

Site: St James Park, Former MMU Campus, Didsbury
Plots: 10 to 17
Date: 17th October 2017
NHBC Ref: Phase A – 517456



1 INTRODUCTION

LK Consult (LKC) has been appointed by PJ Livesey Holdings Ltd to validate the depth of the garden capping layer laid down at the development at St James Park, Former MMU Campus, Didsbury.

This validation report concerns Plots 10 to 17. These plots consist of a rear garden and a small area of landscaping to the front.

The requirement for remedial works across the site arose as a result of previous site investigations and risk assessments carried out by LK Consult Limited (ref. LKC 16 1066-02 Post Demolition Site Investigation, Risk Assessment and Updated Remediation Strategy, dated 15th December 2016) which outlined the remediation and validation requirements. These comprised the following recommendations:

- i) Option 1: Environmental capping layer comprising 450mm clean suitable soil in rear gardens and 300mm in front gardens and areas of landscaping over either 100mm MOT stone (included in total soil depth) or geotextile marker.
- ii) Option 2: Further sampling and risk assessment on a block by block basis (nominally a total of 4 soil samples per plot with 1 in the front garden) or selected soil samples in any landscaped areas. If soil results are below generic assessment criteria then no specific clean validated environmental cover depth will be required, but a nominal 150mm covering of topsoil as a growing medium (if required).
- iii) Validation testing of any site won or imported material to be re-used onsite in gardens and soft landscaping to ensure it is 'suitable for use'. All site won or imported material should be tested at a rate of 1 sample per 50m³ for topsoil and 1 sample per 150m³ for subsoil.
- iv) Details of unexpected contamination.
- v) Provision of waste transfer notes for any disposal of contaminated soil offsite.

2 IMPORTED / SITE WON MATERIAL

Topsoil for use in the garden and soft landscaping areas has been imported to site. The material used comprised approximately 150m³ of topsoil supplied by Grabserve from a greenfield site at New Manor Farm, Stretford and approximately 200m³ of topsoil from Huperade Soil Supplies in Timperley.

Composite topsoil samples were taken from garden areas (ref: TS101-TS104) were subjected to the following analytical suite as a conservative measure:

- Arsenic, cadmium, total chromium, hexavalent chromium, copper, lead, zinc, selenium, nickel, vanadium, mercury, speciated PAH, boron, cyanide (free and total), total phenol, TPH CWG, BTEX, pH, soluble sulphate, asbestos and SOM.

Site won subsoil comprising natural gravelly sand has been used within the capping layer in plots on site (approximately 230m³).

The subsoil was stockpiled onsite and samples were collected (ref: Sand 1 to Sand 3) and subjected to the following analytical suite as a conservative measure:

- Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.

Stockpile sampling of the site won subsoil was undertaken in accordance with guidance given in ISO 10381 Part 8¹. Selected photos of stockpiles are presented in Appendix A. Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation².

Soil samples were collected in plastic tubs, amber glass jars and amber vials and despatched to Chemtest of Newmarket in cool boxes with ice packs.

Soil results for the topsoil and subsoil are presented in Appendix B. No elevated levels of contaminants were identified in the soil samples collected when compared to Generic Assessment Criteria presented in the agreed Remediation Strategy. The Validation Checklist provided to the ground workers is presented in Appendix C.

¹ ISO (2006). "Soil Quality – Sampling – Part 8: Guidance on Sampling of Stockpiles". ISO10381-8.

² EA (2000). "Technical Aspects of Site Investigation. Volumes 1 & 2 Text Supplements Research and Development Technical Report." P5-065/Tr.

3 CAPPING LAYER IN GARDEN AREAS

The recommendation for the garden capping layer in Plots 10 to 17 was that it should comprise a minimum 300mm thickness to the front and 450mm to the rear.

LKC attended site on 14th and 25th September 2017 to inspect the capping layer construction and depth in the rear and front garden areas. Photographs are provided in Appendix D and the observations are summarised below.

Location	Topsoil Depth (mm)	Subsoil Depth (mm)	Membrane or 100mm MOT	Total Depth (mm)	Required Depth (mm)	Pass (✓) or Fail (x)
Plot 10 front	250	N/A	MOT	350	300	✓
Plot 10 rear	150	250	Membrane	400	450	x
Plot 11 front	250	N/A	Membrane and MOT	350	300	✓
Plot 11 rear	150	150	Membrane	300	450	x
Plot 12 front	350	N/A	MOT	450	300	✓
Plot 12 rear	150	300	Membrane	450	450	✓
Plot 13 front	300	N/A	MOT	400	300	✓
Plot 13 rear	150	250	Membrane	400	450	x
Plot 14 front	400	N/A	Membrane	400	300	✓
Plot 14 rear	150	150	Membrane	300	450	x
Plot 15 front	450	N/A	Membrane	450	300	✓
Plot 15 rear	150	300	Membrane	450	450	✓
Plot 16 front	350	N/A	Membrane	350	300	✓
Plot 16 rear	150	200	Membrane	350	450	x
Plot 17 front	350	N/A	Membrane	350	300	✓
Plot 17 rear	200	300	Membrane	500	450	✓

During the site validation works, LKC were unable to penetrate the 100mm MOT break layer with hand excavation tools (spade and hand auger) and as such were unable to fully validate the thickness of the break layer, however this adds a level of comfort that the break is suitable for its proposed purpose.

LKC were able to verify that, in the places inspected within the front gardens of Plots 10 to 17, the capping layer depths were in accordance with the requirements of the Remediation Strategy.

The rear gardens of Plots 10 to 17 have a stepped profile with the lower area flagged and the upper area grassed. The minimum 450mm capping layer was not achieved in the rear gardens of Plots 10, 11, 13, 14 and 16. The rear gardens of Plots 10 to 17 include mature trees towards the east which are part of the Didsbury St James Conservation Area. These

trees are protected by Tree Preservation Orders (TPOs) which limits the ground work which can be carried out within the tree's Root Protection Area (RPA).

