

**FORMER COAL YARD, LLOYD'S LANE,
CHIRK**

**HYDROCARBON REMOVAL VERIFICATION
REPORT**

For: Messer A & B Roberts

May 2018

Report Ref: R2280-R04 v1

DOCUMENT CONTROL SHEET

Report Title: Former Coal Yard, Lloyd's Lane, Chirk
Hydrocarbon Removal Verification Report

Client: Messer A & B Roberts

Report Reference Number: R2280-R04

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Signed For Smith Grant LLP

	Name	Position	Signature	Date
Author	Phillip Magraw BSc, FGS	Consultant		15.05.2018
Reviewer	B Thomas BSc MSc MCIWEM CEnv	Partner	PP 	15.05.2018

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1. Introduction

- 1.1. A former coal yard located to the west of Lloyd's Lane, Chirk is being considered for a residential land use. SGP has produced a Stage 1 & 2 Contaminated Land assessment (R2280-R01 & R2280-R02) and a Remediation Strategy (R2280-R03) for the site. Messer A & B Roberts have subsequently instructed Smith Grant LLP (SGP) to produce a hydrocarbon removal verification report for the remediation works undertaken for submission to Wrexham County Borough Council (WCBC).
- 1.2. The site presently consists of a vacant irregular shaped parcel of land with a slight slope from east to west. Several small buildings are present across the site with two former material storage areas with associated outer walls along the northern boundary of the site. The site boundary and hotspot area are shown in Drawing R2280-R04-D01. Site details are:

Table 1.1: Site details

Address	Former Coal Yard, Lloyd's Lane, Chirk, LL14 5PU
National Grid Reference	329354, 338270
Local Authority	Wrexham County Borough Council
Site Area	3,150m ³
Current Use	Vacant land
Site Access	off Lloyd's Lane
Planning Reference	P/2017/0459
Proposed Use	Erection of four pairs of semi-detached and one detached property with private garden area and formation of vehicular access

Figure 1.1: Site Location



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- 1.3. Planning Permission for redevelopment of the site has been granted by WCBC, reference P/2017/0459. The Planning Condition 7 relevant to land contamination issues is summarised below:

Table 1.2: Planning Condition relating to Contaminated Land

Condition 7	<i>No development shall take place until a phased site investigation of the nature and extent of contamination has been carried out and submitted to and approved in writing by the Local Planning Authority. If any contamination is found during the site investigation, no part of the development shall commence until a scheme specifying the measures that will be taken to remediate the site to render it suitable for the development hereby permitted has been submitted to and approved in writing by the local planning authority. The site shall thereafter be remediated in accordance with the approved scheme. If during the course of development any contamination is found that has not been identified in the site investigation, no further development shall take place on those parts of the site where that contamination has been found until an additional scheme of remediation has been submitted to and approved in writing by the local planning authority for those parts of the site. The relevant parts of the site shall thereafter be remediated in accordance with the additional scheme of remediation.</i>
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- 1.4. This report details the verification of the completed elements of the Remedial Strategy implemented. The assessment methodology follows the framework described in the EA / DEFRA Contaminated Land Report 11: 'Model Procedures for the Management of Land Contamination' 2004, comprising an options appraisal to evaluate and identify feasible remediation options, specification of appropriate techniques, and an implementation programme and verification plan.
- 1.5. It is intended that this Verification Report be submitted to WCBC to allow confidence that further preparatory earthworks and construction may commence on the site for its residential housing occupation, subject to the implementation of construction stage mitigation measures, as required.
- 1.6. A programme of works to physically prepare the site for development will also be required; assessment of the geotechnical properties of the ground, its stability and related impacts on foundation and infrastructure design are outside the scope of this report, which relates to risks from contamination only.

2. Remediation Strategy

1.1. Contamination Sources

1.1.1. The previous investigations and risk assessments had concluded that the site was generally of a low risk from significant land contamination, having been developed from Greenfield land and used as a coal yard. The made ground across the site potentially contains pockets of low level PAH and metal contamination. A potential hydrocarbon hotspot area was reported in the central west of the site (TP3/TP4).

1.1.2. Further assessment and possible removal of the potential hotspot area was recommended and is provided in this report (See Drawing R04-D01) in advance of implementation of construction stage mitigation measures – application of clean soil cover system and radon protection measures.

