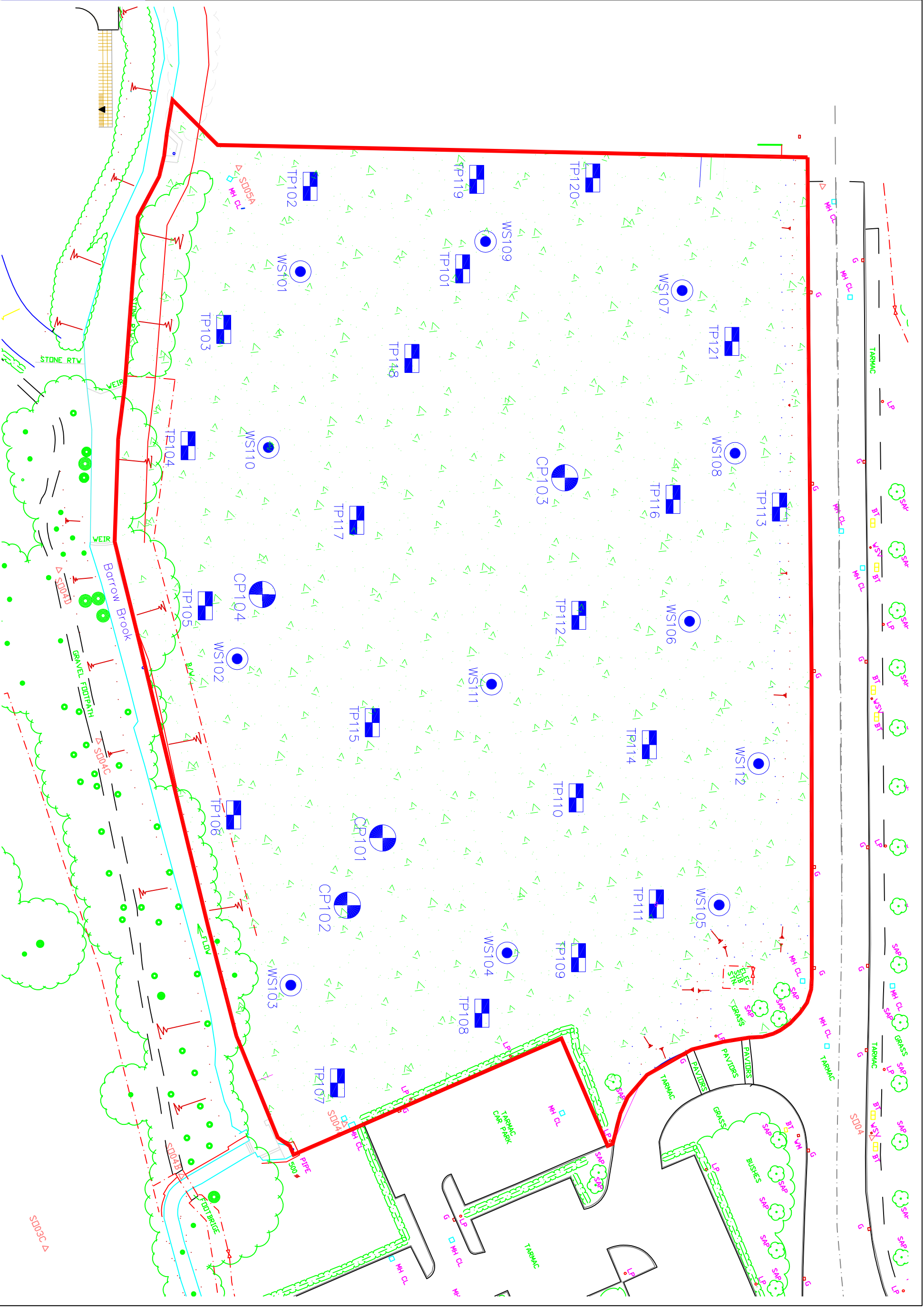


Key

- WS101 Window Sample Probbhole Location
- TP101 Trial Pit Location
- CP101 Cable Percussive Borehole Location

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Job Title

Barrow Brook (2nd Phase)
Clitheroe

Client

Rowland Homes

Job No: 43933

Drawn by: M.Daily

Approved by: M.Dyer

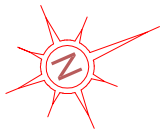
Date

11/03/11

Notes:

Drawing Title

Figure 2
Exploratory Hole
Location Plan



Key

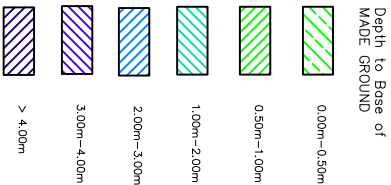
 WS101
Window Sample
Preborehole Location
MG: 1.10
N: 1.10–3.00

