

**COMBINED STAGE I AND STAGE II LAND
CONTAMINATION ASSESSMENT**

Bryn Foty, Gwynfryn

For: Mr Richard C Sciesinski

February 2018

R2492-R01-v1

DOCUMENT CONTROL SHEET

Report Title: Bryn Foty, Gwynfryn
Combined Stage I and Stage II Land Contamination
Assessment

Client: Mr Richard C Sciesinski

Report Reference Number: R2492-R01-v1

Report Status: Final

Version: v1

Report Date: 12th February 2018

	Name	Position	Signature	Date
Author	C Salwa MSc FGS	Consultant		12.02.2018
	S Miller BSc	Consultant		12.02.2018
Reviewer	B Thomas BSc MSc MCIWEM CEnv	Partner		12.02.2018

Document Revision Record:

Version	Report Status	Date	Details of Revision
v1	Final	12/02/2018	For issue

BRYN FOTY, GWYNFRYN COMBINED STAGE I AND STAGE II CONTAMINATION ASSESSMENT

CONTENTS

1. Introduction
2. Information Sources
3. Development History and Current Status
4. Site Characterisation
5. Ground Investigation Methodology and Results
6. Conceptual Model and Risk Assessment
7. Conclusion and Recommendations

DRAWINGS

D01 Trial Pit Locations

APPENDICES

- A. Photographic Record of Walkover Inspection
- B. Trial Pits Photographs
- C. Analytical Results

EXECUTIVE SUMMARY

Current Site Status	The site currently exists as largely undeveloped land to the rear of a residential property, Bryn Foty, with an associated shed and garage located in the west of the site.
Proposed Site Use	Construction of a single 3-bedroom dwelling with an attached double garage.
Scope of Works	Combined Stage 1 and 2 Contamination Assessment comprising site walkover, desk study review of readily available background information and ground investigation.
Site History / Mining	No significant development or changes on the application site have been identified since the 1871-1876 historical mapping. The immediate surrounds comprised a mixed rural / residential area with scattered residential properties present in all directions of the site since the 1871-1876 mapping. Gradual residential development has occurred to the northeast, northwest, west, south and southeast of the site between 1879 and 2006. Areas within the wider surrounds to the northwest, west, southwest, south and southeast were subject to varying degrees of lead mining with individual / collections of shafts and the Ragman and Minera Union mines identified locally; all of the shafts were annotated as disused by 1912. A limestone quarry was identified 350m to the south of the site on the 1871-1876 mapping associated with the adjacent 'Lester Lime Works' and 'Minera Lime Works'; the quarry and associated works appear to have ceased operations prior to 1964.
Site Setting	The site is located within a mixed residential / agricultural area
Ground Conditions	According to BGS, no superficial deposits occur at the site and bedrock consists of Gwespysr Sandstone Formation comprising fine-grained, feldspathic and micaceous sandstones with conglomerate and intercalated siltstone and mudstone beds. Made ground is mapped at distances between 0.36km and 0.48 to the west, southwest and to the south of the site. Observed shallow soils (0.6m depth) comprised a blackish brown topsoil overlying either sand or clay subsoils.
Contamination Assessment	Natural sources of contamination on the site are deemed to be limited, although the site is within an area where it is anticipated that between 10 and 30% properties are above the radon action level. Considering the lead mining activities locally, windblown fine dust may have historically occurred from the lead mining and associated processing areas resulting in potential aerial deposition of lead on the site; the interspersed mining spoil within the site soils is also considered a possibility. The only other potential source of contamination identified is the potential asbestos containing materials within the fabric of the onsite buildings; however, if confirmed following further assessment, the risks presented are considered to be low providing controlled removal is carried out.
Conclusions and Recommendations	Lead contamination has been identified within the top 0.6m of site soils. 600mm clean soil cover should be provided in garden areas with a hard dig layer and/or a high visibility base geotextile. If off-site removal of contaminated soils occurs, the soil testing results should be provided to the accepting waste management company. If soils are imported to achieve the cover system in future gardens / landscaped areas

	validation of the chemical quality will be necessary, the results of which should be reported to WCBC. The depth of placed materials will also need to be independently verified by an environmental consultant. The quality and depth testing frequency should be detailed in a Remediation Strategy and agreed with the WCBC Contaminated Land Officer prior to the commencement of development. Full radon protection measures should be provided for the planned dwelling. An asbestos survey and removal of confirmed ACM will be required for the site buildings in advance of any demolition.
--	--

The executive summary should be read in conjunction with the main report.

