



CONSULTING ENGINEERS

**CIVIL • STRUCTURAL
GEOTECHNICAL • ENVIRONMENTAL**

MD/17040

21st December 2018

Anwyl Homes & Bellway Homes
Anwyl House 2 Alderman Road
St Davids Park Liverpool
Clos Dewi Sant Merseyside
Ewloe L24 9LR
CH5 3DT

Attn: Mr P Harkness & Ms L Whitely

RE: SUPPLEMENTARY INVESTIGATION WORKS AT GRESFORD RD, LLAY, WREXHAM

Dear Mr Harkness,

Further to your recent instructions we have undertaken a programme of supplementary investigations within the locality of an existing ground slab.

The site has been subject to a previous programme of site investigation by REFA which consisted of forty seven (47 No.) machine excavated trial pits and eleven (11 No.) window sample boreholes. The full details of this investigation are reported in report reference 17040/GEIR/A dated November 2018 and should be reviewed when considering this report. REFA recommended that further investigation should be conducted within the area of the concrete slab utilised as a storage yard by the landowner.

- **General**

We understand that the proposed development comprises of three hundred and sixty two (362 No.) residential properties along with associated road access and garden areas. The proposed development plan is appended to this report for reference.

- **Investigations**

This investigation commissioned by REFA utilised five (5 No.) trial pits (TP101 – TP105) which were supervised by a REFA engineer. These trial pits were targeted within the area of the existing slab and utilised a pneumatic breaker to break through the concrete slab. These trial pits were excavated to depths between 1.1 – 2.5m bgl. The locations of the trial pits are shown upon the appended exploratory hole plan (17040/27).

Position TP104 was terminated at a depth of 1.1m bgl due to the very fast influx of perched water within the made ground material masking the excavation and making it unsafe to continue.

- **Ground conditions**

A majority of locations (TP102 – TP105) have identified concrete present at a thickness of 0.2m. Within position TP101 grass covered made ground comprising of a sub base material of limestone and concrete was identified and proven to a depth of 0.3m bgl.

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Underlying the concrete and sub base material all trial pits have identified made ground comprising of intermixed soils with brick and concrete fragments and blocks. The made ground material was proven to depths varying between 0.8 – 1.1m bgl. No visual or olfactory evidence of contamination has been identified within the made ground material but the presence of anthropogenic material may indicate the potential for contaminants. Due to the variable nature of the made ground material it is considered incapable of offering a uniform safe bearing capacity for foundations.

Underlying the made ground deposits the natural strata comprises of firm to stiff brown sandy gravelly clay which has been proven to a maximum depth of 2.5m bgl. In situ hand shear vanes have been conducted within the cohesive natural strata and recorded hand shear vane values between 92 – 138 kPa. Based upon a visual assessment of the natural clay strata and the shear vane results we consider that the natural clay strata is capable of offering a safe bearing capacity of at least 100kN/m² at a minimum depth of 0.9m.

Within position TP104 soft to firm sandy clay was encountered at 0.9m bgl and was proven to 1.1m bgl. It is anticipated that the natural clays within this area are generated by the significant localised perched water in this location. The natural strata in this location should be reviewed following dewatering of perched water.

Ground water ingress has been identified within positions TP104 and TP105 at depths between 0.5 – 1.7m bgl. This ground water ingress is considered to represent perched water within the made ground and natural strata. It is anticipated that during ground works surface water may become perched within the natural clay deposits during periods of inclement weather but this may be remediated using simple sump pumping techniques.

Localised granular units of sand may be present within the site and it is anticipated that perched water may be present within localised granular units and may cause running sand conditions within excavations. This may require specialist ground water removal techniques to be required and specialist support arrangements. If these ground conditions are encountered then the excavation works should cease and the foundations engineer and building inspector should be consulted

It is anticipated that the natural clay strata within the site is considered capable of remaining open for significant periods of time however potential for catastrophic collapse still poses a significant risk within the site.

It is essential that personnel should not be allowed to approach or enter any excavation made upon this site unless appropriate precautions have been adopted to ensure that hazardous side instability has been prevented. This is particularly important in relation to foundation and drainage construction where operatives may be specifically required to enter excavations. Excavations and working practices in the ground at this site should be carried out in accordance with the recommendations laid down in HSE publication HSG 150 "Health & Safety in Construction".

