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Our Ref: DL/19-07-05

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Bicester  
Oxon OX27 8AL

4 Church Street  
Maids Moreton  
MK18 1QE

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12 August 2019

For the attention of Mr Jonty Ashworth

Dear Jonty,

**SUPPLEMENTARY GROUNDWATER MONITORING INVESTIGATION – New Technical Site, Bicester Heritage, Launton, Bicester, OX26 5HA.**

**INTRODUCTION**

Following comments and further discussions on the Condition 8 of the Planning Application 18/01333/F, from Mr Samuel Pocock, Planning Advisor of the Environment Agency, which requested *“that before condition 8 is discharged that groundwater quality is determined for the site by taking some water samples from the Cornbrash aquifer. We are concerned that the previous uses of the site have potentially impacted upon groundwater quality”*.

In order to obtain groundwater samples, three supplementary boreholes were drilled down into the rock-head Cornbrash Formation across the site, until refusal on rock-quality strata was met. Siteworks were undertaken during the week commencing the on the 29<sup>th</sup> July 2019.

The objectives of this investigation and report were to purge groundwater samples from each of the supplementary boreholes at the site, in order to conduct chemical laboratory data on the composition of the underlying groundwater.

Testing was undertaken in line with the recommendations from Mr Samuel Pocock of the Environment Agency:- *“We would recommend you consider a suite of dissolved metals (iron, Zinc, Copper, etc) In addition, given the industrial history and use as an airfield, we would recommend some hydrocarbon analysis, TPH, BTEX, PAHs”*.

**Previous Investigation:-**

Previously as part of Bicester Heritage’s Due diligence work, Geo-Integrity conducted a Phase 1 Desk Study & Phase 2 Site Investigation Report at the site, Report No 18-08-08 issue 3 Final, dated November 2018. Therefore this supplementary letter report should be read in conjuncture with the Ground Investigation Report, and is intended to supplement the previously gathered dataset and analysis.

At the time of the previous investigation no groundwater was encountered within the underlying Cornbrash Limestone. The siteworks were however undertaken at the end of the summer of 2018, after an extended period of unseasonal low rainfall.

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## SUPPLEMENTARY SITEWORK INFORMATION

The three supplementary boreholes were located across the site:-

Borehole Number	Location	Groundwater level	Easting/Northing
WS 1B	Western Area	1.40m bgl	459037/ 224353
WS 2B	Central Area	1.70m bgl	459098/ 224314
WS 5B	Eastern Area	2.02m bgl	459224/ 224224

## LABORATORY TESTING

Groundwater samples were obtained from each of the boreholes, on the 5<sup>th</sup> of August 2019, and were tested for a suite which included Metals, TPHs, BTEX, PAHs and water hardness.






Of each of the samples tested, none of the contaminants tested for recorded values in excess of the relevant UKDWS or EQS values. The full results are enclosed.

## UPDATED ASSESSMENT OF THE RISK TO CONTROLLED WATERS

Based on the results of the initial investigation (2018), the supplementary testing, and the information provided by the Environment Agency the following updated assessment has been compiled:-

The assessment of risks to controlled waters follows guidance provided by the Environment Agency and DEFRA in association with the Contaminated Land (England) Regulations 2000 (SI 2000/227). This guidance is Environment Agency's Remedial Targets Methodology Hydrogeological risk assessment for contaminated land (2006), as such these procedures have been followed.

Whilst some background levels of metals, TPHs and PAHs have been identified at the site within the variable Made Ground, It is considered that there is no elevated risk of Controlled Waters pollution from development at this site, due to the following mitigating factors:-

-  Supplementary Groundwater testing has demonstrated that there are no elevated levels of contamination within the underlying groundwater at the site, and that levels are consistent with "clean" uncontaminated groundwater.
-  Encountered levels in the near-surface soil are below that of concern from a Human Health perspective
-  There are no identified, current, significant sources of pollution at the site (i.e leaking tanks),
-  The proposed development is to include many impermeable structures and hardstanding areas (effectively reducing the infiltration and migration of the determinants).
-  The site is recorded to be located outside of any Source Protection Zones.

- There have been no recorded pollution incidents to controlled waters within the surrounding area of the site.

### **Comments**

The supplementary information and analysis undertaken as part of this investigation, demonstrates that controlled waters are not at any significant risk from development at the site, and that the previous uses of the site have not impacted upon groundwater quality.