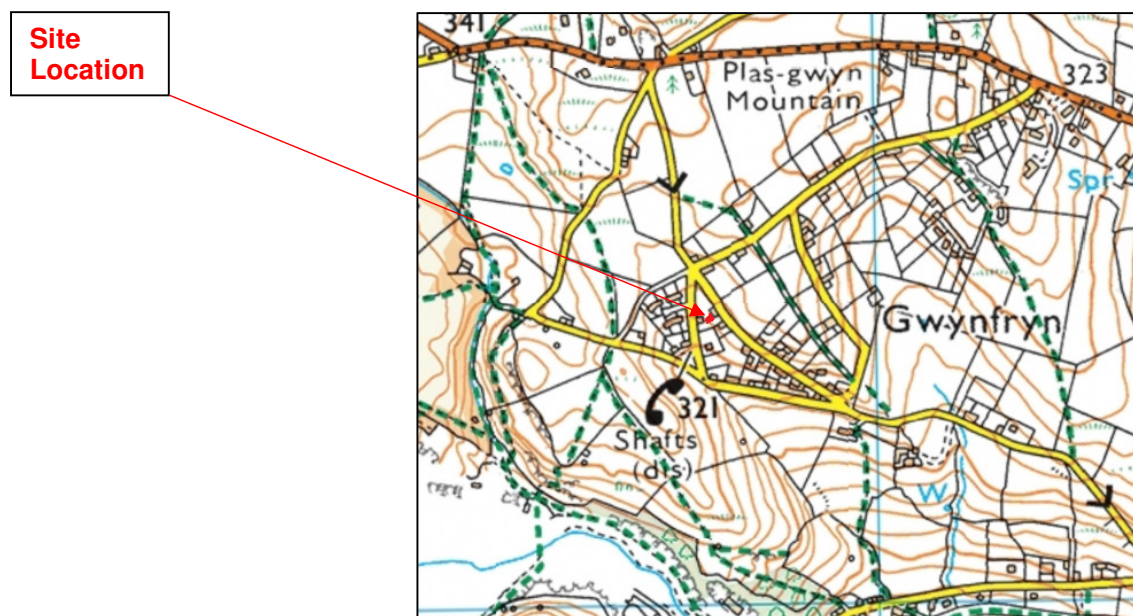
1. Introduction

- 1.1. Planning permission (ref: P/2012/0168) has been granted by Wrexham County Borough Council (WCBC) permitting the erection of a 3-bedroom dwelling with an attached garage at land to the rear of Bryn Foty, Ffordd Isaf, Gwynfryn. Condition 12 of the planning permission requires a phased investigation to identify the extent of contamination and any measures required to remediate the site, including post-development monitoring.
- 1.2. Mr Richard C Sciesinski instructed Smith Grant LLP (SGP) to undertake a Stage 1 and 2 Contamination Assessment to partially satisfy condition 12 of the planning permission. A site location plan is provided below in Figure 1.1 and Drawing D01.
- 1.3. Site details are:

Table 1.1: Site Details

Address	Land to rear of Bryn Foty, Ffordd Isaf, Gwynfryn, Wrexham, LL11 5TS.
National Grid Reference	325746 352464
Local Authority	Wrexham County Borough Council
Site Area	~315m ²
Current Nature of Site	Forms part of the garden to the rear of the residential property, Bryn Foty, with an associated shed and garage located in the west of the site.
Site Access	Via Ffordd Isaf to west of site.
Proposed use	Erection of a single dwelling with attached garage.
Planning Ref	P/2012/0168

Figure 1.1: Site Location



Reproduced with the permission of the Ordnance Survey @Crown Copyright Licence No. 100005799

- 1.4. SGP has been provided with correspondence from WCBC Contaminated Land officers who have confirmed that the condition was applied due to the site's proximity to former lead mining and processing areas in nearby villages. The wording of Condition 12 is reproduced in table 1.2.