- **Chemical Analysis**

Due to the presence of made ground deposits we have obtained samples for chemical analysis to determine whether the made ground is suitable for retention within the site.

Within this investigation three (3 No.) representative samples of made ground strata have been obtained. Samples have been returned to the laboratories of Exova Jones Environmental who are a UKAS and MCERT accredited laboratory facility. Each sample has been subject to a wide ranging programme of chemical analyses which has been based upon the normal range of contaminants

considered to be commonly associated with commercial land. Full results of this testing programme are attached to this report for reference.

In assessing the results we have referred to a series of assessment criteria which have been obtained from varying sources and details of the assessments are shown in tables 1 – 4 which correlate to the made ground material. The underlying natural strata have not identified any visual or olfactory evidence of contamination and therefore no chemical analysis has been carried out upon the natural strata.

Table 1: Summary of Contamination Analysis: Metals & Inorganics					
	No. of Samples	Range of Values (mg/kg)	Assessment Criteria (mg/kg)	No. of Samples Failing	Locations
Arsenic	3	6.9 – 11.5	37 ³	0	-
Cadmium	3	0.1 – 0.3	11.0 ³	0	-
Chromium (total)	3	23.5 – 40.7	910 ³	0	-
Copper	3	17.0 – 27.0	2400 ³	0	-
Lead	3	16.0 – 42.0	200 ¹	0	-
Mercury	3	<0.1	40 ³	0	-
Nickel	3	15.9 – 26.7	180 ³	0	-
Selenium	3	<1.0	250 ³	0	-
Zinc	3	54.0 – 95.0	3700 ³	0	-
Total Cyanide	3	<0.5	34.2 ²	0	-
Phenols	3	<0.15 – 1.66	120 ³	0	-
pH	3	7.98 – 12.11	-	0	-
SOM	3	1.01 – 7.58	-	0	-
SO ₄ (2:1)	3	0.04 – 0.77	0.5 ⁵	1	TP101 – 0.6m
Asbestos	3	ND - Chrysotile	Present/Absent	1	TP103 – 0.5m
¹ DEFRA : SP1010 : Category 4 Screening Levels ² Atkins Atrisk SSV residential without home grown produce (1% SOM) ³ LQM and CIEH S4UL's for Human Health Risk Assessment (Registration No. S4UL 3265) residential with home grown produce (1% SOM) ⁴ BRE Special Digest 1:2005 DS-1 ND – None Detected					

Chemical analysis has not identified any elevated concentrations of metals or inorganics within the samples of made ground.

All samples have been screened for the presence of asbestos fibres and sample TP103 - 0.5m has identified the presence of Chrysotile fibres. Upon identification the fibres have been quantified and recorded a quantity of <0.001%. Based upon this quantity and the lack of visual evidence of ACM's within the made ground it is considered that asbestos fibres do not pose a risk to ground workers or the long term end users of the site. If ACM's or fibres are identified during groundworks then these should be handled and disposed of in accordance with guidance HSG247. The appropriate regulatory authorities should also be notified.

Soil samples obtained from the site investigation have been subject to a programme of analysis which has assessed the concentration of the individual constituents of the Polycyclic Aromatic Hydrocarbon series. A summary of these results is shown in Table 2 and have indicated that all concentrations are below the adopted assessment criteria and therefore no remedial action is required in terms of PAH compounds.

Table 2: Summary of Contamination Analysis: Organics: PAH USEPA 16 Suite

	No. of Samples	Range of Values (mg/kg)	Assessment Criteria ¹ (mg/kg)	No. of Samples Failing	Locations
Acenaphthene	3	<0.05 – 0.44	210	0	-
Acenaphthylene	3	<0.03 – 0.05	170	0	-
Anthracene	3	<0.04 – 0.73	2400	0	-
Benzo[a]anthracene	3	<0.06 – 0.78	7.2	0	-
Benzo[a]pyrene	3	<0.04 – 0.5	5.0 ²	0	-
Benzo[b]fluoranthene	3	<0.05 – 0.71	2.6	0	-
Benzo[ghi]perylene	3	<0.04 – 0.34	320	0	-
Benzo[k]fluoranthene	3	<0.02 – 0.27	77.0	0	-
Chrysene	3	<0.02 – 0.51	15.0	0	-
Dibenz[ah]anthracene	3	<0.04 – 0.12	0.24	0	-
Fluoranthene	3	<0.03 – 2.22	280	0	-
Fluorene	3	<0.04 – 0.38	170	0	-
Indeno[123-cd]pyrene	3	<0.04 – 0.33	27.0	0	-
Naphthalene	3	<0.04 – 0.68	2.3	0	-
Phenanthrene	3	<0.03 – 2.12	95.0	0	-
Pyrene	3	<0.03 – 1.71	620	0	-