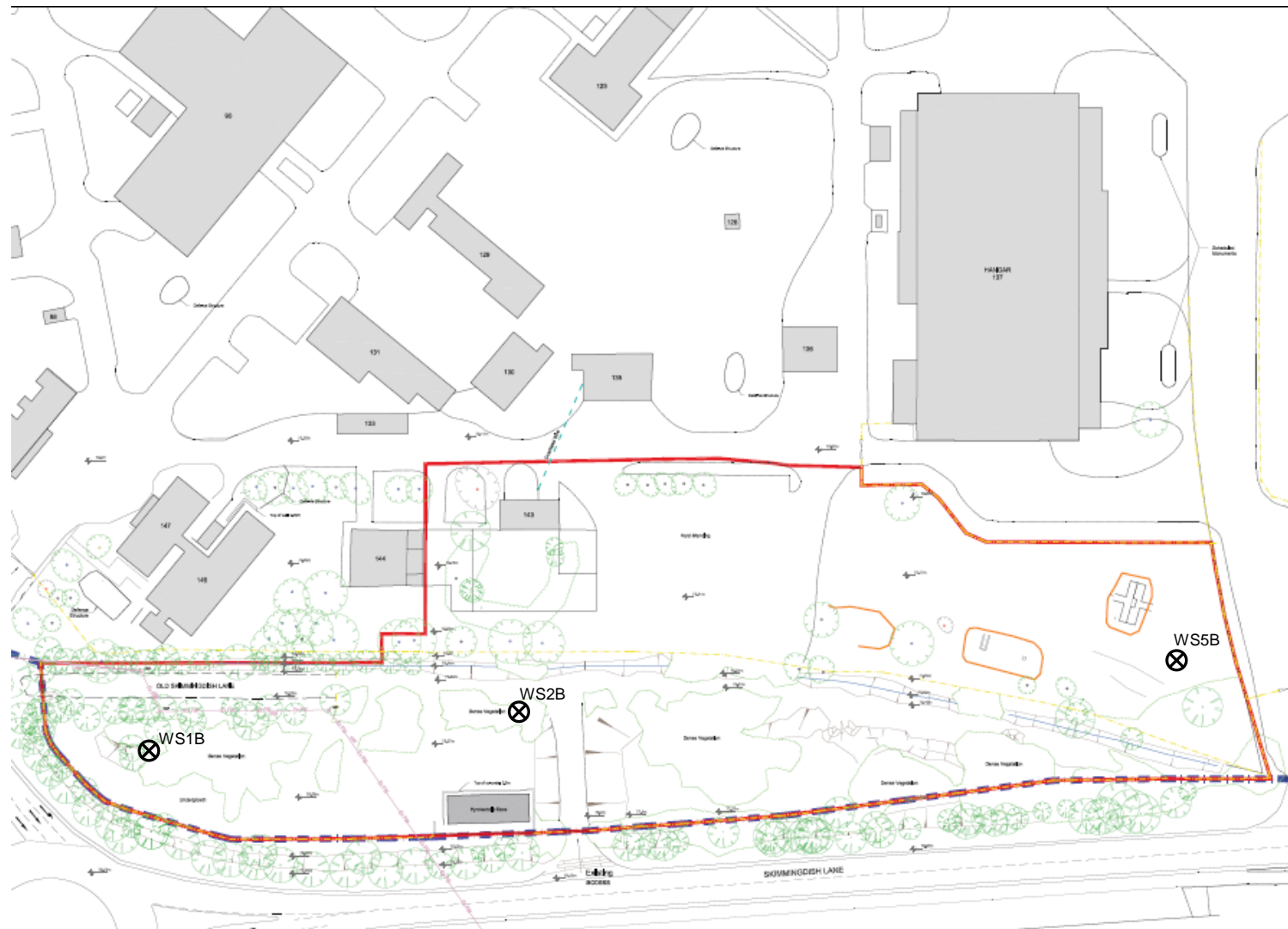
The Environment Agency is the regulatory body charged with protection of controlled waters and is a consultee in the planning process. Therefore we recommend that the conclusions of this report are agreed with the Environment Agency at the earliest stage, to reduce any further delays to the development.

We trust this information is satisfactory to you. In the event of any queries please contact us.