1.2. Remediation Objectives

1.2.1. The remediation objectives, strategy, and implementation plan described below address the contamination identified to date. The strategy included provision to address deficiencies in the available site investigation information which can be addressed most thoroughly and economically during the site preparatory works when suitable resources in terms of plant and supervision will be available. Key remediation objectives were therefore:

- break significant or potentially significant future pollutant linkages resulting from the change of land use;
- remove/remediate significant pollution sources if identified during the works, that pose a risk to man and/or the environment;
- respond appropriately to contingencies, in particular the discovery of currently uncharacterised contamination;
- recover materials with the potential for re-use within the development;
- manage all emissions to air and water to protect local residents, surface waters and groundwater, and the atmosphere during the remediation works;
- allow appropriate additional protection measures to be implemented during construction (if required).

2.1.1. The main potential risk to human health was considered to be exposure to shallow soils in gardens due to low-level contaminants (lead and hydrocarbons). These substances are characteristically widespread in urban areas and their absence (at elevated concentrations) within single averaging areas such as gardens should be confirmed.

2.1.2. SGP specified a 600mm clean soil (as defined by the soils criteria provided in the Remediation Strategy) cover system or stripping of made ground soils to natural strata as sufficient to isolate future residents from direct exposure pathways in garden areas and 300mm clean soil cover in managed Public Open Space (POS) and landscaped areas.

1.3. Scope of Remediation Earthworks

1.3.1. Remediation earthworks within the scope of the Remediation Strategy included:

- segregation and strip of ACMs from all buildings prior to demolition;
- removal of any surface wastes (where present);
- breaking out of hardstanding and removal of subsurface structures with the option of onsite production of aggregate for reuse within the development subject to the necessary verification sampling;
- removal and disposal of hydrocarbon impacted soils including the collection of verification and waste classification samples;
- removal and disposal of impacted soils should currently uncharacterised contamination hotspots be identified during preparatory works including the collection of verification samples;
- stripping of made ground soils from future garden/landscape areas down to natural formation soils or 600mm below finished levels, whichever is shallower. Stripped made ground is suitable for retention below permanent hardstanding or may be disposed of offsite;
- in-situ testing of formation soils within the top 600mm of future gardens/landscaped areas following removal of overlying made ground, if applicable;
- replacement of excavated made ground in gardens and landscape areas with clean validated soils including a minimum 150mm topsoil;
- submission of a water pipeline risk assessment, and;
- installation of full Radon Protection Measures.

1.3.2. The Strategy required that records of all inspections and the results of all verification and validation testing be submitted to the Regulatory Authority. This report details the removal of an identified hotspot of hydrocarbon contamination which was assessed as presenting a potential risk requiring additional measures (source removal) beyond the general provisions for all areas designated in the remediation strategy.

3. Description of Works

3.1. General Approach

3.1.1. The works described within this report were undertaken and completed on 12th April 2018. A record of SGP's inspections of the works is provided in Section 4.

3.1.2. Following the site investigation, the only potential contamination hotspot identified was in the central west of the site, within the vicinity of TP3 and TP4 trial holes where elevated hydrocarbons had been detected. SGP attended site during the excavation and removal of impacted materials at this location and collected a sample of the removed material (for waste classification) and the underlying residual strata in the vicinity (to confirm appropriateness for retention). Results of the verification testing are discussed in section 4.

3.2. Site Waste and Materials Management

3.2.1. Waste transfer documentation for the materials removed from the hotspot are retained by the client.

3.3. Unforeseen Contamination

3.3.1. Soils exposed during the hotspot excavation were consistent with the previous site characterisation and did not require additional assessment or revisions to the agreed Remediation Strategy.

4. Inspections and Testing

4.1. Site Attendance and Records

- 4.1.1. SGP attended the site when the hotspot investigation and removal works were being carried out. SGP undertook a watching brief during the works, took in-situ VOC measurements with a MiniRAE PID (calibration certificate in appendix C) and completed sampling of the waste and the underlying and adjacent strata within the hotspot area.
- 4.1.2. Samples were delivered to an accredited laboratory (Exova Jones Environmental) for laboratory analysis; SGP retains chain of custody documentation.