Table 1.2: Planning Condition relating to Land Contamination

Condition 12 MIN P/2012/0168	<i>No part of the development shall commence until a scheme to deal with potential contamination at the site has been submitted to and approved in writing by the Local Planning Authority. This scheme shall include a phased investigation approach to identify the extent of contamination and any measures required to remediate the site, including post-development monitoring.</i>
---------------------------------	---

- 1.5. This report describes the Stage 1 (desk study and site inspection) and 2 (intrusive investigation) assessment undertaken by SGP in accordance with the anticipated requirements of WCBC and a brief agreed with the client. The assessment methodology follows the framework described in the EA / DEFRA Contaminated Land Report 11: 'Model Procedures for the Management of Land Contamination' 2004.
- 1.6. The report comprises a review of readily available information on the environmental setting of the site and the site's previous and current uses with respect to potential risks to the environment or human health. This report contains the results of the intrusive investigation undertaken, a qualitative risk assessment, and where appropriate makes recommendations for future intrusive investigations and remedial actions appropriate to the future use of the site.

2. Information Sources

2.1. A desk study review of the site and its history has been undertaken to establish the former land usage and the potential for any historically derived sources of chemical contamination. The desk study comprises a review of the following consultations and information sources:

Table 2.1 Information Sources

date and reference	author and source	purpose and information content
Topography, geology, hydrogeology and hydrology		
Promap http://www.promap.co.uk [Accessed November 2017]	Ordnance Survey (OS)	General mapping information including structures, boundaries, ground features, water features etc. at various scales
BGS map viewers (online): Geology of Britain Viewer Onshore GeoIndex [Accessed November 2017]	British Geological Survey (BGS)	Distribution of geological units at surface including drift deposits, bedrock and artificial ground, as well as linear features and borehole database records.
Groundwater Vulnerability 1:100,000 Map, Sheet 16, West Cheshire, 1994.	National Rivers Authority (NRA)	General information on the vulnerability of groundwater to contamination.
Flood risk map https://naturalresources.wales/flood-ing [Accessed November 2017]	Natural Resources Wales	Web-based interactive map containing information on flood risks from surface waters throughout Wales
UK Radon Map http://www.ukradon.org/information/ukmaps [Accessed November 2017]	Public Health England (PHE)	Mapping defining radon affected areas in England & Wales
Historical data		
Historical Maps	Ordnance Survey	Historical mapping at 1:10,560, 1: 10,000 and 1: 2,500 scales from 1871 onwards; site setting mapping
Aerial / satellite photography	Various sources	Historical images of site from 2006-2009
Information review		
www.magic.gov.uk [Accessed November 2017]	DEFRA	Web-based interactive map containing information on nature conservation areas

2.2. Information from the above referenced sources has been utilised to develop a conceptual model of the site and source-pathway-receptor risk assessment.

2.3. Previous Site Investigations

2.3.1. SGP is not aware of any previous site investigation pertaining to the site.

2.4. Site Inspection

2.4.1. A site inspection was carried out by S Miller, SGP Consultant, on 12th January 2018. The inspection comprised a site walkover over all accessible areas of the site and the immediate surrounds. Representative photographs of the site are provided in Appendix A.

3. Development History

3.1. Historical Development

3.1.1. The history of the site has been established by reviewing historical Ordnance Survey (OS) maps and aerial photography of the area, collected as part of the desk study information.

3.1.2. A summary of significant historical features, developments, and land uses identified is provided in Table 3.1 below.

Table 3.1: Summary of Relevant Development History

Map	Site	Surroundings (all distances are approximate)
1871-1876 1:2,500	The site appears to comprise a partially enclosed area of land adjacent to residential properties.	The immediate surroundings predominantly consist of scattered residential development and various roads interspersed between large fields likely to be agricultural in nature, some of which are mapped as rough pasture. Residential properties are present to both the immediate east and immediate west of the site. The general area is mapped as 'Plas-gwyn Mountain'. Several lead mining shafts (old and in use) are mapped within the wider surrounding area, the nearest of which are located 200m to the south (beyond which are further shafts) and 220m to the northwest; a collection of shafts is also present as close as 240m to the west of the site. The 'Ragman' and 'Minera Union' lead mines are also mapped in the wider vicinity of the site 440m to the southwest and 600m to the southeast respectively, both of which are surrounded by numerous shafts. A quarry is located approximately 350m to the south of the site associated with the adjacent 'Lester Lime Works' and 'Minera Lime Works'.
1879 1:10,560	No significant changes to site.	No significant changes to surrounds.
1899 1:2,500	No significant changes to site.	The shaft 220m to the northwest of the site is no longer mapped. A Methodist Chapel has been constructed 60m to the southeast of the site beyond which some minor residential development has occurred.
1900 1:10,560	No significant changes to site.	No significant changes to surrounds.
1912 1:2,500	No significant changes to site.	All lead mining shafts in the surrounding area are now marked as 'Old Shaft(s)' and the Ragman Mine and Minera Union Mine are no longer mapped; the Lester Lime Works is also no longer present on the mapping. A well is indicated 70m to the south of the site.
1914 1:10,560	No significant changes to site.	No significant changes to surrounds.