 TP101
Trial Pit Location
MG: N/A
N: 0.95–3.50

 TP101
Trial Pit Location
(with obstruction)
MG: 2.30
N: N/A
OBSTRUCTION

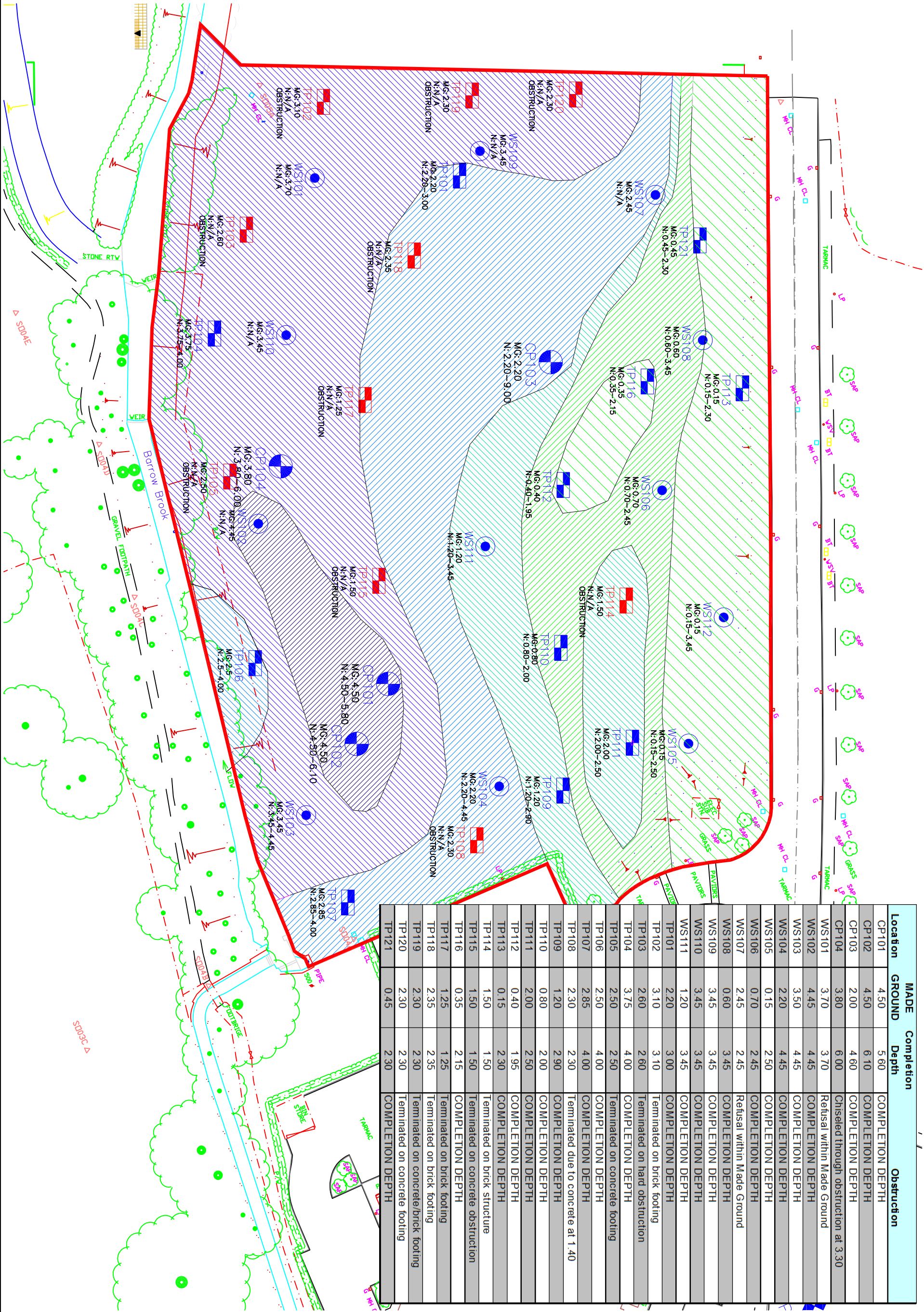
 CP101
Cable Percussive
Borehole Location
MG: 2.20
N: 2.20–9.00

MG: Depth to MG
base
N: Natural Strata



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APPENDIX IV
REC EXPLORATORY HOLE LOGS

Borehole Record - Cable Percussion

Borehole Number: CP101

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Dando 2000



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation
1.0		MADE GROUND: Brown sandy gravelly clay. Gravel is fine to coarse angular to sub-rounded of concrete and brick.	1.90	D B SPT (C)	0.30 0.50-1.00 1.00-1.50 1.00-1.25	10/16/34 over 40mm		
2.0		MADE GROUND: Brown gravelly clay with occasional cobbles. Gravel is fine to coarse angular to sub-rounded of concrete. Cobbles are angular to sub-rounded of concrete.		D SPT	1.80 2.00 2.00-2.45	3/2/2/2/3 N=9		
3.0				D SPT	3.00 3.00-3.45	2/3/4/4/5 N=16		
4.0			4.50	D SPT	4.00 4.00-4.45	2/2/3/2/2 N=9		
5.0		Soft to firm brown SILT.	5.00	D SPT	5.00 5.00-5.10	25 over 30mm N=50 for 25mm		
6.0		Black/dark grey SILTSTONE.		D SPT (C)	5.50 5.50-5.60	25 N=50 for 10mm		
		Borehole completed at 6.10m bgl.	6.10					

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Chiselling: Chiselling between 1.20-1.50m (45 mins), 4.60-5.00m (45 mins) and 5.00-5.50m (60 mins)

Date: 25/3/11

Services: Prior to drilling the location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Addition of water: Limited amounts of water were added to aid drilling in hard strata.

Casing diameter: 150mm

Groundwater: None encountered.

Borehole Record - Cable Percussion

Borehole Number: CP102

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Dando 2000



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation
1.0		MADE GROUND: Brown gravelly clay. Gravel is fine to coarse sub-angular to sub-rounded of brick and concrete.	1.90	D B SPT (C)	0.30 0.50 1.00-1.50 1.00-1.20	14/17/33 over 40mm N=50 for 115mm		
2.0		MADE GROUND: Brown sandy gravelly ashy clay. Gravel is medium to coarse sub-angular to sub-rounded of brick.		D SPT	1.80 2.00 2.00-2.45	3/2/1/1/2 N=6		
3.0				D SPT	3.00 3.00-3.45	2/1/2/1/3 N=7		
4.0			4.50	D SPT	4.00 4.00-4.45	2/1/2/2/2 N=7		
5.0		Soft to firm brown SILT.	5.00	D SPT	4.60 5.00 5.00-5.25	9/8/20/30 N=58 for 200mm		
6.0		Black/dark grey SILTSTONE.	6.10	D SPT	6.00 6.00-6.10	25 N=50 for 20mm		
		Borehole completed at 6.10m bgl.						

Key

B. Bulk (Bag)
W. Water
U100. 100mm Undisturbed
U38. 38mm Undisturbed Sample
SPT. Standard Penetration Test

D. Disturbed
G. Amber Glass Jar / Bottle
CPT. Cone Penetration Test
U100. Blows (Recovery mm)
V. 40ml Glass Vial

T. Plastic Tub
N. 'N' Value
HV. Hand Shear Vane
PID. Photo Ionisation Detector
ES. Environmental Sample

Notes

Chiselling: Chiselling between 1.20-1.50m (30 mins) and 5.50-6.00m (60 mins)
Services: Prior to drilling the location was scanned with a Cable Avoidance Tool (CAT).
Addition of water: Limited amounts of water were added to aid drilling in hard strata.
Casing diameter: 150mm
Groundwater: Water strike at 4.20m bgl rising to 4.00m bgl over 20 mins.

Date: 25/3/11

Status: Final

Borehole Record - Cable Percussion

Borehole Number: CP103

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 10/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Dando 2000



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation
1.0		MADE GROUND: Brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of brick and concrete.		D B	0.30 0.50-1.00			
2.0			2.00	SPT (C) B	1.00-1.45 1.00	2/2/3/1/1 N=7		
3.0		Stiff brown gravelly CLAY with occasional cobbles. Gravel is medium to coarse sub-angular to rounded of mudstone, sandstone and limestone. Cobbles are sub-angular to sub-rounded of mudstone.		D SPT D	1.80 2.00-2.45 2.00	3/2/2/4/7 N=15		
4.0		Very dense grey GRAVEL. Gravel is medium to coarse angular of sandstone.	3.20	D SPT	3.00 3.00-3.15	10/29/21 over 40mm N=50 for 115mm		
				D SPT	3.50 3.50-3.75	19/26/24 over 40mm N=50 for 115mm		
		Grey SILTSTONE.	4.10					
			4.60	D SPT	4.50 4.50-4.60	25 over 30mm/50 over 60mm		
5.0		Borehole completed at 4.60m bgl.						
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Chiselling: Chiselling between 4.10-4.50m (60 mins)

Services: Prior to drilling the location was scanned with a Cable Avoidance Tool (CAT).