4.2. Hydrocarbon hotspot investigation and removal

- 4.2.1. SGP attended site on 12th April 2018 to excavate a potential hydrocarbon hotspot area where the previous site investigation had reported elevated hydrocarbons above generic assessment criteria within samples taken at trial pit locations, TP3 and TP4.
- 4.2.2. Impacted soil exhibiting a characteristic oil/diesel odour with associated moderately elevated PID readings (1-8 ppm) was excavated from the area initially in a 2m radius from TP4 entry. At the base of the made ground, a small gravel filled trench, 0.5m wide, was encountered with a historic clay water drain. The hydrocarbon impacted material was concentrated within this trench. Excavation continued north following the trench as far as reasonably practical to the northern boundary of the site. The trench was then followed south towards the southern boundary of the site, approximately 5m from the southern boundary adjacent to the south west of TP3. An oily diesel filled drum was excavated from above the trench and was inferred as the source of hydrocarbon contamination. The trench had a slight northward dip therefore liquid contamination moved northwards along the trench, this was confirmed with the absence of visual and olfactory contamination indicators south of the oily diesel drum.
- 4.2.3. The main aim of this exercise was to verify effective removal of all significant waste deposits. The residual made ground was subject to detailed visual inspection and screening with a PID. Photographs of the excavation and the excavated material are provided in Appendix A. Initially, an oily residue within the waste material was the only notable contamination indicator until an oil drum, suspected to be the source of hydrocarbon contamination, was identified at the southern end of the excavation within the trench.
- 4.2.4. 11 validation samples (denoted SS1-SS11) were collected at 5m intervals and 25m² base of excavation as per the remediation strategy (R2280-R03) to verify sufficient removal of impacted soils. Samples were submitted to Exova Jones Environmental within 6 hours of collection for TPG CWG analysis. The results are compared to the relevant screening criteria for residential use prescribed in the Remediation Strategy are summarised within Table 4.1 below:

Table 4.1: Summary of Soils Analysis: initial screening criteria

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil standard adopted for a residential scenario (mg/kg or indicated)	Exceedances
Aliphatic C5-C6	11	<0.1	S4UL 42	None
Aliphatic C6-C8	11	<0.1 – 0.3	S4UL 100	None
Aliphatic C8-C10	11	<0.1 – 7.2	S4UL 27	None
Aliphatic C10-C12	11	<0.2 – 124.4	S4UL 130	None
Aliphatic C12-C16	11	<4 – 416.0	S4UL 1,100	None
Aliphatic C16-C21	11	<7 – 856.0	S4UL 5,000	None
Aliphatic C21-C35	11	<7 – 11,244.0	S4UL 5,000	HSTP4-5 HSTP4-10
Aromatic C5-C7	11	<0.1	S4UL 70	None
Aromatic C7-C8	11	<0.1	S4UL 130	None
Aromatic C8-C10	11	<0.1	S4UL 34	None
Aromatic C10-C12	11	<0.2 – 78.7	S4UL 74	HSTP4-10
Aromatic C12-C16	11	<4 – 304.0	S4UL 140	HSTP4-10
Aromatic C16-C21	11	<7 – 693.0	S4UL 260	HSTP4-5 HSTP4-10
Aromatic C21-C35	11	<7 – 4951.0	S4UL 1,100	HSTP4-5 HSTP4-10
Benzene	11	<0.005	S4UL 0.087	None
Toluene	11	<0.005	S4UL 130	None
Ethylbenzene	11	<0.005	S4UL 47	None
m/p-xylene	11	<0.005 – 0.082	S4UL 59/56	None
o-xylene	11	<0.005 – 0.009	S4UL 60	None

Notes to table:

S4UL: Generic assessment criteria published by Chartered Institute of Environmental Health and Land Quality Management Ltd S4UL, residential land use scenario; COPYRIGHT Land Quality Management Limited reproduced with permission; publication number UL3102. All Rights Reserved

4.2.5. Aliphatic hydrocarbons (C21-C35) and aromatic hydrocarbons (C10-C35) were above the screening criteria in one of the samples (HSTP4-10) and aliphatic hydrocarbons (C21-C35) and aromatic hydrocarbons (C16-C21) were elevated in a second sample (HSTP4-5). 9 out of 11 samples remained below the criteria (which are highly conservative for assessment of retained materials) for residential use.