Map	Site	Surroundings (all distances are approximate)
1938-54 1:10,560	No significant changes to site.	No significant changes to surrounds.
1963 1:10,560	No significant changes to site.	Some residential development has occurred in close proximity to the northwest, west and south of the site.
1964 1:2,500	No significant changes to site.	Many of the shafts identified in the vicinity of the site are no longer present on the mapping. The well to the south of the site is no longer indicated. The Minera Lime Works and associated quarry are no longer mapped. The residential property to the immediate west of the site is now annotated as 'Bryn Foty' and the property to the immediate east 'Brynteg Cottage'.
1976 1:10,000	No significant changes to site.	No significant changes to surrounds.
1976-1991 1:10,000	No significant changes to site.	No significant changes to surrounds.
1987 1:10,000	No significant changes to site.	No significant changes to surrounds.
2006 Satellite Image	No significant changes to site.	Scattered residential development has occurred directly to the south of the site and in the wider surrounds to the west and northeast.
2009 Satellite image	No significant changes to site.	No significant changes to surrounds.

3.2. Historical Summary

3.2.1. The mapping indicates that there has been no significant development or changes on the application site since the 1871-1876 mapping.

3.2.2. Historically, the immediate surrounds comprised a mixed rural / residential area along the roads Ffordd Isaf and Allt Y Pentref with scattered residential properties present in all directions of the site since the earliest available mapping (1871-1876) including to the immediate east and west. Development in the nearby vicinity of the site has remained limited with the gradual construction of residences to the northeast, northwest, west, south and southeast occurring between 1879 and 2006, and the construction of a Methodist Chapel 70m to the southeast between 1879 and 1899.

3.2.3. Areas within the wider surrounds of the site to the northwest, west, southwest, south and southeast were subject to varying degrees of lead mining. The closest shaft identified was approximately 200m to the south with the most extensive areas of historical lead mining identified approximately 440m to the southwest and 600m to the southeast in the vicinity of the former Ragman and Minera Union mines, respectively; all of the shafts identified were annotated as disused by 1912. A limestone quarry was identified approximately 350m to the south of the site

on the 1871-1876 mapping associated with the adjacent 'Lester Lime Works' and 'Minera Lime Works'. The quarry and associated works appear to have ceased operations prior to 1964.

3.3. Present Land Condition

3.3.1. A summary of existing significant features noted during SGP's site inspection, and examination of contemporary records, is presented below.

Table 3.2: Present Land Condition

Site Description	The site is approximately 315m ² in size and is located within a mixed residential/agricultural area. Presently, the site is largely undeveloped land which was overgrown at the time of inspection with a shed located along the centre of the western boundary and a garage straddling the southwest corner, all of which are associated with an adjacent residential property to the west. The site topography declines steeply from east to west in keeping with the surrounding land.
Access	The site is accessed from Ffordd Isaf to the west of the site.
Boundaries	North: Open border onto adjacent properties' land. East: Stone walls onto adjacent properties' land. South: Combination of open border, wooden fencing and bushes leading onto adjacent property's land. West: Open border onto land of associated property (north); garage of associated property (south – straddles boundary).
Structures	Two structures were identified on site, a shed located in the centre of the western boundary and a garage which straddles the southwest corner of the site. The former appeared to be constructed from a combination of wood and suspected asbestos cement sheeting, the latter mainly from brick, but also suspected asbestos cement roofing.
Vegetation	The site was heavily vegetated with grasses, mosses, brambles, bushes, mature and immature trees; many of the immature trees had been cut back.
Rights of Way	No public rights of way cross the site.
Services and Utilities	No manhole covers, drains or access points to any potential underlying services were identified during the inspection. A services and utilities pack was not obtained as part of this study.

3.4. Adequacy of Information

3.4.1. Whilst there are some gaps in the historical map coverage it is considered that the available mapping and other information provides adequate coverage of site and its immediate surroundings to inform the assessment of potential ground contamination.