Addition of water: Limited amounts of water were added to aid drilling in hard strata.

Casing diameter: 150mm to 3.00m bgl.

Groundwater: Water strike at 1.80m bgl rising to 1.50m bgl over 20 mins.

Date: 25/3/11

Status: Final

Borehole Record - Cable Percussion

Borehole Number: CP104

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 10/3/11

Date Completed: 10/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Dando 2000



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation
1.0		MADE GROUND: Brown sandy gravelly clay. Gravel is fine to coarse angular to sub-rounded of concrete and brick.	1.80	D B SPT (C)	0.30 0.50-1.00 1.00-1.50 1.00-1.45	2/2/2/3/2/4 N=11		
2.0		MADE GROUND: Brown gravelly clay with occasional cobbles. Gravel is fine to coarse angular to sub-rounded of concrete. Cobbles are angular to sub-rounded of concrete.	3.80	D D SPT	1.80 2.00 2.00-2.45	1/1/2/1/2/3 N=8		
3.0				D SPT (C)	3.00 3.00-3.45	9/10/12/14/24 over 30mm N=50 for 180mm		
4.0		Firm brown SILT with roots.	4.60	D SPT	4.00 4.00-4.45	1/1/2/1/2/2 N=7		
5.0		Very dense grey GRAVEL. Gravel is medium to coarse angular of siltstone.	5.50	D SPT	5.00 5.00-5.25	14/19/31 over 60mm N=50 for 135mm		
6.0		Grey SILTSTONE.	6.00	D SPT	5.90 5.90-6.00	25 over 35mm N=50 for 40mm		
		Borehole completed at 6.00m bgl.						

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Chiselling: Chiselling between 3.30-3.60m (30 mins) and 5.50-5.90m (60 mins)

Services: Prior to drilling the location was scanned with a Cable Avoidance Tool (CAT).

Addition of water: Limited amounts of water were added to aid drilling in hard strata.

Casing diameter: 150mm

Groundwater: None encountered.

Date: 25/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP101

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm) 0 25 50 75 100	Field / Laboratory Testing
		MADE GROUND: Clayey gravelly topsoil.						
1.0		MADE GROUND: Grey/brown gravelly ashy clay with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone limestone and brick. Cobbles are of brick, demolition rubble and concrete.		B	0.70			
2.0			2.20	DG	2.20			
3.0		Firm to stiff light brown sandy slightly gravelly CLAY with occasional cobbles. Gravel is fine to medium sub-angular of mudstone. Cobbles are of limestone.	3.00					
		Trial pit completed at 3.00m bgl.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 3.00m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 17/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP102

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Topsoil.										
		MADE GROUND: Grey/light brown gravelly clay. Gravel is of limestone, sandstone and brick.		DG	0.50							
1.0			1.10									
		MADE GROUND: Brown/grey gravelly clay with occasional cobbles. Gravel is of brick and limestone. Cobbles are of brick.		DG	1.50							
			1.90									
2.0		MADE GROUND: Concrete blocks.										
3.0			3.10									
		Trial pit terminated at 3.10m bgl on concrete obstruction.										
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 3.10m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 17/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP103

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Dark grey clayey gravelly topsoil.	0.15									
		MADE GROUND: Brown/grey mottled gravelly clay with concrete flags. Gravel is of mudstone, brick and limestone.		DG	0.50							
1.0												
			1.70									
		MADE GROUND: Brick and timber.		DG	1.80							
2.0												
		MADE GROUND: Dark grey ashy gravelly clay with occasional boulders. Gravel is of brick, slate and concrete. Boulders are of concrete.	2.45									
			2.60									
3.0		MADE GROUND: Brown/grey ashy gravelly clay. Gravel is of brick, slate and concrete.										
		Trial pit terminated at 2.60m bgl on concrete obstruction.										
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.60m

Date: 17/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP104

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Grey gravelly clayey topsoil.	0.25									
		MADE GROUND: Light brown gravelly clay. Gravel is fine to medium angular to sub-angular of mudstone and brick.										
1.0		MADE GROUND: Brown gravelly clay. Gravel is medium to coarse angular to sub-angular of brick, coal, concrete and mudstone.										
		From 1.20m bgl...Cobbles of white brick and concrete and fragments of timber.	1.70									
2.0		MADE GROUND: Re-inforced concrete with frequent bricks.		DG	2.00							
		MADE GROUND: Black clayey gravel. Gravel is medium to coarse angular to sub-angular of slate, brick and white bricks. Hydrocarbon odour.	2.90									
3.0		MADE GROUND: Grey gravelly clay with cobbles of concrete and brick.										
			3.75	DG	3.50							
4.0		Firm to stiff brown CLAY.	4.00									
		Trial pit completed at 4.00m bgl.										
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 4.00m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 17/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP105

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm) 0 25 50 75 100	Field / Laboratory Testing
		MADE GROUND: Grey gravelly clayey topsoil.	0.30	DG	0.30			
		MADE GROUND: Light brown gravelly clay. Gravel is fine to medium angular to sub-angular of mudstone and brick.						
1.0		MADE GROUND: Brown gravelly clay. Gravel is of brick, mudstone, concrete and tile.		DG	1.00			
2.0								
			2.50					
3.0		Trial pit terminated at 2.50m bgl due to concrete obstruction.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.50m

Date: 17/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP106

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Topsoil.	0.15									
1.0		MADE GROUND: Brown gravelly clay. Gravel is medium to coarse angular to sub-rounded of clinker, brick, mudstone and sandstone.		DG	0.80							
2.0												
			2.50									
3.0		Firm light brown CLAY with roots.										
			3.20									
		Soft grey/green sandy CLAY.		DG	3.50							
4.0			4.00									
		Trial pit completed at 4.00m bgl.										
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 4.00m

Date: 17/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: Water strike at 3.00m bgl.