4.2.6. Following exceedances for samples HSTP4-5 and HSTP4-10, incorporating the organic matter content of the samples provides a revised screening criteria value which removes the exceedances for aliphatic C21-C35 and aromatic C10-C21 hydrocarbons. Exceedances remain for aromatic C21-C35 hydrocarbons; however, a soil cover system will be placed at the site

removing the ingestion and dermal exposure pathways for contaminant. The remaining inhalation exposure for aromatic C21-C35 hydrocarbon has a 0.1% contribution to the total exposure therefore a soil cover system is sufficient to break the pollutant linkage. The revised screening criteria and contribution from inhalation exposure are summarised in Table 4.2 below:

Table 4.2: Summary of Soils Analysis: revised screening criteria

Sample	Organic Matter Content (%)	Contaminant	Revised Screening Criteria (>6% SOM)	Exceedance (mg/kg)	Inhalation exposure [#] (%)
HSTP4-5	11.1	Aliphatic C21-C35	S4UL 110,000	None	7.0
		Aromatic C16-C21	S4UL 1,900	None	0.2
		Aromatic C21-C35	S4UL 1,900	Yes (3,548)	0.1
HSTP4-10	18	Aliphatic C21-C35	S4UL 110,000	None	7.0
		Aromatic C10-C12	S4UL 1,200	None	14.5
		Aromatic C12-C16	S4UL 2,500	None	2.8
		Aromatic C16-C21	S4UL 1,900	None	0.2
		Aromatic C21-C35	S4UL 1,900	Yes (4,951)	0.1

[#]Inhalation exposure combines contribution of total exposure from inhalation of dust (indoor), dust (outdoor), vapour (indoor) and vapour (outdoor) from Table 17-19 published by Chartered Institute of Environmental Health and Land Quality Management Ltd S4UL, residential land use scenario; COPYRIGHT Land Quality Management Limited reproduced with permission: publication number UL3102. All Rights Reserved

4.2.7. Excavation arisings were still on site at time of writing. A representative sample (TP4HS-WASTE) of the material was submitted for a waste characterisation suite to allow an appropriate disposal route to be confirmed. The arisings must be removed by a licensed carrier to a permitted facility.

5. Conclusions

5.1. General

5.1.1. Removal of hydrocarbon impacted ground and the potential source of contamination has been carried out by Messer A & B Roberts in accordance with the Remediation Strategy. SGP has undertaken a watching brief, taken validation samples of the excavated area and a waste sample of the removed impacted material in accordance with the Strategy.

5.1.2. The shallow ground conditions encountered were consistent with that described within previous intrusive reporting. A drum with residual oil/diesel present was removed from the southern portion of the excavation and is believed to be the source of the hydrocarbon contamination hotspot.

5.2. Residual Soil Contamination and Vapour Risks

5.2.1. Visual and olfactory inspection and analysis of residual soils with a PID following removal of impacted materials indicated successful substantial removal of the hydrocarbon hotspot. The exploratory excavation identified the likely source of the contamination (a degraded drum) and the pathway by which localised migration had occurred (a relict land drain). Validation sampling of the excavation following removal of impacted ground resulted in 9 out of 11 samples being below the initial screening criteria values for residential soils for petroleum hydrocarbon.

5.2.2. Further risk assessment of the two samples with exceedances of the initial screening criteria value was undertaken, taking into account the organic matter content of the material and the removal of the ingestion and dermal contaminant exposure pathways through the placement of a soil cover system.

