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CLIENT:	**MR L THOMAS**
PROJECT:	**THE CROFT, ST AGNES, CORNWALL**
REPORT TITLE:	**PHASE 2 SITE INVESTIGATION**
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SUMMARY

Your Environmental Solutions Ltd (YES) has been commissioned by Mr L Thomas to undertake a Phase 2 Site Investigation at a site known as The Croft, St Agnes in Cornwall. This report has been commissioned to assess the site for Cornwall Council's planning requirements in line with the proposed residential development with soft garden areas.

The contamination site investigation comprised three trial pits undertaken across the site. The site investigation identified that the site is underlain by subsoil comprising of silty, gravelly clay. Groundwater was not encountered during the site investigation.

Heavy metal, pesticide, Volatile Organic Compound (VOC) and hydrocarbon concentrations within soils were assessed in accordance with Suitable 4 Use Levels (S4ULs) and/or Site Specific Assessment Criteria (SSAC) for human health risk. Water soluble sulphate concentrations were assessed in line with Building Research Establishment (BRE) sulphate class limits. UK Water Industry Research (WIR) thresholds were consulted to assess the risks to water supply pipework from mineral oil concentrations.

In accordance with the quantitative contamination risk assessment, the risks to human health are considered to be low. Therefore no further action or assessment is required.

The risk to controlled waters is considered to be low with no further action or assessment required.

The risk to flora, fauna and ecosystems is considered to be low with no further action or assessment required.

Standard plastic pipework is considered suitable for potable water supplies at the site.

A DS 1 grade of concrete will be suitable for any new building foundations at the site.

The development will require radon protective measures.

1.0 INTRODUCTION

1.1 Background

Your Environmental Solutions Ltd (YES) has been commissioned by Mr L Thomas to undertake a Phase 2 Site Investigation at a site known as The Croft, St Agnes in Cornwall. This report has been commissioned to assess the site for Cornwall Council's planning requirements in line with the proposed residential development with soft garden areas.

1.2 Objectives

The objectives of the site investigation report are as follows:

- Summarise the site setting and desk study findings.
- Detail the on site investigation(s) undertaken.
- Present the ground conditions encountered.
- Discuss the significance of the chemical analyses and produce a quantitative contamination risk assessment.
- Discuss a remediation strategy (if appropriate) and recommendations for any further works.

1.3 Sources of Information

The following sources of information have been used:

- Site Investigation Photographs (Appendix A).
- Trial Pit Logs (Appendix B).
- Chemical Results (Appendix C).
- CLEA and Statistical Assessments (Appendix D).

1.4 Development Proposals/End Use

It is proposed to construct a new residential dwelling with soft, private garden areas.

2.0 SUMMARY OF THE DESK STUDY FINDINGS

The site is located at coordinates: 171570, 51040, postcode: TR5 0NB.

The site comprises a fenced, tarmacadam tennis court surrounded by a mix of herbaceous, scrub and tree species.

The site is situated within the former surface footprint of a tin mine, within a wider surrounding area used for mining, agriculture and to the northwest of the settlement of St Agnes.

The site and immediate surrounding area are not recorded to be overlain by superficial deposits. The site is recorded to be underlain by the Porthtowan Formation formed in the Devonian Period. These are graded beds of mudstones and sandstones formed in a marine environment.

The site is situated within a mineralised area. The closest recorded mineralised structure (lode) contains tin and is located beneath the site. Topsoil arsenic concentrations in the area of the site are recorded to range between 42mg/kg and 96mg/kg.

The site is recorded to be underlain by a secondary aquifer (A). The nearest surface water feature is a pond located at approximately 42m to the southwest of the site. The site is not within a water source protection zone.

Due to the local mineralogy and historical mining activity on site, a potential for heavy metals and hydrocarbons to be present in the site's soils was identified. The preliminary contamination risk assessment showed a moderate risk to human health, building materials, water supply pipework and controlled waters in line with its proposed use for a residential development with soft garden areas. A Phase 2 Site Investigation with soil sampling and chemical analyses was recommended to quantify the true risks.

The risk to flora, fauna and ecosystems was considered to be low with no further action required.

The site is in a radon affected area. As such radon protection measures should be installed in all buildings.

The risk to the site from subsidence relating to past extractive metalliferous mining was considered to be high. To further assess the risks, an intrusive on site mining investigation was recommended.

3.0 ON SITE INVESTIGATIONS

3.1 Intrusive Site Investigations

A contamination site investigation was undertaken on 8th October 2020. The site investigation comprised three trial pits (TP) undertaken across the site.

The site investigation layout is shown on Figure 3.

The site investigation was carried out in accordance with:

- BS10175: Investigation of Potentially Contaminated Sites: Code of Practice (BSI, 2017)
- BS5930: Code of Practice for Ground Investigations (BSI, 2020).

3.2 Ground Conditions Encountered

The descriptions given below are based on visual observations made during site investigation.

3.2.1 Topsoil

Topsoil was not encountered during the site investigation.

3.2.2 Subsoil/Bedrock

Subsoil was encountered in TP1 and TP2 from surface to a maximum recorded depth of 1.0m below ground level (bgl). Subsoil consisted of orange to brown silty, gravelly clay with abundant subangular cobbles of mudstone.

3.2.3 Groundwater

Groundwater was not encountered during the site investigation.

3.2.4 Visual Signs of Fuel and/or Odours

There were no signs of any fuels, oil stains or odours identified during the site investigation.

3.3 Contamination Sampling and Laboratory Analysis

3.3.1 Sampling

Soil samples for contamination analyses were taken on site at depths between 0.1m and 0.5m bgl from trial pits.

The samples were collected in amber glass jars, stored and transported in cool boxes to ALS Environmental, a fully accredited laboratory.

3.3.2 Laboratory Analysis

All laboratory results are enclosed within Appendix C.

The following chemical analyses were carried out on selected samples at ALS Environmental:

- 4 no. Speciated total petroleum hydrocarbons (soil).
- 4 no. Polyaromatic hydrocarbons (soil).
- 4 no. Volatile Organic Compounds (soil).
- 6 no. Heavy metals (soil).
- 1 no. Water soluble sulphate (soil).
- 4 no. Mineral oil (soil).
- 1 no. pH (soil).
- 2 no. UNIFIED BARGE arsenic bioaccessibility (soil).

4.0 SIGNIFICANCE AND INTERPRETATION OF CHEMICAL RESULTS

Guidance on contaminated land, including a definition and risk assessment protocol, has been enclosed within Appendix E.

4.1 Human Health Risk Assessment Methodology

The human health risk assessment has been carried out using the following documents and tools:

- Contaminated Land Exposure Assessment (CLEA) 1.071 Model (Environment Agency, 2015).
- Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs) (Public Health England, 2017).
- Guidance on Comparing Soil Contamination Data with a Critical Concentration (Contaminated Land: Applications In Real Environments (CL:AIRE), 2020).
- Land contamination risk management (LCRM) Stage 1 Risk Assessment (EA, 2020).
- Land Quality Management (LQM) & Chartered Institute of Environmental Health (CIEH) Suitable 4 Use Levels (S4ULs) for Human Health Risk Assessment (LQM/CIEH, 2015).

Where available, this risk assessment has been undertaken using the residential with homegrown produce Suitable for Use Levels (S4ULs). Where required, Site Specific Assessment Criteria (SSAC) based on a Category 4 Screening Level (C4SL) for a female child, have been produced using the CLEA model.