Trial Pit Record

Trial Pit Number: TP107

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm) 0 25 50 75 100	Field / Laboratory Testing
		MADE GROUND: Topsoil.						
		MADE GROUND: Concrete slabs.						
1.0		MADE GROUND: Brown clayey gravel with occasional plastic bags. Gravel is fine to coarse angular of concrete, brick, sandstone and tiles.	1.00	DG	0.50			
		MADE GROUND: Ashy sand with demolition rubble of glass, tile, brick and pottery.		DG	1.20			
2.0								
		MADE GROUND: Soft light brown clay with cobbles of brick and concrete.	2.50					
3.0		Soft to firm grey/green CLAY.	2.85					
4.0			4.00					
		Trial pit completed at 4.00m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 4.00m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 17/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP108

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Topsoil.	0.15									
		MADE GROUND: Brown very gravelly clay. Gravel is fine to coarse angular to sub-angular of brick, mudstone, limestone and glass.	0.95	DG	0.30							
1.0		MADE GROUND: Dark grey sandy gravel. Gravel is of slate, brick, glass, ash, ceramic and concrete.	1.40									
		MADE GROUND: Re-inforced concrete.	2.30	DG	2.00							
2.0												
		Trial pit completed at 2.30m bgl.										
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.30m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 17/3/11

Status: Final

Trial Pit Record



Trial Pit Number: TP109

Date Started: 9/3/11

Project Number: 43933

Date Completed: 9/3/11

Contract Name: Barrow Brook, Clitheroe

Elevation AOD (m): N/A

Client: Rowland Homes

Co-ordinates: N/A

Engineer: Martin Daily

Excavation Method: JCB 3CX

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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Topsoil.	0.15									
		MADE GROUND: Brown/grey clayey gravel with occasional boulders. Gravel is fine to coarse sub-angular to sub-rounded of limestone and brick. Boulders are of concrete.		DG	0.30							
1.0			1.20									
		MADE GROUND: Brown gravelly clay. Gravel is of mudstone.		DG	1.50							
2.0			2.15									
		Coarse angular GRAVEL of grey mudstone.										
			2.90									
3.0		Trial pit terminated at 2.90m bgl on hard strata (bedrock).										
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.90m

Date: 17/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP110

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Topsoil.	0.15									
		MADE GROUND: Brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of mudstone, limestone and brick.	0.80	DG	0.30							
1.0		Stiff brown gravelly CLAY. Gravel is fine to medium angular to sub-angular of mudstone.		DG	1.50							
2.0		Trial pit terminated at 2.00m bgl on mudstone (bedrock).	2.00									
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.00m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 17/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP111

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm) 0 25 50 75 100	Field / Laboratory Testing
		MADE GROUND: Grey sandy gravel of limestone.	0.15					
		MADE GROUND: Brown gravelly clay. Gravel is fine to coarse angular to sub-rounded of mudstone, brick and limestone.	0.65	DG	0.50			
1.0		MADE GROUND: Light brown gravelly clay with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone. Cobbles are of brick.		DG	1.50			
2.0		Stiff brown gravelly CLAY. Gravel is medium to coarse angular to sub-angular of mudstone.	2.00					
			2.50					
3.0		Trial pit terminated at 2.50m bgl on mudstone (bedrock).						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.50m

Date: 17/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP112

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm) 0 25 50 75 100	Field / Laboratory Testing
		MADE GROUND: Grey gravelly topsoil.	0.15					
		MADE GROUND: Light brown slightly gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of limestone, mudstone and brick.	0.40	DG PP	0.40 0.50			0
1.0		Light brown gravelly CLAY with boulders. Gravel is medium to coarse sub-angular to sub-rounded of limestone and mudstone. Boulders are of limestone and mudstone.		PP DG	1.50 1.50			0.6
			1.95					
2.0		Trial pit terminated at 1.95m bgl on mudstone (bedrock).						
3.0								
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)
W. Water
U100. 100mm Undisturbed
U38. 38mm Undisturbed Sample
SPT. Standard Penetration Test

D. Disturbed
G. Amber Glass Jar / Bottle
CPT. Cone Penetration Test
U100. Blows (Recovery mm)
V. 40ml Glass Vial

T. Plastic Tub
N. 'N' Value
HV. Hand Shear Vane
PID. Photo Ionisation Detector
ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 1.95m

Date: 18/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP113

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Dark grey gravel. Gravel is medium to coarse angular of limestone.	0.15									
		MADE GROUND: Light brown grey mottled gravelly clay. Gravel is of mudstone and limestone.		DG	0.30							
1.0			1.25	PP	1.00							2.5
		Stiff light brown/grey very gravelly CLAY with boulders. Gravel is of mudstone and limestone.										
2.0			2.30	DG PP	2.00 2.00							2.1
		Trial pit terminated at 2.30m bgl on mudstone (bedrock).										
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.30m

Date: 18/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP114

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Dark grey gravelly topsoil.	0.20									
		MADE GROUND: Brown mottled grey very gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of mudstone, limestone and coal.		DG	0.30							
1.0				DG	1.00							
		Circa 1.20m bgl...Void containing old cable, plastic pipe and concrete blocks. Water-filled.	1.50			Strike at 1.35m bgl.						
		Trial pit completed at 1.50m bgl.										
2.0												
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 1.50m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: Water strike at 1.35m bgl.

Date: 18/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP115

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Dark grey gravelly topsoil.	0.20									
1.0		MADE GROUND: Black grey very gravelly sandy clay with occasional cobbles. Gravel is medium to coarse angular to sub-angular of brick, concrete, metal and slate. Cobbles are of concrete and brick.		DG	0.75							
			1.50	DG	1.40							
2.0		Trial pit terminated at 1.50m bgl on obstruction of tarmac, concrete and sandstone flags.										
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 1.50m

Date: 18/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP116

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Grey gravelly topsoil.	0.20	DG	0.15							
		MADE GROUND: Red gravelly clay. Gravel is fine to medium sub-angular to sub-rounded of mudstone.	0.35	DG	0.30							
1.0		Stiff brown very gravelly CLAY with cobbles and boulders. Gravel is medium to coarse sub-angular to sub-rounded of mudstone and limestone.										
2.0			2.15									
		Trial pit terminated at 2.15m bgl mudstone boulder obstruction (possible bedrock).										
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.15m

Date: 18/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP117

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Grey gravelly topsoil.										
		MADE GROUND: Brown very gravelly clay. Gravel is medium to coarse sub-angular to sub- rounded of brick, limestone and mudstone.	0.40	DG	0.30							
1.0		MADE GROUND: Ashy gravelly clay. Gravel is fine to coarse angular to sub-rounded of brick, clinker and slate.	1.05	PP DG	1.00 1.10							0.8
		MADE GROUND: Soft light brown slightly gravelly clay. Gravel is fine to coarse sub- angular to sub-rounded mudstone.	1.25									
2.0		Trial pit terminated at 1.25m bgl on hard footing.										
3.0												
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 1.25m

Date: 18/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP118

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
		MADE GROUND: Grey gravelly topsoil.										
1.0		MADE GROUND: Brown gravelly clay with occasional cobbles. Gravel is medium to coarse sub-angular to sub-rounded of brick, limestone and mudstone. Cobbles are of concrete.	1.30	PP	0.50							0.8
				DG	1.00							
2.0		MADE GROUND: Dark brown ashy gravelly clay with frequent cobbles and metal bars. Gravel is medium to coarse sub-angular to sub-rounded of clinker, limestone, brick and mudstone. Cobbles are of concrete.	2.35	PP	1.50							2.6
				DG	2.00							
3.0		Trial pit terminated 2.35m bgl on obstruction.										
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.35m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 18/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP119

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)	Field / Laboratory Testing
							0 25 50 75 100	
		MADE GROUND: Dark grey gravel. Gravel is medium to coarse sub-angular to sub-rounded of mixed lithology and glass.	0.50	DG	0.30	0.60m bgl.		
		MADE GROUND: Light brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of brick, limestone and glass.	0.90					
1.0		MADE GROUND: Grey ashy clayey gravel with occasional boulders. Gravel is fine to coarse angular to sub-rounded of brick, mudstone and slate. Boulders are of concrete.	1.90	DG	1.50			
2.0		MADE GROUND: Brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of brick, mudstone and slate. Rubber and metal bars at base.	2.30					
3.0		Trial pit terminated 2.30m bgl on obstruction.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.30m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: Seepage at 0.60m bgl.