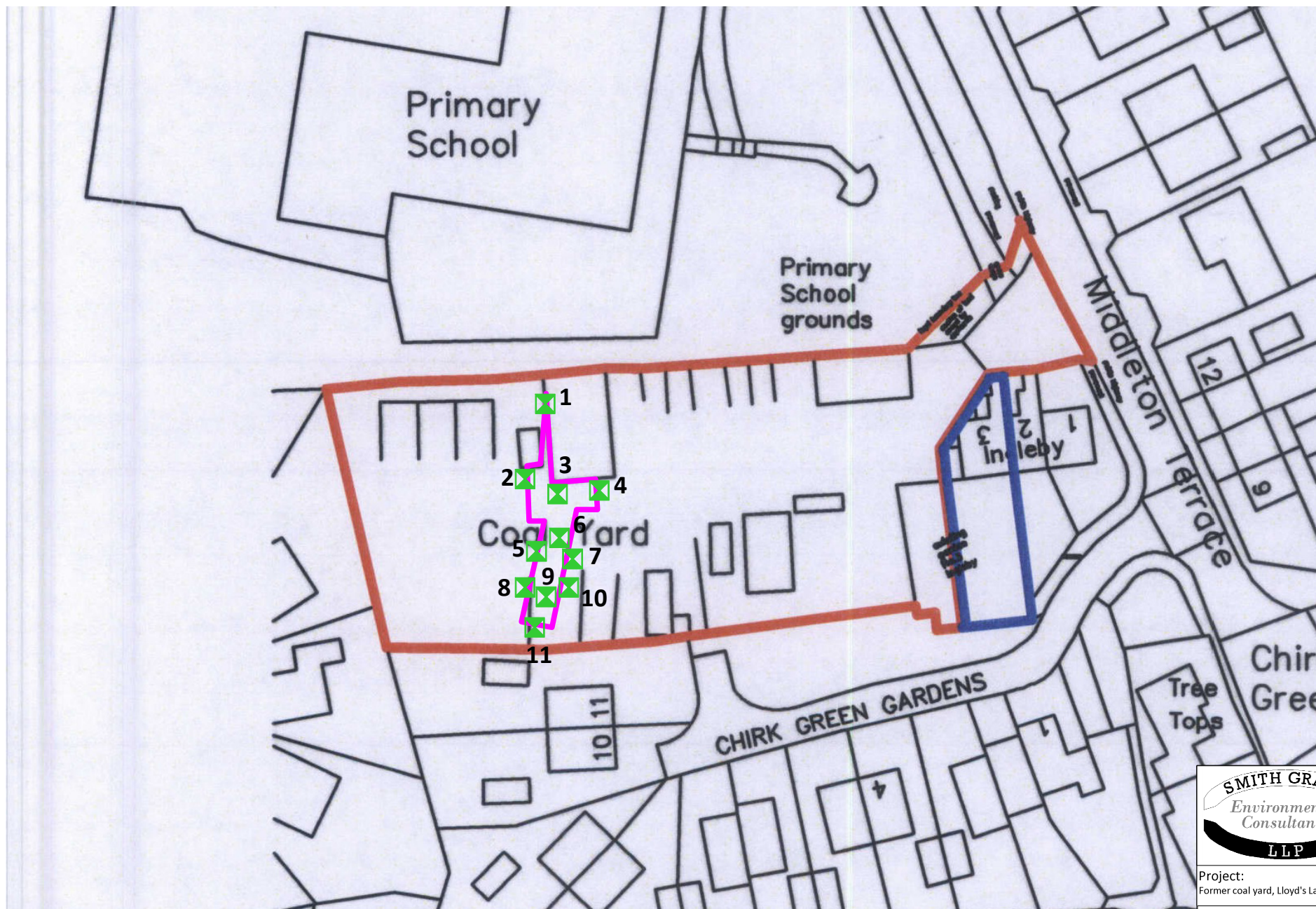
5.2.3. Provided a suitable soil cover system is placed over residual gardens the results will not result in any significant additional risks to future residents through direct exposure through ingestion, plant uptake, dermal contact or track-back into properties.

6. Recommendations

- 6.1. It is not currently proposed that further remediation works to remove or reduce residual contamination sources are required; the specified soil cover system will preclude exposure to the low levels of residual contamination which can be anticipated to be present and full radon protection measures will afford a degree of inherent protection against mobile contaminants in any case.
- 6.2. The remaining mitigation measures required to manage residual risks to future residents from ground contamination can be implemented during the construction stage and must be completed and verified prior to occupation. The recommendations for a soil cover system are based on the assessments of residual risk and is subject to approval by the WCBC. Independent depth and quality validation of all cover soils including quality testing to determine suitability of imported topsoil (no suitable topsoil is anticipated to be present on the site) should be completed at the frequency agreed by the Remediation Strategy (R2280-R03, April 2018), as should the assessment criteria adopted to demonstrate compliance.
- 6.3. Other requirements which relate to Land Contamination which must be addressed prior to the construction-stage of the development are as follows:
- Removal of arisings from the hotspot excavation from site;
 - Segregation and strip of ACMs from all buildings prior to demolition;
 - Removal of any surface wastes (where present);
 - Breaking out of hardstanding and removal of subsurface structures with the option of onsite production of aggregate for reuse within the development subject to the necessary verification sampling;
 - Identification and controlled removal and disposal of impacted soils should other currently uncharacterised contamination hotspots be identified during preparatory works including the collection of verification samples;
 - Stripping of made ground soils from future garden/landscape areas down to natural formation soils or 600mm below finished levels; whichever is shallower. Stripped made ground is suitable for retention below permanent hardstanding or may be disposed of offsite;
 - In-situ testing of formation soils, if present, within the top 600mm of future gardens/landscaped areas following removal of overlying made ground;
 - Replacement of excavated made ground in gardens and landscape areas with clean validated soils including a minimum 150mm topsoil;
 - Submission of a water pipeline risk assessment in accordance with the utility providers requirements for potable water supply pipes, and;
 - Installation of full Radon protection measures.