If a potential contaminant has a maximum value that exceeds the applicable S4UL/SSAC, a statistical assessment is undertaken to establish the 95% Upper Confidence Limit (UCL) of the substance for comparison against the S4UL/SSAC.

4.2 Flora, Fauna and Ecosystems Risk Assessment Methodology

The risks to flora, fauna and ecosystems were not further assessed in this report as the desk study identified a low risk with no further action required.

4.3 Building Materials and Pipework Risk Assessment Methodologies

The risk to water supply pipework has been assessed in accordance with the Guidance for the Selection of Water Supply Pipes to Be Used in Brown Field Sites (UK Water Industry Research, 2010). The UK WIR document is used to outline the threshold concentrations for suitable pipework selection.

The risk to building materials has been assessed in accordance with Concrete in Aggressive Ground - Special Digest 1 (Building Research Establishment, 2005). Special Digest 1 is used to establish a suitable grade of concrete for building foundations in accordance with on site water soluble sulphate concentrations.

4.4 Controlled Waters Risk Assessment Methodology

As outlined in Section 3.2, groundwater was not encountered during the site investigation and as outlined in Section 4.5 hydrocarbon and/or volatile contamination within the site's soils was found to be at minimal concentrations. As such the risks to controlled waters are considered to be low, with no further action or assessment required.

It is to be noted that this contamination risk assessment has been carried out using documents and tools available at the date of this report. New guidance may be issued in the future which may supersede these.

4.5 Soil Contamination and Risks to Human Health/End Users at the Site

4.5.1 Heavy Metals

The following heavy metal concentrations were detected and are assessed in comparison to the available Suitable 4 Use Levels (S4ULs) for a residential with homegrown produce end use.

Table 4.1: Heavy Metal Concentrations in Comparison to S4ULs for a Residential with Homegrown Produce End Use

Substance	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	S4UL (mg/kg)
Hexavalent Chromium	<LOD	<LOD	6
Arsenic	30.2	82.5	37
Cadmium	0.03	1.57	11
Total Chromium	8.39	30.3	*910
Copper	131	182	2,400
Lead	24.9	101	**201
Mercury	<LOD	<LOD	1.2
Nickel	1.44	7.66	180
Selenium	1.26	1.26	250
Zinc	85.6	141	3,700

*S4UL for Chromium III

**Lead SSAC produced in the CLEA Model

As may be noted from Table 4.1, all heavy metals tested, with the exception of arsenic, have concentrations less than their applicable S4UL/SSAC. As such the risks to human health from these heavy metals are considered to be low, with no further action required.

To further assess the risks from arsenic, a statistical assessment of its results was undertaken to produce a 95% Upper Confidence Limit (UCL) concentration for comparison against its applicable S4UL. The following table outlines the result of this assessment.

Table 4.2: Arsenic 95% UCL Concentration in Comparison to the Residential with Homegrown Produce S4UL		
Substance	**95% UCL Concentration (mg/kg)**	**S4UL (mg/kg)**
Arsenic	79	37

As may be noted from Table 4.2, the statistical assessment indicates that arsenic has a 95% UCL concentration which exceeds its S4UL. To further assess the risk to human health, laboratory bioaccessibility testing was undertaken on samples at TP3, 0.1m bgl and TP2, 0.5m bgl, which contained the highest concentrations of arsenic within the made ground and subsoil, respectively. The results of the bioaccessibility testing indicate that arsenic has a maximum bioaccessibility of 26.4%. This percentage was input into the CLEA model to produce a Site Specific Assessment Criterion (SSAC) for comparison against the 95% UCL result. The following table outlines the 95% UCL result compared to the SSAC.

Table 4.3: Arsenic 95% UCL Concentrations in Comparison to the Residential with Homegrown Produce SSAC		
Substance	**95% UCL Concentration (mg/kg)**	**SSAC (mg/kg)**
Arsenic	79	116

As may be noted from Table 4.3, the arsenic 95% UCL concentration is less than the SSAC produced in the CLEA model. It is therefore considered that the risk to human health from arsenic is low with no further action required.

4.5.2 Volatile Organic Compounds (VOCs)

All the VOC results were less than the laboratory limit of detection. It is therefore considered that VOCs pose a low risk to human health with no further action required.

4.5.3 *Total Petroleum Hydrocarbons (TPH)*

The following TPH concentrations were detected and are assessed in comparison to the available S4ULs for a residential with homegrown produce end use.

Table 4.4: TPH Concentrations in Comparison to S4ULs For a Residential With Homegrown Produce End Use

Substance	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	S4UL (mg/kg)
Aliphatics >C5-C6	<LOD	<LOD	42
Aliphatics >C6-C8	<LOD	0.02	100
Aliphatics >C8-C10	<LOD	0.02	27
Aliphatics >C10-C12	<LOD	<LOD	130
Aliphatics >C12-C16	<LOD	<LOD	1,100
Aliphatics >C16-C35	<LOD	10.2	65,000
Aliphatics >C35-C44	<LOD	1.05	65,000
Aromatics >EC5-EC7	<LOD	<LOD	70
Aromatics >EC7-EC8	<LOD	<LOD	130
Aromatics >EC8-EC10	<LOD	0.01	34
Aromatics >EC10-EC12	<LOD	<LOD	74
Aromatics >EC12-EC16	<LOD	<LOD	140
Aromatics >EC16-EC21	<LOD	<LOD	260
Aromatics >EC21-EC35	<LOD	3.66	1,100
Aromatics >EC35-EC44	<LOD	<LOD	1,100
S4ULs for a conservative 1% Soil Organic Matter content			

As shown in Table 4.4, all of the TPH concentrations are less than their applicable S4UL. As such the risk to human health from TPH contamination is considered to be low with no further action needed.

4.5.4 *Polyaromatic Hydrocarbons (PAH)*

All the PAH results were less than the laboratory limit of detection. It is therefore considered that PAHs pose a low risk to human health with no further action required.

4.6 Risk to Building Materials and Pipework

All the mineral oil concentrations were found to be less than the laboratory limit of detection. It is therefore considered in line with these results, the results identified in for human health risk (Section 4.5) and the ground conditions encountered on site (Section 3), that a standard plastic pipework material will be suitable for potable water supplies at the site.

The water soluble sulphate test showed a concentration of 10.5mg/l, which is less than the 500mg/l Design Standard (DS) 1 threshold. It is therefore considered that a DS 1 grade of concrete will be suitable for any new building foundations at the site.

5.0 QUANTITATIVE CONTAMINATION RISK ASSESSMENT

The following table is a revised contamination risk assessment following the quantitative analyses of the laboratory results.