Date: 18/3/11

Status: Final

Trial Pit Record

Trial Pit Number: TP120

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm)					Field / Laboratory Testing
							0	25	50	75	100	
1.0		MADE GROUND: Brown/grey gravelly clay with cobbles and boulders. Gravel is fine to coarse sub-angular to sub-rounded of brick, concrete, slate, sandstone and limestone. Cobbles are of brick. Boulders are of concrete.	2.30	DG	0.70							
2.0				DG	2.10							
3.0		Trial pit terminated 2.30m bgl on concrete obstruction.										
4.0												
5.0												
6.0												

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.30m

Date: 18/3/11

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Status: Final

Stability: Stable

Groundwater: None encountered.

Trial Pit Record

Trial Pit Number: TP121

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Excavation Method: JCB 3CX



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	Water Level (mbgl)	P.I.D (ppm) 0 25 50 75 100	Field / Laboratory Testing
		MADE GROUND: Light brown/grey gravelly clay with boulders. Gravel is fine to medium sub-angular to rounded of brick and limestone. Boulders are of limestone.	0.15					
		Brown clayey GRAVEL. Gravel is medium to coarse sub-angular to sub-rounded of mudstone and limestone.		DG	0.40			
1.0								
				DG	1.50			
2.0								
			2.30					
		Trial pit terminated 2.30m on mudstone boulders (possible bedrock).						
3.0								
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Dimensions: 1.00m x 1.00m x 2.30m

Services: Prior to excavation the trial pit location was scanned with a Cable Avoidance Tool (CAT).

Stability: Stable

Groundwater: None encountered.

Date: 18/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS201

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 10/3/11

Date Completed: 10/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
1.0		MADE GROUND: Firm brown gravelly clay with occasional roots. Gravel is medium to coarse sub-angular to sub-rounded of mudstone, sandstone and clinker.	1.00					
1.75		Firm to stiff brown/grey slightly gravelly CLAY. Gravel is medium to coarse sub-angular to sub-rounded of mudstone and limestone.	1.75					
2.80		Brown slightly clayey medium to coarse SAND.	2.80	SPT	2.80	25 over 70mm 55 over 55mm		
3.0		Probehole terminated at 2.80m bgl on very dense strata.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)
W. Water
U100. 100mm Undisturbed
U38. 38mm Undisturbed Sample
SPT. Standard Penetration Test

D. Disturbed
G. Amber Glass Jar / Bottle
CPT. Cone Penetration Test
U100. Blows (Recovery mm)
V. 40ml Glass Vial

T. Plastic Tub
N. 'N' Value
HV. Hand Shear Vane
PID. Photo Ionisation Detector
ES. Environmental Sample

Notes

Groundwater: None encountered.
Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).
Addition of water: None added.
Casing diameter: 110mm

Date logged: 14/3/11
Status: Final

Borehole Record - Window Sample

Probehole Number: WS202

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 10/3/11

Date Completed: 10/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
0.0		MADE GROUND: Soft brown slightly gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of mudstone and clinker.	0.15					
0.15		Firm brown/grey CLAY.						
1.0								
1.90			1.90					
2.0		Grey slightly clayey medium to coarse SAND.						
2.69			2.69	SPT	2.60-2.69	25 over 40mm 50 over 45mm N=50 for 45mm		
3.0		Probehole terminated at 2.69m bgl on very dense strata.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 14/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS101

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Grey clayey gravel. Gravel is medium to coarse angular of limestone.	0.20					
		MADE GROUND: Firm to stiff light brown grey mottled gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of coal, brick, concrete and sandstone.	0.90	DG	0.50			
1.0		MADE GROUND: Firm brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of sandstone and brick.		SPT	1.00-1.45	2/2/1/1/1 N=4		
				DG	1.50			
2.0		Circa 2.00m bgl...Very stiff.		SPT	2.00-2.45	10/8/5/7/7/11 N=30		
3.0				SPT	3.00-3.45	8/2/2/1/1/1 N=5		
		Circa 3.70m bgl...very stiff.	3.70	SPT	3.70	25 over 15mm 50 over 25mm N=50 for 25mm		
4.0		Probehole terminated at 3.70m bgl due to refusal.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 17/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS102

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Grey gravelly topsoil.	0.15					
		MADE GROUND: Brown/grey gravelly clay. Gravel is of brick, sandstone and mudstone.		DG	0.40			
1.0				SPT	1.00-1.45	1/2/2/2/1 N=7		
		MADE GROUND: Grey slightly gravelly clay. Gravel is of brick, sandstone and mudstone.	1.50					
2.0				SPT	2.00-2.45	1/1/2/2/1/2 N=7		
3.0				SPT	3.00-3.45	3/6/5/6/4/3 N=18		
4.0				DG SPT	4.00-4.45	5/2/3/7/6/8 N=24		
			4.45					
5.0		Probehole completed at 4.45m bgl.						
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 17/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS103

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Dark grey clayey fine to medium angular to sub-angular gravel.	0.30					
		MADE GROUND: Soft to firm brown gravelly clay. Gravel is fine to coarse sub-angular to sub-rounded of brick and limestone.		DG	0.50			
1.0			1.15	SPT	1.00-1.45	5/4/4/2/1/1 N=8		
		MADE GROUND: Grey/brown sandy gravelly clay. Gravel is fine to coarse angular to sub-rounded of limestone, brick, clinker and mudstone.		DG	1.50			
2.0			2.50	SPT	2.00-2.45	1/2/1/3/3/2 N=9		
		MADE GROUND: Dark brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of brick, sandstone and clinker.		DG	2.70			
3.0			3.50	SPT	3.00-3.45	1/1/1/1/1/1 N=4		
		Soft to firm grey/green slightly sandy CLAY.						
4.0			4.45	SPT	4.00-4.45	1/1/1/1/1/1 N=4		
		Probehole completed at 4.45m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 17/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS104

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
0.0		MADE GROUND: Clayey gravelly topsoil.		DG	0.50			
1.0		MADE GROUND: Firm brown gravelly clay. Gravel is of brick, mudstone, sandstone and coal.		SPT	1.00-1.45	1/1/2/2/1/2 N=7		
2.0			2.20	SPT	2.00-2.45	1/1/1/1/1/1 N=4		
3.0		Soft to firm grey/light brown gravelly CLAY. Gravel is fine to medium angular to sub-angular of mudstone.		DG	2.30			
4.0				SPT	3.00-3.45	6/5/6/5/4/4 N=19		
4.45			4.45	SPT	4.00-4.45	9/13/16/25/9 over 20mm N=50 for 170mm		
5.0		Probehole completed at 4.45m bgl.						
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 17/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS105

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Grey gravelly topsoil.	0.15					
1.0		Firm light brown slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded of coal, sandstone and mudstone.		DG SPT	1.00 1.00-1.45	1/1/1/1/1 N=4		
2.0		Circa 2.00m bgl...Very stiff.		DG SPT	2.00 2.00-2.45	12/12/9/8/8/10 N=35		
			2.50					
3.0		Probehole completed at 2.50m bgl.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Additon of water: None added.