Therefore, validation pits in the upper area of the rear gardens had limited depths due to the TPOs present in this area of the site.

With reference to the Arboriculture Report carried out by Urban Green (ref:10768, dated June 2015) *'changes in ground level can be harmful to trees where stripping or filling of soil is carried out in the RPA. It is therefore important that no significant changes in level occur within the RPA of retained trees.'*

This statement is also confirmed in BS5837:2012 'Trees in relation to design, demolition and construction – Recommendations' 7.2.1 *'To avoid damage to tree roots, existing ground levels should be retained within the RPA. Intrusion into soil (other than for piling) within the RPA is generally not acceptable, and topsoil within it should be retained.'*

Therefore, when excavating the existing material to meet the capping layer requirements, the necessary depth could not be achieved.

To add a level of comfort, LKC undertook soil sampling from the made ground before the clean environmental cover system was installed in the upper areas of the rears of Plots 10 to 17. LKC attended site on 1st November 2016 and duly collected 5no. samples of the existing soil from the upper areas behind Plots 10 to 17 (ref P10T-P15T). Selected photographs of the rear gardens prior to remediation are presented in Appendix E

Sampling was undertaken in accordance with guidance given above. No elevated levels of contamination were identified when compared to Generic Assessment Criteria. Results are presented in Appendix F.

Therefore, given the above, LKC consider the reduced capping layer provided to the rear of Plots 10 to 17 to be acceptable.

4 CONCLUSIONS

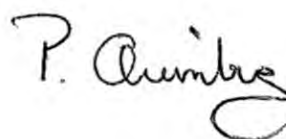
LKC has completed the validation of the garden capping layers within Plots 10 to 17 and conclude that, in the places inspected, chemically suitable material has been laid to an appropriate depth when considering garden constraints (TPOs).

Report Prepared By:



Kerrell Walley
Geo-Environmental Scientist

Report Reviewed By:



Dr Paul Quimby
Director

Enc:

Appendix A: Stockpile Photographs

Appendix B: Certificates of Analysis – Imported and Site Won Soil

Appendix C: Remediation Strategy Validation Checklist

Appendix D: Plot Photographs

Appendix E: Plot Photographs before Remediation

Appendix F: Certificates of Analysis – Made Ground below Capping Layer

Disclaimer

This report has been prepared by LKC who have exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant experienced in preparing reports of a similar scope. However, to the extent that the report is based on or relies upon information contained in records, reports or other materials provided to LKC which have not been independently produced or verified, LKC gives no warranty, representation or assurance as to the accuracy or completeness of such information.

This report is issued on the condition that LKC will not be held liable for any loss arising from ground conditions between sampling points (i.e. boreholes/trial pits/hand augers/surface samples) which have not been shown by the sampling points or related testing carried out during the investigation, nor for any loss arising from conditions below the maximum depth of the investigation, or for any works done to the garden areas following the date of inspection. Opinions on such conditions, where given, are for general guidance only.

This report is prepared solely for the benefit of PJ Livesey Holdings Ltd. It may not be relied upon by, or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full. Those using this information in subsequent assessments or evaluations do so at their own risk.

Appendix A – Stockpile Photographs

	Photograph 1: Stockpiles of site won sand excavated from site.
	Photograph 2: View of site won sand excavated from site.
	Photograph 3: View of stockpiles to be reused as site won material on site.

Appendix B – Certificates of Analysis – Imported and Site Won Soil



Final Report

Report No.: 16-26078-1

Initial Date of Issue: 31-Oct-2016

Client LK Consult

Client Address: Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Rachel Peart
Contaminated Land

Project LKC 16 1066 MMU Didsbury
(Huperade)

Quotation No.:		Date Received:	27-Oct-2016
Order No.:	732176	Date Instructed:	27-Oct-2016
No. of Samples:	4		
Turnaround (Wkdays):	3	Results Due:	31-Oct-2016
Date Approved:	31-Oct-2016		

Approved By:

Details: Glynn Harvey, Laboratory Manager

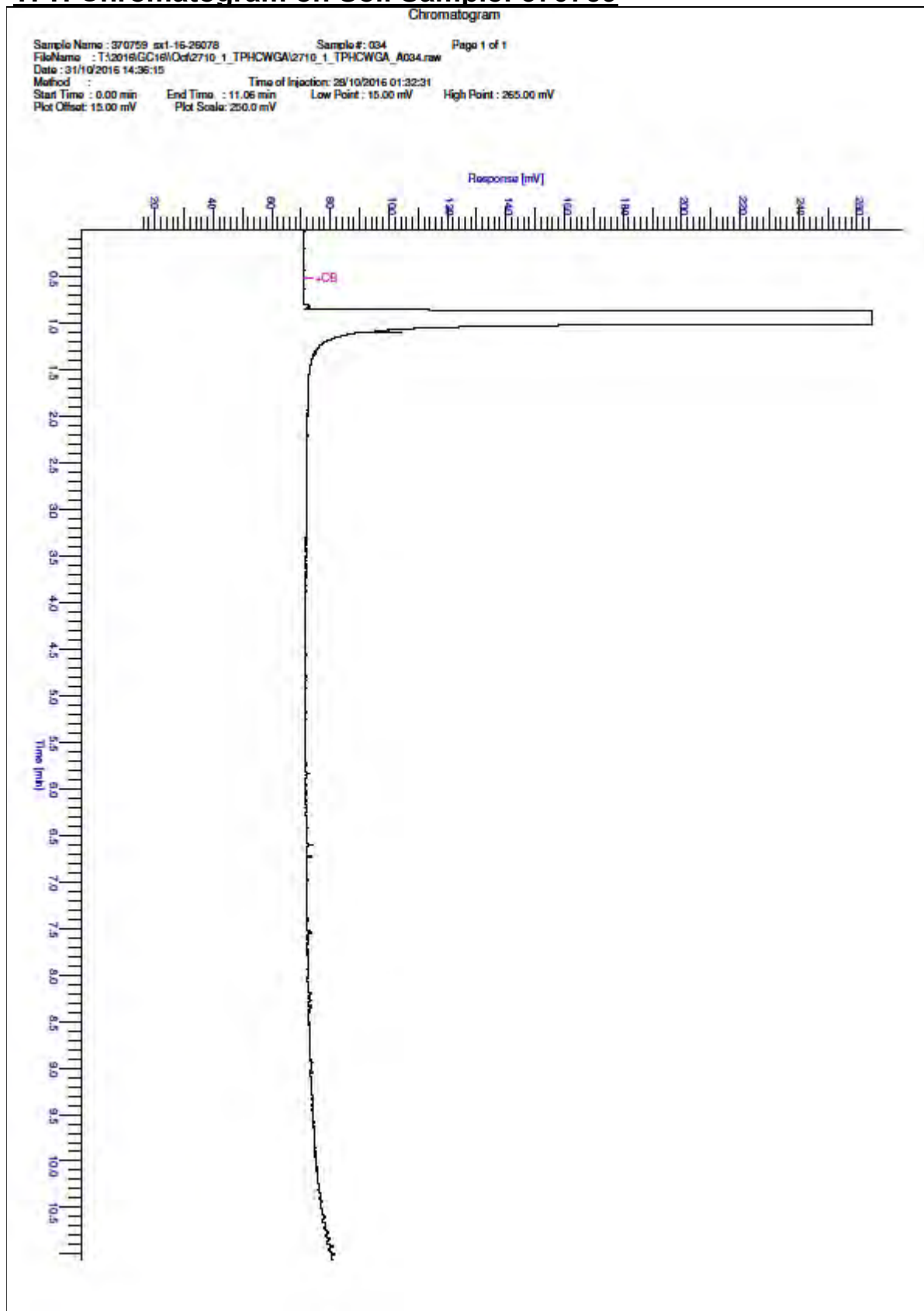
Results - Soil

Client: LK Consult	Chemtest Job No.:				16-26078	16-26078	16-26078	16-26078
Quotation No.:	Chemtest Sample ID.:				370759	370760	370761	370762
	Client Sample ID.:				TS101	TS102	TS103	TS104
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Date Sampled:				25-Oct-2016	25-Oct-2016	25-Oct-2016	25-Oct-2016
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	15	16	15	16
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Clay	Clay	Clay	Clay
Chromatogram (TPH)	N			N/A	See Attached	See Attached	See Attached	See Attached
pH	M	2010		N/A	9.0	8.7	8.6	8.5
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.73	0.53	0.55	0.58
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010	0.12	0.056	0.061	0.066
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	12	13	13	13
Cadmium	M	2450	mg/kg	0.10	0.26	0.30	0.27	0.30
Chromium	M	2450	mg/kg	1.0	15	15	15	13
Copper	M	2450	mg/kg	0.50	36	39	41	29
Mercury	M	2450	mg/kg	0.10	0.28	0.32	0.97	0.25
Nickel	M	2450	mg/kg	0.50	16	18	18	13
Lead	M	2450	mg/kg	0.50	86	99	90	75
Selenium	M	2450	mg/kg	0.20	0.33	0.24	0.29	0.22
Vanadium	U	2450	mg/kg	5.0	18	19	19	15
Zinc	M	2450	mg/kg	0.50	76	82	82	58
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	3.5	4.8	3.3	3.8
Fuel Type	N	2670		N/A	PAH	PAH	PAH	PAH
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	M	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	5.4	1.7	12	14
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	14	13	24	17