Table 5.1: Quantitative Contamination Risk Assessment

Sources	Receptors and Pathways	Categorisation of Risk		
		Probability	Consequence	Risk
Radon: Natural Mineralogy	**Human Health:** Inhalation of vapour	Likely	Medium	Moderate
Heavy Metals: Natural Mineralogy Historical Mining Activity	**Human Health:** Direct soil and dust ingestion Consumption of vegetation Dermal contact with soils Inhalation of dust	Unlikely	Medium	Low
	Controlled Waters: Migration into groundwater Migration through soil Surface water runoff Deposition onto surface water	Unlikely	Mild	Low
	Flora/Fauna and Ecosystems: Plant uptake and accumulation	Unlikely	Mild	Low
	Building Materials: Direct contact with soils (SO_4)	Unlikely	Medium	Low
Hydrocarbons/VOCs: Historical Mining Activity	**Human Health:** Direct soil and dust ingestion Consumption of vegetation Dermal contact with soils Inhalation of dust Inhalation of vapour	Unlikely	Medium	Low
	Controlled Waters: Migration into groundwater Migration through soil Surface water runoff Deposition onto surface water	Unlikely	Medium	Low
	Flora/Fauna and Ecosystems:	Unlikely	Mild	Low

Table 5.1: Quantitative Contamination Risk Assessment				
Sources	**Receptors and Pathways**	**Categorisation of Risk**		
		Probability	**Consequence**	**Risk**
	Plant uptake and accumulation			
	Building Materials: Direct contact with soils	Unlikely	Medium	Low

6.0 CONCLUSIONS AND RECOMMENDATIONS

The contamination site investigation comprised three trial pits undertaken across the site. The site investigation identified that the site is underlain by subsoil comprising of silty, gravelly clay. Groundwater was not encountered during the site investigation.

In accordance with the quantitative contamination risk assessment, the risks to human health are considered to be low. Therefore no further action or assessment is required.

The risk to controlled waters is considered to be low with no further action or assessment required.

The risk to flora, fauna and ecosystems is considered to be low with no further action or assessment required.

Standard plastic pipework is considered suitable for potable water supplies at the site.

A DS 1 grade of concrete will be suitable for any new building foundations at the site.

The development will require radon protective measures.

7.0 LIMITATIONS

The work undertaken to provide the basis of this report includes a study of the readily available documented information from a variety of sources. The information reviewed should not be considered exhaustive and has been accepted in good faith by Your Environmental Solutions ("YES") as providing a true indication of the site conditions. However, no liability can be accepted for the detailed accuracy or otherwise of any of the reports or documents prepared by others for the Client or for third parties, or for any associated errors or omissions.

The exploratory holes carried out during the fieldwork, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The comments made and recommendations given in this report are based on the ground conditions apparent at the site of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that groundwater levels will vary owing to seasonal or other effects.

It should be noted that the environment and contaminated land guidance and legislation are constantly under review, with authoritative guidance documents subject to change. The conclusions presented herein are based on guidance and legislation available at the time of issuing this report, and no liability can be accepted for the retrospective effects of any changes or amendments to such guidance and/or legislation.

YES has produced this report solely for the use of the Client and his agent. The report should not be relied upon in any way by any third party.

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FIGURES

N

Drawing Notes:

Legend:

Client:

Mr L Thomas

Figure 1:

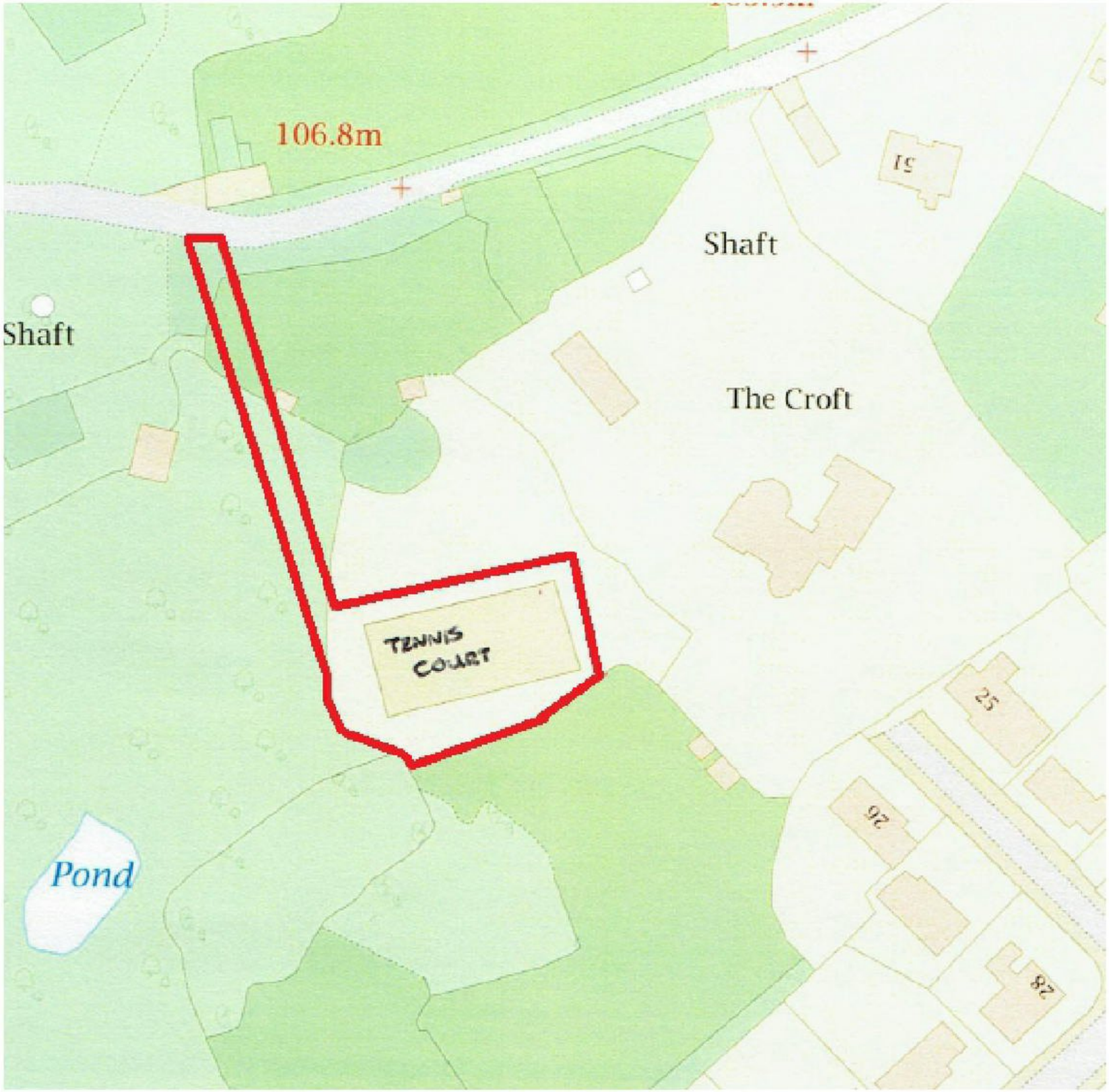
Site Location Plan

The Croft, St Agnes, Cornwall

Project Ref: YES 1028a	Drawing Ref: YES 1028a
Drawn By: AM	Date: 18/09/20
Checked By: AW	Date: 18/09/20
Grid Ref: 171570, 51040	Not To Scale

YES
YOUR ENVIRONMENTAL SOLUTIONS LTD

Woodcocks Roost,
Fore Street, Barripper,
Camborne, Cornwall TR14 0QR
[redacted]
E. info@urenvironmentalsolutions.com
W. www.urenvironmentalsolutions.com



Drawing Notes:

Legend:

Site Boundary

Client:

Mr L Thomas

Figure 2:

Site Boundary Plan

The Croft, St Agnes, Cornwall

Project Ref: YES 1028a	Drawing Ref: YES 1028a
Drawn By: AM	Date: 18/09/20
Checked By: AW	Date: 18/09/20
Grid Ref: 171570, 51040	Not To Scale