Yours sincerely



**Danny Lusardi**  
**Senior Engineering Geologist, Geo-Integrity Ltd.**



**Key**

 Groundwater Installation Standpipe



4 Church Street  
Maids Moreton  
MK18 1QE

Tel:- 01280 816409  
Mob:- 07858 367 125  
www. geo-integrity.co.uk

**Exploratory Hole Location Plan**

**SITE:-** New Technical Site,  
Bicester Heritage, OX26 5HA

**JOB NO.:-** 19-07-05

**CLIENT:-**  
Bicester Heritage

Drawn DL	Checked MB
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Existing



CONTINUOUS TUBE WS 1-B

INTEGRITY

PROJECT NUMBER 19-07-05	DRILLING DATE 29/7/19	EASTINGS 459037
PROJECT NAME BICESTER HERITAGE	TOTAL DEPTH 2.9m	NORTHINGS 224353
CLIENT BICESTER HERITAGE	DIAMETER 100mm-60mm	SURFACE LEVEL 79.01m AOD
	GROUNDWATER 1.30m bgl	

COMMENTS Logged to BS14688:2013	LOGGED BY DL
	CHECKED BY MB

Samples	Groundwater	Depth (m)	Graphic Log	Material Description	SPT/kN/m <sup>2</sup> (HV)	Well Diagram	Depth (m)
				TOPSOIL Soft brown sandy CLAY. With wood fragments and roots.			
D		0.2		CORNBRASH FORMATION - WEATHERED Firm brown silty slightly sandy gravelly CLAY. Gravel is fine to coarse angular of limestone.			0.2
D		0.4		CORNBRASH FORMATION Brownish grey slightly silty slightly sandy gravelly cobbles of fossiliferous LIMESTONE.	N=<50	Seal	0.4
B		1.0		CORNBRASH FORMATION Recovered as: Brownish grey silty gravel of LIMESTONE.			1.0
		1.2					1.2
		1.4					1.4
		1.6					1.6
		1.8					1.8
		2.0			N=<50	Screen	2.0
		2.2					2.2
		2.4		FOREST MARBLE FORMATION - MUDSTONE Stiff grey silty CLAY.			2.4
		2.6		FOREST MARBLE FORMATION - LIMESTONE Recovered as light brownish grey silty gravel of limestone.			2.6
		2.8			N=<50		2.8
				Termination Depth at:2.9 m In rock quality strata, after 45m of no penetration >=3mm.			



# CONTINUOUS TUBE WS 2-B

## INTEGRITY

<b>PROJECT NUMBER</b> 19-07-05	<b>DRILLING DATE</b> 29/7/19	<b>EASTINGS</b> 459098
<b>PROJECT NAME</b> BICESTER HERITAGE	<b>TOTAL DEPTH</b> 2.40m	<b>NORTHINGS</b> 224314
<b>CLIENT</b> BICESTER HERITAGE	<b>DIAMETER</b> 100mm-60mm	
	<b>GROUNDWATER</b> 1.40m bgl	

<b>COMMENTS</b> Logged to BS14688:2013	<b>LOGGED BY</b> DL
	<b>CHECKED BY</b> MB

Samples	Groundwater	Depth (m)	Graphic Log	Material Description	SPT/kN/m <sup>2</sup> (HV)	Well Diagram	Depth (m)
		0.0 - 0.2		TOPSOIL Soft brown sandy CLAY. With wood fragments and roots.			0.0 - 0.2
D		0.2 - 0.4		CORNBRASH FORMATION - WEATHERED Firm brown silty slightly sandy gravelly CLAY. Gravel is fine to coarse angular of limestone.			0.2 - 0.4
D		0.4 - 0.6		CORNBRASH FORMATION Brownish grey slightly silty slightly sandy gravelly cobbles of fossiliferous LIMESTONE.	N=<50		0.4 - 0.6
		0.6 - 1.0		CORNBRASH FORMATION Recovered as: Brownish grey silty gravel of LIMESTONE.			0.6 - 1.0
B		1.0 - 1.2					1.0 - 1.2
		1.2 - 1.4					1.2 - 1.4
		1.4 - 1.6					1.4 - 1.6
		1.6 - 1.8					1.6 - 1.8
		1.8 - 2.0					1.8 - 2.0
		2.0 - 2.2					2.0 - 2.2
		2.2 - 2.4					2.2 - 2.4
		2.4 - 2.6		Termination Depth at:2.4 m In rock quality strata, after 45m of no penetration >/=3mm.	N=>50		2.4 - 2.6
		2.6 - 2.8					2.6 - 2.8



CONTINUOUS TUBE WS 5-B

INTEGRITY

PROJECT NUMBER 19-07-05	DRILLING DATE 29/7/19	EASTINGS 459224
PROJECT NAME BICESTER HERITAGE	TOTAL DEPTH 2.30m	NORTHINGS 224224
CLIENT BICESTER HERITAGE	DIAMETER 100mm-60mm	
	GROUNDWATER dry	