¹ LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (1% SOM)

² DEFRA : SP1010 : Category 4 Screening Levels

As part of the chemical analysis a sample of made ground was analysed for the presence of hydrocarbons and a review of table 3 below indicated that all concentrations recorded below the adopted assessment criteria and therefore there is no requirement for remedial works in relation to hydrocarbons.

Table 3: Summary of Contamination Analysis: Organics: TPH (CWG) Suite

	No. of Samples	Range of Values mg/kg	Assessment* Criteria mg/kg	No. of Samples Failing	Notes
Aliphatic EC> 5 - 6	1	<0.1	42.0	0	-
Aliphatic EC> 6 - 8	1	<0.1	100	0	-
Aliphatic EC> 8 - 10	1	<0.1	27.0	0	-
Aliphatic EC> 10 - 12	1	<0.2	130	0	-
Aliphatic EC> 12 - 16	1	<4.0	1100	0	-
Aliphatic EC> 16 - 35	1	34.0	65000	0	-
Aromatic EC> 5 - 7	1	<0.1	70.0	0	-
Aromatic EC> 7 - 8	1	<0.1	130.0	0	-
Aromatic EC> 8 - 10	1	<0.1	34.0	0	-
Aromatic EC> 10 - 12	1	<0.2	74.0	0	-
Aromatic EC> 12 - 16	1	<4.0	140	0	-
Aromatic EC> 16 - 21	1	<7.0	260	0	-
Aromatic EC> 21 - 35	1	86.0	1100	0	-

*Criteria values based upon LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (1% SOM)

As part of the hydrocarbon analysis BTEX range of hydrocarbons were also analysed, which are displayed in table 4 below. A review of the results indicate all concentrations have been recorded below the limit of detection. Therefore no remedial works are required in terms of BTEX hydrocarbons.

Table 4: Summary of Contamination Analysis: Organics: BTEX Suite					
	No. of Samples	Range of Values (mg/kg)	Assessment* Criteria (mg/kg)	No. of Samples Failing	Notes
<i>Benzene</i>	1	<0.05	0.087	0	
<i>Toluene</i>	1	<0.05	130	0	
<i>EthylBenzene</i>	1	<0.05	47.0	0	
<i>M/PyXylenes</i>	1	<0.05	59.0	0	
<i>O - Xylene</i>	1	<0.05	60.0	0	
<i>Methyl tert-Butyl Ether</i>	1	<0.05	20 ¹	0	
Criteria values based upon LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (1% SOM) ¹ Atkins Atrisk SSV residential with home grown produce (1% SOM)					

Within the program of laboratory testing each sample has also been analysed to determine the concentration of water soluble sulphates within the ground. Reference to the laboratory results presented by Exova Jones confirms that soluble sulphates are present at concentrations are between 0.04 – 0.77g/l. Reference to BRE Special Publication 1 : 2005 “Concrete in Aggressive Ground” confirms that at <0.5g/l, the design sulphate class for this site is DS-1. For sample TP101 – 0.6m the design sulphate class for this sample is DS – 2. However the ACEC class for the site is assessed to be AC-1s on the basis that the site does not have mobile groundwater and the pH value is >5.5. Reference to Table D of BRE Special Publication 1 indicates that the DC class for this site should be considered to be DC-1.

CONCLUSIONS

- **Contamination**

This investigation has not identified any elevated concentrations of the determinants tested within the made ground material.

Asbestos screening has identified the presence of Chrysotile fibres within sample TP103 – 0.5m but recorded at a quantity of <0.001%. Therefore asbestos fibres are not considered to pose a hazard to ground workers or the long term end users.

A remediation strategy has already been produced for this development (Report Ref: 17040/REM/001 dated November 2018) detailing the requirement for clean inert capping in the garden areas to plots 231 – 237, 246 – 250, 271 – 273 & 348 – 352. Following analysis of the made ground below the existing slab it is considered suitable for retention within the proposed development and does not require any form of clean inert capping.