YES
YOUR ENVIRONMENTAL SOLUTIONS LTD

Woodcocks Roost,
Fore Street, Barripper,
Camborne, Cornwall TR14 0QR
[redacted]
E. info@urenvironmentalsolutions.com
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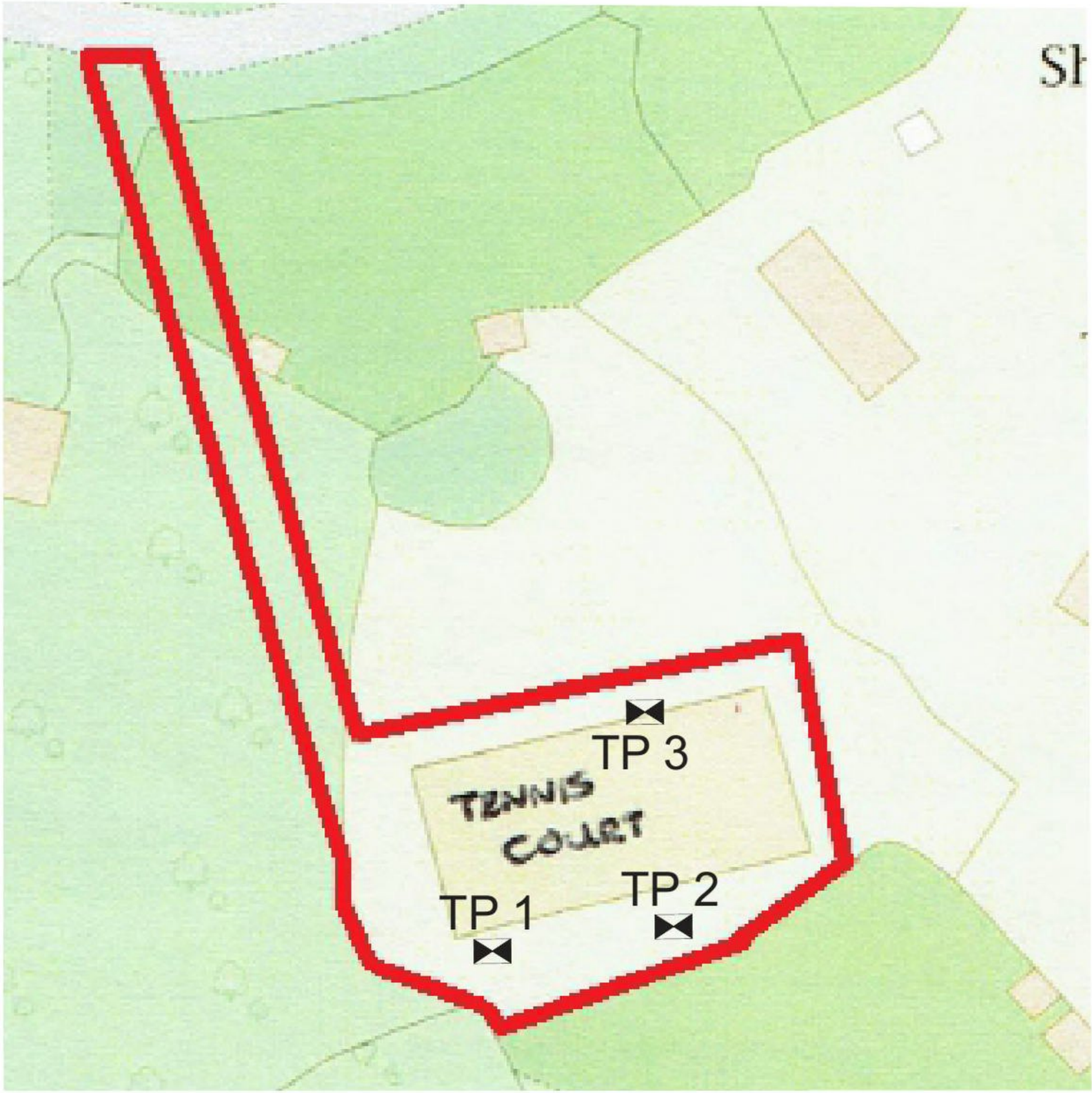

Drawing Notes:

Legend:

Site Boundary

Trial Pit

Client:

Mr L Thomas

Figure 3:

Site Investigation Plan

The Croft, St Agnes, Cornwall

Project Ref: YES 1028a	Drawing Ref: YES 1028a
Drawn By: AM	Date: 12/11/20
Checked By: AW	Date: 12/11/20
Grid Ref: 171570, 51040	Not To Scale

YES
YOUR ENVIRONMENTAL SOLUTIONS LTD

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Fore Street, Barripper,
Camborne, Cornwall TR14 0QR
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APPENDIX A

SITE INVESTIGATION PHOTOGRAPHS

SITE INVESTIGATION PHOTOGRAPHS

PHOTOGRAPH 1: TP1

PHOTOGRAPH 2: TP1

PHOTOGRAPH 3: TP2

PHOTOGRAPH 4: TP2

PHOTOGRAPH 5: TP3

PHOTOGRAPH 6: TP3

APPENDIX B

TRIAL PIT LOGS

YOUR ENVIRONMENTAL SOLUTIONS
Woodcocks Roost, Fore Street, Barripper, Camborne, Cornwall, TR14 0QR
E. info@urenvironmentalsolutions.com M. 07766 850351 W. www.urenvironmentalsolutions.com

Job Number: YES 1028b	Trial Pit Number: TP1
Project: The Croft, St Agnes	
Client: Mr L Thomas	
Logged By: AW	Checked By: AM
Method of Excavation: Mechanical	Equipment Used: Excavator
	Excavation Date: 22/09/2020

m bgl	Insitu Testing		Samples			Strata		
	Depth	Test Type - Results	Type	No.	Depth	Description of Strata	Thickness	Legend
0.0			Soil	1	0.10			
0.2								
0.4			Soil	1	0.50	Orange to brown silty gravelly CLAY with abundant subangular cobbles of mudstone	1.00	
0.6								
0.8								
1.0						End of Trial Pit		
1.2								
1.4								
1.6								
1.8								
2.0								
2.2								
2.4								
2.6								
2.8								
3.0								

Remarks:

YOUR ENVIRONMENTAL SOLUTIONS
Woodcocks Roost, Fore Street, Barripper, Camborne, Cornwall, TR14 0QR
E. info@urenvironmentalsolutions.com M. 07766 850351 W. www.urenvironmentalsolutions.com

Job Number: YES 1028b	Trial Pit Number: TP2
Project: The Croft, St Agnes	
Client: Mr L Thomas	
Logged By: AW	Checked By: AM
Method of Excavation: Mechanical	Equipment Used: Excavator
	Excavation Date: 22/09/2020

m bgl	Insitu Testing		Samples			Strata		
	Depth	Test Type - Results	Type	No.	Depth	Description of Strata	Thickness	Legend
0.0			Soil	1	0.10			
0.2								
0.4			Soil	1	0.50	Orange to brown silty gravelly CLAY with abundant subangular cobbles of mudstone	1.00	
0.6								
0.8								
1.0						End of Trial Pit		
1.2								
1.4								
1.6								
1.8								
2.0								
2.2								
2.4								
2.6								
2.8								
3.0								

Remarks:

YOUR ENVIRONMENTAL SOLUTIONS
Woodcocks Roost, Fore Street, Barripper, Camborne, Cornwall, TR14 0QR
E. info@urenvironmentalsolutions.com M. 07766 850351 W. www.urenvironmentalsolutions.com

