

**REPORT ON PHASE 2 GEO-ENVIRONMENTAL GROUND INVESTIGATION WORKS
UNDERTAKEN ON LAND LAND OFF
BUTTON LANE, WYTHENSHAW, MANCHESTER M23 0NA**

Prepared for:-

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**Q377 SFK (TLC1009) rep JG WCHG 171218
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**Project Quality Assurance
Information Sheet**

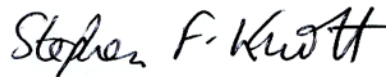
***Report on Phase 2 Geo-Environmental Ground Investigation Works undertaken on Land off
Button Lane, Wythenshawe, Manchester M23 0NA.***

Job Number : TLC1009 **Report Status** : Final

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1.0 INTRODUCTION

- 1.1 The Land Consultancy Limited (TLC) has been commissioned by Mr James Garner of the Wythenshawe Community Housing Group (by e-mail), to complete Phase 2 geo-environmental related ground investigation works for a parcel of land located just off Button Lane, Wythenshawe, Manchester M23 0NA. The site boundary (edged in red) is indicated on Drawing No. TLC1009/02 in Appendix A.
- 1.2 A Phase 1 geo-environmental desk study¹ report has already been completed for the property by TLC. The works undertaken by TLC as part of this Phase 2 investigation of the property follow on from the conclusions and recommendations made within the desk study. It is essential that the reader refers to the desk study for background information.
- 1.3 The site is intended to be redeveloped out with a single block of two-storey semi-detached housing. The development will include front and rear garden areas. A proposed development plan is presented in Drawing No. TLC1009/04.
- 1.4 The investigation has been commissioned to help discharge planning conditions which have been imposed on the development by Manchester City Council.
- 1.5 The ground investigation works which have been completed by TLC included the following:
- The sinking of 3no. windowless sampling boreholes in-situ testing and with soil sampling;
 - The excavation of 4no. hand pits with soil sampling;
 - The installation of 2no. of the boreholes with groundwater level monitoring and sampling equipment;
 - Carrying out soakaway testing within one of the hand pits in accordance with BRE Digest 365²;
 - Logging all of the strata encountered to BS 5930:2015³;
 - Obtaining groundwater levels and samples from the installed boreholes; and,
 - The scheduling of soil samples for laboratory testing.
- 1.6 TLC's remit also included:
- Factually reporting on the works undertaken;
 - Providing advice with respect to contamination and ground gases; and
 - Providing advice with respect to foundations, floorslab and buried concrete design, excavation stability and groundwater control.

1.7 General

- 1.7.1 It should be noted that the assessment of the factual data obtained as part of this investigation has been undertaken in accordance with generally accepted consulting practice, and in line with currently accepted national and international guidelines.

¹ Report dated August 2018, referenced Q261 SFK (TLC1009) rep MB MDAssoc 070818, and entitled 'Phase 1 Geo-Environmental Desk Study for Land off Button Lane, Wythenshawe, Manchester M23 0NA'.

² BRE Digest 365 entitle 'Soakaway design', dated 2003.

³ BSI Standards Publication BS 5930: 2015 entitled 'Code of practice for ground investigations',

- 1.7.2 The assessment and recommendations made in this report are limited to those, which can be made based on the findings of the available site investigation data. TLC assumes all third-party data to be true and correct. No responsibility can be accepted by TLC for inaccuracies in the information supplied by any other party.
- 1.7.3 The interpretation of site investigation data presented in this report involves the interpolation of data in between exploratory holes. No responsibility can be accepted by TLC for any unexpected variations that may occur in the ground conditions between the exploratory holes.
- 1.7.4 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may require a re-interpretation of the report in whole or in part after its original submission. TLC reserves the right to alter the conclusions and recommendations made in this report in the light of further information which may become available. This report is provided for the sole use of the client and is confidential to them and their professional advisors.

2.0 SITE LOCATION AND DESCRIPTION

- 2.1 At the time the site investigation works were carried out, the condition of the property was identical to that reported within TLC's desk study. Therefore, the reader is referred to the desk study report for information on site location and description.
- 2.2 General site location plans are presented in Drawing Nos. TLC1009/01a and 01b in Appendix A. More detailed plans of the site are presented in Drawing Nos. TLC1010/02 and 03.

3.0 FIELDWORKS

3.1 Introduction

- 3.1.1 A complete record of the soils recovered in the exploratory holes providing descriptions of strata, in-situ testing results and samples obtained is given on the record sheets in Appendix B (windowless sampling and hand pit logs). The exploratory hole locations are given on Drawing No. TLC1009/04 in Appendix A.
- 3.1.2 Each position was first checked against the services plans provided to TLC by the client, and then scanned using a Cable Avoidance Tool. Hand pits were also excavated to $\approx 1.20\text{m}$ depth prior to advancing the windowless sampling boreholes as a final check for the presence of services. It should be noted that the exploratory hole locations were restricted by the presence of buried electricity cables.

3.2 Windowless Sampling Boreholes and Hand Pit

- 3.2.1 3no. small diameter windowless sampling boreholes (WS1 to WS3) were sunk using a tracked Archway Competitor Dart rig to depths of either 5.45m bgl (WS1 and WS2) or 6.45m bgl (WS3). Boring commenced from the base of the hand pits excavated at each location.
- 3.2.2 Soil cores were recovered from each borehole in plastic liners which were subsequently split for logging and sampling purposes. The soils recovered from each borehole were logged by TLC to BS5930:2015.
- 3.2.3 Standard penetration tests (SPT's) were carried out at regular intervals within the boreholes. No corrections have been applied to the 'N' values displayed on the borehole logs. Hand held shear vane testing was also carried out on suitable samples of clay core recovered within the plastic core liners; the undrained shear strength values obtained (Cu values) are also presented on the borehole logs.
- 3.2.4 Upon completion, standpipe installations (35mm ID uPVC) were placed within WS2 and WS3 to facilitate subsequent groundwater level monitoring and sampling. Installation details are provided on the logs.
- 3.2.5 WS1 was backfilled with bored arisings following completion of soils logging and sampling.

3.3 Hand Pits (including Soakaway Test Pit)

- 3.3.1 3no. hand pits (HP1 to HP3) were excavated to depths of either 1.20m bgl (HP1 and HP3) or 1.30m bgl (HP2). The purpose of these hand pits was to enable the thickness and nature of the Made Ground to be proven at locations investigated, and to enable samples of Made Ground to be taken for laboratory analysis.
- 3.3.2 An additional hand excavated pit (SA1) was formed to enable soakaway testing to be carried out. This pit was 0.73m x 0.22m in plan area and it was excavated to 1.55m bgl. The intention was to advance the pit to $\approx 1.70\text{m}$ bgl; however, very gravelly sand and cobbles were encountered below 1.45m bgl which made deepening the pit below 1.55m bgl impossible using hand tools.
- 3.3.3 A perforated water level observation tube was placed within SA1 following excavation and then the pit was backfilled with washed 10mm pipe bedding gravel back up to 0.72m bgl. The purpose of the gravel was to maintain the dimensions of the test pit following water filling during each soakage test.

- 3.3.4 It should be noted that groundwater was not encountered within the soakaway test pit. Three soakage tests were carried out within the test pit; the water for each test was delivered rapidly from several 25litre containers. Standing water levels within the test pit following water filling were recorded using a solinst level logger.
- 3.3.4 The soils recovered in each test pit were logged by TLC to BS5930:2015; soil samples were taken from HP1-HP3 for subsequent laboratory analysis.
- 3.3.5 Upon completion, hand pit was backfilled with compacted excavated arisings.

3.4 Exploratory Hole Locations

- 3.4.1 As well as being positioned for general site coverage purposes, a number of exploratory holes were targeted to potential areas of concern highlighted by the desk study, as summarised in the table below:

Borehole	Reason Exploratory Hole Sunk at that Location
WS1	Sunk close to electricity substation located adjacent to the NW site boundary. Triangulated with WS2 & WS3 around the footprint of the proposed houses for foundation design purposes.
WS2	General site coverage purposes. Triangulated with WS1 & WS3 around the footprint of the proposed houses for foundation design purposes.
WS3	Sunk close to electricity substation located adjacent to the NW site boundary. Triangulated with WS1 & WS2 around the footprint of the proposed houses for foundation design purposes.
HP1	Sunk close to electricity substation located adjacent to the NW site boundary. General site coverage purposes.
HP2	Sunk close to electricity substation located adjacent to the NW site boundary. General site coverage purposes.
HP3	General site coverage purposes.
SA1	Soakaway test location.

3.5 Groundwater Level Monitoring and Sampling

- 3.5.1 The response zones within the installed exploratory holes are summarised below:

Hole ID	Response Zone (bgl)	Depth (bgl)	Geology
WS2	1.00 to 4.02	1.00 to 3.40m	Glaciofluvial Sheet Deposits (gravelly SAND).
		3.40 to 4.02m	Glacial Till (slightly sandy and gravelly CLAY).
WS3	1.00 to 3.60m	1.00 to 3.60m	Glaciofluvial Sheet Deposits (gravelly SAND).
		3.60 to 3.92	Glacial Till (slightly sandy and gravelly CLAY).

- 3.5.2 'Spot' monitoring of the installations was carried out on 5th December 2018 using a Geotechnical Instruments dip-meter.
- 3.5.4 A groundwater sample was obtained from WS3 on 5th December 2018 using a bailer. The groundwater sample was obtained after three well volumes of groundwater had been removed from the borehole.

3.6 Laboratory Testing

- 3.6.1 All of the soil samples to be subjected to contamination testing were transported to the testing laboratory in cool boxes kept $<4^{\circ}\text{C}$. The majority of the tests undertaken at the laboratory are MCERTS and UKAS accredited.
- 3.6.2 A number of samples were also forwarded onto an UKAS accredited geotechnical testing laboratory for analysis.

4.0 GROUND CONDITIONS

4.1 The desk study indicated that the natural geology beneath the site was likely to comprise of Devensian Glaciofluvial Sheet Deposits (potentially >5m thick) probably over Devensian Glacial Till (diamicton), over Tarporley Siltstone (mudstone, siltstone and sandstone).

4.2 The strata types encountered during the investigation are summarised below:

4.3 Made Ground

4.3.1 Made Ground was encountered within all of the exploratory holes formed across the site to depths of between 0.60m (WS2) and 1.10m (HP2); the average thickness of the Made Ground was 0.80m.

4.3.2 The Made Ground typically comprised of a black or dark grey gravelly or very gravelly SAND with a low or medium cobble content. The Made Ground was often noted to be slightly organic rich to organic rich; rootlets (are rarely roots) were recorded at some locations. The Made Ground was noted to be ashy or possibly ashy in several of the exploratory holes.

4.3.3 Gravels predominantly comprised of brick and sandstone. Other gravels which were less commonly observed included concrete, clinker, cinders, pottery, glass, coal, tarmac, ceramic, quartzite and slate. Cobbles comprised of sandstone, brick or concrete. Wire, a metal curtain rail, and plastic food wrapper and foil fragments were also noted in WS1; an iron bar was encountered in SA1; and, frequent metal fragments were recorded in WS3 between 0.45-0.55m bgl.

4.3.4 Reworked Glaciofluvial Sheet Deposits (yellowish brown gravelly SAND which contained a ceramic fragment) were recorded in WS1 (0.25-0.75m bgl). Similar materials (brownish grey gravelly SAND) were recorded in WS3 (0.55-0.70m bgl); gravels in both boreholes comprised of sandstone and quartzite.

4.4 Relic Topsoil

4.4.1 Slightly organic rich black SAND (0.20-0.30m thick), which was locally slightly silty and slightly gravelly, was recorded beneath the Made Ground in HP1 (at 0.90m bgl), in HP3 (at 0.65m bgl), in WS1 (at 0.75m bgl) and WS2 (at 0.60m bgl). This Relic topsoil material is considered to represent the former ground surface level.

4.4.2 The observed gravels comprised of rounded or subrounded sandstone.

4.5 Glaciofluvial Sheet Deposits

4.5.1 Glaciofluvial Sheet Deposits are considered to have been encountered beneath the Made Ground or Relic Topsoil within all of the exploratory holes formed. This material was proven to the base of the hand excavated pits to depths of between 1.20-1.55m bgl. This material was penetrated in the boreholes at depths of between 3.40m bgl (WS2) and 4.80m bgl (WS1); the thickness range of this deposit was 2.50m (WS2) to 3.80m (WS1).

4.5.2 These deposits comprised of a slightly gravelly to a very gravelly SAND with a low cobble content. Gravels and cobbles comprised of rounded or subrounded sandstone and quartzite. The following colours were recorded for this material: pale brown, brown, greyish brown, dark greyish brown, pale yellowish brown, brownish grey and grey.

4.5.3 A 4cm thick reddish brown sandy clay band was encountered within this deposit at 2.75m in WS1.

4.5.4 SPT N values obtained in the boreholes from within this deposit are summarised below:

- 1.20-1.65m – N = 13 to 30 (3no. results obtained - average = 22)
- 2.00-2.45m – N = 14 to 24 (3no. results obtained - average = 19)
- 3.00-3.45m – N = 5 to 14 (3no. results obtained - average = 9)
- 4.00-4.45m – N = 12 (1no. result obtained)

4.5.5 The N values indicate that the Glaciofluvial Sheet Deposits are medium dense to dense to ≈2.50m bgl, and loose to medium dense below this depth.

4.6 Glacial Till

4.6.1 Soils materials considered to represent Glacial Till were encountered within the boreholes below the Glaciofluvial Sheet Deposits. The Glacial Till was proven only (i.e. not penetrated) to depths of either 5.45m bgl (WS1 and WS2) or 6.45m bgl (WS3).

4.6.2 The Glacial Till was encountered as a brown slightly sandy and gravelly CLAY. Gravels comprised of sandstone, mudstone and siltstone.

4.6.3 The consistency of the Glacial Till ranged from soft to firm to firm.

4.6.4 SPT N values obtained within the boreholes within this deposit are summarised below:

- 4.00-4.45m – N = 12 and 13 (2no. results obtained)
- 5.00-5.45m – N = 9 (3no. results obtained)
- 6.00-6.45m – N = 8 (1no. result obtained)

4.6.5 The N values suggest that the Glacial Till was of medium strength.

4.6.6 Undrained shear strength C_u values obtained within the Glacial Till using a hand-held shear vane ranged between 40kPa to 58kPa, which again indicate that the Glacial Till tested was of medium strength.

4.7 Tarporley Siltstone

4.7.1 Rockhead was not encountered during the site investigation works.

4.7 Groundwater

4.7.1 Groundwater strikes were made within the Glaciofluvial Sheet Deposits encountered within the boreholes at depths of between 2.35-2.65m bgl. Rates of groundwater ingress were estimated to be fast.

4.7.2 Standing water levels recorded within the boreholes several hours after the water strikes had been made ranged from 2.38-2.68m bgl. Standing water levels recorded within WS2 and WS3 on 5th December 2018 of 2.33mbgl and 2.65m bgl respectively were obtained.

4.8 Contamination Observations

4.8.1 No visual or olfactory evidence for the presence of potentially mobile contamination (e.g. solvents, hydrocarbons etc) was associated with any of the soils or groundwater encountered.

- 4.8.2 Anthropogenic components recorded within the Made Ground included: ash, cinder, clinker, brick, concrete, ceramic, pottery, tarmac, ceramic, glass, wire, foil fragments, metal pieces, an iron bar and plastic food wrappers.

5.0 CHEMICAL LABORATORY TESTING

5.1 Selected soil samples were analysed for the determinands indicated in the table below.

Testing Schedule for Soils Samples from **Button Lane, Wythenshawe** which were recovered on **26th November 2018**
TLC Job No.: **TLC1009**

		Samples												
Determinand(s)	Units	WS1 0.15 MG	WS1 0.90m RT	WS1 1.50m GFD	WS2 0.30m MG	WS3 0.20m MG	WS2 0.70m RT	WS3 0.40m MG	HP1 0.30m MG	HP1 0.80m MG	HP2 0.50m MG	HP3 0.50m MG	No.	
Soils Screening Suite (see below)	mg/kg	-	-	-	1	1	-	-	1	-	1	1	5	
Chromium (vi)	mg/kg	-	-	-	1	1	-	-	-	-	-	1	3	
Asbestos Fibre Screen	-	1	-	-	1	1	-	-	1	-	-	1	5	
TOC	% w/w C	-	-	-	-	-	1	1	-	-	-	-	2	
TPH (CWG)	mg/kg	-	-	-	1	1	-	-	-	-	-	-	2	
PCB-EC7	mg/kg	1	-	-	-	1	-	-	-	-	-	-	2	
BRE Digest SD-1 reduced Suite	-	-	1	1	1	-	-	-	-	1	-	-	4	

Any problems with the schedule then please ring:

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M: 07771 800859
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Key

MG	Made Ground
RT	Relic Topsoil
GFD	Glaciofluvial Deposits

Soil Screening Suite includes:

Arsenic
Cadmium
Chromium (total)
Copper
Lead
Mercury
Nickel
Selenium
Zinc
Boron
pH
Sulphate (total)
TOC
Cyanide
Phenols
TPH (C10-C40)
Speciated PAH

BRE Digest SD-1 Reduced Suite includes:

Total sulphate
Total sulphur
Water soluble sulphate (2:1 extract)
pH value

BRE Digest SD-1 Full Suite includes:

Total sulphate
Total sulphur
Water soluble sulphate (2:1 extract)
pH value
Water soluble chloride (2:1 extract)
Water soluble nitrate (2:1 extract)
Water soluble magnesium (2:1 extract)

5.2 The sample of groundwater which was obtained from WS3 on 5th December 2018 was analysed for pH value and sulphate content only.