- 6.4. SGP concludes that the hydrocarbon hotspot removal works for the former coal yard, Lloyd's Lane, Chirk have been completed in accordance with the Remediation Strategy (R2280-R03) and that only precautionary construction stage mitigation measures described above require implementation by the future developer.
- 6.5. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.
- 6.6. This report has been prepared by Smith Grant LLP, for the sole and exclusive use of Messer A & B Roberts, the benefit of this report may not be assigned to any third party without the prior agreement in writing of Smith Grant LLP. Reasonable skill, care and diligence has been exercised within the timescale and budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.

DRAWINGS



☒ Validation Sample Location (HSTP4-)

☐ Hotspot Removal Area

☐ Site Boundary



Project:
Former coal yard, Lloyd's Lane

Drawing:
Hydrocarbon Hotspot Removal Area
& Validation Sampling Locations

Drawn: PRM	Checked: BJT
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Date: 04.05.18	Scale: 1:300
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Project No: R2280	Drawing No: R04-D01
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APPENDIX A

Site Photographs

1.



12.04.18 – Breaking out of concrete hardstanding in a 2m radius around TP4.

2.



12.04.18 – Exposed made ground following the removal of concrete hardstanding, consisting of crushed brick.

3.



12.04.18 – Minor diesel staining within the made ground.

4.



12.04.18 – Excavation of made ground identified mixed waste with diesel staining. Underlying natural clay exposed.

5.



12.04.18 – Diesel impacted arising segregated and placed on concrete hardstanding surface.

6.



12.04.18 – Made ground excavated to natural clay, disused water pipe visible at the centre of the image.

7.



12.04.18 – All diesel impacted made ground segregated from the excavation.

8.



12.04.18 – Pockets of water present within the made ground.

9.



12.04.18 – Facing north towards the initial excavation.

10.



12.04.18 – Excavation along the old water pipeline northwards adjacent to the tin shed.

11.



12.04.18 – Extent of northwards excavation of the pipeline to the northern boundary of the site.

12.



12.04.18 – Visible diesel impacted made ground present to the south of the initial excavation.

13.



12.04.18 - Excavation continues southwards along the extent of the old water pipeline.

14.



12.04.18 - Excavation undertaken to underlying natural clay, diesel impacted made ground stockpiled to the west of the excavation.

15.



12.04.18 - Exposed clay along the central extent of the excavation continuing southwards.

16.



12.04.18 – Made ground being excavated to the natural clay.

17.



12.04.18 – The western portion of excavation continued to a greater depth as the trench continued into the underlying clay.

18.



12.04.18 - Typical cross section through the excavation, concrete hardstanding, crushed brick, mixed soil and inert wastes and natural clay.

19.



12.04.18 - Suspected contamination source following removal, an old oil drum with oily diesel residue within.

20.



12.04.18- Facing north along the extent of the excavation with impacted material to the west and clean arisings to replace to the east.

21.



12.04.18 – Breaking out concrete to the south of the drum removed to confirm contamination has only moved northwards.

22.



12.04.18 – Excavation continued south confirms no diesel impacted made ground to the south of the drum.

23.



12.04.18 – Extent of excavation prior to replacement of unimpacted arisings.

24.



12.04.18 – Extent of impacted waste material from the excavation placed in concrete hardstanding adjacent to the excavation.

APPENDIX B

Laboratory Analysis Certificates



Exova Jones Environmental

Registered Address : Exova (UK) Ltd, Lochend Industrial Estate, Newbridge, Midlothian, EH28 8PL

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Smith Grant LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

Tel: +44 (0) 1244 833780

Fax: +44 (0) 1244 833781



4225



Attention :	Phillip Magraw
Date :	26th April, 2018
Your reference :	R2280
Our reference :	Test Report 18/5513 Batch 1
Location :	Lloyds Lane Chirk
Date samples received :	13th April, 2018
Status :	Final report
Issue :	1

Twelve samples were received for analysis on 13th April, 2018 of which twelve 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:

Phil Sommerton BSc
Project Manager

Please see attached notes for all abbreviations and acronyms

Client Name: Smith Grant LLP
 Reference: R2280
 Location: Lloyds Lane Chirk
 Contact: Phillip Magraw
 JE Job No.: 18/5513