Job Number: YES 1028b	Trial Pit Number: TP3
Project: The Croft, St Agnes	
Client: Mr L Thomas	
Logged By: AW	Checked By: AM
Method of Excavation: Mechanical	Equipment Used: Excavator
	Excavation Date: 22/09/2020

m bgl	Insitu Testing		Samples			Strata		
	Depth	Test Type - Results	Type	No.	Depth	Description of Strata	Thickness	Legend
0.0			Soil	1	0.10			
0.2								
0.4			Soil	1	0.50	Brown silty gravelly CLAY MADE GROUND with abundant subangular cobbles of mudstone	1.00	
0.6								
0.8								
1.0						End of Trial Pit		
1.2								
1.4								
1.6								
1.8								
2.0								
2.2								
2.4								
2.6								
2.8								
3.0								

Remarks:

APPENDIX C

CHEMICAL RESULTS

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

YES
Woodcocks Roost
Fore Street
Barripper
Camborne
Cornwall
TR14 0QR

Attention: Andrea Woodcock

CERTIFICATE OF ANALYSIS

Date of report Generation:	25 November 2020
Customer:	YES
Sample Delivery Group (SDG):	201009-129
Your Reference:	1028
Location:	CROFT ST AGNES
Report No:	577116

This report has been revised and directly supersedes 572097 in its entirety.

We received 6 samples on Friday October 09, 2020 and 6 of these samples were scheduled for analysis which was completed on Wednesday November 25, 2020. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

[redacted]

Sonia McWhan

Operations Manager

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
23002912	TP1		0.10	08/10/2020
23002913	TP1		0.50	08/10/2020
23002914	TP2		0.10	08/10/2020
23002915	TP2		0.50	08/10/2020
23002916	TP3		0.10	08/10/2020
23002917	TP3		0.50	08/10/2020

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container	Sample Type
			2302912	TP1		0.10	250g Amber Jar (ALE210)	S
			2302913	TP1		0.50	250g Amber Jar (ALE210)	S
			2302914	TP2		0.10	250g Amber Jar (ALE210)	S
			2302915	TP2		0.50	60g VOC (ALE215)	S
			2302916	TP3		0.10	250g Amber Jar (ALE210)	S
			2302917	TP3		0.50	60g VOC (ALE215)	S
Anions by Kone (soil)	All	NDPs: 0 Tests: 1						
								X
Bioaccessible Metals	All	NDPs: 0 Tests: 2						
							X	X
EPH CWG GC (S)	All	NDPs: 0 Tests: 4						
							X	X
GRO by GC-FID (S)	All	NDPs: 0 Tests: 4						
							X	X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 6						
			X	X	X		X	X
Metals in solid samples by OES	All	NDPs: 0 Tests: 6						
			X	X	X		X	X
PAH by GCMS	All	NDPs: 0 Tests: 4						
							X	X
pH	All	NDPs: 0 Tests: 6						
			X	X	X		X	X
Sample description	All	NDPs: 0 Tests: 6						
			X	X	X		X	X
TPH CWG GC (S)	All	NDPs: 0 Tests: 4						
							X	X
VOC MS (S)	All	NDPs: 0 Tests: 4						
							X	X

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
23002912	TP1	0.10	Dark Brown	Sandy Loam	Stones	Vegetation
23002913	TP1	0.50	Dark Brown	Sandy Loam	Stones	Vegetation
23002914	TP2	0.10	Dark Brown	Stone/Soil	Stones	None
23002915	TP2	0.50	Dark Brown	Stone/Soil	Stones	None
23002916	TP3	0.10	Dark Brown	Sandy Loam	Stones	Vegetation
23002917	TP3	0.50	Dark Brown	Loamy Sand	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP1	TP1	TP2	TP2	TP3	TP3
			Depth (m)	0.10	0.50	0.10	0.50	0.10	0.50
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	08/10/2020	08/10/2020	08/10/2020	08/10/2020	08/10/2020	08/10/2020
			Sample Time	-	-	-	-	-	-
			Date Received	09/10/2020	09/10/2020	09/10/2020	09/10/2020	09/10/2020	09/10/2020
			SDG Ref	201009-129	201009-129	201009-129	201009-129	201009-129	201009-129
			Lab Sample No.(s)	23002912	23002913	23002914	23002915	23002916	23002917
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		16	15	8.2	12	11	11
pH	1 pH Units	TM133		6.12 M	5.25 M	7.15 #	7.73 #	4.7 M	4.83 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Arsenic	<0.6 mg/kg	TM181		30.2 M	33.6 M	31.2 #	45.4 #	82.5 M	31.6 M
Cadmium	<0.02 mg/kg	TM181		<0.02 M	0.484 M	1.57 #	0.468 #	0.0343 M	0.476 M
Chromium	<0.9 mg/kg	TM181		27.7 M	30.3 M	8.39 #	24 #	10.6 M	13 M
Copper	<1.4 mg/kg	TM181		147 M	163 M	156 #	182 #	159 M	131 M
Lead	<0.7 mg/kg	TM181		40.4 M	44.4 M	41.6 #	24.9 #	101 M	28.4 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 #	<0.14 #	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		5.27 M	3.73 M	6.37 #	1.44 #	5.38 M	7.66 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	1.26 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		114 M	114 M	85.6 #	106 #	120 M	141 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243							0.0105 M
Arsenic after stomach only extraction	<5 mg/kg	TM409					<5	<5	
Arsenic after Stomach and Intestine extraction	<12 mg/kg	TM409					<12	<12	
Bioaccessible Arsenic (Stomach only Extraction)	%	TM409					<11	<6.06	
Bioaccessible Arsenic (Stomach and Instestine Ex.)	%	TM409					<26.4	<14.5	

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP2	TP2	TP3	TP3		
			Depth (m)	0.10	0.50	0.10	0.50		
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)		
			Date Sampled	08/10/2020	08/10/2020	08/10/2020	08/10/2020		
			Sample Time	.	.	.	.		
			Date Received	09/10/2020	09/10/2020	09/10/2020	09/10/2020		
			SDG Ref	201009-129	201009-129	201009-129	201009-129		
			Lab Sample No.(s)	23002914	23002915	23002916	23002917		
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		89.5	88.7	93.1	92		
Acenaphthene-d10 % recovery**	%	TM218		87.2	85.8	89.6	89		
Phenanthrene-d10 % recovery**	%	TM218		86.9	85.8	89.1	87.4		
Chrysene-d12 % recovery**	%	TM218		81.4	80	85.9	80.8		
Perylene-d12 % recovery**	%	TM218		80.1	79	88.3	77.7		
Naphthalene	<9 µg/kg	TM218		<9 #	<9 #	<9 M	<9 M		
Acenaphthylene	<12 µg/kg	TM218		<12 #	<12 #	<12 M	<12 M		
Acenaphthene	<8 µg/kg	TM218		<8 #	<8 #	<8 M	<8 M		
Fluorene	<10 µg/kg	TM218		<10 #	<10 #	<10 M	<10 M		
Phenanthrene	<15 µg/kg	TM218		<15 #	<15 #	<15 M	<15 M		
Anthracene	<16 µg/kg	TM218		<16 #	<16 #	<16 M	<16 M		
Fluoranthene	<17 µg/kg	TM218		<17 #	<17 #	<17 M	<17 M		
Pyrene	<15 µg/kg	TM218		<15 #	<15 #	<15 M	<15 M		
Benz(a)anthracene	<14 µg/kg	TM218		<14 #	<14 #	<14 M	<14 M		
Chrysene	<10 µg/kg	TM218		<10 #	<10 #	<10 M	<10 M		
Benzo(b)fluoranthene	<15 µg/kg	TM218		<15 #	<15 #	<15 M	<15 M		
Benzo(k)fluoranthene	<14 µg/kg	TM218		<14 #	<14 #	<14 M	<14 M		
Benzo(a)pyrene	<15 µg/kg	TM218		<15 #	<15 #	<15 M	<15 M		
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		<18 #	<18 #	<18 M	<18 M		
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 #	<23 #	<23 M	<23 M		
Benzo(g,h,i)perylene	<24 µg/kg	TM218		<24 #	<24 #	<24 M	<24 M		
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		<118	<118	<118	<118		