5.3 The chemical testing results obtained are presented in Appendix C.

6.0 CHEMICAL TESTING AND GROUND GASES - RESULTS AND ASSESSMENT

6.1 Generic Quantitative Risk Assessment

6.1.1 Human Health Assessment

6.1.1.1 In line with CLR11⁴, a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the measured concentrations of contaminants from the chemical analysis.

6.1.1.2 The GQRA comprises the comparison of the measured concentrations with Generic Assessment Criteria (GAC). The GAC used for the assessment of soil concentrations comprise Soil Guideline Values (SGVs) and values that have been derived using the CLEA⁵ model (v 1.06) adopting the appropriate assumptions and input parameters provided in the Environment Agency SR series of reports⁶ and with reference to the LQM/CIEH⁷ and EIC/AGS/CL:AIRE reports⁸. If exceeded, measured concentrations have been compared to the recently produced C4SLs⁹ where available, with the exception of lead where the C4SL value has been adopted due to the withdrawal of the SGV, as it was not considered to be sufficiently health protective. With respect to soil risk assessment, TLC has adopted the following hierarchy:

- C4SLs
- LQM/CIEH S4ULs
- EIC/AGS/CL:AIRE screening levels

6.1.1.3 7no. Made Ground samples were analysed for Total Organic Carbon (TOC) content. Soil organic matter (SOM) contents were calculated from the TOC results. The SOM contents which have been derived from the TOC results are summarised in the table below; appropriate GAC for the SOM content indicated have been used to carry out the human health risk assessment.

Soil Type	No. of Samples	Average	Std Dev	Max	Min	GAC used for SOM Content
		Sample SOM Concentration				
Made Ground	7	4.6%	2.1%	7.5%	2.8%	2.5

6.1.1.4 The Made Ground PAH congener results were analysed using the LQM PAH profiling tool to determine whether using benzo(a)pyrene (BaP) as a surrogate marker for PAH contamination derived from coal tar was appropriate. The graph below presents the results of this assessment. Although the assessment was affected by several non-detects, as all of

⁴ Environment Agency/Department for Environment, Food and Rural Affairs, 2004, Model Procedures for the Management of Land Contamination, CLR11

⁵ <https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool>

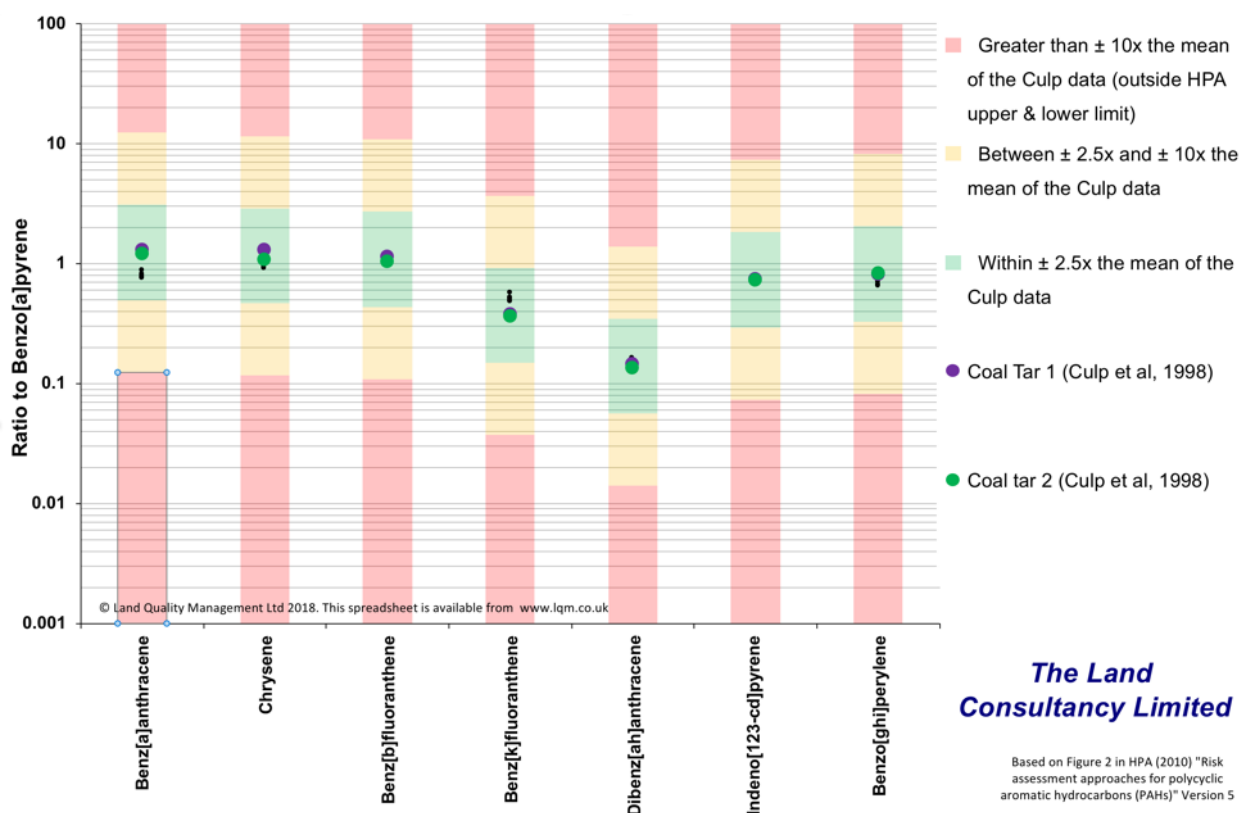
⁶ Environment Agency, 2009, Human health toxicological assessment of contaminants in soil (SR2) & Updated technical background to the CLEA model (SR3)

⁷ Nathanail, C.P., McCaffrey, C., Gillet, A.G, Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

⁸ The EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment. December 2009.

⁹ Defra (2014a & b). SP1010 – Development of Category 4 Screening Levels for assessment of land affected by contamination.

the results plot within $\pm 2.5x$ the mean of the Culp PAH data, the use of BaP as a surrogate marker for PAH contamination was considered to be justified. It should be noted that non-detect concentrations were treated as being equal to the laboratory detection limit.



- 6.1.1.5 The site is proposed to be developed out with a block of semi-detached housing which will incorporate front and rear garden areas. The chemical testing results obtained have therefore been compared to screening concentrations derived for the residential with plant uptake scenario.
- 6.1.1.6 The summary table in Appendix C present the results of the human health GQRA. No elevated determinand concentrations were recorded within respect to human health and statistical analysis of the chemical testing data was not considered necessary.
- 6.1.1.7 5no. Made Ground samples were screened for asbestos fibres. No asbestos fibres were detected.
- 6.1.1.8 Two Made Ground samples (WS2 @ 0.30m and WS3 @ 0.20m) recorded TPH C10-C40 screening concentrations of 1,675mg/kg and 1,737mg/kg respectively, suggesting that there was a possibility that elevated concentrations of aliphatic and/or aromatic petroleum hydrocarbon fractions could be present within these samples. Speciation of this hydrocarbon contamination (TPH CWG aromatic and aliphatic splits) indicated that no elevated concentrations were present with respect to human health.
- 6.1.1.9 Two Made Ground samples (WS1 @ 0.15m and WS3 @ 0.20m) were analysed for PCB contamination. PCB congener concentrations were below detection limits within both samples.

6.2 Phytotoxic Risk

6.2.1 No elevated phytotoxic concentrations of boron, copper, zinc or nickel were recorded within any of the Made Ground samples analysed.

6.2.2 Phytotoxicity screening concentrations (and their source) are presented in Appendix C.

6.3 Groundwater

6.3.1 Contamination testing of groundwater samples obtained from beneath the site was not considered necessary.

6.4 Buried Concrete

6.4.1 Risks to buried concrete are considered in sections 8.3 and 9.2.

6.5 Ground Gas

6.5.1 TLC's August 2018 Phase 1 desk study report did not indicate that the site was at significant risk from landfill type ground gases, and consequently, gas monitoring was not advised to be carried out as part of the site investigation works.

6.5.2 CL:AIRE RB17¹⁰ is commonly used to assess gas risk on low risk sites. Using RB17, gas risk is assessed using the average Made Ground thickness across a site, the age of the Made Ground and the TOC content of the Made Ground. For this site:

- The average Made Ground depth across the site is 0.80m.
- The Made Ground is likely to have been in place for >20 years.
- TOC contents for the Made Ground ranged between 1.36% and 4.35% (7no. samples analysed).
- TOC contents for the Relic Topsoil of 0.46% and 3.42% were obtained.

6.5.3 Anthropogenic components to the Made Ground included ash, cinders, clinker, brick, concrete, tarmac, metal fragments, foil, wire, iron, pottery, glass and ceramic. This material is not considered putrescible or degradable and is not considered to generate ground gas.

6.5.4 RB17 states that ash, clinker and coal can give high TOC results that do not represent the risk of gas emissions from such material (it is generally not degradable so cannot produce methane or carbon dioxide). The ash, cinders, clinker and coal observed at several locations within the Made Ground during the fieldworks may have contributed to the TOC contents recorded from some of the Made Ground samples.

6.5.5 Using the maximum TOC content obtained puts the site within Characteristic Situation 3 (CS3) of Table 1 of RB17.

¹⁰ CL:AIRE Research Bulletin RB 17 dated November 2012 and entitled 'A Pragmatic Approach to Ground Gas Risk Assessment'.

6.6 Risk Assessment

6.6.1 Risks to the potential receptors identified for site derived contamination (see the following table) have been classified with reference to CIRIA guidance C552¹¹ using the following risk classifications:

- High Risk – There is a high probability that severe harm could arise or is occurring to the designated receptor from an identified hazard.
- Moderate Risk – It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
- Low Risk – It is possible that harm could arise to a designated receptor from an identified hazard, but it is unlikely that this harm, if realised, would at worst be normally mild.

6.6.2 Where the pollutant linkage is considered to not be viable, then a negligible risk rating has been adopted. As such, the conceptual site model from the desk study has been updated to take into account the generic screening and risk assessment and is tabulated overleaf.

¹¹ CIRIA, 2001, Contaminated Land Risk Assessment – A Guide to Good Practice, C552

Source	Pathway	Receptor	Comment	Risk	Mitigation Measures	Residual Risk
Made Ground	– Dermal contact. – Inhalation of contaminated soil and dust. – Consumption of home grown produce – Inhalation of fibres.	– Future site residents	No elevated determinand concentrations were recorded. No asbestos fibres were detected.	Very Low	None required.	Very Low.
Made Ground	– Dermal contact. – Inhalation of contaminated soil and dust. – Inhalation of fibres.	– Construction and future site maintenance workers	No elevated determinand concentrations were recorded. No asbestos fibres were detected.	Very Low	None required.	Very Low
Made Ground	– Inhalation of contaminated soil and dust during the construction period. – Inhalation of fibres.	– Neighbouring residents/office workers	No elevated determinand concentrations were recorded. No asbestos fibres were detected.	Negligible	None required.	Negligible
Made Ground	– Leaching with offsite migration – Contact with contaminated leachate	– Off-site residents/office workers	No elevated soils determinand concentrations were recorded.	Negligible	None required.	Negligible
Made Ground	– Leaching with vertical migration	– Glaciofluvial Sheet Deposits Secondary A Aquifer	No elevated determinand concentrations were recorded with the Made Ground with respect to human health. It is unlikely that large quantities of contaminated leachate could be generated from beneath the site. There are no Environment Agency defined groundwater source protection zones within at least 1km of the site. No groundwater abstractions have been identified within at least 321m of the site.	Very Low	None required.	Very Low
Made Ground	– Leaching with vertical migration	– Tarporley Siltstone Secondary B Aquifer	No elevated determinand concentrations were recorded with the Made Ground with respect to human health. It is unlikely that large quantities of contaminated leachate could be generated from beneath the site. There are no Environment Agency defined groundwater source protection zones within at least 1km of the site. No groundwater abstractions have been identified within at least 321m of the site.	Negligible	None required.	Negligible

Source	Pathway	Receptor	Comment	Risk	Mitigation Measures	Residual Risk
Made Ground	Leaching with lateral migration	Potentially culverted stream (215m NW)	No elevated determinand concentrations were recorded with the Made Ground with respect to human health. It is unlikely that large quantities of contaminated leachate could be generated from beneath the site. This together with the fact that the potentially culverted stream is 215m from the site implies that it is unlikely to be at risk from the site.	Negligible	None required.	Negligible
Made Ground and Relic Topsoil	- Inhalation of hazardous gas concentrations. - Migration through permeable strata. - Build-up in confined areas.	- End users - Residents within adjacent property - Construction and Future maintenance workers.	No significant sources of ground gas were identified within TLC's August 2018 desk study. Gas risk to end users has been assessed in line with CL:AIRE RB17. Average depth of Made Ground across the site is 0.80m. The Made Ground is likely to have been in place for >20 years. TOC contents of the Made Ground of up to 4.35% have been recorded. Relic Topsoil TOC contents of up to 3.42% have been recorded.	Low to medium (End users) Very low (Residents in adjacent property) Low (Construction and future maintenance workers)	Install gas measures commensurate with CS3. None required. Take appropriate precautions in deep excavations.	Negligible Very low Very Low
Soil/Groundwater	Reaction	Buried concrete	Low pH and high sulphate concentrations can cause buried concrete to degrade and weaken.	Very Low	Use an appropriate specification of concrete to suite the ground conditions.	Negligible
Made Ground	- Ingestion of tainted water supply. - Degradation of plastic water supply pipes and seals.	- Future site residents - Pipe work	Low level organic contamination has been identified within the Made Ground.	Low/Medium	A United Utilities potable water pipe risk assessment will need to be completed to determine whether standard medium density polyethylene (MDPE) water pipe can be used. Alternatively use barrier pipe (e.g. protecta-line).	Negligible
Made Ground	Root uptake of phytotoxic contaminants.	Flora	No elevated concentrations of copper, zinc, boron or nickel were recorded within the Made Ground.	Negligible	No specific remedial measures required. However, the Made Ground is not considered to be suitable as a growing medium for flora within garden areas and topsoil will need to be imported.	Negligible

7.0 CONTAMINATION AND GROUND GASES – CONCLUSIONS AND RECOMMENDATIONS

7.1 Contamination

- 7.1.1 3no. small diameter boreholes (WS1-WS3) were sunk across the site to depths of either 5.45m bgl or 6.45m bgl, and 4no. pits (HP1-HP3 and SA1) were hand excavated to depths of between 1.20-1.55m bgl.
- 7.1.2 Made Ground (0.60-1.10m thick) was encountered at the surface which was underlain by a discontinuous horizon (0.20-0.30m thick) of Relic Topsoil; the Relic Topsoil in turn overlay Glaciofluvial Sheet Deposits 2.50-3.80m thick) and Glacial Till (diamicton). The Glacial Till was proven to the base of the boreholes. Groundwater strikes were made within the Glaciofluvial Deposits between 2.35-2.65m bgl.
- 7.1.3 The Made Ground typically comprised of an organic rich gravelly to very gravelly SAND which often contained cobbles. Anthropogenic components noted within the Made Ground included ash, cinders, clinker, brick, concrete, pottery, glass, ceramic, pieces of metal (including foil and wire), an iron bar and plastic food wrapper fragments. The Relic Topsoil comprised of a slightly organic rich SAND and almost certainly represents the former ground level. The Glaciofluvial Sheet Deposits were encountered as a gravelly SAND and the Glacial Till comprised of a brown slightly sandy and gravelly CLAY which was laminated below ≈6m bgl in WS3.
- 7.1.4 No visual or olfactory evidence for the presence of potentially mobile contamination (e.g. hydrocarbons, solvents etc) were recorded during the fieldworks.
- 7.1.5 The property is intended to be developed out with a housing block containing two demi-detached dwellings which will each incorporate front and rear garden areas.
- 7.1.6 Laboratory testing of the Made Ground recorded no elevated determinand concentrations with respect to human health. No asbestos fibres were recorded. No potentially phytotoxic concentrations of boron, nickel, zinc or copper were recorded from the Made Ground.
- 7.1.7 The chemical testing results and on-site fieldworks observations indicate that the Made Ground and perched groundwater beneath the site is unlikely to pose a risk to controlled waters.
- 7.1.8 Therefore, specific remedial measures are not considered necessary to reduce any risks that the Made Ground or groundwater beneath the site poses to controlled waters (nearby watercourses/aquifers), flora or to human health.
- 7.1.9 Despite the above, United Utilities will require that a risk assessment for potable water supply pipe will need to be completed by a contaminated land consultant if it is proposed to use standard medium density polyethylene (MDPE) water pipe. Completing this risk assessment may require that additional soil samples will need to be analysed from along the proposed route of the water pipe and at the depth at which it is intended to be laid. Alternatively, barrier pipe (e.g. protecta-line) could be used or standard pipes could be laid in trenches backfilled with clean inert material; independent validation would be needed to confirm that appropriate pipe and backfill materials have been used.