If during ground works suspicious ground conditions or contamination are identified then the consulting engineer should be consulted and appropriate regulatory authorities should be notified.

- **Foundations**

The ground investigations have identified superficial deposits consisting of sandy clays and this natural stratum is considered to offer a safe bearing capacity of at least 100kN/m² at a minimum depth of 0.9m.

Softer clay deposits were identified within position TP104 at depths between 0.9 – 1.1m bgl and it is anticipated that this is related to the significant amount of perched water in this locality above the natural clays. Following dewatering in this area the natural clay strata in this locality should be reassessed by the foundations engineer.

Where cohesive deposits have been identified within the south eastern corner and the western half of the site it is anticipated that the clay strata is capable of offering a safe bearing capacity in the order of 100kN/m² at a minimum depth of 0.9m below original ground level. Therefore it is anticipated that in these areas traditional strip type foundations may be formed at depths varying between 0.9 – 1.5m below ground level. Where tree root influences are present, foundations may need to extend to depths up to 2.5m bgl.

Properties in close proximity to trees, tree roots may influence foundation depths which may mean they may have to extend to depths of 2.5m. Previous plasticity index analysis within the original investigation by REFA identified that the natural clays have a low volume change potential as defined by NHBC Handbook Chapter 4.2.

- **Ground Floor Construction**

It is recommended that all properties within this site should be provided with a suspended ground floor construction. This may be of a specialist manufactured precast concrete beam and block type arrangement, or of a designed cast insitu construction. In areas where tree root effects are critical, it will be necessary for the foundations to be designed in accordance with the requirements of the NHBC Handbook Chapter 4.2 in conjunction with the arboriculturist report. The clay soils within this site are considered to have a low volume change potential for design purposes.

The site is located within an area where 5 % - 10% of properties are above the action level for radon gas and therefore basic radon ground gas precautions are required within the ground floor construction of all properties on this site in accordance with BR211 : Radon "Guidance on Protective Measures for new Dwellings".

We trust that this information meets with your requirements at this time but if you do require anything further or have any queries then please do not hesitate to contact us.

Yours Sincerely



Mark Davies B.Sc(Hons)
R E FRY & ASSOCIATES LTD

ENC:

Site layout

Supplementary Investigation Plan (17040/27)

Trial pit records

Trial pit photographs

Exova Jones Laboratory test results

PRELIMINARY LAYOUT TO ASSIST CLIENT BRIEF



STRAIGHT MILE

Notes:
Do not scale from this drawing.
All dimensions must be taken from the drawing and checked dimensions.
All dimensions must be taken from the drawing and checked dimensions.
Any discrepancies between drawings, specifications and the conditions must be brought to the attention of the supervising officer.

ACCOMMODATION SCHEDULE - LLAY - BELLWAY HOMES

Unit Ref/Name	Bed No.	Unit No.	Unit ft²	ft² Total
Private				
4A129 LARCH	4BED2STOREY DETACHED	15	1283	19385
4A124 FARHAVEN	4BED2STOREY DETACHED	19	1239	23541
4A115 CHAWOOD	4BED2STOREY DETACHED	26	1151	29926
3WE103 WESTON	3BED2STOREY DETACHED	24	1025	24600
3GD088 GORDON ALT	3BED2STOREY DETACHED	17	978	16626
3L084 LANDOWN	3BED2STOREY DETACHED	21	943	19803
3RU081 RUFFORD	3BED2STOREY SEMI-DETACHED	12	800	9708
Affordable Units				
3SH091 SHIELLY	3BED2STOREY SEMI-DETACHED	2	919	1820
3CH073 CHATSWORTH	3BED2STOREY SEMI-DETACHED	9	733	6597
2WUFF068 WISTARTON	2BED APARTMENT FF	8	684	5472
2ST062 STUDLEY	2BED2STOREY SEMI-DETACHED	20	619	12380
1WUFF055 WISTARTON	1BED APARTMENT GP	8	551	4408
Total:		181 Units		174276 ft²
Nett Area 11.20 acres				