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP2	TP2	TP3	TP3		
			Depth (m)	0.10	0.50	0.10	0.50		
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)		
			Date Sampled	08/10/2020	08/10/2020	08/10/2020	08/10/2020		
			Sample Time	.	.	.	.		
			Date Received	09/10/2020	09/10/2020	09/10/2020	09/10/2020		
			SDG Ref	201009-129	201009-129	201009-129	201009-129		
			Lab Sample No.(s)	23002914	23002915	23002916	23002917		
			AGS Reference						
GRO Surrogate % recovery**	%	TM089		124	96.9	118	92.2		
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10		
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	15.7	<10		
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	17.9	<10		
Aliphatics >C10-C12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aliphatics >C12-C16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aliphatics >C16-C21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aliphatics >C21-C35	<1000 µg/kg	TM414		<1000	<1000	2880	10200		
Aliphatics >C35-C44	<1000 µg/kg	TM414		<1000	<1000	<1000	1050		
Total Aliphatics >C10-C44	<5000 µg/kg	TM414		<5000	<5000	<5000	11400		
Total Aliphatics & Aromatics >C10-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	16200		
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	11.2	<10		
Aromatics > EC10-EC12	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aromatics > EC12-EC16	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aromatics > EC16-EC21	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aromatics > EC21-EC35	<1000 µg/kg	TM414		<1000	<1000	3400	3660		
Aromatics >EC35-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Aromatics > EC40-EC44	<1000 µg/kg	TM414		<1000	<1000	<1000	<1000		
Total Aromatics > EC10-EC44	<5000 µg/kg	TM414		<5000	<5000	<5000	<5000		
Total Aliphatics & Aromatics >C5-C44	<10000 µg/kg	TM414		<10000	<10000	<10000	11400		
Total Aliphatics >C5-C10	<50 µg/kg	TM089		<50	<50	<50	<50		
Total Aromatics >EC5-EC10	<50 µg/kg	TM089		<50	<50	<50	<50		
GRO >C5-C10	<20 µg/kg	TM089		<20	<20	<20	<20		

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP2	TP2	TP3	TP3		
			Depth (m)	0.10	0.50	0.10	0.50		
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)		
			Date Sampled	08/10/2020	08/10/2020	08/10/2020	08/10/2020		
			Sample Time	.	.	.	.		
			Date Received	09/10/2020	09/10/2020	09/10/2020	09/10/2020		
			SDG Ref	201009-129	201009-129	201009-129	201009-129		
			Lab Sample No.(s)	23002914	23002915	23002916	23002917		
			AGS Reference						
Dibromofluoromethane**	%	TM116		110	111	110	109		
Toluene-d8**	%	TM116		99	99.4	94.9	99.9		
4-Bromofluorobenzene**	%	TM116		93.5	91	76	85.5		
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 #	<10 #	<10 M	<10 M		
Benzene	<9 µg/kg	TM116		<9 #	<9 #	<9 M	<9 M		
Toluene	<7 µg/kg	TM116		<7 #	<7 #	<7 M	<7 M		
Ethylbenzene	<4 µg/kg	TM116		<4 #	<4 #	<4 M	<4 M		
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #		
o-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 M	<10 M		
Sum of Detected Xylenes	<0.02 mg/kg	TM116		<0.02	<0.02	<0.02	<0.02		
Sum of BTEX	<40 µg/kg	TM116		<40	<40	<40	<40		

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) by Headspace GC-FID (C4-C12)
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM218	Shaker extraction - EPA method 3546.	The determination of PAH in soil samples by GC-MS
TM243		Mixed Anions In Soils By Kone
TM409	UBS procedure for the measurement of inorganic contaminant bioaccessibility from solid matrices	Determination of Bioaccessibility of Metals
TM414	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden (Method codes TM) or ALS Life Sciences Ltd Aberdeen (Method codes S).

Validated

CERTIFICATE OF ANALYSIS

SDG:	201009-129	**Client Reference:**	1028	**Report Number:**	577116
Location:	CROFT ST AGNES	**Order Number:**	1028	**Superseded Report:**	572097

Test Completion Dates

Lab Sample No(s)	23002912	23002913	23002914	23002915	23002916	23002917
Customer Sample Ref.	TP1	TP1	TP2	TP2	TP3	TP3
AGS Ref.						
Depth	0.10	0.50	0.10	0.50	0.10	0.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)						21-Oct-2020
BARGE Stomach & Intest A				25-Nov-2020	25-Nov-2020	
BARGE Stomach & Intest B				25-Nov-2020	25-Nov-2020	
BARGE Stomach A				25-Nov-2020	25-Nov-2020	
BARGE Stomach B				25-Nov-2020	25-Nov-2020	
Bioaccessible Metals				25-Nov-2020	25-Nov-2020	
EPH CWG GC (S)			20-Oct-2020	21-Oct-2020	21-Oct-2020	20-Oct-2020
GRO by GC-FID (S)			20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020
Hexavalent Chromium (s)	20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020
Metals in solid samples by OES	21-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020	21-Oct-2020	20-Oct-2020
PAH by GCMS			20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020
pH	20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020
Sample description	19-Oct-2020	19-Oct-2020	19-Oct-2020	19-Oct-2020	19-Oct-2020	19-Oct-2020
TPH CWG GC (S)			20-Oct-2020	21-Oct-2020	21-Oct-2020	20-Oct-2020
VOC MS (S)			20-Oct-2020	20-Oct-2020	20-Oct-2020	20-Oct-2020

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2017).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX D

STATISTICAL ASSESSMENT & CLEA MODEL

CLEA Software Version 1.071

Report generated	26-Nov-20
Report title	The Croft, St Agnes
Created by	Anne Mihalop at YES

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group						
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
1	Lead (C4SL child)	2.01E+02	NR	NR	1.00	NR	NR	NR	No	No	Yes	Yes	No	Yes	No	No	No
2	Arsenic (C4SL child)	1.16E+02	5.26E+02	NR	1.00	0.22	NR	NR	No	No	Yes	Yes	No	No	No	No	Yes
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Environment Agency

	Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group						
	oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
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Environment Agency

		Soil Distribution				Media Concentrations													
		Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
		%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
1	Lead (C4SL child)	99.9	0.1	0.0	100.0	2.01E+02	NR	1.00E+02	8.55E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.42E-01	8.08E-01	1.47E+00	1.50E-01	4.12E-02	4.60E-02
2	Arsenic (C4SL child)	99.9	0.1	0.0	100.0	1.16E+02	NR	5.80E+01	4.94E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.99E-02	4.64E-02	2.67E-02	3.83E-02	2.32E-02	1.28E-01
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Environment Agency