Casing diameter: 110mm

Date logged: 17/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS106

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Grey gravel of limestone.						
		MADE GROUND: Brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of limestone, brick and mudstone.	0.70	DG	0.40			
1.0		Grey/brown gravelly CLAY with cobbles. Gravel is fine to coarse angular to sub-rounded of limestone and mudstone. Cobbles are angular to sub-rounded of limestone and mudstone.		SPT	1.00-1.45	6/5/3/3/3 N=12		
2.0				DG	1.50			
				SPT	2.00-2.45	6/11/10/13/13/14 N=50		
			2.45					
3.0		Probehole completed at 2.45m bgl.						
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 17/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS107

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Brown gravel. Gravel is medium to coarse angular to sub-angular of mixed lithology.	0.15					
		MADE GROUND: Firm to stiff brown very gravelly clay. Gravel is medium to coarse angular to sub-angular of limestone, brick, sandstone and mudstone.		DG	0.50			
1.0		Between 1.00-1.20m bgl...Soft.		SPT DG	1.00-1.45 1.20	9/16/14/10/7/16 N=47		
		Very stiff brown/red gravelly CLAY with cobbles. Gravel is fine to coarse angular to sub-rounded of sandstone.	1.60	SPT	2.00-2.45	9/6/6/20/16/8 for 50mm N=50 for 275mm		
2.0		Probehole terminated at 2.00m bgl due to refusal.	2.00					
3.0								
4.0								
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 18/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS108

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Soft brown slightly sandy gravelly clay with roots. Gravel is fine to coarse sub-angular to sub-rounded of limestone and mudstone.	0.60	PP DG	0.50 0.50	0		
1.0		Stiff brown gravelly CLAY with cobbles. Gravel is medium to coarse sub-angular to sub-rounded of limestone. Cobbles are of limestone.		PP SPT	1.00 1.00-1.45	1.2 2/3/5/4/5/5 N=19		
2.0				DG	1.50			
				PP SPT	2.00 2.00-2.45	3.0 8/14/17/12/9/7 N=45		
3.0				PP SPT	3.00 3.00-3.45	2.8 10/9/11/10/10/11 N=42		
			3.45					
4.0		Probehole completed at 3.45m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 18/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS109

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Grey gravelly topsoil.	0.15					
		MADE GROUND: Firm brown gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of clinker and mixed lithology.	0.50	DG PP	0.40 0.50	3.6		
1.0		MADE GROUND: Firm brown sandy gravelly clay. Gravel is medium to coarse angular to sub-angular of limestone coal and brick.	1.60	PP SPT	1.00 1.00-1.45	2.5 2/2/3/3/1/1 N=8		
2.0		MADE GROUND: Very stiff brown gravelly sandy clay. Gravel is medium to coarse angular to sub-angular of limestone, sandstone and brick.		PP	1.50	1.2		
				DG PP SPT	2.00 2.00 2.00-2.45	>4.5 11/9/8/7/5/5 N=25		
3.0				PP SPT	3.00 3.00-3.45	>4.5 5/5/8/13/12/11 N=44		
			3.45					
4.0		Probehole completed at 3.45m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 18/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS110

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



Osprey House
Pacific Quay
Broadway
Manchester, M50 2UE
Tel: 0161 868 1300 / Fax: 0161 868 1301
www.recltd.co.uk

SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
0.0		MADE GROUND: Grey gravelly topsoil. Gravel is of mixed lithology.		PP DG	0.50 0.50			
1.0		MADE GROUND: Firm grey gravelly clay. Gravel is medium to coarse sub-angular to sub-rounded of limestone, brick, mudstone and clinker.		PP SPT	1.00 1.00-1.45	2/2/3/2/2/2 N=9		
2.0		Below circa 2.00m bgl...Very stiff.		DG	1.50			
3.0				PP SPT	2.00 2.00-2.45	2/2/4/5/5/8 N=22		
3.45			3.45	PP SPT	3.00 3.00-3.45	25 over 40mm/50 over 20mm		
4.0		Probehole completed at 3.45m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 18/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS111

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
0.0		MADE GROUND: Grey gravelly topsoil. Gravel is of mixed lithology.		DG	0.25			
1.0		MADE GROUND: Soft brown gravelly clay. Gravel is medium to coarse angular to sub-rounded of brick, limestone and mudstone.	1.20	PP SPT	1.00 1.00-1.45	2.0 1/2/1/1/2/2 N=6		
2.0		MADE GROUND: Soft to firm light brown gravelly clay. Gravel is fine to coarse angular to sub-rounded of mudstone.	2.20	DG	1.30			
3.0		Stiff grey gravelly CLAY. Gravel is medium to coarse angular to sub-rounded of mudstone and sandstone.	2.20	PP	2.00 2.00-2.45	3.6 11/11/10/10/9/8 N=37		
3.0			3.45	SPT	2.80-3.25	13/12/ over 60mm 18/18/14 over 55mm N=50 for 205mm		
3.0			3.45	PP	3.00	1.0		
4.0		Probehole completed at 3.45m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 18/3/11

Status: Final

Borehole Record - Window Sample

Probehole Number: WS112

Project Number: 43933

Contract Name: Barrow Brook, Clitheroe

Client: Rowland Homes

Engineer: Martin Daily

Date Started: 9/3/11

Date Completed: 9/3/11

Elevation AOD (m): N/A

Co-ordinates: N/A

Drilling Equipment: Mini tracked window sampler rig



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SUBSURFACE PROFILE

SAMPLES AND IN-SITU TESTING

Depth (mbgl)	Legend	Description	Depth of Strata (mbgl)	Type	Depth (mbgl)	In-Situ Testing SPT / U100	Water Level (mbgl)	Monitoring Installation / Backfill
		MADE GROUND: Clayey gravelly topsoil.	0.15					
		Stiff brown/light brown slightly gravelly CLAY. Gravel is medium to coarse angular to sub-rounded of mudstone and limestone.		DG	0.30			
1.0				SPT	1.00-1.45	2/3/3/6/5/4 N=18		
			1.75					
2.0		Very stiff grey gravelly CLAY. Gravel is medium to coarse angular to sub-angular of mudstone.		SPT	2.00-2.45	8/9/12/13/10/12 N=47		
				DG	2.50			
3.0				SPT	2.80-3.25	20/5 over 20mm 22/24/4 over 10mm		
			3.45					
4.0		Probehole completed at 3.45m bgl.						
5.0								
6.0								