ACCOMMODATION SCHEDULE - LLAY - ANWYL

Unit Ref/Name	Bed No.	Unit No.	Unit ft²	ft² Total	
BU	BEAUMARIS	4BED2STOREY DETACHED	2	1551	3102
BE	BRECON	4BED2STOREY DETACHED	17	1508	25636
BE	BETWIS	3BED2STOREY DETACHED	9	1479	13311
GL	GLYN	4BED2STOREY DETACHED	5	1404	7020
CA	CARDIGAN	4BED2STOREY DETACHED	19	1175	22325
AB	ABERROCH	4BED2STOREY DETACHED	14	1063	15082
PO	PORTHMAHOOG	3BED2STOREY DETACHED	8	1017	8136
CL	CLYWD	3BED2STOREY SEMI-DETACHED	11	956	10516
HO	HOPKIN	3BED2STOREY DETACHED	12	953	11436
OV	OVERTON	3BED2STOREY SEMI-DETACHED	20	811	16220
PE	PENLEY	3BED2STOREY SEMI-DETACHED	20	775	15500
Affordable Units					
MD	MONMOUTH	3BED2STOREY SEMI-DETACHED	12	804	9648
CA	CARMARTHEN	2BED2STOREY SEMI-DETACHED	15	685	10280
FL	FLAT	1BED APARTMENT	14	495	6930
TOTAL			44		57222.6 ft²

PRELIMINARY
ISSUE

04	27.10.16	Numbers increased to Anwyll parcels	JNL
05	25.10.16	Sketch prepared with Bellway / Anwyll split	JNL
06	05.05.16	Revised with Anwyll split only	MP
07	04.08.2015	Final issue	KK
08	04.08.2015	Final issue	KK

Client:
ANWYL **Bellway**
Thoughtful homes

Project:
**Hope Farm, Gresford Road
Llay, Wrexham**

Drawing Title:
Sketch Layout

Drawn by: **JNL** Checked by: **JNL** Date: **Oct 2016**

Status: **PRELIMINARY** Scale: **1:500**

Job no: **A085** Depn: **SK01** Rev: **P4**

ANWYL
Bellway
Thoughtful homes

ANWYL
Bellway
Thoughtful homes

Draft Planning Layout

Scale: 1:500

1:500 0 5 10 15 25m



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Trial Pit Log

Trial Pit No
TP101
Sheet 1 of 1

Project Name: Gresford Rd, LLay, Wrexham

Project No.
17040

Co-ords: -
Level:

Date
06/12/2018

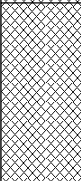
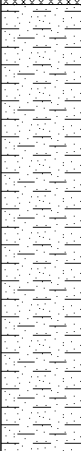
Location: Gresford Rd, LLay, Wrexham

Dimensions (m) 2.20

Scale
1:25

Logged
MGD

Client: Anwyl Construction/Bellway Homes Ltd

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.60	ES		0.30			Grass over MADE GROUND: Dark grey, sandy, fine to coarse, sub-angular to angular gravel of various lithologies including limestone and concrete. Sand is fine to coarse.	
				0.90			MADE GROUND: Dark brown, sandy, slightly clayey, fine to coarse, sub-angular to angular gravel of brick, concrete and limestone. Sand is fine to coarse. Medium cobble content.	
	1.50		HVP=92				Firm to stiff, mottled greyish brown, slightly sandy CLAY. Sand is fine to medium.	1
	2.00		HVP=98					2
				2.40			End of Pit at 2.40m	3
								4
								5

Remarks: No groundwater encountered.

Stability: Pit Stable





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Trial Pit Log

Trial Pit No
TP102
Sheet 1 of 1

Project Name: Gresford Rd, LLay, Wrexham	Project No. 17040	Co-ords: - Level:	Date 06/12/2018
Location: Gresford Rd, LLay, Wrexham		Dimensions (m)	Scale 1:25
Client: Anwyl Construction/Bellway Homes Ltd			Logged

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Concrete Slab (recovered as light grey, angular cobbly coarse gravel).	
				1.10			MADE GROUND: Dark grey, sandy, slightly clayey, fine to coarse, sub-angular to angular gravel of brick, concrete and limestone. Sand is fine to coarse. Low cobble content.	1
	2.00		HVP=120	2.20			Firm to stiff, mottled greyish brown, slightly sandy CLAY. Sand is fine to medium.	2
							End of Pit at 2.20m	3
								4
								5

Remarks: No groundwater encountered. At rear of trial pit an additional layer of concrete was encountered at 0.6-1.0m below ground level.