Report : Solid

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

J E Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	Please see attached notes for all abbreviations and acronyms		
Sample ID	HSTP4-1	HSTP4-2	HSTP4-3	HSTP4-4	HSTP4-5	HSTP4-6	HSTP4-7	HSTP4-8	HSTP4-9	HSTP4-10			
Depth	1.00	1.00	1.50	1.00	1.00	2.00	1.00	1.00	2.00	1.00			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>C6-C8 ^{#M}	<0.1	<0.1	<0.1	<0.1	0.3 ^{SV}	<0.1	<0.1 ^{SV}	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	7.2 ^{SV}	1.6	<0.1 ^{SV}	0.2	2.2	0.4 ^{SV}	<0.1	mg/kg	TM36/PM12
>C10-C12 ^{#M}	<0.2	<0.2	<0.2	<0.2	120.1	<0.2	<0.2	8.3	5.5	124.4 ⁺⁺	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 ^{#M}	<4	<4	<4	<4	231	<4	<4	19	8	416 ⁺⁺	<4	mg/kg	TM5/PM8/PM16
>C16-C21 ^{#M}	<7	<7	<7	<7	590	17	22	50	18	856 ⁺⁺	<7	mg/kg	TM5/PM8/PM16
>C21-C35 ^{#M}	<7	<7	<7	13	8663	933	518	2201	306	11244 ⁺⁺	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35	<19	<19	<19	<19	9612	952	540	2279	340	12641 ⁺⁺	<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Aromatics													
>C5-EC7 [#]	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>EC7-EC8 [#]	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{#M}	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>EC10-EC12 [#]	<0.2	<0.2	<0.2	<0.2	45.1	<0.2	<0.2	<0.2	<0.2	78.7	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 [#]	<4	<4	<4	<4	112	<4	<4	15	<4	304	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 [#]	<7	<7	<7	<7	406	<7	22	57	<7	693	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 [#]	<7	<7	<7	<7	3548	173	318	284	76	4951	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 [#]	<19	<19	<19	<19	4111	173	340	356	76	6027	<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Total aliphatics and aromatics(C5-35)	<38	<38	<38	<38	13723	1125	880	2635	416	18668	<38	mg/kg	TM5/PM8/PM16/PM12/PM10
GRO (>C6-C8) ^{#M}	-	-	-	-	-	-	-	-	-	-	<100	ug/kg	TM36/PM12
GRO (>C8-C10) ^{#M}	-	-	-	-	-	-	-	-	-	-	<100	ug/kg	TM36/PM12
GRO (>C6-C10) ^{#M}	-	-	-	-	-	-	-	-	-	-	<100	ug/kg	TM36/PM12
MTBE [#]	<5	<5	<5	<5	<5 ^{SV}	<5	<5 ^{SV}	<5	<5	<5 ^{SV}	<5	ug/kg	TM31/PM12
Benzene [#]	<5	<5	<5	<5	<5 ^{SV}	<5	<5 ^{SV}	<5	<5	<5 ^{SV}	<5	ug/kg	TM31/PM12
Toluene [#]	<5	<5	<5	<5	<5 ^{SV}	<5	<5 ^{SV}	<5	<5	<5 ^{SV}	<5	ug/kg	TM31/PM12
Ethylbenzene [#]	<5	<5	<5	<5	<5 ^{SV}	<5	<5 ^{SV}	<5	<5	<5 ^{SV}	<5	ug/kg	TM31/PM12
m/p-Xylene [#]	<5	<5	<5	<5	82 ^{SV}	<5	<5 ^{SV}	<5	<5	7 ^{SV}	<5	ug/kg	TM31/PM12
o-Xylene [#]	<5	<5	<5	<5	<5 ^{SV}	<5	<5 ^{SV}	<5	<5	9 ^{SV}	<5	ug/kg	TM31/PM12
Total Phenols HPLC	-	-	-	-	-	-	-	-	-	-	<0.15	mg/kg	TM26/PM21
Natural Moisture Content	29.1	25.1	21.6	22.0	49.7	16.1	39.6	18.5	17.4	48.4	<0.1	%	PM4/PM0
Total Cyanide ^{#M}	-	-	-	-	-	-	-	-	-	-	<0.5	mg/kg	TM89/PM45
Organic Matter	1.2	1.7	1.2	0.6	11.1	0.9	7.8	1.4	3.0	18.0	<0.2	%	TM21/PM24
Sulphide	-	-	-	-	-	-	-	-	-	-	<10	mg/kg	TM106/PM119
Loss on Ignition [#]	-	-	-	-	-	-	-	-	-	-	<1.0	%	TM22/PM0
pH ^{#M}	-	-	-	-	-	-	-	-	-	-	<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	None		PM13/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: Smith Grant LLP
 Reference: R2280
 Location: Lloyds Lane Chirk
 Contact: Phillip Magraw
 JE Job No.: 18/5513