Key

B. Bulk (Bag)

W. Water

U100. 100mm Undisturbed

U38. 38mm Undisturbed Sample

SPT. Standard Penetration Test

D. Disturbed

G. Amber Glass Jar / Bottle

CPT. Cone Penetration Test

U100. Blows (Recovery mm)

V. 40ml Glass Vial

T. Plastic Tub

N. 'N' Value

HV. Hand Shear Vane

PID. Photo Ionisation Detector

ES. Environmental Sample

Notes

Groundwater: None encountered.

Services: Prior to drilling the location was scanned with a cable avoidance tool (CAT).

Addition of water: None added.

Casing diameter: 110mm

Date logged: 18/3/11

Status: Final

APPENDIX V
SOIL AND GROUNDWATER ANALYTICAL 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

Certificate of Analysis

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

Report Number: Second supplement to 230963-1

Date of Report: 23-Mar-2011

Customer: Resource Environmental Consultants Ltd
Osprey House
Pacific Quay
Broadway
Salford
M50 2UE

Customer Contact: Mr Martin Dyer

Customer Job Reference: 43933

Date Job Received at SAL: 11-Mar-2011

Date Analysis Started: 15-Mar-2011

Date Analysis Completed: 21-Mar-2011

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



1549

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager

Issued by :
Mr Ross Walker
Customer Services Manager

Soil	Analysed as Soil
Total and Speciated USEPA16 PAH	

SAL Reference					230963 003	230963 007	230963 009	230963 016	230963 021	230963 024	230963 025
Customer Sample Reference					TP102 0.5	TP104 2.0	TP105 0.3	TP108 2.0	TP111 0.5	TP112 1.5	TP113 0.3
Date Sampled					09-MAR-2011	09-MAR-2011	09-MAR-2011	09-MAR-2011	09-MAR-2011	10-MAR-2011	10-MAR-2011
Determinand	Method	Test Sample	LOD	Units							
Naphthalene	T149	AR	0.01	mg/kg	0.01	0.08	0.04	0.08	<0.01	<0.01	<0.01
Acenaphthylene	T149	AR	0.01	mg/kg	<0.01	0.12	0.01	0.02	<0.01	<0.01	<0.01
Acenaphthene	T149	AR	0.01	mg/kg	0.01	0.02	0.06	0.08	<0.01	<0.01	<0.01
Fluorene	T149	AR	0.01	mg/kg	0.01	0.05	0.06	0.05	<0.01	<0.01	<0.01
Phenanthrene	T149	AR	0.01	mg/kg	0.13	0.32	0.83	0.74	0.01	<0.01	0.01
Anthracene	T149	AR	0.01	mg/kg	0.03	0.31	0.22	0.19	<0.01	<0.01	<0.01
Fluoranthene	T149	AR	0.01	mg/kg	0.22	1.0	1.7	1.2	0.01	0.01	0.01
Pyrene	T149	AR	0.01	mg/kg	0.19	0.93	1.4	1.0	0.01	0.01	0.01
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	0.11	0.85	0.54	0.40	<0.01	<0.01	<0.01
Chrysene	T149	AR	0.01	mg/kg	0.11	0.78	0.50	0.41	<0.01	<0.01	<0.01
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	0.19	1.5	1.1	0.87	0.02	0.01	0.01
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	0.09	0.72	0.44	0.34	0.01	0.01	<0.01
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	0.05	0.37	0.34	0.28	0.01	0.01	<0.01
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	0.01	0.11	0.07	0.06	<0.01	0.01	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	0.06	0.38	0.41	0.34	<0.01	<0.01	<0.01
PAH(total)	T149	AR	0.01	mg/kg	1.2	7.5	7.7	6.1	0.07	0.06	0.04

Soil	Analysed as Soil
Total and Speciated USEPA16 PAH	

SAL Reference					230963 033	230963 042	230963 047	230963 051	230963 055	230963 061
Customer Sample Reference					TP117 0.3	TP121 1.5	WS103 0.5	WS104 2.3	WS106 1.5	WS109 2.0
Date Sampled					10-MAR-2011	10-MAR-2011	09-MAR-2011	09-MAR-2011	09-MAR-2011	10-MAR-2011
Determinand	Method	Test Sample	LOD	Units						
Naphthalene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01	0.39
Acenaphthylene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.01	<0.01	<0.01	0.03
Acenaphthene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01	0.14
Fluorene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01	0.11
Phenanthrene	T149	AR	0.01	mg/kg	0.01	<0.01	0.23	0.01	0.01	1.2
Anthracene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.06	<0.01	<0.01	0.43
Fluoranthene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.38	0.01	<0.01	1.7
Pyrene	T149	AR	0.01	mg/kg	0.01	<0.01	0.35	0.01	<0.01	1.6
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.20	<0.01	<0.01	1.1
Chrysene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.18	<0.01	<0.01	0.97
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	0.01	<0.01	0.32	0.01	<0.01	1.8
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.16	<0.01	<0.01	0.88
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.09	<0.01	<0.01	0.48
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01	0.11
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	<0.01	<0.01	0.10	<0.01	<0.01	0.55
PAH(total)	T149	AR	0.01	ma/kg	0.03	<0.01	2.2	0.04	0.01	11

Index to symbols used in Second supplement to 230963-1

Value	Description
AR	As Received
N.D.	Not Detected
9	LOD raised due to dilution of sample
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplemental report issued to correct the sampling dates for samples 001-022
Asbestos in samples 009, 047 and 061: Loose fibres found within soil.