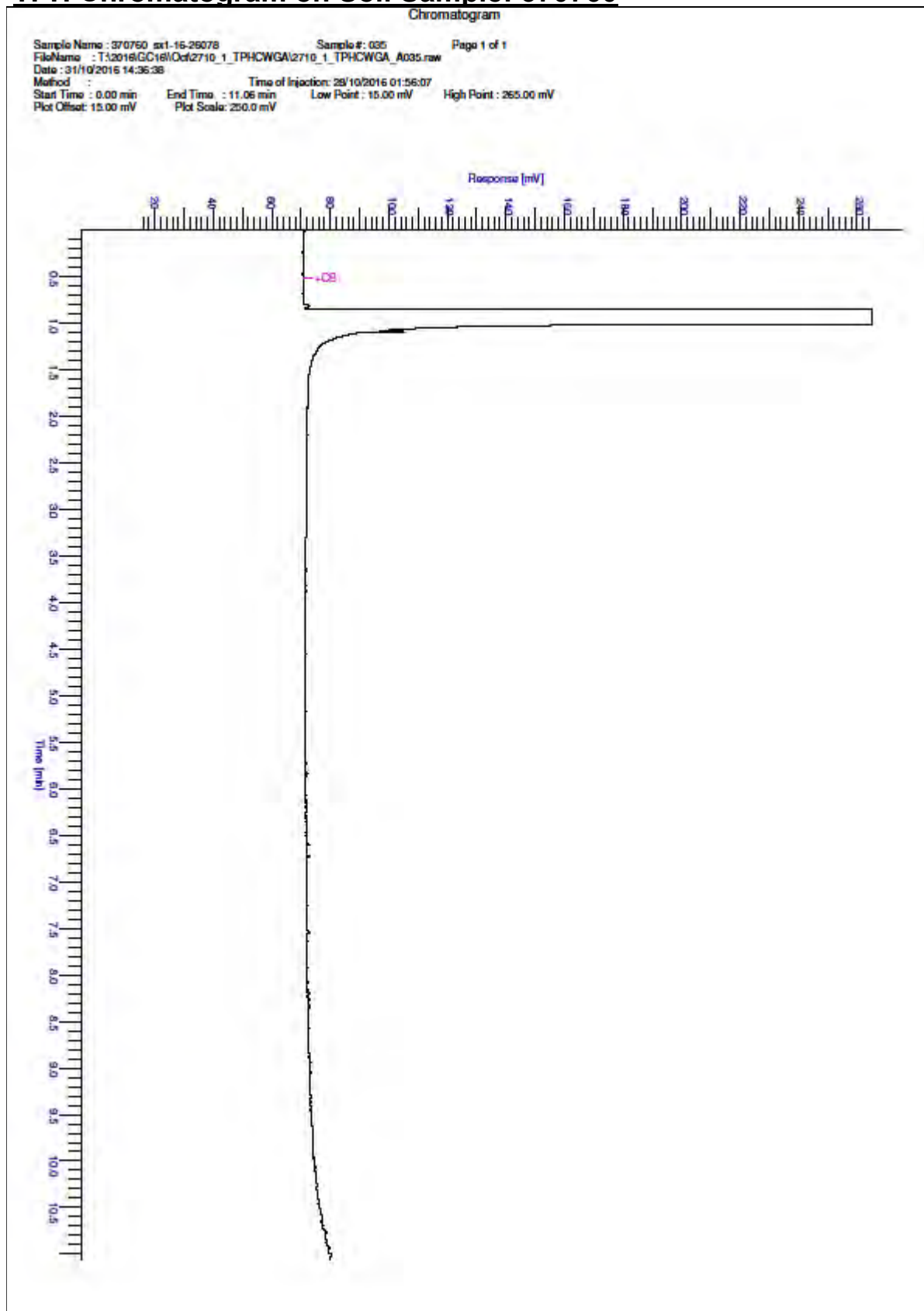
Results - Soil

Client: LK Consult	Chemtest Job No.:				16-26078	16-26078	16-26078	16-26078
Quotation No.:	Chemtest Sample ID.:				370759	370760	370761	370762
	Client Sample ID.:				TS101	TS102	TS103	TS104
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Date Sampled:				25-Oct-2016	25-Oct-2016	25-Oct-2016	25-Oct-2016
Determinand	Accred.	SOP	Units	LOD				
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	40	33	60	46
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	3.5	4.8	5.9	6.0
Total Aromatic Hydrocarbons	M	2680	mg/kg	5.0	63	52	100	82
Total Petroleum Hydrocarbons	M	2680	mg/kg	10	63	52	100	82
Naphthalene	M	2700	mg/kg	0.10	< 0.10	0.10	0.20	0.30
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	0.45	0.16	0.15
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	0.81	0.18	0.13
Fluorene	M	2700	mg/kg	0.10	< 0.10	0.18	0.13	0.18
Phenanthrene	M	2700	mg/kg	0.10	1.2	2.1	1.6	1.1
Anthracene	M	2700	mg/kg	0.10	0.33	0.60	0.54	0.14
Fluoranthene	M	2700	mg/kg	0.10	2.3	4.3	2.5	2.0
Pyrene	M	2700	mg/kg	0.10	2.1	3.9	2.7	1.9
Benzo[a]anthracene	M	2700	mg/kg	0.10	1.1	2.3	1.3	1.0
Chrysene	M	2700	mg/kg	0.10	1.8	3.0	2.0	1.6
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	1.5	2.8	1.9	1.4
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	0.81	1.5	1.2	0.91
Benzo[a]pyrene	M	2700	mg/kg	0.10	1.3	2.2	1.3	1.1
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.92	1.4	1.0	0.53
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.56	0.48	0.37	0.32
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	0.94	1.3	1.1	0.77
Total Of 16 PAH's	M	2700	mg/kg	2.0	15	27	18	14
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30