4. Site Characterisation

4.1. The environmental setting of the site is described in Table 4.1 below:

Table 4.1: Environmental Setting

Site Setting	The site is located within a mixed residential and agricultural area in the village of Gwynfryn, Wrexham, situated between the roads Fford Isaf to the west and Allt Y Pentref to the east. The site is surrounded in all directions by residential development and associated gardens including new built development to the north; fields are present in the wider surrounds. Site access is gained from Ffordd Isaf to the west of the site.
Topography	The site is shown by Ordnance Survey mapping to be located at between approximately 335 and 330m aod sloping from the northeast to southwest. During the site inspection it was noted that the site topography declined steeply from the east to the west.
Ground Conditions / Geology	Reference to published geological information on the area indicates the following: - Made ground is not anticipated to be widespread across the site; the nearest artificial ground is mapped at distances between 0.36km and 0.48km to the west, southwest and south of the site. - According to BGS no superficial deposits are recorded on site. - Bedrock consists of the Gwespys Sandstone Formation comprising fine-grained, feldspathic and micaceous sandstones with conglomerate and intercalated siltstone and mudstone beds An inferred fault trending north/west – south/east is indicated on the BGS mapping immediately to the south-west of the site.
Hydrogeology / Groundwater	According to the NRA Groundwater Vulnerability Map the area is underlain by a Minor Aquifer (variably permeable), with high primary permeability.
Hydrology / Drainage	The site appeared to be relatively free draining at the time of the visit which took place in dry weather. No drains were evident on the site. Storm water is likely to infiltrate the soils or runoff the surface into drains of either the adjacent property Bryn Foty or the road Ffordd Isaf to the west of site. The nearest surface watercourse is a stream located approximately 380m to the south of the site flowing from west to east feeding into the River Clywedog approximately 2km to the southeast of the site. According to the Natural Resources Wales Flood Risk Map, the site is considered to be at very low risk (<0.1%) of flooding from rivers, sea and surface water. The site is also not considered to be at risk of flooding from reservoirs.
Radon	The maps provided by Public Health England show the site to be within an area of elevated radon potential where between 10 and 30% of homes are anticipated to be above the radon action level.
Ecology and Conservation	No invasive species were noted during the inspection, however a full ecological assessment has not been carried out.
Mining	The historic Ragman and Minera Union lead mines and various disused lead shafts have been identified in the vicinity of the site as described in the historical review.

Landfilling	No areas of landfilling have been identified in the nearby vicinity which are considered likely to impact the site.
Industrial Land use	The site is located within a mixed agricultural / residential area with no industrial activities in the immediate vicinity, however, in the wider surrounds historical lead mining is known to have resulted in the deposition of lead containing particulates.
Risk of Gaseous Contamination	Following the guidance given in the paper "A pragmatic approach to ground gas risk assessment for the 21st Century" Card and Wilson, 2011 and the CIRIA Report 665 the provisional assessment of the ground gas impacting the site establishes the following: • No credible sources or pathways for landfill gas migration from an offsite landfill have been identified. • The site has not been a registered landfill. • The Made Ground is not expected to be 5m deep or an average of 3m of thickness. • The site is not located on a carbonate rich rock that can produce carbon dioxide • The site does not lie on potential naturally organic soil or humic or degradable Made Ground soil • Radon protection measures are recommended for the site.
Potentially Sensitive Land Uses	The site is located approximately 80m to the north of the Berwyn and South Clwyd Mountains which are classified as both a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC).

5. Ground Investigation Methodology and Results

5.1. Objectives and Rationale

5.1.1. The Stage 1 assessment indicates the potential presence of elevated concentrations of heavy metals (principally lead, cadmium and zinc) and soluble sulphates within the shallow soils across the site. As the site is within the wider area of lead mines and smelters, other properties in the surrounding areas are known to have been impacted by elevated lead, cadmium and zinc as a result of aerial deposition from windblown dust off spoil tips and fumes and/or particulates from the smelting process.

5.1.2. It was therefore determined that representative soil samples should be collected from near-surface locations for chemical analysis of a range of metals / metalloids to inform the human health risk assessment for soils following redevelopment.

5.2. Field work

5.2.1. The site investigation comprised hand-dug trial pits to permit visual inspection of shallow strata and to obtain representative samples from the topsoil, subsoil and made ground (if present). The investigation was undertaken on 12th January 2018 by SGP Consultant S Miller. Photographs of the entries are provided in Appendix B.