Report : Solid

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

J E Sample No.	21-22	23-25									Please see attached notes for all abbreviations and acronyms		
Sample ID	HSTP4-11	HSTP4-Waste											
Depth	1.00												
COC No / misc													
Containers	V J	V J T											
Sample Date	12/04/2018	12/04/2018											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	13/04/2018	13/04/2018									LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 ^{#M}	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C6-C8 ^{#M}	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	0.1									<0.1	mg/kg	TM36/PM12
>C10-C12 ^{#M}	<0.2	60.3									<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 ^{#M}	<4	170									<4	mg/kg	TM5/PM8/PM16
>C16-C21 ^{#M}	<7	315									<7	mg/kg	TM5/PM8/PM16
>C21-C35 ^{#M}	459	4462									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35	459	5007									<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Aromatics													
>C5-EC7 [#]	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC7-EC8 [#]	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{#M}	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC10-EC12 [#]	<0.2	63.5									<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 [#]	<4	190									<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 [#]	11	503									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 [#]	181	3212									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 [#]	192	3969									<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Total aliphatics and aromatics(C5-35)	651	8976									<38	mg/kg	TM5/PM8/PM16/PM12/PM10
GRO (>C6-C8) ^{#M}	-	<100									<100	ug/kg	TM36/PM12
GRO (>C8-C10) ^{#M}	-	175									<100	ug/kg	TM36/PM12
GRO (>C6-C10) ^{#M}	-	175									<100	ug/kg	TM36/PM12
MTBE [#]	<5	<5									<5	ug/kg	TM31/PM12
Benzene [#]	<5	<5									<5	ug/kg	TM31/PM12
Toluene [#]	<5	<5									<5	ug/kg	TM31/PM12
Ethylbenzene [#]	<5	<5									<5	ug/kg	TM31/PM12
m/p-Xylene [#]	<5	<5									<5	ug/kg	TM31/PM12
o-Xylene [#]	<5	<5									<5	ug/kg	TM31/PM12
Total Phenols HPLC	-	0.18									<0.15	mg/kg	TM26/PM21
Natural Moisture Content	13.8	23.1									<0.1	%	PM4/PM0
Total Cyanide ^{#M}	-	1.4									<0.5	mg/kg	TM89/PM45
Organic Matter	1.2	-									<0.2	%	TM21/PM24
Sulphide	-	<10									<10	mg/kg	TM106/PM119
Loss on Ignition [#]	-	8.3									<1.0	%	TM22/PM0
pH ^{#M}	-	7.28									<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay									None		PM13/PM0

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

Please see attached notes for all abbreviations and acronyms

Matrix : Solid

Client Name: Smith Grant LLP
Reference: R2280
Location: Lloyds Lane Chirk
Contact: Phillip Magraw

[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.: 18/5513

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: 18/5513

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.				
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
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	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	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			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	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	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	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	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

JE Job No: 18/5513

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
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	
TM21	Modified USEPA 415.1. 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.			AD	Yes
TM22	Modified USEPA 160.4. Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (450°C)	PM0	No preparation is required.	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	Yes	AD	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, 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.	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.	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.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.	Yes	Yes	AD	Yes

JE Job No: 18/5513

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
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	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	Yes	AR	Yes
TM106	Determination of Sulphide 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

APPENDIX C

Photo Ionisation Detector (PID) Calibration Certificate



Certificate of Calibration

Customer: Smith Grant LLP

Instrument: Mini RAE 3000

Job: Service, Test & Calibration

Serial number: 915404

Fleet Number: -

Certificate no: 915404/161117

Next calibration due date: 16.11.2018

Tested on: 16.11.2017

Calibrated for: Isobutylene

<u>Applied Gas Concentration:</u>	<u>Cylinder Reference:</u>	<u>Initial Sensor Reading</u>	<u>Final Sensor Reading</u>	<u>Accuracy Limits</u>
100 ppm VOC	AGG1576-11-1	142.7ppm	99.9ppm	±10%

The Instrument has been calibrated after Re-Zeroing & Introducing Span Calibration Gas, using gas that is traceable to national standards and has been prepared in accordance with BS EN ISO6145-6:2008

Calibration Engineer: Chris Shillitoe

Sign:

Shillitoe

Quality Assessed by (Print):	<u>RH BAINBRIDGE</u>	Sign:	<i>R Bainbridge</i>
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