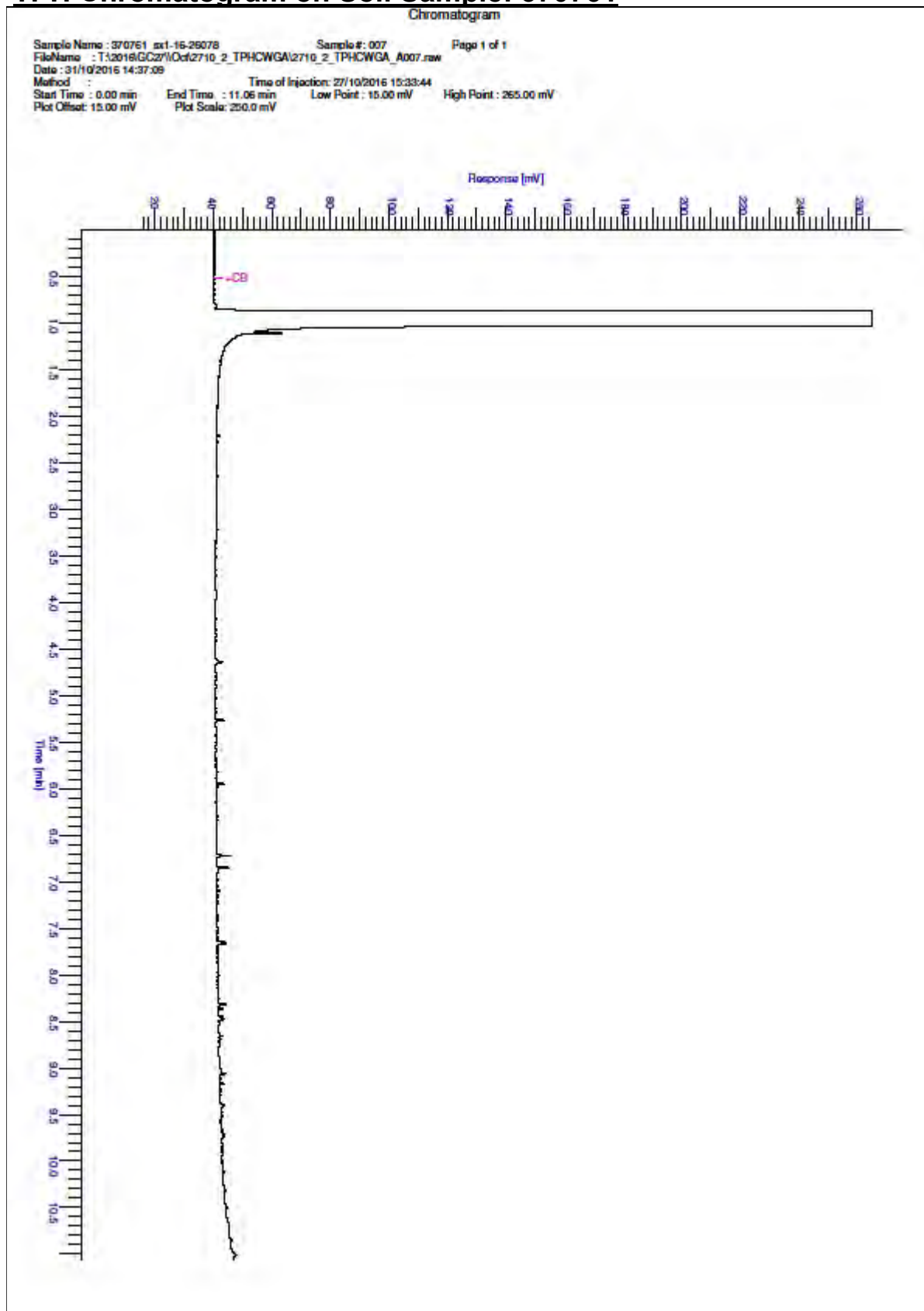
TPH Chromatogram on Soil Sample: 370759



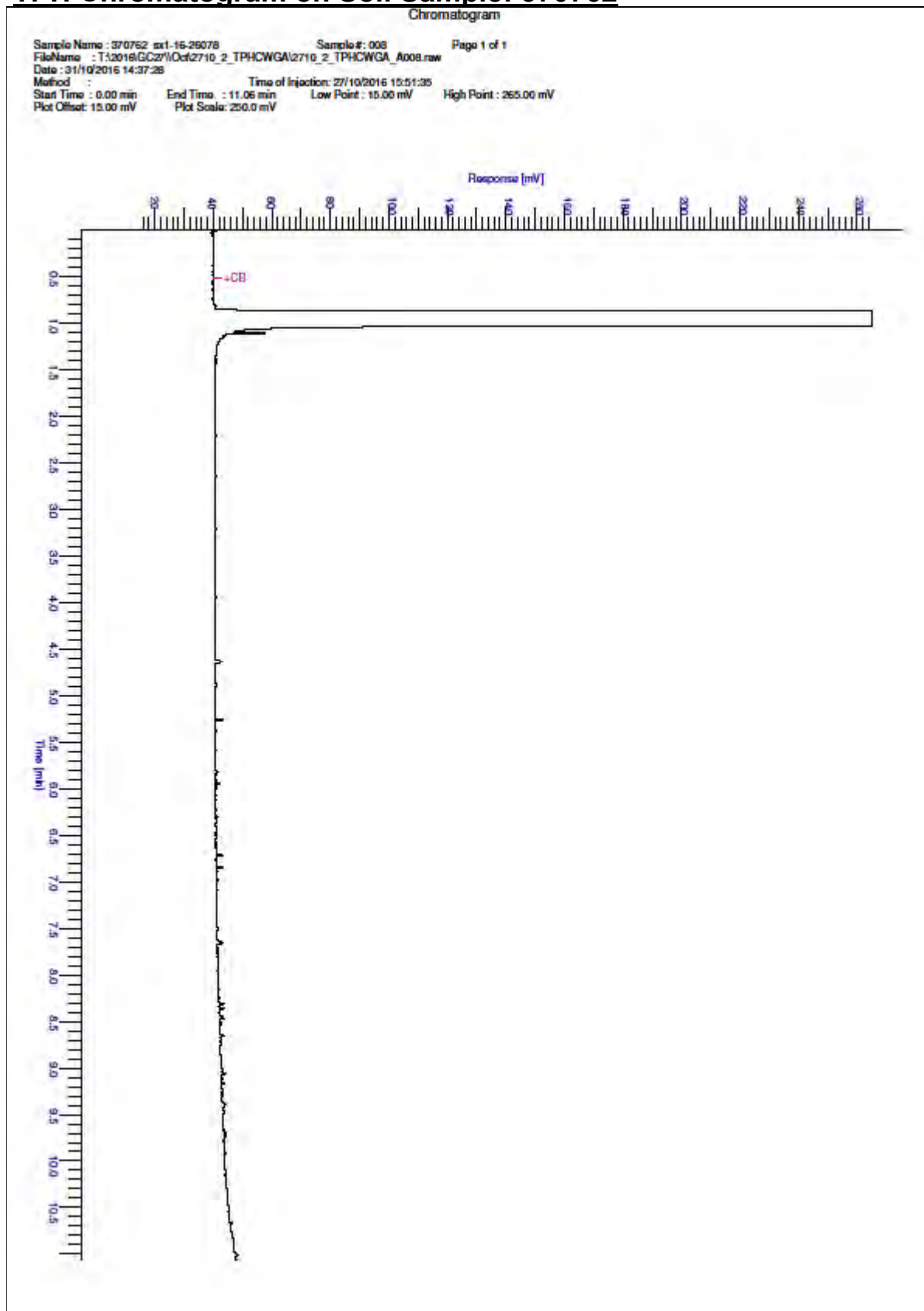
TPH Chromatogram on Soil Sample: 370760



TPH Chromatogram on Soil Sample: 370761



TPH Chromatogram on Soil Sample: 370762



Test Methods

SOP	Title	Accreditation	Parameters included	Method summary
2010	pH Value of Soils	UKAS accreditedMCERTS accredited	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)		Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)		Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	UKAS accreditedMCERTS accredited	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	UKAS Accredited	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	UKAS accreditedMCERTS accredited	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	UKAS accreditedMCERTS accredited	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils		Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	UKAS accreditedMCERTS accredited	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	UKAS accreditedMCERTS accredited*	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Normal Level TPH A/A Split is MCERTS accredited. Low Level TPH A/A Split is unaccredited	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	UKAS accreditedMCERTS accredited	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	UKAS accreditedMCERTS accredited*	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2920	Phenols in Soils by HPLC	UKAS accreditedMCERTS accredited	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report No.: 16-28631-1