5.2.2. Works involved:

- excavation of 5 trial holes (TP1-TP5) to depths between 0.0 and 0.6m bgl (the locations of which are provided in Drawing D01);
- visual inspection of all soil arisings;
- collection of 10 soil samples from varying strata (shallow topsoil and subsoils).

5.2.3. Trial pits were backfilled immediately following excavation. All trial pits were extended into natural subsoil strata with the exception TP1 where the topsoil was present to a depth of greater than 0.6m bgl.

5.2.4. The sampling locations were positioned so as to provide representative information from across the site at depths where future exposure of residents can reasonably be anticipated.

5.3. Chemical Analysis

5.3.1. All chemical analysis of soils was carried out by Jones Environmental Laboratories, Deeside, working where possible to MCERTS and / or ISO 17025 accreditation. Soil samples were stored in appropriate containers as advised by the laboratory, placed in a cool box, and delivered to Jones Environmental. Chain of custody documentation was completed and is retained by SGP.

5.3.2. Samples were analysed for cadmium, lead, and zinc. A subset of four samples were also analysed for soluble sulphate and pH.

5.4. Field Observations

5.4.1. Topsoil consisting of a blackish brown very slightly sandy silty clay with fine to coarse angular to sub-rounded gravel, occasional cobbles and frequent organic matter (roots) was present in all entries from the surface to depths of between 0.25m bgl to unproven at 0.6m bgl. The only anthropogenic material noted within the topsoil was a cobble of red brick observed in trial pit 3 at a depth of 0.2m bgl suggesting that this material was either reworked or has possibly been imported onto site.

5.4.2. Subsoils were encountered in entries TP2, TP3, TP4 and TP5 from depths of between 0.25m to 0.4m bgl extending to the base of each trial pit (0.6m bgl). The subsoil encountered was variable and comprised the following:

- TP2: grey orange-mottled fine clayey silty SAND with frequent fine to coarse angular gravel of weathered sandstone and occasional angular cobbles of weathered sandstone;
- TP3: light grey fine silty SAND with frequent fine to coarse angular gravel of sandstone, and;
- TP4 & TP5: grey orange-mottled soft silty CLAY with occasional medium coarse sub-angular gravel of stone.

5.4.3. Bedrock was not encountered in any location on the site.

5.5. Results of Soil Chemical Analysis

5.5.1. The complete soil analytical data are presented in Appendix B and are summarised below in Table 5.2.

5.5.2. The results of the soil analyses are compared to human health critical values (CVs) for initial screening purposes. The CVs adopted are appropriate to the environmental setting and proposed future residential with garden use of the site, and are taken primarily from Category 4 Screening Level (C4SL) which is the statutory guidance value for Part 2A of the Environmental Protection Act 1990 where the level of risk posed is defined as 'acceptably low'. This value was therefore used as part of the screening levels for this investigation for the main contaminant of concern, lead.

5.5.3. For all other contaminants, SGP have therefore referred to the most up-to-date Generic Assessment Criteria (GACs) for residential land-use in order to carry out a preliminary

assessment of the soil test results. The “Suitable for Use” Criteria (S4ULs) are published by LQM/CIEH¹.

Table 5.2: Summary of Soils Analysis

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil standard adopted and concentration (mg/kg or indicated)	Exceedances
Cadmium	10	<0.1-1.5	11 S4UL	No
Lead	10	110 – 5378	200 C4SL	Yes
Zinc	10	29-228	3700 S4UL	Yes
Soluble Sulphate	4	<0.0015g/l – 0.005g/l	1.2g/l BRE	No
pH	4	6.91 – 7.66	None	N/A

5.5.4. The six samples collected from the topsoil and the two samples collected from the sand subsoil exceeded the C4SL lead screening criteria; no exceedances were reported in the two samples collected from the natural clay subsoil. The most elevated concentration of lead occurred in a sample of topsoil collected from trial pit 1 (TP1-S2; 0.5m bgl) with a recorded value of 5,378 mg/kg.

5.5.5. No other exceedances of the adopted screening criteria were recorded for any other contaminant tested for, and no exceedances were recorded within either of the samples collected from the clay subsoil, including lead.

¹ Copyright Land Quality Management Ltd, reproduced with permission; Publication Number S4UL3102. All rights reserved

6. Conceptual Site Model and Risk Assessment

6.1. Methodology

6.1.1. Information from the desk study and intrusive investigation has been used to identify the likely source-pathway-target relationships that may exist at the site during and following the proposed development. Principal factors that may determine potential sources of contaminants at the site, receptor vulnerability and potential pathways have been identified and each assessed in turn to derive a Conceptual Site Model (CSM).