COMMENTS Logged to BS14688:2013	LOGGED BY DL
	CHECKED BY MB

Samples	Groundwater	Depth (m)	Graphic Log	Material Description	SPT/kN/m <sup>2</sup> (HV)	Well Diagram	Depth (m)
D		0.2		TOPSOIL Soft brown sandy CLAY. With wood fragments and roots.			0.2
D		0.4		CORNBRASH FORMATION - WEATHERED Firm brown silty slightly sandy gravelly CLAY. Gravel is fine to coarse angular of limestone.			0.4
		0.6					0.6
		0.8			N=38		0.8
B		1.0		CORNBRASH FORMATION Recovered as: Brownish grey silty gravel of LIMESTONE.			1.0
		1.2				1.2	
		1.4				1.4	
		1.6				1.6	
		1.8				1.8	
		2.0			N=<50	2.0	
		2.2		FOREST MARBLE FORMATION - MUDSTONE Stiff grey silty CLAY.		2.2	
		2.2		FOREST MARBLE FORMATION - LIMESTONE Recovered as light brownish grey silty gravel of limestone.	N=>50	2.2	
		2.4		Termination Depth at:2.3 m In rock quality strata, after 45m of no penetration >=3mm.		2.4	
		2.6				2.6	
		2.8				2.8	



## Final Report

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**Report No.:** 19-26422-1

**Initial Date of Issue:** 09-Aug-2019

**Client:** Geo Integrity

**Client Address:** 4 Church Street  
Maids Moreton  
Bucks  
MK18 1QE

**Contact(s):** Danny Lusardi

**Project:** Bicester Heritage, New Technical Site


**Quotation No.:** Q18-13722      **Date Received:** 07-Aug-2019

**Order No.:**      **Date Instructed:** 07-Aug-2019

**No. of Samples:** 3

**Turnaround (Wkdays):** 3      **Results Due:** 09-Aug-2019

**Date Approved:** 09-Aug-2019

**Approved By:**  


**Details:** Martin Dyer, Laboratory Manager

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Client: Geo Integrity	Chemtest Job No.:				19-26422	19-26422	19-26422
Quotation No.: Q18-13722	Chemtest Sample ID.:				869357	869358	869359
	Sample Location:				WS1B	WS2B	WS5B
	Sample Type:				WATER	WATER	WATER
	Top Depth (m):				1.4	2.02	1.7
	Date Sampled:				05-Aug-2019	05-Aug-2019	05-Aug-2019
Determinand	Accred.	SOP	Units	LOD			
Chemical Oxygen Demand	U	1100	mg O2/l	10	22	110	25
Calcium	U	1415	mg/l	5.0	120	110	77
Potassium	U	1415	mg/l	0.50	3.2	14	4.6
Magnesium	U	1415	mg/l	0.50	4.8	8.5	2.5
Sodium	U	1415	mg/l	0.50	32	50	54
Total Hardness as CaCO3	U	1270	mg/l	15	320	300	200
Arsenic (Dissolved)	U	1450	µg/l	1.0	3.3	2.5	1.3
Boron (Dissolved)	U	1450	µg/l	20	230	360	180
Barium (Dissolved)	U	1450	µg/l	5.0	36	41	26
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	1.6	3.2	2.3
Copper (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.7	1.4
Iron (Dissolved)	N	1450	µg/l	20	270	230	180
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0	2.3	2.9	1.6
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	< 1.0	2.4	5.1
Zinc (Dissolved)	U	1450	µg/l	1.0	2.1	< 1.0	2.1
TPH >C6-C10	N	1670	µg/l	0.10	< 0.10	< 0.10	< 0.10
TPH >C10-C21	N	1670	µg/l	0.10	< 0.10	< 0.10	< 0.10
TPH >C21-C40	N	1670	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total TPH >C6-C40	U	1670	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0	< 2.0
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

Client: Geo Integrity	Chemtest Job No.:				19-26422	19-26422	19-26422
Quotation No.: Q18-13722	Chemtest Sample ID.:				869357	869358	869359
	Sample Location:				WS1B	WS2B	WS5B
	Sample Type:				WATER	WATER	WATER
	Top Depth (m):				1.4	2.02	1.7
	Date Sampled:				05-Aug-2019	05-Aug-2019	05-Aug-2019
Determinand	Accred.	SOP	Units	LOD			
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

SOP	Title	Parameters included	Method summary
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l <sup>-1</sup> CaCO <sub>3</sub> equivalent.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	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 (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.

## **Report Information**

### **Key**

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- 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**

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- 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
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### **Sample Retention and Disposal**

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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.com](mailto:customerservices@chemtest.com)