Method Index

Value	Description
T7	Probe
T54	GC/MS (Headspace)
T6	ICP/OES
T27	PLM
T8	GC/FID
T149	GC/MS (SIR)
T21	OX/IR
T4	Colorimetry

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Cadmium	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Chromium	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Lead	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Mercury	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Selenium	T6	AR	3	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Copper	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Nickel	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Zinc	T6	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
pH	T7	AR			U	003,007,009,016,021,024-025,033,042,047,051,055,061
SO4(Total)	T6	AR	0.01	%	N	003,007,009,016,021,024-025,033,042,047,051,055,061
SO4(2:1)	T6	AR	0.1	g/l	N	003,007,009,016,021,024-025,033,042,047,051,055,061
Cyanide(Total)	T4	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Phenols(Mono)	T4	AR	1	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Chromium VI	T6	AR	1	mg/kg	N	003,007,009,016,021,024-025,033,042,047,051,055,061
Naphthalene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Acenaphthylene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Acenaphthene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Fluorene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Phenanthrene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Anthracene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Fluoranthene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Pyrene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Chrysene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
PAH(total)	T149	AR	0.01	mg/kg	U	003,007,009,016,021,024-025,033,042,047,051,055,061
TPH (C5-C6)	T54	AR	0.1	mg/kg	N	003,007,009,016,021,025,033,042,047,051,055,061
TPH (C6-C8)	T54	AR	0.1	mg/kg	N	003,007,009,016,021,025,033,042,047,051,055,061
TPH (C8-C10)	T54	AR	0.10	mg/kg	N	003,007,009,016,021,025,033,042,047,051,055,061
TPH (C10-C12)	T8	AR	1	mg/kg	U	003,007,009,016,021,025,033,042,047,051,055,061
TPH (C12-C16)	T8	AR	1	mg/kg	U	003,007,009,016,021,025,033,042,047,051,055,061
TPH (C16-C21)	T8	AR	1	mg/kg	U	003,007,009,016,021,025,033,042,047,051,055,061

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
TPH (C21-C35)	T8	AR	1	mg/kg	U	003,007,009,016,021,025,033,042,047,051,055,061
Asbestos ID	T27	AR			SU	003,007,009,016,021,025,033,042,047,055,061
Total Organic Carbon	T21	AR	0.1	%	N	003,055





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Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories

Certificate of Analysis

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Report Number: 231573-1

Date of Report: 28-Mar-2011

Customer: Resource Environmental Consultants Ltd
Osprey House
Pacific Quay
Broadway
Salford
M50 2UE

Customer Contact: Mr Martin Dyer

Customer Job Reference: 43933

Customer Site Reference: Barrow Brook

Date Job Received at SAL: 18-Mar-2011

Date Analysis Started: 21-Mar-2011

Date Analysis Completed: 28-Mar-2011

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



1549

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager

Issued by :
Mr Ross Walker
Customer Services Manager

SAL Reference: 231573 Project Site: Barrow Brook Customer Reference: 43933 Water Analysed as Water REC Ltd 002W						
SAL Reference				231573 001	231573 002	
Customer Sample Reference				UPSTREAM	DOWNSTREAM	
Date Sampled				17-MAR-2011	17-MAR-2011	
Determinand	Method	Test Sample	LOD	Units		
As (Dissolved)	T281	AR	0.2	µg/l	1.1	2.1
Cd (Dissolved)	T281	AR	0.02	µg/l	0.04	0.05
Cr (Dissolved)	T281	AR	1	µg/l	8	14
Pb (Dissolved)	T281	AR	0.3	µg/l	0.3	1.6
Hg (Dissolved)	T281	AR	0.05	µg/l	<0.05	<0.05
Se (Dissolved)	T281	AR	0.5	µg/l	1.5	1.6
Cu (Dissolved)	T281	AR	0.5	µg/l	3.1	7.9
Ni (Dissolved)	T281	AR	1	µg/l	4	5
Zn (Dissolved)	T281	AR	2	µg/l	6	16
pH	T7	AR			8.3	8.2
SO4(Total)	T6	AR	50000	µg/l	<50000	<50000
Cyanide(Total)	T4	AR	50	µg/l	<50	<50
Phenols(Mono)	T4	AR	100	µg/l	<100	<100
Chromium VI	T4	AR	30	µg/l	<30	<30

SAL Reference: 231573 Project Site: Barrow Brook Customer Reference: 43933 Water Analysed as Water Total and Speciated USEPA16 PAH						
SAL Reference				231573 001	231573 002	
Customer Sample Reference				UPSTREAM	DOWNSTREAM	
Date Sampled				17-MAR-2011	17-MAR-2011	
Determinand	Method	Test Sample	LOD	Units		
Naphthalene	T149	AR	0.01	µg/l	<0.01	<0.01
Acenaphthylene	T149	AR	0.01	µg/l	<0.01	<0.01
Acenaphthene	T149	AR	0.01	µg/l	<0.01	<0.01
Fluorene	T149	AR	0.01	µg/l	<0.01	<0.01
Phenanthrene	T149	AR	0.01	µg/l	<0.01	<0.01
Anthracene	T149	AR	0.01	µg/l	<0.01	<0.01
Fluoranthene	T149	AR	0.01	µg/l	<0.01	<0.01
Pyrene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(a)Anthracene	T149	AR	0.01	µg/l	<0.01	<0.01
Chrysene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(b/k)Fluoranthene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(a)Pyrene	T149	AR	0.01	µg/l	<0.01	<0.01
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	<0.01	<0.01
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	<0.01	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	<0.01	<0.01
PAH(total)	T149	AR	0.01	µg/l	<0.01	<0.01

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Fluoranthene	T149	AR	0.01	µg/l	U	001-002
Pyrene	T149	AR	0.01	µg/l	U	001-002
Benzo(a)Anthracene	T149	AR	0.01	µg/l	U	001-002
Chrysene	T149	AR	0.01	µg/l	U	001-002
Benzo(b/k)Fluoranthene	T149	AR	0.01	µg/l	U	001-002
Benzo(a)Pyrene	T149	AR	0.01	µg/l	U	001-002
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	U	001-002
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	U	001-002
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	U	001-002
PAH(total)	T149	AR	0.01	µg/l	U	001-002



APPENDIX VI
ORIGIN OF TIER 1 VALUES

ORIGIN OF REC TIER I VALUES

Constituent	Origin of Risk Assessment Value
Arsenic	2009 SGV
Cadmium	LQM CIEH 2 nd Edition 2009
Chromium	LQM CIEH 2 nd Edition 2009
Lead	Half 2003 EA SGV based on planned target blood lead level reduction to 5µg/l.
Mercury	2009 SGV
Nickel	2009 SGV
Selenium	Soil guideline value, DEFRA/Environment Agency
Copper	LQM CIEH 2 nd Edition 2009
Zinc	LQM CIEH 2 nd Edition 2009
Cyanide - Total	CLEA 1.06 Derived Value
Phenols - Total.	LQM CIEH 2 nd Edition 2009 – 1% SOM
Naphthalene	General Assessment Criteria (GAC) developed by CIEH / LQM the using CLEA 1-06 with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene ⁽ⁱ⁾	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C ₅ -C ₆ (aliphatic)	
TPH C ₆ -C ₈ (aliphatic)	
TPH C ₈ -C ₁₀ (aliphatic)	
TPH C ₁₀ -C ₁₂ (aliphatic)	
TPH C ₁₂ -C ₁₆ (aromatic)	
TPH C ₁₆ -C ₂₁ (aromatic)	
TPH C ₂₁ -C ₃₅ (aromatic)	

APPENDIX VII
GEOTECHNICAL LABORATORY TEST RESULTS

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