Stability: Pit Stable





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Trial Pit Log

Trial Pit No

TP103

Sheet 1 of 1

Project Name: Gresford Rd, LLay, Wrexham

Project No.
17040

Co-ords: -

Level:

Date

06/12/2018

Location: Gresford Rd, LLay, Wrexham

Dimensions (m) 2.20
0.70

Scale

1:25

Logged

Client: Anwyl Construction/Bellway Homes Ltd

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES	HVP=138	0.20			MADE GROUND: Concrete Slab (recovered as light grey, cobbly, coarse, angular gravel).	
	0.50						MADE GROUND: Dark brown, very sandy, fine to coarse, sub-angular to angular gravel of concrete, brick and limestone. Sand is fine to coarse. Low cobble content.	
	1.00			0.80			Stiff, mottled greyish brown, slightly gravelly CLAY. Gravel is medium to coarse, sub-angular to rounded of various lithologies.	1
	2.00		HVP=120	2.50			End of Pit at 2.50m	2
								3
								4
								5

Remarks: Groundwater ingress at 2m. Slow rate of infiltration.

Stability: Pit Stable

AGS



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Trial Pit Log

Trial Pit No

TP104

Sheet 1 of 1

Project Name: Gresford Rd, LLay, Wrexham

Project No.
17040

Co-ords: -

Level:

Date

06/12/2018

Location: Gresford Rd, LLay, Wrexham

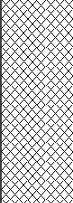
Dimensions (m) 2.20
0.70

Scale

1:25

Logged

Client: Anwyl Construction/Bellway Homes Ltd

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Concrete Slab (recovered as light grey, cobbly, coarse, angular gravel).	
							MADE GROUND: Dark greyish brown, sandy, fine to coarse, angular gravel of brick and concrete. Sand is fine to coarse. Contains concrete blocks and bricks.	
				0.90			Soft to firm, yellowish brown, sandy CLAY. Sand is fine to medium.	1
				1.10			End of Pit at 1.10m	
								2
								3
								4
								5

Remarks: Groundwater ingress at 0.5m. Fast rate of infiltration. Trial pit terminated at 1.1m due to excessive water.

Stability: Pit Stable

AGS



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Trial Pit Log

Trial Pit No
TP105
Sheet 1 of 1

Project Name: Gresford Rd, LLay, Wrexham	Project No. 17040	Co-ords: -	Date 06/12/2018
		Level:	
Location: Gresford Rd, LLay, Wrexham		Dimensions (m) 0.70 2.20	Scale 1:25
Client: Anwyl Construction/Bellway Homes Ltd			Logged

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Concrete Slab (recovered as light grey, cobbly, coarse, angular gravel).	
	0.70	ES		0.80			MADE GROUND: Reddish brown, sandy, fine to coarse, sub-angular to angular gravel of brick and concrete. Sand is fine to coarse.	
	1.00		HVP=92				Firm to stiff, mottled greyish brown, sandy, slightly gravelly CLAY. Sand is fine to medium. Gravel is medium to coarse, sub-angular to rounded of various lithologies.	1
	2.00		HVP=135	2.10			End of Pit at 2.10m	2
								3
								4
								5

Remarks: Groundwater ingress at 1.7m. Slow rate of infiltration.

Stability: Pit Stable



Trial Pit Photographs – Gresford Road, Llay



Photo 1 – Trial Pit 101



Photo 2 – Arising's from Trial Pit 101



Photo 3 – Trial Pit 102



Photo 4 – Arising's from Trial Pit 102



Photo 5 – Trial Pit 103



Photo 6 – Arising's from Trial Pit 103



Photo 7 – Trial Pit 104



Photo 8 – Arising's from Trial Pit 104



Photo 9 – Trial Pit 105



Photo 10 – Arising's from Trial Pit 105



Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
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Attention :	Matthew Dowling
Date :	13th December, 2018
Your reference :	17040
Our reference :	Test Report 18/19837 Batch 1
Location :	Gresford Rd, Llay
Date samples received :	6th December, 2018
Status :	Final report
Issue :	1

Three samples were received for analysis on 6th December, 2018 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Bruce Leslie
Project Co-ordinator

Please see attached notes for all abbreviations and acronyms

Client Name: Robert E Fry & Associates Ltd
Reference: 17040
Location: Gresford Rd, Llay
Contact: Matthew Dowling
JE Job No.: 18/19837