Initial Date of Issue: 25-Nov-2016

Client LK Consult

Client Address: Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Paul Quimby
Contaminated Land

Project LKC 16 1066 MMU Didsbury

Quotation No.: **Date Received:** 23-Nov-2016

Order No.: 732176 **Date Instructed:** 23-Nov-2016

No. of Samples: 3

Turnaround (Wkdays): 3 **Results Due:** 25-Nov-2016

Date Approved: 25-Nov-2016

Approved By:

Details: Robert Monk, Technical Development
Chemist

Project: LKC 16 1066 MMU Didsbury

Client: LK Consult	Chemtest Job No.:				16-28631	16-28631	16-28631
Quotation No.:	Chemtest Sample ID.:				381845	381846	381847
	Client Sample ID.:				SAND1	SAND2	SAND3
	Sample Type:				SOIL	SOIL	SOIL
	Date Sampled:				22-Nov-2016	22-Nov-2016	22-Nov-2016
	Asbestos Lab:				COVENTRY		COVENTRY
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	6.4	8.8	8.5
Soil Colour	N	2040		N/A	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand
pH	M	2010		N/A	8.5	8.6	8.3
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010	< 0.010	0.030	0.024
Arsenic	M	2450	mg/kg	1.0	1.4	2.4	1.3
Cadmium	M	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chromium	M	2450	mg/kg	1.0	5.9	7.6	4.8
Copper	M	2450	mg/kg	0.50	5.7	7.8	4.9
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	8.2	9.7	5.7
Lead	M	2450	mg/kg	0.50	4.0	5.6	3.2
Selenium	M	2450	mg/kg	0.20	0.22	0.21	< 0.20
Vanadium	U	2450	mg/kg	5.0	5.3	7.5	5.5
Zinc	M	2450	mg/kg	0.50	17	21	14
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	0.43	< 0.40	< 0.40
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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- I/S Insufficient Sample
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Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

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Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

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customerservices@chemtest.co.uk

Appendix C – Remediation Strategy Validation Checklist

Site Works / Validation Check List – LKC 16 1066 – MMU Didsbury Housing Development



Plots	Validation Work	Additional Notes
Imported / Site Won Soil / stone	-Require information from soil provider on source and amount of soil provided (if sourced offsite). -LKC will need to collect and analyse a suitable number of samples per stockpile/source. -Topsoil tested at 1 sample 50m³. -Subsoil tested at 1 sample per 150m³. -Stone tested at 1 sample per 500m³. -If provenance proven that subsoil is natural quarried material then no testing required. -A minimum of 3 samples per source is required. -If site won material then should be stockpiled and tested at the same rate, but will need appropriate exemptions / permits to re-use onsite.	-Soil sampling should be undertaken from source or from a stockpile onsite. Can be sampled when in gardens; however, may have to be removed if unsuitable. -Soil samples will be undertaken on an accelerated 3 working day turnaround.
Option 2 Block Specific SI	-Useful if time constraints and where you do not wish for an environmental capping layer. -Nominal 3 soil sample from rear garden and 1 soil sample from front. -Selected soil sampling in landscaped (POS) areas. -All data in that block / POS will be risk assessed and a Block by Block / POS assessment and recommendations provided in a report. -This additional sampling will apply near TPO's, where the full environmental capping layer may not be able to be achieved. Due to root protection.	-If data fail then an environmental capping layer will still be required and a report will not be needed. - If soil passes and no formal environmental capping layer is required then a formal depth is not necessary. A nominal 150mm topsoil is recommended as a growing medium and to cover undesirable material.
Option 1 Garden Areas	<u>Rear Gardens</u> <i>Unless a Block by Block site investigation is undertaken and soil passes.</i> -450mm total depth soil capping layer (includes minimum 150m topsoil) required for these plots. -This includes a Hi-Viz geotextile at the base of the capping layer OR 100mm MOT type 1 (minimal fines) and 350mm depth soil capping layer (includes minimum 150mm topsoil).	-Site manager to photograph laying of separation geotextile OR 100mm MOT in each garden area. -LKC need to validate the depth of the cover layer by digging small hole in each garden area, measuring the depth and taking validatory photos.
Option 1 Landscaped Areas	<u>All Front gardens and Landscaped Areas</u> <i>Unless a Block by Block / POS site investigation is undertaken and soil passes.</i> -300mm total depth soil capping layer (includes minimum 150m topsoil) required for these landscaped areas. -This includes a Hi-Viz geotextile at the base of the capping layer OR 100mm MOT type 1 (minimal fines) and 200mm depth soil capping layer (includes minimum 150mm topsoil).	-Site manager to photograph laying of separation geotextile OR 100mm MOT in each garden area. -LKC need to validate the depth of the cover layer by digging small hole in each garden area, measuring the depth and taking validatory photos.
Site	<u>Unexpected Contamination</u> -During earthworks if contractor finds visual or olfactory evidence of contamination and/or asbestos then LKC should be informed and if necessary material will need to be sampled so that it can be disposed of at an appropriate licensed tip. -Material should be stockpiled on Visqueen and covered prior to disposal and/or testing. -All disposal tickets will be required for the Completion Report.	-If considerable earthworks or soil movement is occurring it would be advisable that LKC undertake a Watching Brief during earthworks.
Site	<u>Local Authority Site Completion Report</u> -Manchester Council require a Site Completion Report for whole site once all validation complete. -Individual plot reports may be required for NHBC for individual plot sales before site is fully completed.	-Can only be done once development is completed. -Manchester Council may provide a letter of comfort for each plot that has been completed satisfactory (if individual plot reports undertaken).