	Soil Distribution				Media Concentrations													
	Sorbed	Dissolved	Vapour	Total	Soil	Soil gas	Indoor Dust	Outdoor dust at 0.8m	Outdoor dust at 1.6m	Indoor Vapour	Outdoor vapour at 0.8m	Outdoor vapour at 1.6m	Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
	%	%	%	%	mg kg^{-1}	mg m^{-3}	mg kg^{-1}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg m^{-3}	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW	mg kg^{-1} FW
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Environment Agency

		Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
		Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
1	Lead (C4SL child)	8.94E-04	5.04E-04	0.00E+00	2.13E-06	0.00E+00	0.00E+00	0.00E+00	63.85	35.99	0.00	0.15	0.00	0.00	0.00	0.00
2	Arsenic (C4SL child)	2.27E-04	6.12E-05	1.15E-05	1.92E-06	0.00E+00	0.00E+00	0.00E+00	75.75	20.41	3.84	0.00	0.00	0.00	0.00	0.00
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Environment Agency

	Average Daily Exposure (mg kg^{-1} bw day^{-1})							Distribution by Pathway (%)							
	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
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Environment Agency

		Oral Health Criteria Value (µg kg^{-1} BW day^{-1})		Inhalation Health Criteria Value (µg kg^{-1} BW day^{-1})		Oral Mean Daily Intake (µg day^{-1})	Inhalation Mean Daily Intake (µg day^{-1})	Air-water partition coefficient (K_{aw}) (cm^3 cm^{-3})	Coefficient of Diffusion in Air (m^2 s^{-1})	Coefficient of Diffusion in Water (m^2 s^{-1})	log K_{oc} (cm^3 g^{-1})	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor (g g^{-1} DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
1	Lead (C4SL child)	ID	1.4	NR	0	NR	NR	NR	NR	NR	NR	NR	0	0.5	1	0.6	0.64
2	Arsenic (C4SL child)	ID	0.3	ID	0.0087	NR	NR	NR	NR	NR	NR	NR	0.03	0.5	1	**0.264**	1
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Environment Agency

		Oral Health Criteria Value (µg kg^{-1} BW day^{-1})		Inhalation Health Criteria Value (µg kg^{-1} BW day^{-1})		Oral Mean Daily Intake (µg day^{-1})	Inhalation Mean Daily Intake (µg day^{-1})	Air-water partition coefficient (K_{aw}) (cm^3 cm^{-3})	Coefficient of Diffusion in Air (m^2 s^{-1})	Coefficient of Diffusion in Water (m^2 s^{-1})	log K_{oc} (cm^3 g^{-1})	log K_{ow} (dimensionless)	Dermal Absorption Fraction (dimensionless)	Soil-to-dust transport factor (g g^{-1} DW)	Sub-surface soil to indoor air correction factor (dimensionless)	Relative bioavailability via soil ingestion (unitless)	Relative bioavailability via dust inhalation (unitless)
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Environment Agency

		Soil-to-water partition coefficient ($cm^3 g^{-1}$)	Vapour pressure (Pa)	Water solubility (mg L^{-1})	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
1	Lead (C4SL child)	1.00E+03	NR	2.96E+05	0.00419 fw	0.00402 fw	0.00731 fw	0.00074 fw	0.00020 fw	0.00022 fw
2	Arsenic (C4SL child)	5.00E+02	NR	1.25E+06	0.00043 fw	0.0004 fw	0.00023 fw	0.00033 fw	0.0002 fw	0.0011 fw
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Environment Agency

	Soil-to-water partition coefficient ($cm^3 g^{-1}$)	Vapour pressure (Pa)	Water solubility (mg L^{-1})	Soil-to-plant concentration factor for green vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for root vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tuber vegetables (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for herbaceous fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for shrub fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)	Soil-to-plant concentration factor for tree fruit (mg g^{-1} plant DW or FW basis over mg g^{-1} DW soil)
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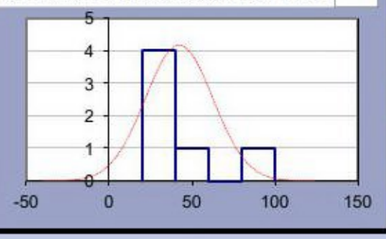
Test Results

Client/client ref:
Project ref: 1028b

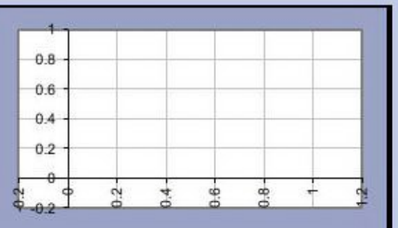
Site ref: The Croft, St Agnes
Data description:

Date: 26-Nov-2020
User details: Anne Mihalop

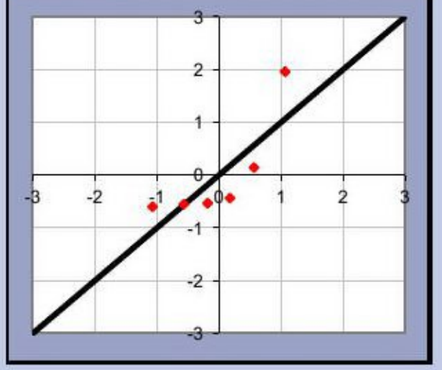
Dataset:	As
Sample mean, $\overline{x}$	42.417
Sample standard deviation, s	20.422
Sample size, n	6
Critical concentration, Cc	116



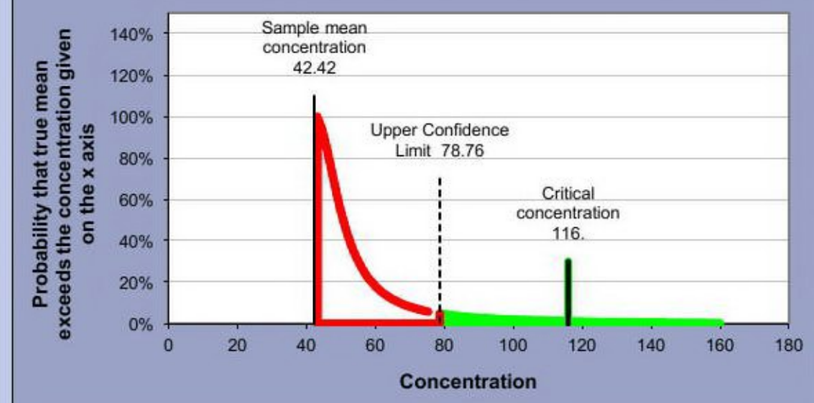
Outliers & non-detects	
Outliers present?	YES
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	99%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test

APPENDIX E

GUIDANCE ON CONTAMINATED LAND

CONTAMINATED LAND

SUPPORTING INFORMATION & RISK ASSESSMENT METHODOLOGY

Legal Definition of Contaminated Land

Part IIA of the Environmental Protection Act (1990) has introduced a statutory definition for contaminated land, which states:

"....any land which *appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land , that -*

significant harm is being caused or there is a significant possibility of such harm being caused

or

b) significant pollution of controlled waters is being or is likely to be, caused…"*

** To be implemented under the water Framework Directive and Water Act.*

This means that Contaminated Land as defined by the Act is land where substances are present in sufficient quantities or concentrations to cause or be likely to cause harm directly or indirectly to man, to the environment or on occasions to other targets.