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2	3								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP101	TP103	TP105										
Depth	0.60	0.50	0.70										
COC No / misc													
Containers	J	J	J										
Sample Date	06/12/2018 10:00	06/12/2018 10:45	06/12/2018 11:15										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	06/12/2018	06/12/2018	06/12/2018								LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1 ^{SV}	-	-								<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1 ^{SV}	-	-								<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1 ^{SV}	-	-								<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	-	-								<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	-	-								<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	-	-								<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	34	-	-								<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35	34	-	-								<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Aromatics													
>C5-EC7 #	<0.1 ^{SV}	-	-								<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1 ^{SV}	-	-								<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1 ^{SV}	-	-								<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	-	-								<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	-	-								<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	-	-								<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	86	-	-								<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 #	86	-	-								<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Total aliphatics and aromatics(C5-35)	120	-	-								<38	mg/kg	TM5/PM8/PM16/PM12/PM10
MTBE #	<5 ^{SV}	-	-								<5	ug/kg	TM31/PM12
Benzene #	<5 ^{SV}	-	-								<5	ug/kg	TM31/PM12
Toluene #	<5 ^{SV}	-	-								<5	ug/kg	TM31/PM12
Ethylbenzene #	<5 ^{SV}	-	-								<5	ug/kg	TM31/PM12
m/p-Xylene #	<5 ^{SV}	-	-								<5	ug/kg	TM31/PM12
o-Xylene #	<5 ^{SV}	-	-								<5	ug/kg	TM31/PM12
Total Phenols HPLC	<0.15	1.66	0.24								<0.15	mg/kg	TM26/PM21
Natural Moisture Content	10.6	16.4	23.0								<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	9.6	14.1	18.7								<0.1	%	PM4/PM0
Sulphate as SO4 (2:1 Ext) #	0.7709	-	0.0918								<0.0015	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext)	-	0.0424	-								<0.0015	g/l	TM38/PM60
Total Cyanide #	<0.5	<0.5	<0.5								<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	4.41	NDP	0.59								<0.02	%	TM21/PM24
Sulphide	<10	<10	<10								<10	mg/kg	TM107/PM119
pH #	7.98	11.80	12.11								<0.01	pH units	TM73/PM11

Client Name: Robert E Fry & Associates Ltd
Reference: 17040
Location: Gresford Rd, Llay
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Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth
Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/19837	1	TP101	0.60	1	07/12/2018	General Description (Bulk Analysis)	soil-stones
					07/12/2018	Asbestos Fibres	NAD
					07/12/2018	Asbestos ACM	NAD
					07/12/2018	Asbestos Type	NAD
					07/12/2018	Asbestos Level Screen	NAD
18/19837	1	TP103	0.50	2	07/12/2018	General Description (Bulk Analysis)	soil-stones
					07/12/2018	Asbestos Fibres	Fibre Bundles
					07/12/2018	Asbestos ACM	NAD
					07/12/2018	Asbestos Type	Chrysotile
					07/12/2018	Asbestos Level Screen	less than 0.1%
					13/12/2018	Total ACM Gravimetric Quantification (% Asb)	<0.001 (mass %)
					13/12/2018	Total Detailed Gravimetric Quantification (% Asb)	<0.001 (mass %)
18/19837	1	TP105	0.70	3	13/12/2018	Total Gravimetric Quantification (ACM + Detailed) (% Asb)	<0.001 (mass %)
					07/12/2018	General Description (Bulk Analysis)	soil-stones
					07/12/2018	Asbestos Fibres	NAD
					07/12/2018	Asbestos ACM	NAD
					07/12/2018	Asbestos Type	NAD
					07/12/2018	Asbestos Level Screen	NAD

Matrix : Solid

[illegible]

Client Name: Robert E Fry & Associates Ltd

Reference: 17040

Location: Gresford Rd, Llay

Contact: Matthew Dowling

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 18/19837

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Please include all sections of this report if it is reproduced

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 18/19837

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes

JE Job No: 18/19837

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM31	Modified USEPA 8015B. Determination of Methylterbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes		AR	Yes
TM107	Determination of Sulphide/Thiocyanate by Skalar Continuous Flow Analyser	PM119	As received solid samples are extracted with 1M NaOH by orbital shaker for Sulphide and Thiocyanate analysis.			AR	Yes
TM131	Quantification of Asbestos Fibres and ACM, based on HSG248 and SCA method.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	Yes