NOTE:

Minimum 24 hours notice to attend site.

Contacts

LK Consult

Unit 29, Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200

Paul Quimby – p.quimby@thelkgroup.com

Kerrell Walley – k.walley@thelkgroup.com

SUITABILITY OF ANY IMPORTED MATERIAL AS CLEAN COVER

Recommended validation sampling requirements for environmental capping layer soils presented in the following table.

Material Type	Source	Suite of Analysis	Sampling Rate
Topsoil	Greenfield	Suite A	1 sample per 50m ³ (minimum of 3 samples per source)
	Brownfield / Unknown / Site Won	Suite B	
Subsoil	Brownfield / Unknown / Site Won	Suite B	1 sample per 150m ³ (minimum of 3 samples per source)
	First Generation i.e. quarried sand (su (break layer)	No testing is required. Certification of material provenance is required.	
Physical Stone Break Layer	Recycled Stone (6F2 / min. fines)	Suite B	1 sample per 500m ³ (minimum of 3 samples per source)

Recommended validation sampling requirements for environmental capping layer soils.

Notes:

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.

Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.

ENVIRONMENTAL COVER LAYER

Private Gardens

Private garden areas should comprise a cover layer depth of at least 450mm. A typical construction detail is provided below. Subsoil may be replaced by topsoil if required.

GROUND LEVEL

450mm (minimum)		150mm (minimum) chemically validated TOPSOIL
		200mm chemically validated SUBSOIL
		100mm PHYSICAL BREAK LAYER (typically MOT Type 1)
		Existing MADE GROUND

Soft Landscaped Areas and Front Gardens

Soft landscaping areas and front gardens should comprise a cover layer depth of at least 300mm. A typical construction detail is provided below:

GROUND LEVEL

300mm (minimum)		200mm (minimum) chemically validated TOPSOIL
		100mm PHYSICAL BREAK LAYER (typically MOT Type 1)
		Existing MADE GROUND

If suitable break layer material is not available, then the **break layer may be substituted for a separation geotextile** and the subsoil / topsoil depth increased by 100mm to maintain the required capping layer material depth.

Appendix D – Plot Photographs

Plot 10



Photograph 4:
View of front garden of Plot 10.



Photograph 5:
View of soil in capping layer excavation in front garden of Plot 10 with MOT break layer visible.



Photograph 6:
Depth measurement in front garden of Plot 10.



Photograph 7:

View of the upper level of the rear garden of Plot 10. Northern extent of photo shows the lower level (fully paved).



Photograph 8:

View of soil in capping layer excavation in rear garden of Plot 10 with geotextile membrane visible.



Photograph 9:

Depth measurement in rear garden of Plot 10.

Plot 11



Photograph 10:
View of front garden of Plot 11.



Photograph 11:
View of soil in capping layer excavation in front garden of Plot 11 with geotextile membrane visible.



Photograph 12:
Depth measurement in front garden of Plot 11.



Photograph 13:

View of the upper level of the rear garden of Plot 11. Please note the lower level of the rear garden was fully paved.



Photograph 14:

View of soil in capping layer excavation in rear garden of Plot 11 with geotextile membrane visible.



Photograph 15:

Depth measurement in rear garden of Plot 11.

Plot 12



Photograph 16:
View of front garden of Plot 12.



Photograph 17:
View of soil in capping layer excavation in front garden of Plot 12 with geotextile membrane visible.



Photograph 18:
Depth measurement in front garden of Plot 12.



Photograph 19:

View of the upper level of the rear garden of Plot 12 with evidence of flagging.
Please note the lower level of the rear garden was fully paved.



Photograph 20:

View of soil in capping layer excavation in rear garden of Plot 12 with geotextile membrane visible.



Photograph 21:

Depth measurement in rear garden of Plot 12.

Plot 13



Photograph 22:
View of front garden of Plot 13.



Photograph 23:
View of soil in capping layer excavation in front garden of Plot 13 with geotextile membrane visible.



Photograph 24:
Depth measurement in front garden of Plot 13.



Photograph 25:

View of the upper level of the rear garden of Plot 13 with evidence of flagging. Please note the lower level of the rear garden was fully paved.



Photograph 26:

View of soil in capping layer excavation in rear garden of Plot 13 with geotextile membrane visible.



Photograph 27:

Depth measurement in rear garden of Plot 13.

Plot 14



Photograph 28:
View of front garden of Plot 14.



Photograph 29:
View of soil in capping layer excavation in front garden of Plot 14 with geotextile membrane visible.



Photograph 30:
Depth measurement in front garden of Plot 14.



Photograph 31:

View of the upper level of the rear garden of Plot 14 with evidence of flagging in the lower level of the garden.



Photograph 32:

View of soil in capping layer excavation in rear garden of Plot 14 with geotextile membrane visible.



Photograph 33:

Depth measurement in rear garden of Plot 14.

Plot 15



Photograph 34:
View of front garden of Plot 15.



Photograph 35:
View of soil in capping layer excavation in front garden of Plot 15 with geotextile membrane visible.



Photograph 36:
Depth measurement in front garden of Plot 15.



Photograph 37:

View of the upper level of the rear garden of Plot 15 with evidence of flagging in the lower level of the garden.



Photograph 38:

View of soil in capping layer excavation in rear garden of Plot 15 with geotextile membrane visible.



Photograph 39:

Depth measurement in rear garden of Plot 15.

Plot 16



Photograph 40:
View of front garden of Plot 16.