7.1.10 Although, the Made Ground on the site does not pose a significant risk to controlled waters, human health or to flora, as it is unlikely to be suitable for use growing medium in garden areas, clean and suitable for use topsoil type material will need to be imported into proposed garden areas.

7.1.11 It is advised that a design sulphate class of DS-1 is adopted for buried concrete; the ACEC classification of site is AC-1. (see section 9.2).

7.1.11 Risks to construction workers are considered to be managed through health and safety procedures including the CDM regulations. Standard health and safety precautions (as per HSE guidance¹²) should be adopted by all workers involved with site enabling and construction works, and future maintenance works. These should include as a minimum:

- Ensuring wind blow is minimised by dampening down exposed surfaces.
- Ensuring that all vehicles leaving the site are clean and if necessary have used a wheel wash.
- Wearing appropriate PPE.
- Limiting unauthorised access to the site.
- The provision and use of washing facilities for site staff, requirement for high standards of personal hygiene to be adopted by all site staff, particularly before and during meals.
- Restrict smoking to designated areas.

7.2 Ground Gas

7.2.1 A gas risk assessment has been carried out by TLC in accordance with RB17¹³.

7.2.2 Based off the encountered ground conditions, likely age of the Made Ground and laboratory testing results, TLC determined that the site should be placed within Characteristic Situation 3 (CS3) as presented within CIRIA report C665¹⁴.

7.2.3 Using the guidance within BS 8485:2015¹⁵, for CS3 and the proposed development a gas protection score of 4.5 will need to be achieved by the installation of gas protection measures. A score of 4.5 or greater can be achieved by the installation of:

- A reinforced cast in-situ suspended floor with minimal penetrations – will give 1 points worth of protection;

incorporating both a

- Passive subfloor gas dispersal layer (e.g.– formed by a clear void, polystyrene void former blanket, geo-composite void former blanket, or a no fines gravel layer with gas drains) - will give 1.5 to 2.5 points worth of protection;

¹² HSE (1991). 'Protection of workers and the general public during the development of contaminated land'. London HMSO.

¹³ CL:AIRE Research Bulletin RB 17 dated November 2012 and entitled 'A Pragmatic Approach to Ground Gas Risk Assessment'.

¹⁴ CIRIA report C665 dated 2007 and entitled 'Assessing risks posed by hazardous ground gases to buildings'.

¹⁵ BS 8485:2015 *Incorporating corrigendum No.1*. 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

and a

- gas resistant membrane – will give a further 2 points worth of protection.

7.2.4 Any gas protection measures should be approved by the building control and contaminated land sections of the Local Authority prior to installation. Documentary evidence that the gas protection measures have been adequately installed will need to be reviewed and approved by the Local Authority; a gas membrane fitting inspection/validation service is offered by TLC.

7.2.5 Construction workers should be made aware that elevated concentrations of ground gas (especially carbon dioxide on this site) could be present in any deep excavations. Risks to construction workers are considered to be managed through health and safety procedures including the CDM regulations.

7.2.6 Risks to residents residing within developments located within property adjacent/close to the site, from site derived gases are considered to be negligible.

7.3 Remedial Strategy Report

7.3.1 This will be required by Manchester City Council prior to any remedial related works being undertaken at this site.

7.3.2 The remedial strategy report would provide details of how the gas protection measures would be incorporated into the floorslab design, how services penetrations of the gas membrane would be dealt with, the type of gas membrane which would be used and how the gas measures would be validated.

7.3.3 The report would indicate how any imported soils would be validated.

7.4 Remediation, Verification and Site Completion Report

7.4.1 It is recommended that all remediation related works which are carried out on site are validated by a third party, and suitable documentary evidence is subsequently provided in a Site Completion Report; documentary evidence could comprise of photographs, consignment documents and analytical results. The Site Completion Report should include as a minimum:

- Validation of the installed gas protection measures.
- Details of the areas of the site from where Made Ground has been removed and/or relocated.
- Verification of all imported soils to be placed in garden and soft landscaped areas. The sampling suite and regime should follow Council guidance. A typical sampling regime would be 1no. sample analysed per 250m³ for subsoil and 1no. sample per 50m³ of topsoil (or a minimum of 3no. samples per source). Samples would be tested for a comprehensive suite of determinands comprising as a minimum: metals, speciated PAHs, petroleum hydrocarbons and an asbestos screen.
- Information on the installation of protective pipes and /or sterile trenches.

7.4.2 The Site Completion Report will assist the Council in the discharge of the contaminated land planning condition, and will be of use to solicitors acting on behalf of any prospective

conveyancer who may have concerns over the site. The NHBC would also require sight of the Site Completion Report prior to providing warranties for the properties.

8.0 GEOTECHNICAL LABORATORY TESTING – RESULTS AND ASSESSMENT

8.1 Geotechnical Testing

- 8.1.1 A programme of laboratory and in-situ testing was undertaken in accordance with BS:1377 (1990) 'Methods of Test for Soils for Civil Engineering Purposes'. The following tests being carried out:

BS Test No.	Description
Part 2:3	Moisture Content
Part 2:4, 5	Determination of Atterberg Limits
Part 3:5, 9	Sulphate Content, pH value
Additional Tests as per BRE Special Digest 1:2005	Sulphur Content

- 8.1.2 The Atterberg limits and moisture content testing results are presented in Appendix D. The chemical testing results (pH value, sulphur and sulphate contents) are presented in Appendix C.

8.2 Atterberg Limits and Moisture Content Determinations

- 8.2.1 2no. samples of Glacial Till were analysed for natural Moisture Content and Atterberg limits. The results of this testing are summarised in the table below:

Description	%
Moisture Content	25 & 26
Plastic Limit	21 & 22
Liquid Limit	44 & 51
Plasticity Index*	23 & 29

* - Corrected in accordance with NHBC Chapter 4.2

- 8.2.2 The samples tested are of intermediate and high plasticity and should be regarded as being of medium volume change potential.

8.3 Buried Concrete

- 8.3.1 4no. samples (2no. Made Ground and 1no. Relic Topsoil and 1no. Glaciofluvial Sheet Deposits) were analysed for water soluble sulphate content, pH value, total acid soluble sulphate and total acid soluble sulphur. The testing was carried out in accordance with BRE Special Digest 1:2005 and the results are summarised in the tables below:

Determinand	No. of Results	Results
Made Ground		
pH (units)	2	7.5 & 7.9
Water Soluble (2:1) Sulphate (mg/l)	2	17 & 220
Total Sulphate (%)	2	0.381 & 0.142
Total Sulphur (%)	2	0.079 & 0.153
Total Potential Sulphate (%)*	2	0.238 & 0.458
Potential Amount of Oxidisable Sulphide (%)*	2	0.077 & 0.997

Determinand	No. of Results	Results
Relic Topsoil		
pH (units)	1	7.6
Water Soluble (2:1) Sulphate (mg/l)	1	15
Total Sulphate (%)	1	0.017
Total Sulphur (%)	1	0.019
Total Potential Sulphate (%)*	1	0.059
Potential Amount of Oxidisable Sulphide (%)*	1	0.042

Determinand	No. of Results	Results
Glaciofluvial Sheet Deposits		
pH (units)	1	7.8
Water Soluble (2:1) Sulphate (mg/l)	1	12
Total Sulphate (%)	1	0.014
Total Sulphur (%)	1	0.014
Total Potential Sulphate (%)*	1	0.042
Potential Amount of Oxidisable Sulphide (%)*	1	0.029

- 8.3.2 All of the calculated oxidisable sulphide concentrations were below the 0.3% threshold specified in BRE Special Digest 1:2005, whereby if this value is exceeded, pyrite may be present. Pyrite is therefore unlikely to be present within any of the soil samples analysed.
- 8.3.3 The sample of groundwater obtained from WS3 was analysed for pH value and sulphate content. The pH value of the groundwater was 6.8 and the sulphate concentration was 96mg/l.

9.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

9.1 Geotechnical Model

9.1.1 Based on the site investigation data, the following ground model has been adopted for the geotechnical assessment:

Stratum	Depth to Base (bgl) (Thickness)	Notes/Consistency/Strength Parameters
Made Ground	0.60m to 1.10m (0.60m to 1.10m)	Encountered at all exploratory hole locations. Typically comprised of a dark grey/black sandy gravelly to very gravelly SAND which often contained cobbles. Generally slightly organic rich to organic rich. Roots and rootlets noted locally. Anthropogenic components included brick, concrete, glass, pottery, ceramic, pieces of metal, ash, clinker and cinders, with occasional plastic food wrappers.
Relic Topsoil	0.85m to 1.10m (0.20m to 0.30m)	Encountered in HP1, HP3, WS1 and WS3 only. Typically recorded as a black slightly organic rich SAND.
Glaciofluvial Sheet Deposits	3.40m to 4.80m (2.50 to 3.80m)	Encountered at all exploratory hole locations. Penetrated in the boreholes only. Comprised of a slightly gravelly to very gravelly SAND with a low cobble content. Variable coloured but typically brown, greyish brown, brownish grey or grey. A 4cm thick reddish brown clay band was encountered within this deposit in WS1 @ 2.75m bgl. <u>SPT N values</u> 1.20-1.65m – N = 13 to 30 (3no. results) 2.00-2.45m – N = 14 to 24 (3no. results) 3.00-3.45m – N = 5 to 14 (3no. results) 4.00-4.45m – N = 12 (1no. result)
Glacial Till	5.45m+ to 6.45m+ (0.65m+ to 2.85m+)	Encountered in WS1-WS3 only. Not penetrated. Comprised of a brown slightly sandy and gravelly CLAY. Thinly laminated in WS3 below ≈6m bgl. Clay consistency ranged from soft to firm to firm. The undrained shear strength (Cu value) ranged from 40kPa to 58kPa indicating that the clay is of medium strength. SPT N values obtained within the Glacial Till ranged from 8 to 13, suggesting that the clay was of medium strength. 2no. samples of Glacial Till were subject to Atterberg Limit and moisture content determinations. The results indicate that this material is of intermediate to high plasticity and of medium volume change potential.
Tarporley Siltstone	-	Not encountered.

9.1.2 The groundwater table beneath the site was recorded between ≈2.35-2.65m bgl. Rates of groundwater ingress within the Glaciofluvial Sheet Deposits were estimated to be fast.

9.1.3 Groundwater levels across the site recorded between 30th August and 8th October 2018 ranged from 0.43m bgl to 2.44m bgl.

9.1.4 The property is intended to be developed out with a block of semi-detached housing.

9.2 Foundations, Floorslabs and Buried Concrete

- 9.2.1 The Made Ground and Relic Topsoil are not considered suitable as a founding stratum due to the risk of excessive total and differential settlement occurring.
- 9.2.2 The proposed houses could be supported on spread foundations emplaced into the Glaciofluvial Sheet Deposits encountered below 0.70-1.10m bgl, and designed on an allowable bearing pressure of 150kN/m².
- 9.2.3 Suspended floorslabs are recommended.
- 9.2.4 It is advised that a design sulphate class of DS-1 is adopted for buried concrete; the ACEC classification of site is AC-1¹⁶.

9.3 General

- 9.3.1 Excavations to ≈1m depth through the granular Made Ground and natural soil may stand unsupported in the short term; deeper excavations would not be expected to stand unsupported and temporary support would be required; alternatively, if sufficient space is available, excavations could be battered back to a suitable angle of repose.
- 9.3.2 Excavation advice is provided within CIRIA Report 97: Trenching Practice, dated 2001.
- 9.3.3 Given the position of the groundwater table, it is unlikely that groundwater will be encountered within foundation excavations and it is unlikely that groundwater control measures will be necessary. If required, advice on de-watering is given in CIRIA Report No C750, dated 2016 and entitled 'Groundwater control: design and practice'.

¹⁶ Concrete design guidance has been taken from BRE Special Digest 1:2005 'Concrete in Aggressive Ground'

10.0 SOAKAWAY TEST RESULTS

10.1 In accordance with the methodology set out within BRE Digest 365 entitled 'Soakaway design', values of a_{p50} and V_{p75-25} were calculated, and values of t_{p75-25} were estimated from the graphs in Appendix E. Soil infiltration rates were then determined for each test. It should be noted that the value of the rainfall ratio 'r', which was used in the soakaway calculations for the location of the soakaway, was determined to be 0.42; this value was obtained from Figure 1 of BRE Digest 365.

10.2 The soakaway test results for SA1 are summarised in the table below:

Parameter	Soakaway Test Location SA1		
	Test 1	Test 2	Test 3
Drain Invert Level* (m bgl)	0.679	0.694	0.675
Total Effective Storage Depth (m)	0.822	0.806	0.825
75% Empty Depth (m bgl)	1.295	1.299	1.290
25% Empty Depth (m bgl)	0.884	0.900	0.881
Volume** (m ³), $V_{p75} - V_{p25}$	0.02	0.02	0.02
Area (m ²), a_{p50}	0.94	0.93	0.94
Time** (seconds), t_{p75-25}	547	865	1215
Soil infiltration rate (m/s), f	4.42×10^{-5}	2.79×10^{-5}	1.99×10^{-5}

* - Drain invert level was taken as being the water filling depth.

** - Calculated using a gravel porosity of 0.345 (measured).

10.3 In accordance with BRE Digest 365, the lowest soil infiltration rate obtained from the set of three tests carried out within a test pit should be used for soakaway design purposes. The table below summarises the recommended design infiltration rates for the near surface soils encountered at these locations:

Test Location	Recommended Design Infiltration Rate (m/s)
SA1	1.99×10^{-5}

APPENDICES

APPENDIX A

DRAWINGS



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Project:

Land off Button Lane, Wythenshawe, Manchester
M23 0NA

Title:

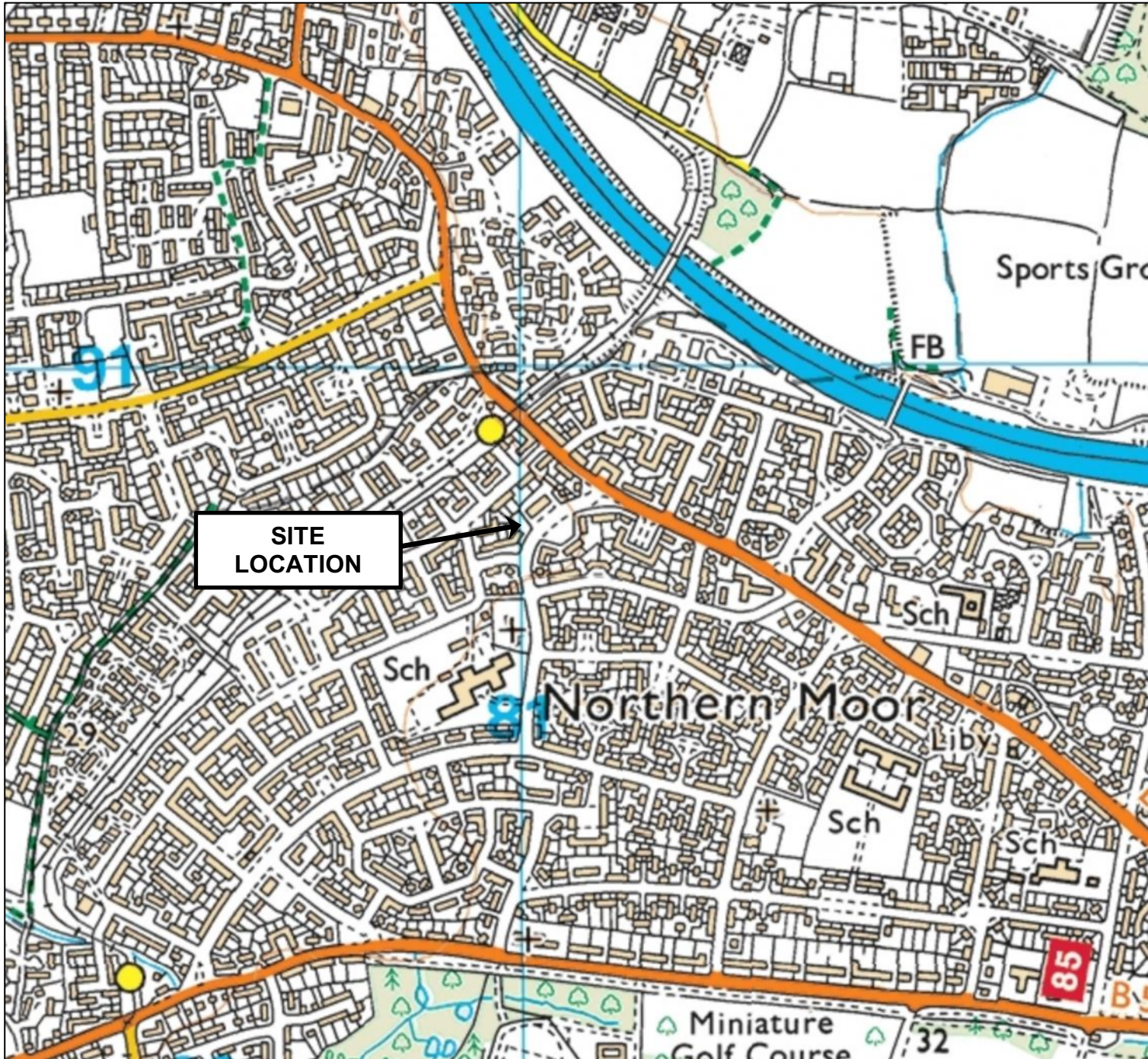
Site Location Plan

Scale:
NTS

Drawn by:
SFK

Date:
07/08/2018

Drawing No.: TLC1009/01a



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Project:

Land off Button Lane, Wythenshawe, Manchester
M23 0NA

Title:

Site Location Plan

Scale:

NTS

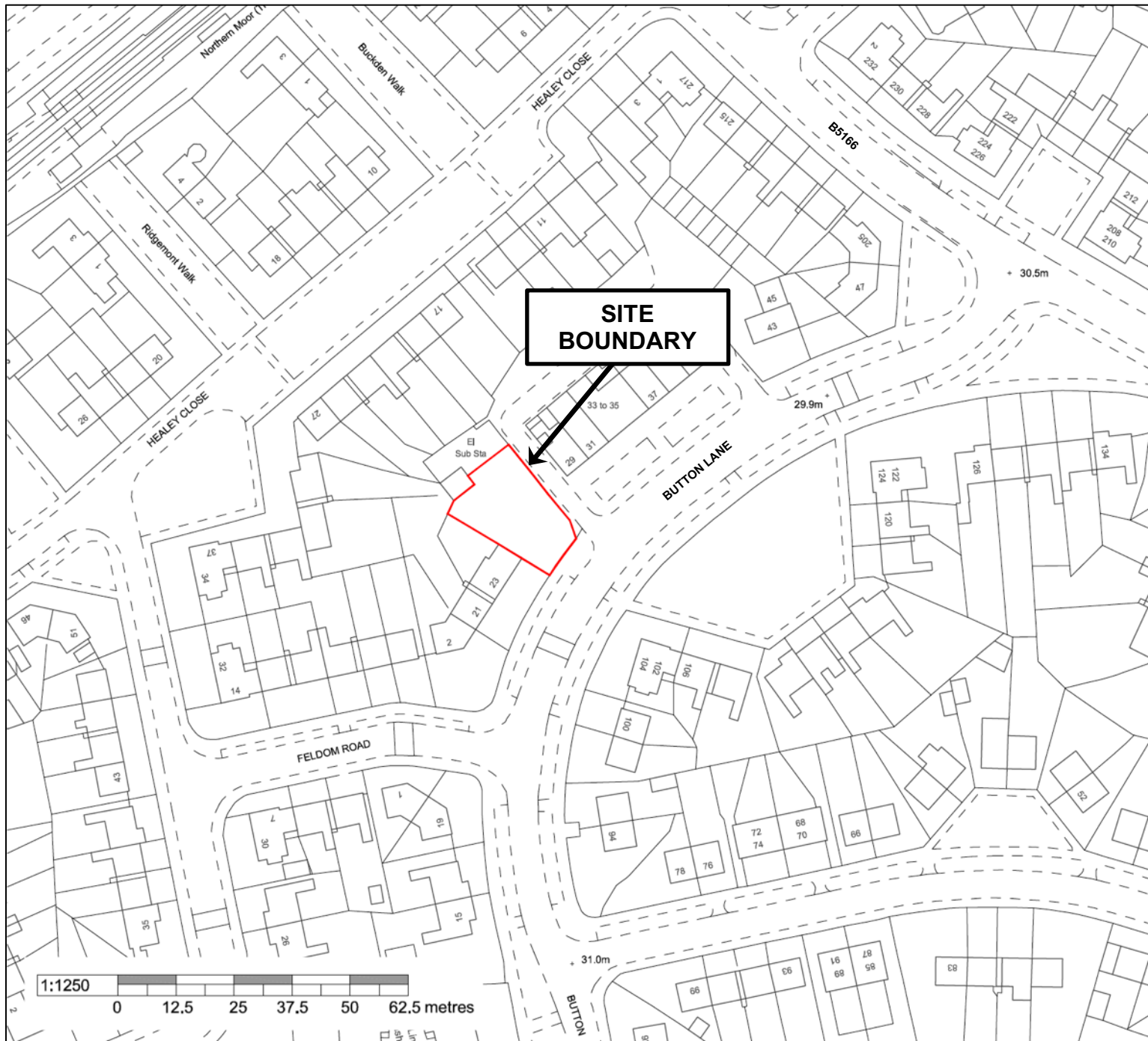
Drawn by:

SFK

Date:

07/08/2018

Drawing No.: TLC1009/01b



Reproduced from Michael Dyson Associates Ltd's Drawing No. 001-(SK)-8315 dated July 2018

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Project:

Land off Button Lane, Wythenshawe, Manchester
M23 0NA

Title:

Site Boundary Plan

Scale:

As Shown

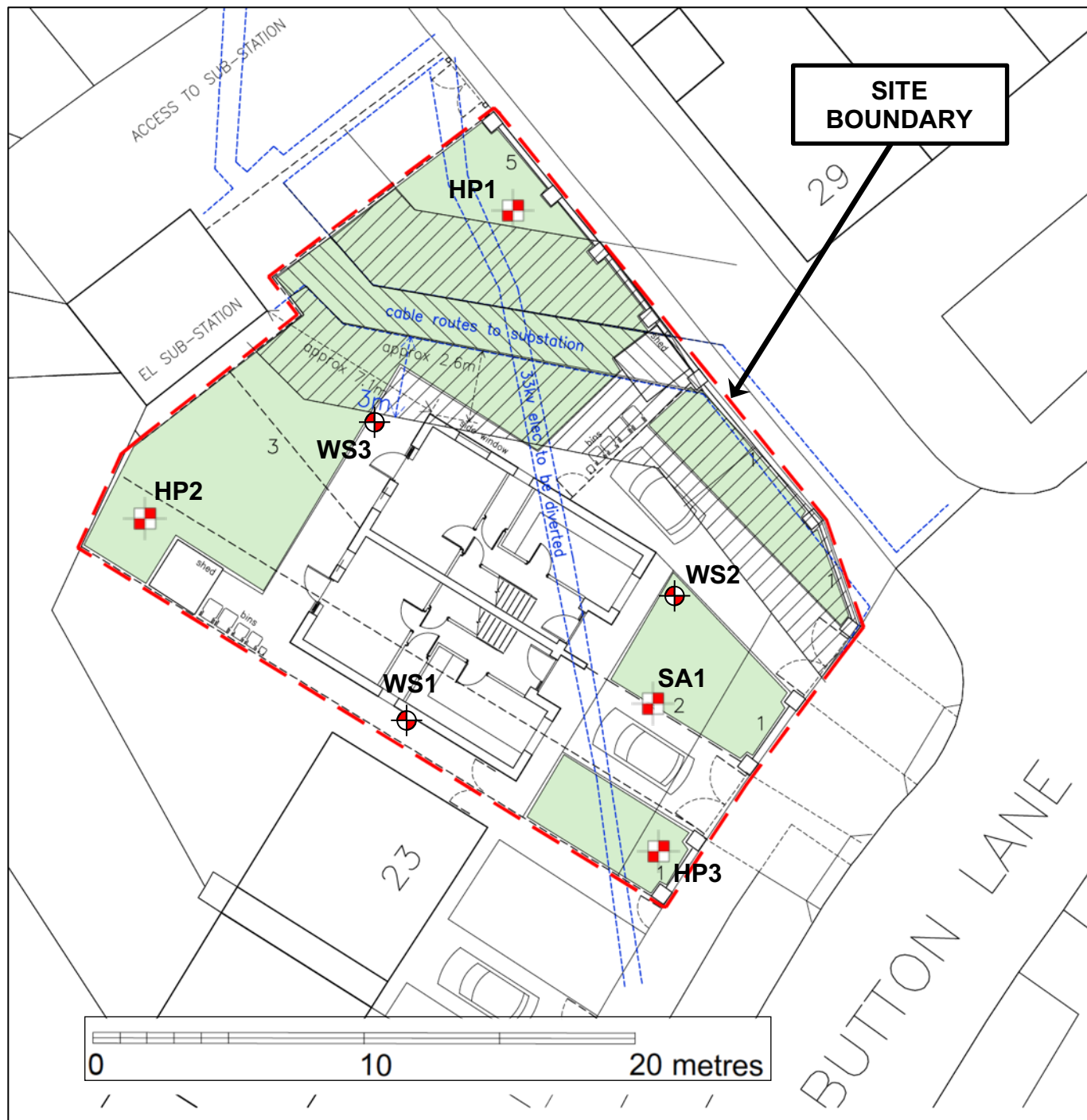
Drawn by:

SFK

Date:

07/08/2018

Drawing No.: TLC1009/02



WS2 Windowless sampling borehole location. WS2 & WS3 were both installed.

HP2 Hand excavated pit location.

SA1 Hand excavated soakaway test pit location.

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Project:
Land off Button Lane, Wythenshawe, Manchester
M23 0NA

Title:
Proposed Development Plan showing Exploratory
Hole Locations.

Scale:
As Shown

Drawn by:
SFK

Date:
17/12/2018

Drawing No.: TLC1009/04

APPENDIX B

EXPLORATORY HOLE LOGS

Trial Pit No
HP1
Sheet 1 of 1

Date
26/11/2018

Scale
1:25

Logged By
S.F.Knott

Samples and In-Situ Tests			Depth (m)	Level (m OD)	Legend	Stratum Description
Depth (m)	Type	Results (kPa)				
0.30	D		0.90 1.10 1.20			Patchy grass over black slightly silty gravelly SAND with low cobble content. Sand is fine and medium grained. Roots and rootlets. Organic rich. Gravel is fine to coarse angular of brick, sandstone and occasional glass, pottery and coal. Cobbles are of sandstone and brick. Metal curtain rail fragment at 0.30m. (MADE GROUND) 0.50m - Concrete flagstone fragment (boulder size) recovered. 0.55m - Wire fragment and foil recovered. >0.60m - Occasional clinker, cinders and tarmac gravel fragments recovered. Fragments of plastic food wrappers noted.
0.80	D					Black slightly silty fine and medium grained SAND. Slightly organic rich. (Relic Topsoil)
						Yellow brown gravelly SAND. Gravel is fine to coarse subrounded of sandstone. (Glaciofluvial Sheet Deposits)
						Trial Pit Complete at 1.200m

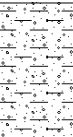
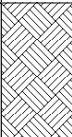
Groundwater: No groundwater encountered.

THE LAND CONSULTANCY LIMITED				The Land Consultancy Limited Tel : 01772 610609 email : sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk		Trial Pit No HP2 Sheet 1 of 1	
Project Name Land off Button Lane			Project No. TLC1009		Coords: E: N: Level (m AOD):		Date 26/11/2018
Location: Wythenshawe, Manchester M23 0NA				Dimensions (m) Depth 1.30 0.30		Scale 1:25	
Client: Wythenshawe Community Housing Group						Logged By	
Samples and In-Situ Tests			Depth (m)	Level (m OD)	Legend	Stratum Description	
Depth (m)	Type	Results (kPa)					
0.50	D		0.30			Dark grey slightly silty gravelly SAND with medium cobble content. Slightly organic rich. Occasional rootlets. Gravel is fine to coarse angular of brick and sandstone. Cobbles are of brick. (MADE GROUND)	
						Dark grey/black gravelly SAND with occasional rootlets. Slightly organic rich. Gravel is fine to coarse angular to subrounded of brick, sandstone and occasional cinders. (MADE GROUND)	
						Orangish brown gravelly SAND. Gravel is fine to coarse subrounded of sandstone. (Glaciofluvial Sheet Deposits)	
			1.10				
			1.30			Trial Pit Complete at 1.300m	
1 2 3 4 5							
Remarks: Excavated to 1.30m using hand tools. Hand pit was backfilled with excavated arisings on completion. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.							
Groundwater: No groundwater encountered.							

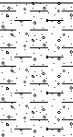
THE LAND CONSULTANCY LIMITED				The Land Consultancy Limited Tel : 01772 610609 email : sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk		Trial Pit No HP3 Sheet 1 of 1	
Project Name Land off Button Lane			Project No. TLC1009		Coords: E: N: Level (m AOD):		Date 26/11/2018
Location: Wythenshawe, Manchester M23 0NA				Dimensions (m) Depth 1.20 0.30		Scale 1:25	
Client: Wythenshawe Community Housing Group						Logged By	
Samples and In-Situ Tests			Depth (m)	Level (m OD)	Legend	Stratum Description	
Depth (m)	Type	Results (kPa)					
0.50	D		0.10			Weeds over GRAVEL with a little black sand matrix. Gravel is fine to coarse angular of brick and concrete. (MADE GROUND)	
						Black slightly gravelly SAND. Slightly organic rich. Gravel is fine to coarse angular of brick, glass and occasional cinders. (MADE GROUND)	
			0.65			Black slightly silty SAND. Slightly organic rich. (Relic Topsoil)	
			0.85			Brown gravelly SAND. Gravel is fine to coarse subrounded of sandstone. (Glaciofluvial Sheet Deposits)	
			1.20			Trial Pit Complete at 1.200m	
							1
							2
							3
							4
							5
Remarks: Excavated to 1.20m using hand tools. Hand pit was backfilled with excavated arisings on completion. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.							
Groundwater: No groundwater encountered.							

THE LAND CONSULTANCY LIMITED				The Land Consultancy Limited Tel : 01772 610609 email : sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk		Trial Pit No SA1 Sheet 1 of 1		
Project Name Land off Button Lane			Project No. TLC1009		Coords: E: N: Level (m AOD):		Date 05/12/2018	
Location: Wythenshawe, Manchester M23 0NA					Dimensions (m) Depth 1.55 0.22		Scale 1:25	
Client: Wythenshawe Community Housing Group							Logged By	
Samples and In-Situ Tests			Depth (m)	Level (m OD)	Legend	Stratum Description		
Depth (m)	Type	Results (kPa)						
			0.10			Greyish brown sandy GRAVEL with medium cobble content. Gravel is fine to coarse. Gravel and cobbles are angular of concrete, brick and slate. (MADE GROUND)		
						Dark grey silty gravelly SAND with medium cobble content. Organic rich. Gravel is fine to coarse angular of brick, sandstone, pottery and glass. Cobbles are of brick and sandstone. (MADE GROUND)		
						 0.50m - Iron bar encountered which straddled the pit.		
			0.90			Greyish brown slightly gravelly SAND. Gravel is fine to coarse subrounded of sandstone. (Glaciofluvial Sheet Deposits)		
			1.55			 >1.45m - Very gravelly and with occasional cobbles. Gravel and cobbles are of sandstone. Very difficult to dig using hand tools.		
						Trial Pit Complete at 1.550m		
Remarks: Soakaway test location. Excavated to 1.55m using hand tools. No samples taken. Hand pit was backfilled with excavated arisings on completion. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.								
Groundwater: No groundwater encountered.								

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Land off Button Lane		Client: Wythenshawe Community Housing Group			Borehole ID: WS1							
	Contract Number: TLC1009	Logged By: S.F.Knott	Checked By: S.F.Knott	Start Date: 26/11/2018	End Date: 26/11/2018	Sheet 1 of 2							
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole Log			Scale: 1:25						
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans & Mick Worthington		Method / Plant Used Archway Competitor Dart Rig			Weather / Ground Conditions Dry, sunny spells, light wind, T=6-8C / Damp								
Samples & In Situ Testing			Strata Details				Groundwater						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation					
0.15	D1	SPT(S) 1.20m, N=13 (1,2/3,3,3,4)		0.25		Occasional weeds over dark grey/black gravelly SAND with occasional rootlets. Slightly organic rich. Sand is slightly ashy. Gravel is fine to coarse angular of brick and sandstone. (MADE GROUND)	1						
0.50	D2			(0.50)		Pale yellowish brown gravelly SAND. Gravel is fine to coarse subrounded to subangular of sandstone and quartzite. Ceramic fragment noted. (MADE GROUND)							
0.90	D3			0.75		Uncompact black slightly gravelly SAND. Slightly organic rich. Gravel is fine to coarse subrounded of sandstone. (Relic Topsoil)							
1.50	D4	SPT(S) 2.00m, N=14 (3,4/4,4,3,3)		1.00		Medium dense orangish brown gravelly SAND. Gravel is fine to coarse subrounded to subangular of sandstone. (Glaciofluvial Sheet Deposits)	2						
2.50	D5			 >1.40m - Pale brown, brown and pale yellowish brown.									
				 >1.80m - Brownish grey gravelly to very gravelly and with low cobble content. Cobbles are of sandstone.									
		 >2.70m - Brown and brownish grey.											
3.60	D6	SPT(C) 3.00m, N=5 (1,2/1,1,2,1)		(3.80)		 >3.00m - Loose below approx. 3.00m. Greyish brown gravelly sand.	3						
				 2.75m - 4cm thick band of soft reddish brown sandy clay.									
				 >4.00m - Medium dense below approx. 4.00m.									
		SPT(C) 4.00m, N=12 (1,2/2,3,3,4)		4.80		Soft to firm and firm brown slightly sandy slightly gravelly CLAY. Gravel is fine subrounded to subangular of sandstone,	4						
						Continued next sheet	5						
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Hand pit excavated to 1.20m depth to clear services. Borehole was backfilled with bored arisings on completion. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.				
Chiselling			Installation		Water Strikes								
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
								2.60					Rapid ingress.