Contamination & The Planning System

The planning system uses a slightly different definition of contaminated land. Within planning guidance the term "land affected by contamination" is used, which includes "the actual or suspected presence in, on or under the land may cause risks to people, human activity or the environment" regardless of whether or not the land meets the legal definition of contaminated land. Under the planning system the risks are assessed based on the "suitable for use, the new or intended use" of the land rather than the existing use upon which risks are based under the legal/Part IIA regime. For planning purposes, it is immaterial whether the presence of "contaminants" arise from anthropogenic or human activity or are naturally occurring.

The key question for a site going through the planning system is:

Is there sufficient evidence that the true mean concentration in soil (μ) is less than some critical concentration (Cc)?

The relevant statistical test involves comparing a conservative estimate of the true population mean (i.e. the 95% Upper Confidence Limit, or 95% UCL) with the critical concentration, Cc.

Since the 95% UCL is at most times greater than the true population mean, it follows that if the 95% UCL is less than the Cc, the assessor will know (with a defined high level of

confidence) that the true population mean (μ, the value which is not known) is also likely to be less than Cc.

Where the soil chemical results are at or below the critical concentrations, Cc, the null hypothesis has been rejected and therefore:

"*The evidence suggests the μ is not greater than Cc, i.e. the area of the land being assessed can be considered 'suitable for use'*".

In this instance no further consideration of the data or remediation of the land would be require.

Where the UCL exceeds the critical concentration, it would imply that there is a potential risk to human health and further consideration of that data may be required and/or site remediation.

Risk Assessment of Potentially Contaminated Land

The assessment of contaminated land involves three elements, as follows:

- Identification of potential **sources** of contamination;
- Identification of potential **receptors** for the contamination;
- Identification of suitable **pathways** between the source(s) and the receptor(s).

If all three of the above exist then a plausible pollutant linkage has been identified and there is a potential for the contamination to be a hazard and the site to be considered contaminated in terms of Part IIA or unsuitable for use in terms of a planning application/proposed development.

Guidance on Contamination Risk Assessment

The assessment of the risks to human health, surface water, groundwater, ecosystems and buildings from contaminated soil and groundwater is provided using information that is fit for purpose given the regulatory context and is completed in accordance with UK best practice. A summary of the risk assessment process is given below. More detailed information on risk assessment is contained in various reports published by the Environment Agency (EA) and Department of Environment, Food and Rural Affairs (DEFRA) in August 2008 including:

- Human Health Toxicological Assessment of Contaminants in Soil (the TOX Guidance Report)
- Updated Technical Background to the Contaminated Lane Exposure Assessment Model (the CLEA Report)
- Contaminated Land Exposure Assessment Software Version 1.03 beta & handbook

Soil Contamination Guidance

The Environment Agency (EA) has duties and powers to ensure the protection of groundwater and the remediation of contaminated land and groundwater. In order to achieve this, the EA employs the principle of risk assessment – the risk of a contaminant source causing harm or pollution via a given pathway to an identified receptor. If one of the source-pathway-receptor linkages is not considered to be present then there is no risk. However, if a contaminant source is present and there is a pathway for that contaminant to reach a receptor then there is a risk of harm to the receptor. Therefore, if the source-pathway-receptor linkages are complete, there is a requirement to undertake a risk assessment related to the receptor of concern, be it human health, surface water, groundwater buildings or other property or ecological issues.

The first stage in the assessment of a site is development of a conceptual site model. This is a consideration of all possible sources of contamination on site, the potential receptors and whether there is a plausible pathway between the two. This allows evaluation of whether further risk assessment for an identified receptor is necessary. Once plausible receptors have been identified a number of risk assessment models are available, including:

- Contaminated Land Exposure Assessment (CLEA) – human health risks
- Remedial Targets Methodology – hydrological risk assessment for contaminated land
- AETM Risk Based Corrective Action (RBCA) – human health, surface water and groundwater

In March 2002 the EA and DEFRA released a package of guidance to assess the health risks posed by contaminated land as part of the statutory framework for contaminated land. The Contaminated Land Exposure Assessment (CLEA) model is a framework for estimating the likely exposure to contaminants in the soil as part of the wider approach of the UK's assessment of risk and suitability for use. The methodology adopted for CLEA builds upon the source-pathway-receptor model for the assessment of risk. Following the CLEA model, generic Soil Guideline Values (SGVs) were developed to act as triggers for intervention in a number of end-use scenarios. The EA commenced a programme looking at fifty five contaminants. The CLEA methodology has recently been updated and the SGVs have been withdrawn from use (August 2008). New SGVs have been published, however as at 1st July 2010 only a limited number of SGVs are available with further being released during the next 12 months or so.

The CLEA SGVs are derived using specific parameters, which may not be relevant to each site. The CLEA software allows parameters to be changed and site specific SGVs can be generated. The CLEA methodology also uses a statistical evaluation of all data collected in order to give an overall impression of the site rather than using individual contaminant values, which may vary dramatically across the site. The statistical tests calculate a normalised upper bound value for the site as a whole and also gives an idea of whether a particular value is a statistical outlier (hotspot) or whether it is part of the whole population of samples.

The SGVs derived from the CLEA model are intended for use in assessing the risk to long term human users of the site. There is also a requirement to consider the potential for harm from short-term exposure to contaminants at the site, e.g. to construction workers who may be exposed to risk via inhalation of dust or dermal contact with any contaminated material.

Where CLEA guidelines do not include contaminants of concern many practitioners rely upon published international screening values such as; the Generic Assessment Criteria (GAC) published by the Chartered Institute for Environmental Health and Land Quality Management (CIEH/LQM); the corrected Dutch Intervention Values (cDIV); United States Environment Protection Agency Preliminary Remediation Goals (USEPA PRG); and the Ecological Soil Screening Levels (Eco-SSL) published by USEPA. These values have no legal standing in the UK but, in the absence of more appropriate guidelines, they may give an indication of significance.

Statistical Analysis

Statistical analysis is used to identify if the data set for each substance tested contains outliers, has a normal or non-normal distribution and if there is significant evidence that the mean concentration, as defined by the 95% upper confidence level (UCL), is less than the adopted screening value. This process follows the CLAIRE/CIEH Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008. A computer programme from ESI known as 'Contaminated Land Statistical Calculator' has been used by YES to generate the statistical analysis. In some circumstances if it is known that soil remediation will definitely be needed due to the concentrations and statistical results of a substance, for example for arsenic, the remaining substances tested may not all be subjected to the analysis, as this would be of little worth.

Results from the statistical testing can be used to inform decisions on whether land is suitable for use under the land use planning system.

Water Contamination Guidance

If the receptor is groundwater/drinking water the concentrations of contaminants detected in the groundwater and/or leaching tests are compared to the UK Drinking Water Standards (UK DWS) including the Water Supply (Water Quality) Regulations 1989 and Water Supply (Water Quality) Regulations 2000. Where surface water is the receptor the EA Environmental Quality Standards (EQS) are used.

Where the UK DWS and EQS do not include contaminants of concern reference is made to other appropriate guidance. This includes the European Union Council Directives 98/83/EC and 75/440/EEC on the quality of water intended for human consumption and the quality required of surface water intended for the abstraction of drinking water respectively. Additional screening values are derived from the World Health Organisation (WHO) Guidelines for Drinking Water Quality (1984) and the Dutch Target and Intervention Values for Soil Remediation.

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