Photograph 41:
View of soil in capping layer excavation in front garden of Plot 16 with geotextile membrane visible.



Photograph 42:
Depth measurement in front garden of Plot 16.



Photograph 43:

View of the upper level of the rear garden of Plot 16 with evidence of flagging.
Please note the lower level of the rear garden was fully paved.



Photograph 44:

View of soil in capping layer excavation in rear garden of Plot 16 with geotextile membrane visible.



Photograph 45:

Depth measurement in rear garden of Plot 16.

Plot 17



Photograph 46:
View of front garden of Plot 17.



Photograph 47:
View of soil in capping layer excavation in front garden of Plot 17 with geotextile membrane visible.



Photograph 48:
Depth measurement in front garden of Plot 17.



Photograph 49:

View of the upper level of the rear garden of Plot 17 with evidence of flagging in the lower level of the garden.



Photograph 50:

View of soil in capping layer excavation in rear garden of Plot 17 with geotextile membrane visible.



Photograph 51:

Depth measurement in rear garden of Plot 17.

Appendix E – Plot Photographs before Remediation



Photograph 52:

View along the upper levels of the rear gardens of Plots 10 to 17 prior to remediation. Mature trees protected under TPOs are present in view.



Photograph 53:

View of the upper level of the rear garden of Plot 10 with a mature tree under a TPO present in view.



Photograph 54:

View of the upper level of the rear garden of Plot 11 with a mature tree under a TPO present in view.



Photograph 55:

View of the upper level of the rear garden of Plot 12 with a mature tree under a TPO present in view.



Photograph 56:

View of the upper levels of the rear gardens of Plots 13 and 14 with several mature trees under TPOs present in view.



Photograph 57:

View of the upper level of the rear garden of Plot 15 with a mature tree under a TPO present in view.

Appendix F – Certificates of Analysis – Made Ground below Capping Layer



Final Report

Report No.: 16-26624-1

Initial Date of Issue: 04-Nov-2016

Client LK Consult

Client Address: Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Paul Quimby
Contaminated Land

Project LKC 16 1066 MMU Didsbury

Quotation No.: **Date Received:** 02-Nov-2016

Order No.: 732168 **Date Instructed:** 02-Nov-2016

No. of Samples: 5

Turnaround (Wkdays): 3 **Results Due:** 04-Nov-2016

Date Approved: 04-Nov-2016

Approved By:

Details: Keith Jones, Technical Manager

Results - Soil

Client: LK Consult	Chemtest Job No.:				16-26624	16-26624	16-26624	16-26624	16-26624
Quotation No.:	Chemtest Sample ID.:				373261	373262	373263	373264	373265
	Client Sample ID.:				P10(T)	P11(T)	P12(T)	P13-14(T)	P15(T)
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Date Sampled:				01-Nov-2016	01-Nov-2016	01-Nov-2016	01-Nov-2016	01-Nov-2016
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD					
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	23	19	19	18	19
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones, Roots	Stones, Roots	Stones, Roots	Stones, Roots	Stones, Roots
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand
pH	M	2010		N/A	7.4	7.8	7.7	7.5	6.3
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010	0.074	0.019	< 0.010	< 0.010	< 0.010
Arsenic	M	2450	mg/kg	1.0	21	18	16	14	17
Cadmium	M	2450	mg/kg	0.10	0.83	0.85	0.76	0.62	0.61
Chromium	M	2450	mg/kg	1.0	21	23	21	18	20
Copper	M	2450	mg/kg	0.50	49	63	59	46	49
Mercury	M	2450	mg/kg	0.10	0.39	0.47	0.59	0.49	0.52
Nickel	M	2450	mg/kg	0.50	24	24	22	19	21
Lead	M	2450	mg/kg	0.50	190	220	360	340	290
Selenium	M	2450	mg/kg	0.20	0.36	0.85	0.63	0.47	0.64
Vanadium	U	2450	mg/kg	5.0	23	28	27	24	30
Zinc	M	2450	mg/kg	0.50	350	190	170	150	140
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	16	15	9.0	7.2	8.6
Naphthalene	M	2700	mg/kg	0.10	1.2	0.68	0.35	0.54	1.1
Acenaphthylene	M	2700	mg/kg	0.10	0.45	0.21	0.13	< 0.10	0.12
Acenaphthene	M	2700	mg/kg	0.10	0.31	0.16	0.14	0.13	0.14
Fluorene	M	2700	mg/kg	0.10	0.36	0.17	< 0.10	< 0.10	0.12
Phenanthrene	M	2700	mg/kg	0.10	4.3	2.1	1.2	1.2	1.3
Anthracene	M	2700	mg/kg	0.10	0.97	0.53	0.30	0.36	0.25
Fluoranthene	M	2700	mg/kg	0.10	8.2	3.8	2.7	2.7	3.0
Pyrene	M	2700	mg/kg	0.10	8.5	3.9	2.9	2.7	3.2
Benzo[a]anthracene	M	2700	mg/kg	0.10	4.2	1.9	1.5	1.4	1.7
Chrysene	M	2700	mg/kg	0.10	4.8	2.0	1.6	1.4	1.6
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	6.2	2.8	2.2	1.9	2.4
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	2.9	1.9	1.4	1.3	1.5
Benzo[a]pyrene	M	2700	mg/kg	0.10	4.4	2.2	1.6	1.4	1.9
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	3.4	1.8	1.2	1.2	1.3
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	1.1	0.95	0.16	0.63	0.73
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	3.8	2.3	1.5	1.0	1.4
Total Of 16 PAH's	M	2700	mg/kg	2.0	55	27	19	18	22

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2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID

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Manchester M26 2ZS

Tel: 0161 763 7200

The Corn Exchange, Fenwick Street,
Liverpool L2 7QL

Tel: 0151 235 8716

Unit 121, Wright Business Centre,
1 Lonmay Road, Glasgow G33 4EL

Tel: 0141 773 6269

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