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Land off Button Lane		Client: Wythenshawe Community Housing Group			Borehole ID: WS1 Sheet 2 of 2							
	Contract Number: TLC1009	Logged By: S.F.Knott	Checked By: S.F.Knott	Start Date: 26/11/2018	End Date: 26/11/2018								
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole Log		Scale: 1:25							
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans & Mick Worthington		Method / Plant Used Archway Competitor Dart Rig		Weather / Ground Conditions Dry, sunny spells, light wind, T=6-8C / Damp									
Samples & In Situ Testing			Strata Details				Groundwater						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation					
		SPT(S) 5.00m, N=9 (2,1/2,3,2,2)		(0.65)		siltstone and mudstone. (Glacial Till)							
				5.45		End of Borehole at 5.45m							
							6						
							7						
							8						
							9						
							10						
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)					
Chiselling			Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
								2.60					Rapid ingress.

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Land off Button Lane		Client: Wythenshawe Community Housing Group			Borehole ID: WS2	
	Contract Number: TLC1009	Logged By: S.F.Knott	Checked By: S.F.Knott	Start Date: 26/11/2018	End Date: 26/11/2018		
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole Log			Scale: 1:25
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans and Mick Workthington			Method / Plant Used Archway Competitor Dart Rig		Weather / Ground Conditions Dry, sunny spells, light wind, T=6-8C / Damp		
Samples & In Situ Testing			Strata Details				Groundwater
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike
0.30	D1			(0.60)		Very compact black very gravelly SAND with medium cobble content. Slightly organic rich. Sand is ashy. Gravel is fine to coarse angular of brick, glass, sandstone, concrete and occasional cinders. Cobbles are of brick and concrete. (MADE GROUND)	
0.70	D2			(0.30)		Uncompact black fine and medium grained SAND. Slightly organic rich. (Relic Topsoil)	
1.60	D3	SPT(S) 1.20m, N=24 (3,4/5,7,6,6)		(2.50)		Medium dense yellowish brown slightly gravelly medium and coarse grained SAND. Gravel is fine to coarse subrounded and rounded of sandstone and quartzite. (Glaciofluvial Sheet Deposits)	1
2.60	D4	SPT(C) 2.00m, N=20 (5,5/6,5,4,5)		3.40		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular to subrounded of sandstone, siltstone and mudstone. (Glacial Till)	2
3.60	D5			(2.05)		Hand pit excavated to 1.20m depth to clear services. Installation detail: 35mm ID uPVC pipe used - g.l. to 1.00m = plain casing and 1.00m to 4.02m = slotted casing; end caps, geosock and protective cover fitted. Backfilling detail: g.l. to 0.10m = concrete; 0.10m to 1.00m = bentonite; 1.00m to 4.02m = washed 10mm pea gravel; and, 4.02m to 5.45m = bentonite. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.	3
3.80	FIELD	HV 3.80m, Cu = 52 kPa				Uncompact black fine and medium grained SAND. Slightly organic rich. (Relic Topsoil)	4
3.95	FIELD	HV 3.95m, Cu = 58 kPa SPT(S) 4.00m, N=13 (3,2/3,3,4,3)				Uncompact black fine and medium grained SAND. Slightly organic rich. (Relic Topsoil)	5
-5.00 - 5.45	D6					Continued next sheet	
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	4.00 110
Chiselling			Installation				Water Strikes
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)
				0.00	1.00	PLAIN	35
				1.00	4.02	SLOTTED	35
				Depth Strike	Depth Casing	Depth Sealed	Time (mins)
				2.35	2.00		
				Rose To (m)	Remarks		
					Fast ingress.		

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Land off Button Lane		Client: Wythenshawe Community Housing Group			Borehole ID: WS2 Sheet 2 of 2							
	Contract Number: TLC1009	Logged By: S.F.Knott	Checked By: S.F.Knott	Start Date: 26/11/2018	End Date: 26/11/2018								
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole Log			Scale: 1:25						
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans and Mick Workthington		Method / Plant Used Archway Competitor Dart Rig		Weather / Ground Conditions Dry, sunny spells, light wind, T=6-8C / Damp									
Samples & In Situ Testing			Strata Details				Groundwater						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/Installation					
		SPT(S) 5.00m, N=9 (2,2/2,2,2,3)		5.45		Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular to subrounded of sandstone, siltstone and mudstone. (Glacial Till)							
						End of Borehole at 5.45m							
							6						
							7						
							8						
							9						
							10						
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)					
							4.00	110					
Hand pit excavated to 1.20m depth to clear services. Installation detail: 35mm ID uPVC pipe used - g.l. to 1.00m = plain casing and 1.00m to 4.02m = slotted casing; end caps, geosock and protective cover fitted. Backfilling detail: g.l. to 0.10m = concrete; 0.10m to 1.00m = bentonite; 1.00m to 4.02m = washed 10mm pea gravel; and, 4.02m to 5.45m = bentonite. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.													
Chiselling				Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
				0.00	1.00	PLAIN	35	2.35	2.00		120	2.38	Fast ingress.
				1.00	4.02	SLOTTED	35						

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk	Contract Name: Land off Button Lane		Client: Wythenshawe Community Housing Group			Borehole ID: WS3							
	Contract Number: TLC1009	Logged By: S.F.Knott	Checked By: S.F.Knott	Start Date: 26/11/2018	End Date: 26/11/2018	Sheet 1 of 2							
	Easting:	Northing:	Ground Level (mAOD):	Hole Type: Windowless Sampling Borehole Log			Scale: 1:25						
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans & Mick Worthington		Method / Plant Used Archway Competitor Dart Rig			Weather / Ground Conditions Dry, sunny spells, light wind, T=6-8C / Damp								
Samples & In Situ Testing			Strata Details				Groundwater						
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation					
0.20	D1	SPT(S) 1.20m, N=30 (2,4/6,7,7,10)		0.26		Occasional weeds over compact brownish grey very gravelly SAND with medium cobble content. Occasional rootlets noted. Gravel is fine to coarse angular of slate, brick, concrete and occasional glass. Cobbles are of brick and concrete. (MADE GROUND) Black slightly gravelly SAND. Organic rich. Gravel is fine and medium angular to subrounded of coal and sandstone. (MADE GROUND) Brick COBBLES with a little dark grey gravelly sand matrix. Frequent metal fragments recorded. Sand is possibly ashy. Gravel is of brick. (MADE GROUND) Brownish grey gravelly SAND with low cobble content. Gravel is fine to coarse rounded to subrounded of sandstone and quartzite. Cobbles are of sandstone. (Possible MADE GROUND) Dark brown and orangish brown gravelly medium and coarse grained SAND. Gravel is fine to coarse rounded to subrounded of sandstone and quartzite. (Glaciofluvial Sheet Deposits) >0.90m - Dark yellowish brown. >1.00m - Yellowish brown. >1.25m - Dense >1.35m - Greyish brown and grey gravelly to very gravelly.	1						
0.40	D2			0.45									
				0.55									
				0.70									
1.00	D3												
1.80	D4	SPT(C) 2.00m, N=24 (7,6/7,6,5,6)	(2.90)				2						
2.70	D5	SPT(C) 3.00m, N=9 (3,2/3,3,2,1)	3.60				3						
3.75	FIELD	HV 3.75m, Cu = 42 kPa					4						
3.90 - 4.00	D6	HV 3.95m, Cu = 50 kPa SPT(S) 4.00m, N=12 (1,2/2,3,3,4)											
3.95	FIELD												
4.35	FIELD	HV 4.35m, Cu = 52 kPa											
4.55	D7	HV 4.60m, Cu = 48 kPa					5						
4.60	FIELD												
4.85	FIELD	HV 4.85m, Cu = 52 kPa											
Start & End of Shift Observations			Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Hand pit excavated to 1.20m depth to clear services. Installation detail: 35mm ID uPVC pipe used - g.l. to 1.00m = plain casing and 1.00m to 3.92m = slotted casing; end caps, geosock and protective cover fitted. Backfilling detail: g.l. to 0.10m = concrete; 0.10m to 1.00m = bentonite; 1.00m to 3.92m = washed 10mm pea gravel and; 3.92m to 6.45m = bentonite. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.				
							4.00	110					
Chiselling			Installation				Water Strikes						
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
				0.00	1.00	PLAIN	35	2.65	2.00				Fast ingress.
				1.00	3.92	SLOTTED	35						

The Land Consultancy Limited T: 01772 610609 sfknott@thelandconsultancy.co.uk www.thelandconsultancy.co.uk			Contract Name: Land off Button Lane			Client: Wythenshawe Community Housing Group			Borehole ID: WS3 Sheet 2 of 2					
			Contract Number: TLC1009	Logged By: S.F.Knott	Checked By: S.F.Knott	Start Date: 26/11/2018	End Date: 26/11/2018							
Easting:			Northing:		Ground Level (mAOD):		Hole Type: Windowless Sampling Borehole Log			Scale: 1:25				
Drilling Contractor / Drillers LOT Geotechnics Ltd / Keith Evans & Mick Worthington					Method / Plant Used Archway Competitor Dart Rig			Weather / Ground Conditions Dry, sunny spells, light wind, T=6-8C / Damp						
Samples & In Situ Testing					Strata Details					Groundwater				
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description				Water Strike	Backfill/Installation			
5.20	FIELD	SPT(S) 5.00m, N=9 (1,2/1,2,3,3) HV 5.20m, Cu = 40 kPa				 >5.00m - Soft to firm.								
5.50 - 5.60	D8 FIELD	HV 5.50m, Cu = 40 kPa												
5.75	FIELD	HV 5.75m, Cu = 45 kPa		(2.85)										
5.90	FIELD	HV 5.90m, Cu = 48 kPa SPT(S) 6.00m, N=8 (1,2/1,2,2,3)				 >6.00m - Clay contains extremely closely spaced brown silty fine sand and sandy silt partings.				6				
						End of Borehole at 6.45m								
										7				
										8				
										9				
										10				
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Hand pit excavated to 1.20m depth to clear services. Installation detail: 35mm ID uPVC pipe used - g.l. to 1.00m = plain casing and 1.00m to 3.92m = slotted casing; end caps, geosock and protective cover fitted. Backfilling detail: g.l. to 0.10m = concrete; 0.10m to 1.00m = bentonite; 1.00m to 3.92m = washed 10mm pea gravel; and, 3.92m to 6.45m = bentonite. Soils were logged by Dr Stephen Knott of The Land Consultancy Ltd to BS5930 2015.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Depth Strike	Depth Casing	Depth Sealed	Time (mins)	Rose To (m)	Remarks
					0.00	1.00	PLAIN	35	2.65	2.00				Fast ingress.
					1.00	3.92	SLOTTED	35						

APPENDIX C

CHEMICAL TESTING RESULTS AND SCREENING VALUES

TLC1009 - Land off Button Lane, Wythenshawe - End Users Human Health GAC Screen

Values is **red** exceed the GAC screening concentration.
Proposed End Usage: Residential with Plant Uptake

MG	Made Ground (ash and cinder rich)
RT	Relic Topsoil
GFD	Glaciofluvial Sheet Deposits

Made Ground GAC: Values for 2.5% SOM used (no. samples = 7; average SOM = 4.6%; sdev = 2.1% ; max = 7.5%; min = 2.8%)

NAD = No Asbestos Detected

Hole ID		Screening Value (1% SOM)	Screening Value (2.5% SOM)	Screening Value (6% SOM)	Source of Screening Value	HP1 0.30m	HP1 0.80m	HP2 0.50m	HP3 0.50m	WS1 0.15m	WS1 0.90m	WS1 1.50m	WS2 0.30m	WS2 0.30m	WS3 0.20m	WS3 0.40m	Pass/Fail?
Depth from (m)																	
Depth to (m)																	
Soil Type						MG	MG	MG	MG	MG	RT	GFD	MG	RT	MG	MG	
pH	pH	NV	NV	NV	-	7.4	7.5	7.4	7.5	-	7.6	7.8	7.9	-	7.8	-	-
pH BRE	pH	NV	NV	NV	-	7.4	7.5	7.4	7.5	-	7.6	7.8	7.9	-	8.8	-	-
Magnesium BRE (water sol 2:1)	mg/l	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride BRE, SO4 equiv. (water sol 2:1)	mg/l	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate BRE, SO4 equiv. (water sol 2:1)	mg/l	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate BRE (water sol 2:1)	mg/l	NV	NV	NV	-	-	17	-	-	-	15	12	220	-	-	-	-
Sulphate BRE (acid sol)	% w/w	NV	NV	NV	-	977	3811	483	381	-	170	135	1415	-	3371	-	-
Sulphur BRE (total)	% w/w	NV	NV	NV	-	-	1526	-	-	-	198	141	794	-	1377	-	-
Ammonium NH4 BRE (water sol 2:1)	mg/l	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (total)	mg/kg	NV	NV	NV	-	<1	-	<1	<1	-	-	-	<1	-	<1	-	-
Phenols - Total by HPLC	mg/kg	120	200	380	a	5.2	-	<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	PASS
Total Organic Carbon	% w/w	NV	NV	NV	-	4.35	4.29	1.63	1.36	-	0.46	-	2.11	3.42	1.89	2.97	PASS
Arsenic	mg/kg	37	37	37	b	7.2	-	8.0	7.8	-	-	-	9.2	-	6.9	-	PASS
Boron (water soluble)	mg/kg	290	290	290	a	1.4	-	<0.5	<0.5	-	-	-	0.7	-	0.6	-	PASS
Cadmium	mg/kg	22	22	22	b	0.6	-	0.2	<0.2	-	-	-	0.3	-	0.5	-	PASS
Chromium (total)	mg/kg	NV	NV	NV	-	56	-	109	110	-	-	-	76	-	78	-	-
Chromium (hexavalent)	mg/kg	21	21	21	b	-	-	-	<1	-	-	-	<1	-	<1	-	PASS
Copper	mg/kg	2400	2400	2400	a	28	-	23	20	-	-	-	27	-	30	-	PASS
Lead	mg/kg	200	200	200	b	117	-	67	58	-	-	-	77	-	145	-	PASS
Mercury	mg/kg	40	40	40	a	<0.5	-	<0.5	2.7	-	-	-	<0.5	-	<0.5	-	PASS
Nickel	mg/kg	130	130	130	a	11	-	14	9	-	-	-	19	-	18	-	PASS
Selenium	mg/kg	250	250	250	a	0.4	-	0.5	0.4	-	-	-	0.6	-	0.4	-	PASS
Zinc	mg/kg	3700	3700	3700	a	86	-	64	38	-	-	-	73	-	88	-	PASS
EPH total (>C10-C40)	mg/kg	NV	NV	NV	-	179	-	123	98	-	-	-	1675	-	1737	-	-
VPH total (>C5-C10)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos in Soil (inc. matrix)																	
Asbestos in soil (fibre screen)		-	-	-	-	NAD	-	-	NAD	NAD	-	-	NAD	-	NAD	-	PASS
Asbestos matrix (visual)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos matrix (microscope)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos in soil (quantification)	% w/w	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-
PAH 16																	
Acenaphthene	mg/kg	210	510	1100	a	0.04	-	0.04	0.05	-	-	-	0.57	-	0.88	-	PASS
Acenaphthylene	mg/kg	170	420	920	a	<0.01	-	<0.01	<0.01	-	-	-	0.21	-	0.08	-	PASS
Anthracene	mg/kg	2400	5400	11000	a	0.15	-	0.14	0.18	-	-	-	1.23	-	1.64	-	PASS
Benzo(a)anthracene	mg/kg	7.2	11	13	a	0.99	-	0.77	0.68	-	-	-	2.59	-	3.87	-	PASS
Benzo(a)pyrene	mg/kg	2.2	2.7	3.0	a	1.32	-	0.98	0.88	-	-	-	3.16	-	4.40	-	FAIL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	a	1.57	-	1.16	1.06	-	-	-	3.49	-	4.90	-	FAIL
Benzo(ghi)perylene	mg/kg	320	340	350	a	0.92	-	0.65	0.57	-	-	-	2.09	-	2.91	-	PASS
Benzo(k)fluoranthene	mg/kg	77	93	100	a	0.75	-	0.50	0.46	-	-	-	1.55	-	2.12	-	PASS
Chrysene	mg/kg	15	22	27	a	1.21	-	0.94	0.88	-	-	-	2.92	-	4.53	-	PASS
Dibenzo(ah)anthracene	mg/kg	0.24	0.28	0.30	a	0.21	-	0.15	0.14	-	-	-	0.48	-	0.72	-	FAIL
Fluoranthene	mg/kg	280	560	890	a	1.77	-	1.50	1.50	-	-	-	5.81	-	9.41	-	PASS
Fluorene	mg/kg	170	400	860	a	0.03	-	0.02	0.04	-	-	-	0.53	-	0.64	-	PASS
Indeno(123-cd)pyrene	mg/kg	27	36	41	a	0.92	-	0.66	0.60	-	-	-	2.09	-	2.96	-	PASS
Naphthalene	mg/kg	2.3	5.6	13	a	0.06	-	0.08	0.04	-	-	-	0.34	-	0.94	-	PASS
Phenanthrene	mg/kg	95	220	440	a	0.56	-	0.47	0.71	-	-	-	4.15	-	5.63	-	PASS
Pyrene	mg/kg	620	1200	2000	a	1.72	-	1.39	1.32	-	-	-	5.40	-	8.59	-	PASS
PAH (total 16)	mg/kg	NV	NV	NV	-	12.2	-	9.44	9.12	-	-	-	36.6	-	54.2	-	-
Coal Tar (BaP used as surrogate marker)	mg/kg	0.79	0.98	1.1	a	1.32	-	0.98	0.88	-	-	-	3.16	-	4.40	-	FAIL
Coal Tar (BaP used as surrogate marker)	mg/kg	-	-	5.0	b	1.32	-	0.98	0.88	-	-	-	3.16	-	4.40	-	PASS
TPH CWG																	
Ali >C5-C6	mg/kg	42	78	160	a	-	-	-	-	-	-	-	<0.1	-	<0.1	-	PASS
Ali >C6-C8	mg/kg	100	230	530	a	-	-	-	-	-	-	-	<0.1	-	<0.1	-	PASS
Ali >C8-C10	mg/kg	27	65	150	a	-	-	-	-	-	-	-	<0.1	-	<0.1	-	PASS
Ali >C10-C12	mg/kg	130	330	770	a	-	-	-	-	-	-	-	<4	-	4	-	PASS
Ali >C12-C16	mg/kg	1100	2400	4300	a	-	-	-	-	-	-	-	34	-	23	-	PASS
Ali >C16-C21	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ali >C21-C35	mg/kg	65000	92000	110000	a	-	-	-	-	-	-	-	1248	-	1235	-	PASS
Aliphatic >C35-C44	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	717	-	884	-	-
Total Aliphatics	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Aro >C5-C7	mg/kg	70	140	300	a	-	-	-	-	-	-	-	<0.01	-	<0.01	-	PASS
Aro >C7-C9	mg/kg	130	290	660	a	-	-	-	-	-	-	-	<0.01	-	<0.01	-	PASS
Aro >C8-C9	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aro >C9-C10	mg/kg	3400	83	190	a	-	-	-	-	-	-	-	<0.01	-	<0.01	-	PASS
Aro >C10-C12	mg/kg	74	180	380	a	-	-	-	-	-	-	-	<1	-	1	-	PASS
Aro >C12-C16	mg/kg	140	330	860	a	-	-	-	-	-	-	-	4	-	5	-	PASS
Aro >C16-C21	mg/kg	1100	1500	1700	a	-	-	-	-	-	-	-	28	-	30	-	PASS

Hole ID		Screening Value (1% SOM)	Screening Value (2.5% SOM)	Screening Value (6% SOM)	Source of Screening Value	HP1 0.30m	HP1 0.80m	HP2 0.50m	HP3 0.50m	WS1 0.15m	WS1 0.90m	WS1 1.50m	WS2 0.30m	WS2 0.30m	WS3 0.20m	WS3 0.40m	Pass/Fail?
Depth from (m)	Depth to (m)																
Soil Type						MG	MG	MG	MG	MG	RT	GFD	MG	RT	MG	MG	
Aro >C21-C35	mg/kg	1100	1500	1700	a	-	-	-	-	-	-	-	32	-	36	-	PASS
Aro >C35-C44	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	4	-	5	-	PASS
Total Aromatics	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH (Ali & Aro)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH (C5-C10)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH (C10-C40)	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX Compounds & MTBE																	
Benzene	mg/kg	-	-	0.87	b	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	130	290	660	a	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl Benzene	mg/kg	47	110	260	a	-	-	-	-	-	-	-	-	-	-	-	-
m & p Xylene	mg/kg	59	140	320	a	-	-	-	-	-	-	-	-	-	-	-	-
o Xylene	mg/kg	60	140	330	a	-	-	-	-	-	-	-	-	-	-	-	-
Xylene (mixed isomers)	mg/kg	56	140	310	a	-	-	-	-	-	-	-	-	-	-	-	-
MTBE	mg/kg	49	84	160	c	-	-	-	-	-	-	-	-	-	-	-	-
SVOC																	
Hexachlorobenzene	µg/kg	1800	3300	4900	a	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	µg/kg	120000	260000	570000	c	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/kg	1400000	3300000	7200000	c	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/kg	280000	610000	1100000	c	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy)methane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethyl)ether	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cresols (2-, 3- & 4-Methylphenol)	µg/kg	80000	180000	400000	c	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenyl ether	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/kg	870	2000	4500	a	-	-	-	-	-	-	-	-	-	-	-	-
2-Methyl-4, 6-dinitrophenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2, 6-Dinitrotoluene	µg/kg	780	1700	3900	c	-	-	-	-	-	-	-	-	-	-	-	-
2, 4-Dinitrotoluene	µg/kg	1500	3200	7200	c	-	-	-	-	-	-	-	-	-	-	-	-
2, 4-Dimethylphenol	µg/kg	19000	43000	97000	c	-	-	-	-	-	-	-	-	-	-	-	-
2, 4-Dichlorophenol	µg/kg	870	2000	4500	a	-	-	-	-	-	-	-	-	-	-	-	-
2, 4, 6-Trichlorophenol	µg/kg	870	2000	4500	a	-	-	-	-	-	-	-	-	-	-	-	-
2, 4, 5-Trichlorophenol	µg/kg	870	2000	4500	a	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	µg/kg	3700	9200	22000	c	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroisopropyl)ether	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2, 4-Dinitrophenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4, 6-Dinitro-2-methylphenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	µg/kg	120000	200000	380000	a	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/kg	220	520	1200	a	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitrosodimethylamine	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-diisopropylamine	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctylphthalate	µg/kg	2300000	2800000	3100000	c	-	-	-	-	-	-	-	-	-	-	-	-
n-Dibutylphthalate	µg/kg	130000	31000	67000	c	-	-	-	-	-	-	-	-	-	-	-	-
1, 2-Dichlorobenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	µg/kg	200	480	1100	c	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Perylene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC																	
Dichlorodifluoromethane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	µg/kg	8.3	9.8	13	c	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	µg/kg	0.64	0.87	1.4	a	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	µg/kg	8300	11000	18000	c	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1, 1-Dichloroethene	µg/kg	230	400	820	c	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulphide	µg/kg	140	290	620	a	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	µg/kg	580	980	1700	c	-	-	-	-	-	-	-	-	-	-	-	-
trans 1, 2-Dichloroethene	µg/kg	190	340	700	c	-	-	-	-	-	-	-	-	-	-	-	-
1, 1-Dichloroethane	µg/kg	2400	3900	7400	c	-	-	-	-	-	-	-	-	-	-	-	-
cis 1, 2-Dichloroethene	µg/kg	110	190	370	c	-	-	-	-	-	-	-	-	-	-	-	-

Hole ID		Screening Value (1% SOM)	Screening Value (2.5% SOM)	Screening Value (6% SOM)	Source of Screening Value	HP1 0.30m	HP1 0.80m	HP2 0.50m	HP3 0.50m	WS1 0.15m	WS1 0.90m	WS1 1.50m	WS2 0.30m	WS2 0.30m	WS3 0.20m	WS3 0.40m	Pass/Fail?
Depth from (m)						MG	MG	MG	MG	MG	RT	GFD	MG	RT	MG	MG	
Depth to (m)																	
Soil Type																	
2,2-Dichloropropane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	µg/kg	NV	NV	NV	c	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	µg/kg	910	1700	3400	a	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	8800	18000	39000	a	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	µg/kg	26	56	130	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	µg/kg	7.1	11	19	a	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	µg/kg	16	34	75	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/kg	24	42	84	c	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/kg	16	30	61	c	-	-	-	-	-	-	-	-	-	-	-	-
cis 1,3-Dichloropropene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
trans 1,3-Dichloropropene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	600	1200	2700	c	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	µg/kg	180	390	900	a	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/kg	460	1000	2400	a	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1200	2800	6400	a	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	µg/kg	8100	19000	43000	c	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform (Tribromomethane)	µg/kg	2800	5900	13000	c	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	µg/kg	11000	27000	64000	c	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1600	3400	7500	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	µg/kg	870	2000	4700	c	-	-	-	-	-	-	-	-	-	-	-	-
n-Propylbenzene	µg/kg	34000	82000	190000	c	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	350	850	2000	c	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	400	1000	2300	a	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	61000	150000	350000	a	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	23000	55000	130000	a	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	2600	6400	15000	a	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/kg	290	700	1600	c	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1500	3600	8600	a	-	-	-	-	-	-	-	-	-	-	-	-
Speciated PCB-EC7 & WHO12																	
PCB BZ 28	mg/kg	NV	NV	NV	-	-	-	-	-	<0.004	-	-	<0.004	-	-	-	-
PCB BZ 52	mg/kg	NV	NV	NV	-	-	-	-	-	<0.004	-	-	<0.004	-	-	-	-
PCB BZ 81	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 101	mg/kg	NV	NV	NV	-	-	-	-	-	<0.008	-	-	<0.008	-	-	-	-
PCB BZ 105	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 114	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 118	mg/kg	NV	NV	NV	-	-	-	-	-	<0.006	-	-	<0.006	-	-	-	-
PCB BZ 123	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 126	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 138	mg/kg	NV	NV	NV	-	-	-	-	-	<0.006	-	-	<0.006	-	-	-	-
PCB BZ 153	mg/kg	NV	NV	NV	-	-	-	-	-	<0.009	-	-	<0.009	-	-	-	-
PCB BZ 156	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 157	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 167	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 169	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 180	mg/kg	NV	NV	NV	-	-	-	-	-	<0.008	-	-	<0.008	-	-	-	-
PCB BZ 189	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB BZ 77	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Speciated PCB-EC7 & WHO12	mg/kg	NV	NV	NV	-	-	-	-	-	-	-	-	-	-	-	-	-

Source References

- a Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F., 'The LQM/CIEH S4ULs for Human Health Risk Assessment'. Dated 2015 and published by Land Quality Press, Nottingham.
- b Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Final Project Report', March 2014; & Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Policy Companion Document', March 2014.
- c CL:AIRE / AGS / EIC (December 2009), 'The Soil Generic Assessment Criteria for Human Health Risk Assessment'.

	All Concentrations are in mg/kg DW)																					Source
	Residential with Plant Uptake			Residential without Plant Uptake			Allotments			Commercial			Public Open Space (in a Residential Area)			Public Open Space (Park)						
	SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)						
	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	
METALS and SEMI-METALS																						
Antimony	ND			550			ND			7500			ND			ND			ND			c
Arsenic	37			40			43			640			79			79			170			a (S4UL)
Arsenic	37			40			43			640			79			79			170			b (CASL)
Barium	ND			1300			ND			22000			ND			ND			ND			c
Beryllium	1.7			1.7			35			40			2.2			63			a (S4UL)			a (S4UL)
Boron	290			11000			45			240000			21000			46000			120			a (S4UL)
Cadmium	85			56			19			190			532			120			120			a (S4UL)
Cadmium	26			149			4.9			410			220			880			b (CASL)			b (CASL)
Chromium (III)	910			910			18000			8600			33000			a (S4UL)			a (S4UL)			a (S4UL)
Chromium (VI)	6			6			1.8			33			7.7			220			a (S4UL)			a (S4UL)
Chromium (VI)	21			21			6			21			23			250			b (CASL)			b (CASL)
Copper	2400			7100			520			68000			12000			44000			a (S4UL)			a (S4UL)
Lead	200			310			80			2330			630			1300			b (CASL)			b (CASL)
Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			a (S4UL)			a (S4UL)
Mercury (inorganic)	40			56			19			1100			240			240			a (S4UL)			a (S4UL)
Mercury (Methyl)	11			15			6			320			68			68			a (S4UL)			a (S4UL)
Molybdenum	ND			670			ND			17000			ND			ND			c			c
Nickel	130			53			88			980			230			800			a (S4UL)			a (S4UL)
Selenium	250			430			88			12000			1100			1800			a (S4UL)			a (S4UL)
Vanadium	410			1200			91			8000			5000			5000			a (S4UL)			a (S4UL)
Zinc	3700			40000			620			730000			81000			170000			a (S4UL)			a (S4UL)
PETROLEUM HYDROCARBONS																						
Aliphatic EC <4	42	78	180	42	78	180	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	600000	59000 (304)	130000 (558)	160000 (1150)	a (S4UL)			a (S4UL)
Aliphatic EC >4	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	600000	610000	620000	160000 (144)	220000 (322)	320000 (736)	a (S4UL)			a (S4UL)
Aliphatic EC >10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	a (S4UL)			a (S4UL)
Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	770 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000 (283)	a (S4UL)			a (S4UL)
Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4400 (142)	11000	13000	13000	59000 (24)	82000 (59)	140000 (142)	13000	13000	13000	25000 (24)	29000 (59)	29000 (142)	a (S4UL)			a (S4UL)
Aliphatic EC >16-20	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	480000	a (S4UL)			a (S4UL)
Aliphatic EC >35-44	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	480000	a (S4UL)			a (S4UL)
Aromatic EC 5-7 (benzene)	30	370	1400	30	370	1400	13	27	300	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	78000 (1220)	84000 (2260)	92000 (4710)	a (S4UL)			a (S4UL)
Aromatic EC >7-8 (toluene)	130	290	860	130	290	860	22	51	120	56000 (869)	110000 (1920)	180000 (4380)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4380)	a (S4UL)			a (S4UL)
Aromatic EC >8-10 (xylene)	34	83	270	34	83	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	a (S4UL)			a (S4UL)
Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	54000 (2150)	5000	5000	5000	5200 (364)	9700 (899)	10000	a (S4UL)			a (S4UL)
Aromatic EC >12-16	140	330	660	1800	2300 (419)	2500	46	110	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	a (S4UL)			a (S4UL)
Aromatic EC >16-21	260	340	930	1900	1900	1900	23	57	280	28000	28000	28000	3800	3800	3800	7600	7700	7800	a (S4UL)			a (S4UL)
Aromatic EC >21-35	1100	1900	1700	3700	3700	3700	1900	1900	1900	28000	28000	28000	3800	3800	3800	7800	7800	7900	a (S4UL)			a (S4UL)
Aromatic EC >35-44	1100	1900	1700	1900	1900	1900	370	280	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	a (S4UL)			a (S4UL)
Aliphatic + Aromatic EC >44-70	1600	1900	1900	1900	1900	1900	1200	820	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	a (S4UL)			a (S4UL)
POLYNUCLEAR AROMATIC HYDROCARBONS																						
Acenaphthene	210	510	1100	3000 (57.0)	4700 (141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	a (S4UL)			a (S4UL)
Acenaphthylene	420	1000	2200	2900 (86.1)	4600 (212)	5900 (359)	28	160	160	83000 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	a (S4UL)			a (S4UL)
Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	a (S4UL)			a (S4UL)
Benzo(a)anthracene	7.2	11	13	11	14	15	29	6.5	13	170	170	180	29	6.5	29	49	56	62	a (S4UL)			a (S4UL)
Benzo(a)pyrene	2.2	2.7	3.0	3.2	3.2	3.2	0.97	2.0	3.5	35	35	36	5.7	5.7	5.7	11	12	13	a (S4UL)			a (S4UL)
Benzo(b)fluoranthene	3.0	3.4	3.7	3.9	4.0	4.0	0.99	2.1	4.5	44	44	45	7.2	7.2	7.2	15	16	17	a (S4UL)			a (S4UL)
Benzo(g,h,i)perylene	360	320	340	360	390	420	640	360	400	4000	4000	4000	640	640	640	1400	1500	1600	a (S4UL)			a (S4UL)
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	a (S4UL)			a (S4UL)
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	a (S4UL)			a (S4UL)
Dibenz(a,h)anthracene	0.24	0.28	0.31	0.31	0.32	0.33	0.43	0.14	0.27	3.6	3.6	3.6	0.57	0.57	0.57	1.3	1.4	1.4	a (S4UL)			a (S4UL)
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	a (S4UL)			a (S4UL)
Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	68000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	a (S4UL)			a (S4UL)
Indeno(1,23-cd)pyrene	27	36	41	45	46 (212)	48	9.5	21	38	500	510	510	82	82	82	160	170	180	a (S4UL)			a (S4UL)
Naphthalene	47	110	130	5.3	13	13	4.1	10	13	190 (176.4)	4100 (1183)	1000 (432)	4900	4900	4900	1200 (176.4)	4200 (1183)	4300	a (S4UL)			a (S4UL)
Phenanthrene	95	220	440	1300 (36.0)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	a (S4UL)			a (S4UL)
Pyrene	620	1200	2000	3700	3800 (76.5)	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	a (S4UL)			a (S4UL)
Coal Tar (BaP used as a surrogate marker)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	b (CASL)		b (CASL)
Coal Tar (BaP used as a surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	a (S4UL)			a (S4UL)
BTX COMPOUNDS																						
Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	72	73	90	100	110	a (S4UL)		a (S4UL)
Toluene	-	-	0.87	-	-	3.3	-	-	0.18	-	-	98	-	-	-	-	-	-	230	b (CASL)		b (CASL)
Benzene	130	290	660	880 (869)	1900	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4380)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4380)	a (S4UL)			a (S4UL)
Ethylbenzene	47	110	130	63	150	140	260	91	39	5700 (518)	13000 (1520)	27000 (2840)	24000	24000	24000	17000 (518)	22000 (1520)	27000 (2840)	a (S4UL)			a (S4UL)
Xylene, o-	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	41000	41000	17000 (478)	24000 (1120)	33000 (2620)	a (S4UL)			a (S4UL)
Xylene, m-	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	42000	42000	42000	17000 (625)	24000 (1470)	32000 (3460)	a (S4UL)			a (S4UL)
Xylene, p-	56	140	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	43000	43000	43000	17000 (576)	23000 (1350)	31000 (3170)	a (S4UL)			a (S4UL)
Xylenes (mixed isomers)	140	140	310	79	180	430	28	67	160	5900 (576)	14000 (1350)	30000 (3170)	41000	41000	41000	17000 (576)	23000 (1350)	31000 (3170)	a (S4UL)			a (S4UL)
* = Based off lowest of the 3 xylene congener results returned																						
PHENOL, CHLOROPHENOLS & OTHER PHENOL COMPOUNDS																						
Phenol	120	200	380	440	690	1200	23	42	83	440	690	1300	440	690	1300	440	690	1300	a (S4UL)			a (S4UL)
Chlorophenols (except Pentachlorophenol)	0.87	2.0	4.5	0.87	2.																	

General Assessment Criteria (GAC) Screening Values for the Protection of Human Health

Screening Values shown are for a Sandy Loam soil with a pH of 7.0

With respect to elemental mercury, hydrocarbons and other organic contamination, it is assumed that free phase contamination is not present.

	All Concentrations are in mg/kg DW																		Source		
	Residential with Plant Uptake			Residential without Plant Uptake			Allotments			Commercial			Public Open Space (in a Residential Area)			Public Open Space (Park)					
	SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)			SOM (%)					
	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
Tetrachloroethene (PCE)	0.18	0.39	0.90	0.18	0.40	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	810 (424)	1100 (951)	1500	a (S4UL)		
Tetrachloromethane (Carbon Tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.130	0.45	1.0	2.4	2.9	6.3	14	890	920	950	190	270	400	a (S4UL)		
Trans 1,2 Dichloroethene	0.19	0.34	0.70	0.19	0.35	0.71	0.93	1.9	4.0	22.0	40	81	ND	ND	ND	ND	ND	ND	c		
Trichloroethene (TCE)	0.016	0.034	0.075	0.017	0.036	0.080	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	a (S4UL)		
Trichloromethane (Chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	a (S4UL)		
Tribromomethane (Bromoform)	2.8	5.9	13	5.2	11	23	0.95	2.1	4.6	760	1500	3100	ND	ND	ND	ND	ND	ND	c		
Vinyl Chloride (Chloroethene)	0.00064	0.00087	0.0014	0.00077	0.0010	0.0015	0.00055	0.0010	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5.0	5.4	a (S4UL)		
CHLOROBENZENES (+ other BENZENE RELATED COMPOUNDS)																					
Bromobenzene	0.87	2.0	4.7	0.91	2.1	4.9	3.2	7.6	18	97	220	520	ND	ND	ND	ND	ND	ND	c		
Chlorobenzene	0.46	1.0	2.4	0.46	1.0	2.4	5.9	14	32	56	30	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	a (S4UL)		
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	a (S4UL)		
1,3-Dichlorobenzene	0.40	1.0	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	a (S4UL)		
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	a (S4UL)		
Hexachlorobenzene	1.8 (0.20)	3.3 (0.50)	4.9	4.1 (0.20)	5.7 (0.50)	6.7 (1.2)	0.47	1.1	2.5	110 (0.20)	120	120	16	16	16	30	30	30	a (S4UL)		
Isopropylbenzene	11	27	64	12	28	67	32	79	190	1400 (390)	3300 (950)	7700 (2250)	ND	ND	ND	ND	ND	ND	c		
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7.0	640 (43.0)	770 (107)	830	100	100	100	190	190	190	a (S4UL)		
Propylbenzene	34	82	190	40	97	230	34	83	200.0	4100 (402)	9700 (981)	21000 (2330)	ND	ND	ND	ND	ND	ND	c		
1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	26	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	a (S4UL)		
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700 (318)	2600 (786)	4000 (1880)	a (S4UL)		
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	a (S4UL)		
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	a (S4UL)		
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.90	2.2	49 (39.4)	120 (98.1)	240 (235)	78	78	79	110 (39)	120	130	a (S4UL)		
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	a (S4UL)		
1,2,4-Trimethylbenzene	0.35	0.85	2.0	0.41	0.99	2.3	0.38	0.93	2.2	42	99	220	ND	ND	ND	ND	ND	ND	c		
PESTICIDES																					
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	a (S4UL)		
Dieldrin	0.97	2.0	3.5	7.0	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	31	31	a (S4UL)		
Atrazine	3.3	7.60	17.4	610	620	620	0.50	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	a (S4UL)		
Dichlorvos	0.032	0.066	0.14	6.4	6.5	6.5	0.0049	0.010	0.022	140	140	140	16	16	16	26	26	27	a (S4UL)		
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.9	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2400	a (S4UL)		
Beta-Endosulfan	7.0	17	39	190 (0.00007)	320 (0.0002)	440 (0.0004)	1.1	2.7	6.4	6300 (0.00007)	7800 (0.0002)	8700	1200	1200	1200	2400	2400	2500	a (S4UL)		
Alpha-Hexachlorocyclohexane (inc. Lindane)	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	a (S4UL)		
Beta-Hexachlorocyclohexane (inc. Lindane)	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	a (S4UL)		
Gamma-Hexachlorocyclohexane (inc. Lindane)	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	a (S4UL)		
PHTHALATES																					
Bis (2-Ethylhexyl) Phthalate	280 (6.68)	610 (21.6)	1100 (51.7)	2700 (6.68)	2800 (21.6)	2800 (51.7)	47 (6.68)	120 (21.6)	280 (51.7)	85000 (6.68)	86000 (21.6)	86000 (51.7)	ND	ND	ND	ND	ND	ND	c		
Butyl Benzy Phthalate	1400 (26.3)	3300 (64.7)	7200 (154)	42000 (26.3)	44000 (64.7)	7200 (154)	220 (26.3)	550 (64.7)	1300 (154)	940000 (26.3)	940000 (64.7)	950000 (154)	ND	ND	ND	ND	ND	ND	c		
Diethyl Phthalate	120 (13.7)	260 (29.1)	570 (65)	1900 (13.7)	3500 (29.1)	6300 (65)	19 (13.7)	41 (29.1)	94 (65)	150000 (13.7)	220000 (29.1)	290000 (65)	ND	ND	ND	ND	ND	ND	c		
Di-n-Butyl Phthalate	13 (4.65)	31 (11.4)	67 (27.3)	450 (4.65)	450 (11.4)	450 (27.3)	2.0	5.0	12	15000 (4.65)	15000 (11.4)	15000 (27.3)	ND	ND	ND	ND	ND	ND	c		
Di-n-Octyl Phthalate	2300 (32.6)	2800 (81.5)	3100 (196)	3400 (32.6)	3400 (81.5)	3400 (196)	940 (32.6)	2100 (81.5)	3900 (196)	89000 (32.6)	89000 (81.5)	89000 (196)	ND	ND	ND	ND	ND	ND	c		
TOLUENE COMPOUNDS & EXPLOSIVES																					
2,4,6-Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.40	1000	1000	1000	130	130	130	260	270	270	a (S4UL)		
2,4-Dinitrotoluene	1.5	3.2	7.2	170 (141)	170	170	0.22	0.49	1.10	3700 (141)	3700 (299)	3800 (669)	ND	ND	ND	ND	ND	ND	c		
2,6-Dinitrotoluene	0.78	1.7	3.9	78	84	87	0.12	0.27	0.61	1900 (287)	1900 (622)	1900 (1400)	ND	ND	ND	ND	ND	ND	c		
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	a (S4UL)		
HMX	5.7	13	28	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	a (S4UL)		
OTHER COMPOUNDS																					
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	a (S4UL)		
2-Chloronaphthalene	3.7	9.2	22	3.80	9.3	22	40	98	230	390	960	2200 (669)	ND	ND	ND	ND	ND	ND	c		
Bisphenyl	66 (34.4)	160	360	220 (34.4)	500 (84.3)	980 (201)	14	35	83	33000 (84.3)	83	48000 (201)	ND	ND	ND	ND	ND	ND	c		
Styrene	8.1	19	43	35	78	170	1.6	3.7	8.7	3300 (626)	6500 (1440)	11000 (3350)	ND	ND	ND	ND	ND	ND	c		
Methyl Tert-Butyl Ether (MTBE)	49	84	160	73	120	220	23	44	90	7900	13000	24000	ND	ND	ND	ND	ND	ND	c		
Tributyl Tin Oxide	0.25	0.59	1.3	1.4	3.1	5.7	0.042	0.10	4.0	130 (41.3)	180 (101)	200 (241)	ND	ND	ND	ND	ND	ND	c		
Hexachloro-1,3-Butadiene	0.29	0.70	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	a (S4UL)		

■ The GAC presented exceeds the solubility saturation limit, which is presented in brackets. Soil concentrations above soil saturation may indicate that NAPL is present. Risks from NAPL need to be considered separately.

■ The GAC presented exceeds the vapour saturation limit, which is presented in brackets.

Source References

a Nathanael, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanael, J.F., 'The LQM/CI/EH S4ULs for Human Health Risk Assessment', Dated 2015 and published by Land Quality Press, Nottingham.

b Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Final Project Report', March 2014; & Defra, 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (SP1010): Policy Companion Document', March 2014. Values are advised to be used by the NHBC - see Issue 15 of their 'Technical Extra' document dated October 2014.

c CL:AIRE / AGS / EIC (December 2009), 'The Soil Generic Assessment Criteria for Human Health Risk Assessment'.

ICRCL 59/83 Guideline Levels for Assessing Phytotoxicity

	Trigger Value (mg/kg)
Boron	3
Copper	130
Nickel	70
Zinc	300

Note: The phytotoxic effects of copper, nickel and zinc may be additive. The trigger values given here are for pH=6.5 (which is the approximate acidity of pure rainwater). In neutral or alkaline soils, phytotoxic effects are unlikely at the above concentrations.

Note: Grass is more resistant to phytotoxic effects than are most other plants and its growth may not be adversely affected at these concentrations.

ICRCL 59/83 'The Assessment and Redevelopment of Contaminated Land', published by DEFRA, 1987



ANALYTICAL TEST REPORT

Contract no: 75453(1)
Contract name: Button Lane, Wythenshawe
Client reference: TLC1009
Clients name: The Land Consultancy
Clients address: 4 Parker Lane
Whitestake
Preston, Lancashire
PR4 4JX

Samples received: 29 November 2018

Analysis started: 02 December 2018

Analysis completed: 18 December 2018

Report issued: 18 December 2018

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

Dave Bowerbank
Customer Services Co-ordinator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
75453-1	HP1	0.30	Sand with Gravel & Roots	-	-	14.2
75453-2	HP1	0.80	Sand with Gravel	-	-	6.8
75453-3	HP2	0.50	Sand with Gravel	-	-	6.4
75453-4	HP3	0.50	Sand with Gravel	-	-	8.8
75453-5	WS1	0.15	Sand with Gravel	-	-	11.3
75453-6	WS1	0.90	Sand	-	-	9.9
75453-7	WS1	1.50	Sand with Gravel	-	-	7.6
75453-8	WS2	0.30	Sand with Gravel	-	-	8.9
75453-9	WS2	0.70	Sandy Clay	-	-	12.6
75453-10	WS3	0.20	Sand with Gravel	-	-	9.3
75453-11	WS3	0.40	Sandy Clay with Gravel	-	-	11.6

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SOILS

Lab number Sample id Depth (m) Date sampled			75453-1 HP1 0.30 26/11/2018	75453-2 HP1 0.80 26/11/2018	75453-3 HP2 0.50 26/11/2018	75453-4 HP3 0.50 26/11/2018	75453-5 WS1 0.15 26/11/2018	75453-6 WS1 0.90 26/11/2018
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	7.2	-	8.0	7.8	-	-
Boron (water soluble)	CE063 ^M	mg/kg B	1.4	-	<0.5	<0.5	-	-
Cadmium (total)	CE127 ^M	mg/kg Cd	0.6	-	0.2	<0.2	-	-
Chromium (total)	CE127 ^M	mg/kg Cr	56	-	109	110	-	-
Chromium (VI)	CE146	mg/kg CrVI	-	-	-	<1	-	-
Copper (total)	CE127 ^M	mg/kg Cu	28	-	23	20	-	-
Lead (total)	CE127 ^M	mg/kg Pb	117	-	67	58	-	-
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	-	<0.5	2.7	-	-
Nickel (total)	CE127 ^M	mg/kg Ni	11	-	14	8.9	-	-
Selenium (total)	CE127 ^M	mg/kg Se	0.4	-	0.5	0.4	-	-
Zinc (total)	CE127 ^M	mg/kg Zn	86	-	64	38	-	-
pH	CE004 ^M	units	7.4	7.5	7.4	7.5	-	7.6
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	-	17	-	-	-	15
Sulphate (total)	CE062 ^M	mg/kg SO ₄	977	3811	483	381	-	170
Sulphur (total)	CE127	mg/kg S	-	1526	-	-	-	198
Cyanide (total)	CE077	mg/kg CN	<1	-	<1	<1	-	-
Phenols (total)	CE078	mg/kg PhOH	5.2	-	<0.5	<0.5	-	-
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	4.35	4.29	1.63	1.36	-	0.46
PAH								
Naphthalene	CE087 ^M	mg/kg	0.06	-	0.08	0.04	-	-
Acenaphthylene	CE087 ^M	mg/kg	<0.01	-	<0.01	<0.01	-	-
Acenaphthene	CE087 ^M	mg/kg	0.04	-	0.04	0.05	-	-
Fluorene	CE087 ^U	mg/kg	0.03	-	0.02	0.04	-	-
Phenanthrene	CE087 ^M	mg/kg	0.56	-	0.47	0.71	-	-
Anthracene	CE087 ^U	mg/kg	0.15	-	0.14	0.18	-	-
Fluoranthene	CE087 ^M	mg/kg	1.77	-	1.50	1.50	-	-
Pyrene	CE087 ^M	mg/kg	1.72	-	1.39	1.32	-	-
Benzo(a)anthracene	CE087 ^U	mg/kg	0.99	-	0.77	0.68	-	-
Chrysene	CE087 ^M	mg/kg	1.21	-	0.94	0.88	-	-
Benzo(b)fluoranthene	CE087 ^M	mg/kg	1.57	-	1.16	1.06	-	-
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.75	-	0.50	0.46	-	-
Benzo(a)pyrene	CE087 ^U	mg/kg	1.32	-	0.98	0.88	-	-
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.92	-	0.66	0.60	-	-
Dibenz(ah)anthracene	CE087 ^M	mg/kg	0.21	-	0.15	0.14	-	-
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.92	-	0.65	0.57	-	-
PAH (total of USEPA 16)	CE087	mg/kg	12.2	-	9.44	9.12	-	-
TPH								
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	-	-	-	-	-	-
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	-	-	-	-	-	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	-	-	-	-	-	-
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	-	-	-	-	-	-

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SOILS

Lab number Sample id Depth (m) Date sampled			75453-1 HP1 0.30 26/11/2018	75453-2 HP1 0.80 26/11/2018	75453-3 HP2 0.50 26/11/2018	75453-4 HP3 0.50 26/11/2018	75453-5 WS1 0.15 26/11/2018	75453-6 WS1 0.90 26/11/2018
Test	Method	Units						
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	-	-	-	-	-	-
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	-	-	-	-	-	-
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	-	-	-	-	-	-
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	-	-	-	-	-	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-	-	-	-	-	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-	-	-	-	-	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-	-	-	-	-	-
EPH Aliphatic (>C10-C12)	CE068	mg/kg	-	-	-	-	-	-
EPH Aliphatic (>C12-C16)	CE068	mg/kg	-	-	-	-	-	-
EPH Aliphatic (>C16-C35)	CE068	mg/kg	-	-	-	-	-	-
EPH Aliphatic (>C35-C44)	CE068	mg/kg	-	-	-	-	-	-
EPH (>C10-C40)	CE033 ^M	mg/kg	179	-	123	98	-	-
PCB								
PCB Congener 28	CE137 ^M	mg/kg	-	-	-	-	<0.004	-
PCB Congener 52	CE137 ^M	mg/kg	-	-	-	-	<0.004	-
PCB Congener 101	CE137 ^M	mg/kg	-	-	-	-	<0.008	-
PCB Congener 118	CE137 ^M	mg/kg	-	-	-	-	<0.006	-
PCB Congener 138	CE137 ^M	mg/kg	-	-	-	-	<0.006	-
PCB Congener 153	CE137 ^M	mg/kg	-	-	-	-	<0.009	-
PCB Congener 180	CE137 ^M	mg/kg	-	-	-	-	<0.008	-
PCB (total of ICES 7)	CE137 ^M	mg/kg	-	-	-	-	<0.045	-
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	-	-	NAD	NAD	-

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SOILS

Lab number Sample id Depth (m) Date sampled			75453-7 WS1 1.50 26/11/2018	75453-8 WS2 0.30 26/11/2018	75453-9 WS2 0.70 26/11/2018	75453-10 WS3 0.20 26/11/2018	75453-11 WS3 0.40 26/11/2018
Test	Method	Units					
Arsenic (total)	CE127 ^M	mg/kg As	-	9.2	-	6.9	-
Boron (water soluble)	CE063 ^M	mg/kg B	-	0.7	-	0.6	-
Cadmium (total)	CE127 ^M	mg/kg Cd	-	0.3	-	0.5	-
Chromium (total)	CE127 ^M	mg/kg Cr	-	76	-	78	-
Chromium (VI)	CE146	mg/kg CrVI	-	<1	-	<1	-
Copper (total)	CE127 ^M	mg/kg Cu	-	27	-	30	-
Lead (total)	CE127 ^M	mg/kg Pb	-	77	-	145	-
Mercury (total)	CE127 ^M	mg/kg Hg	-	<0.5	-	<0.5	-
Nickel (total)	CE127 ^M	mg/kg Ni	-	19	-	18	-
Selenium (total)	CE127 ^M	mg/kg Se	-	0.6	-	0.4	-
Zinc (total)	CE127 ^M	mg/kg Zn	-	73	-	88	-
pH	CE004 ^M	units	7.8	7.9	-	7.8	-
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	12	220	-	-	-
Sulphate (total)	CE062 ^M	mg/kg SO ₄	135	1415	-	3371	-
Sulphur (total)	CE127	mg/kg S	141	794	-	1377	-
Cyanide (total)	CE077	mg/kg CN	-	<1	-	<1	-
Phenols (total)	CE078	mg/kg PhOH	-	<0.5	-	<0.5	-
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	-	2.11	3.42	1.89	2.97
PAH							
Naphthalene	CE087 ^M	mg/kg	-	0.34	-	0.94	-
Acenaphthylene	CE087 ^M	mg/kg	-	0.21	-	0.08	-
Acenaphthene	CE087 ^M	mg/kg	-	0.57	-	0.88	-
Fluorene	CE087 ^U	mg/kg	-	0.53	-	0.64	-
Phenanthrene	CE087 ^M	mg/kg	-	4.15	-	5.63	-
Anthracene	CE087 ^U	mg/kg	-	1.23	-	1.64	-
Fluoranthene	CE087 ^M	mg/kg	-	5.81	-	9.41	-
Pyrene	CE087 ^M	mg/kg	-	5.40	-	8.59	-
Benzo(a)anthracene	CE087 ^U	mg/kg	-	2.59	-	3.87	-
Chrysene	CE087 ^M	mg/kg	-	2.92	-	4.53	-
Benzo(b)fluoranthene	CE087 ^M	mg/kg	-	3.49	-	4.90	-
Benzo(k)fluoranthene	CE087 ^M	mg/kg	-	1.55	-	2.12	-
Benzo(a)pyrene	CE087 ^U	mg/kg	-	3.16	-	4.40	-
Indeno(123cd)pyrene	CE087 ^M	mg/kg	-	2.09	-	2.96	-
Dibenz(ah)anthracene	CE087 ^M	mg/kg	-	0.48	-	0.72	-
Benzo(ghi)perylene	CE087 ^M	mg/kg	-	2.09	-	2.91	-
PAH (total of USEPA 16)	CE087	mg/kg	-	36.6	-	54.2	-
TPH							
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	-	<0.01	-	<0.01	-
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	-	<0.01	-	<0.01	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	-	<0.01	-	<0.01	-
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	-	<1	-	1	-

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SOILS

Lab number Sample id Depth (m) Date sampled			75453-7 WS1 1.50 26/11/2018	75453-8 WS2 0.30 26/11/2018	75453-9 WS2 0.70 26/11/2018	75453-10 WS3 0.20 26/11/2018	75453-11 WS3 0.40 26/11/2018
Test	Method	Units					
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	-	4	-	5	-
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	-	28	-	30	-
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	-	32	-	36	-
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	-	4	-	5	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-	<0.1	-	<0.1	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-	<0.1	-	<0.1	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-	<0.1	-	<0.1	-
EPH Aliphatic (>C10-C12)	CE068	mg/kg	-	<4	-	4	-
EPH Aliphatic (>C12-C16)	CE068	mg/kg	-	34	-	23	-
EPH Aliphatic (>C16-C35)	CE068	mg/kg	-	1248	-	1235	-
EPH Aliphatic (>C35-C44)	CE068	mg/kg	-	717	-	884	-
EPH (>C10-C40)	CE033 ^M	mg/kg	-	1675	-	1737	-
PCB							
PCB Congener 28	CE137 ^M	mg/kg	-	<0.004	-	-	-
PCB Congener 52	CE137 ^M	mg/kg	-	<0.004	-	-	-
PCB Congener 101	CE137 ^M	mg/kg	-	<0.008	-	-	-
PCB Congener 118	CE137 ^M	mg/kg	-	<0.006	-	-	-
PCB Congener 138	CE137 ^M	mg/kg	-	<0.006	-	-	-
PCB Congener 153	CE137 ^M	mg/kg	-	<0.009	-	-	-
PCB Congener 180	CE137 ^M	mg/kg	-	<0.008	-	-	-
PCB (total of ICES 7)	CE137 ^M	mg/kg	-	<0.045	-	-	-
Subcontracted analysis							
Asbestos (qualitative)	\$	-	-	NAD	-	NAD	-

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	M	100	mg/kg SO ₄
CE127	Sulphur (total)	Acid extraction, ICP-MS	Dry		100	mg/kg S
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	Wet		1	mg/kg CN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	Wet		0.5	mg/kg PhOH
CE073	Phenols (speciated)	HPLC	Wet		0.01	mg/kg PhOH
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE087	Naphthalene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	Wet	U	0.01	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	Wet	M	0.01	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	Wet	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	Wet	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	Wet		0.27	mg/kg
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	Wet		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	Wet		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	Wet		0.01	mg/kg
CE068	EPH Aromatic (>EC10-EC12)	Solvent extraction, GC-FID	Wet		1	mg/kg
CE068	EPH Aromatic (>EC12-EC16)	Solvent extraction, GC-FID	Wet		1	mg/kg
CE068	EPH Aromatic (>EC16-EC21)	Solvent extraction, GC-FID	Wet		1	mg/kg
CE068	EPH Aromatic (>EC21-EC35)	Solvent extraction, GC-FID	Wet		1	mg/kg
CE068	EPH Aromatic (>EC35-EC44)	Solvent extraction, GC-FID	Wet		1	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	Wet		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	Wet		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	Wet		0.1	mg/kg
CE068	EPH Aliphatic (>C10-C12)	Solvent extraction, GC-FID	Wet		4	mg/kg
CE068	EPH Aliphatic (>C12-C16)	Solvent extraction, GC-FID	Wet		4	mg/kg
CE068	EPH Aliphatic (>C16-C35)	Solvent extraction, GC-FID	Wet		4	mg/kg
CE068	EPH Aliphatic (>C35-C44)	Solvent extraction, GC-FID	Wet		10	mg/kg
CE033	EPH (>C10-C40)	Solvent extraction, GC-FID	Wet	M	10	mg/kg
CE137	PCB Congener 28	Solvent extraction, GC-MS	Wet	M	0.004	mg/kg
CE137	PCB Congener 52	Solvent extraction, GC-MS	Wet	M	0.004	mg/kg
CE137	PCB Congener 101	Solvent extraction, GC-MS	Wet	M	0.008	mg/kg
CE137	PCB Congener 118	Solvent extraction, GC-MS	Wet	M	0.006	mg/kg
CE137	PCB Congener 138	Solvent extraction, GC-MS	Wet	M	0.006	mg/kg
CE137	PCB Congener 153	Solvent extraction, GC-MS	Wet	M	0.009	mg/kg
CE137	PCB Congener 180	Solvent extraction, GC-MS	Wet	M	0.008	mg/kg
CE137	PCB (total of ICES 7)	Solvent extraction, GC-MS	Wet	M	0.045	mg/kg
CE181	PCB Congener 77	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 81	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 105	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 114	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 118	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 123	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 126	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 156	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 157	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 167	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 169	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB Congener 189	Solvent extraction, GC-MS	Wet		0.006	mg/kg
CE181	PCB (WHO 12)	Solvent extraction, GC-MS	Wet		0.072	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
75453-1	HP1	0.30	N	
75453-2	HP1	0.80	N	
75453-3	HP2	0.50	N	
75453-4	HP3	0.50	N	
75453-5	WS1	0.15	N	
75453-6	WS1	0.90	N	
75453-7	WS1	1.50	N	
75453-8	WS2	0.30	N	
75453-9	WS2	0.70	N	
75453-10	WS3	0.20	N	
75453-11	WS3	0.40	N	

FINAL ANALYTICAL TEST REPORT

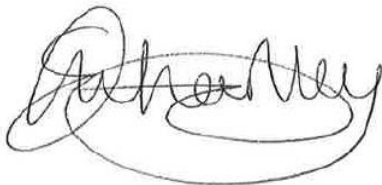
Envirolab Job Number: 18/10315
Issue Number: 1

Date: 12 December, 2018

Client: The Land Consultancy Ltd
4 Parker Lane
Preston
PR4 4JX

Project Manager: Stephen Knott
Project Name: Button Lane, Wythenshawe
Project Ref: TLC1009
Order No: N/A
Date Samples Received: 06/12/18
Date Instructions Received: 07/12/18
Date Analysis Completed: 12/12/18

Prepared by:



Elisha Hartley
Admin Assistant

Approved by:



Georgia King
Admin & Client Services Supervisor

Envirolab Job Number: 18/10315

Client Project Name: Button Lane, Wythenshawe

Client Project Ref: TLC1009

Lab Sample ID	18/10315/1								Units	Method ref
Client Sample No										
Client Sample ID	WS3									
Depth to Top										
Depth To Bottom										
Date Sampled	05-Dec-18									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
pH (w) _A [#]	6.77								pH	A-T-031w
Sulphate (w) _A [#]	96								mg/l	A-T-026w

REPORT NOTES

General:

This report shall not be reproduced, except in full, without written approval from Envirolab.

All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed.

Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client: The Land Consultancy Ltd, 4 Parker Lane, Preston, PR4 4JX

Project No: 18/10315

Project: Button Lane, Wythenshawe

Date Instructions Received: 07/12/2018 (am)

Clients Project No: TLC1009

Cool Box Temperatures (°C): 13.1

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

APPENDIX D

GEOTECHNICAL TESTING RESULTS



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 41911

Client Ref:

Report Date: **12-12-2018**

Client PO:

Client **The Land Consultancy**
4 Parker Lane
Whitestake
Preston
PR4 4JX

Contract Title: **Button Lane, Wythenshawe**
For the attention of: **Dr. Stephen Knott**

Date Received: **30-11-2018**
Date Commenced: **30-11-2018**
Date Completed: **12-12-2018**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	2
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	2
Disposal of samples for job	1

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

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)

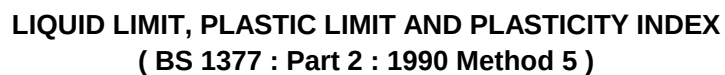
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Accounts Assistant)

Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



Contract Number

41911

Site Name

Button Lane, Wythenshawe

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

The graph illustrates the relationship between Plasticity Index (PI) and Liquid Limit (LL) for soil classification. The x-axis represents Liquid Limit (%) from 0 to 120, and the y-axis represents Plasticity Index (%) from 0 to 90. The regions are defined by the following boundaries:

- CL (Clay Low Plasticity):** $0 < LL < 40$ and $PI < 7$
- CI (Clay Intermediate Plasticity):** $40 < LL < 60$ and $7 < PI < 17$
- CH (Clay High Plasticity):** $60 < LL < 80$ and $PI < 17$
- CV (Clay Very High Plasticity):** $80 < LL < 100$ and $PI < 17$
- CE (Clay Extra High Plasticity):** $LL > 100$ and $PI < 17$
- ML (Silt Low Plasticity):** $0 < LL < 40$ and $PI < 7$
- MI (Silt Intermediate Plasticity):** $40 < LL < 60$ and $7 < PI < 17$
- MH (Silt High Plasticity):** $60 < LL < 80$ and $PI < 17$
- MV (Silt Very High Plasticity):** $80 < LL < 100$ and $PI < 17$
- ME (Silt Extra High Plasticity):** $LL > 100$ and $PI < 17$

The A-line is defined by the equation $PI = LL - 0.73$. The U-line is defined by the equation $PI = 0.73(200 - LL)$. The region between the A-line and the U-line is labeled **CI** for $LL < 40$ and **CH** for $40 < LL < 60$.



APPENDIX E

SOAKAWAY TESTING RESULTS

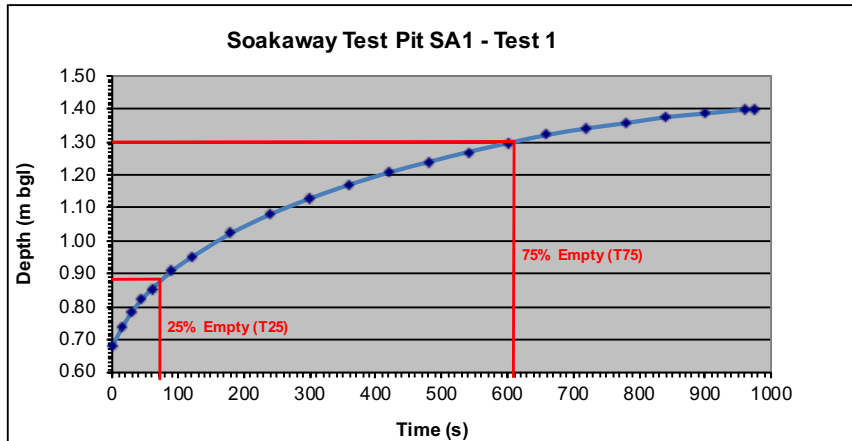
SA1 Soakaway Test Pit Results

Test 1		Test 2		Test 3	
Time (s)	Depth (m bgl)	Time (s)	Depth (m bgl)	Time (s)	Depth (m bgl)
0	0.679	0	0.694	0	0.675
15	0.736	15	0.707	15	0.685
30	0.784	30	0.723	30	0.694
45	0.822	45	0.749	45	0.708
60	0.853	60	0.777	60	0.731
90	0.907	90	0.799	120	0.795
120	0.949	120	0.830	240	0.877
180	1.022	180	0.884	420	0.972
240	1.080	240	0.930	600	1.054
300	1.128	300	0.969	750	1.111
360	1.170	360	1.011	900	1.162
420	1.207	420	1.045	1050	1.207
480	1.239	480	1.080	1200	1.245
540	1.269	540	1.112	1350	1.279
600	1.296	600	1.142	1485	1.306
660	1.321	660	1.169		
720	1.341	720	1.194		
780	1.357	780	1.213		
840	1.375	840	1.235		
900	1.386	900	1.255		
960	1.398	1200	1.341		
975	1.400	1500	1.394		
		1615	1.409		

Notes

Test pit dimensions - 0.22m wide x 0.73m long x 1.50m deep

Test pit was backfilled with washed 10m pipe bedding gravel to 0.72m bgl

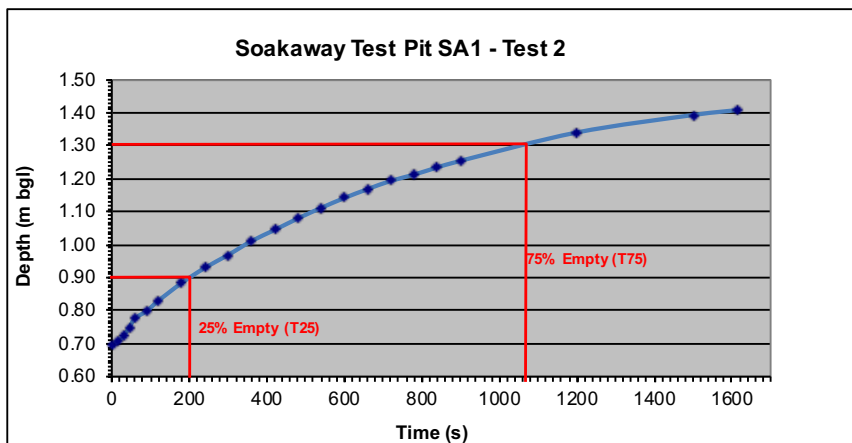


Assumed drain invert level = 0.679m bg

T75 = 620 seconds

T25 = 73 seconds

T75 - T25 = 547 seconds

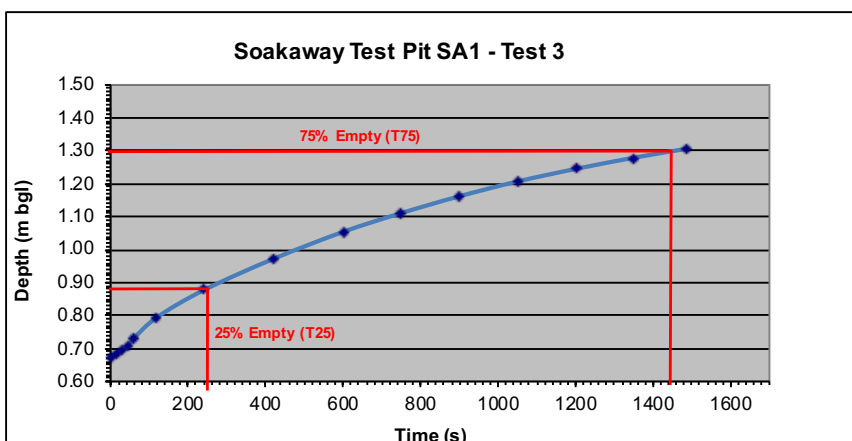


Assumed drain invert level = 0.694m bg

T75 = 1070 seconds

T25 = 205 seconds

T75 - T25 = 865 seconds



Assumed drain invert level = 0.675m bg

T75 = 1445 seconds

T25 = 230 seconds

T75 - T25 = 1215 seconds