6.2. Site Source Risk Assessment

6.2.1. The historical mapping indicates that there has been no significant development or changes on the application site since the earliest available mapping; however, the site inspection did reveal the presence of both a shed positioned along the centre of the western boundary and a garage that straddles the southwest corner of the site, both of which appeared to be constructed in part with suspected asbestos cement sheeting. No industrial activities have been identified as occurring on site or in the immediate surrounds.

6.2.2. Lead contamination has impacted the site. The site also lies in an area where homes have a maximum radon action potential of between 10 and 30%. Other natural sources of contamination on the site are deemed to be limited and no significant sources of ground gas generation have been identified that are considered likely to impact the site.

6.2.3. Made Ground was not anticipated to be widespread across the site, however, it is suspected that the topsoil may have historically been imported to site or reworked, as indicated by the presence of a red brick cobble within this material in trial pit 3. No suspect asbestos containing materials (ACM), odours, staining or other contamination indicators were encountered within the site soils, and other sources of significant on-site contamination are not considered likely. Although made ground soils commonly contain marginally elevated metals (other than those targeted in the ground investigation), combustion products (polycyclic aromatic hydrocarbons) and low-level disbursed asbestos fibres in urban settings, any remediation methods to preclude future users from the identified presence of elevated lead should also be suitable with respects to these potential contaminants as well.

6.3. Off-Site Sources & Migration Pathways

6.3.1. Scattered residential development occurred in the vicinity of the site before the earliest available mapping, including directly to the west and east of the site. Subsequent development in the nearby vicinity has remained limited with the gradual construction of residences and a Methodist Chapel to the northeast, northwest, west, south and southeast of the site between 1879 and 2006.

6.3.2. During the historical review, areas within the wider surrounds of the site to the northwest, west, southwest, south and southeast were identified as being subject to varying degrees of lead mining. The closest shaft identified was approximately 200m to the south with the most extensive areas of historical lead mining identified approximately 440m to the southwest and 600m to the southeast in the vicinity of the former Ragman and Minera Union mines, respectively; all of the shafts identified were annotated as disused by 1912. According to information obtained from available sources on the internet (WCBC), the Minera Union Mine was shut down in 1914 and the land was reclaimed in approximately year 2000 according to the historical mapping.

6.3.3. Wind dispersion of fine dusts may have historically occurred from the lead mining and associated processing areas resulting in the potential aerial deposition of contaminants over a wide area, possibly including the site. Due to the close proximity of the site to old shafts and spoil heaps, it is possible mining spoils could have been spread and interspersed within the soils across the site and surrounding area. The presence of lead in the sand subsoils as well as the near surface soils may indicate this. No sources of current migration of contamination onto the site have been identified.

6.4. Potential Receptors

6.4.1. The proposed use of the site is housing with associated landscaped areas; this is regarded as a sensitive landuse with respect to ground contamination. The principal vulnerable receptors under the proposed development and use of the site are therefore considered to be future occupants, in particular infants and children, who are more sensitive to the potential effects of common ground contaminants, particularly lead.

6.4.2. Other potential vulnerable receptors will be construction workers who may be exposed to likely contaminants during preparatory and construction works.

6.4.3. The following receptors with regard to the environment and controlled waters have been identified:

- Berwyn and South Clwyd Mountains (SSSI and SAC) 80m to the north of the site, and;
- Minor aquifer in the Gwespyr Sandstone which underlies the site.

6.5. Pathways

6.5.1. Future residents may be exposed to lead contaminants via direct contact, ingestion or inhalation of soils and dust, and possible plant uptake in homegrown produce. Future residents may also be exposed to inhalation of radon gas via migration into buildings from the underlying natural geology.

6.5.2. Windblown contaminants from the historical lead mines presumably affect a much wider area. The minerals, galena and sphalerite, are sulphides of very low solubility. Even though soils on the site have been found to be impacted, these are not likely to result in a potential pollution

source given the wider local context; the likely impacts to the underlying aquifer and nearby SSSI / SAC are therefore considered to be negligible.

6.6. Site Conceptual Model

6.6.1. Potential pollution linkages between the identified contamination sources and existing and future receptors are summarised in Table 6.1 below:

Table 6.1: Conceptual Site Model

Receptor	Source / Contaminant	Pathway / Exposure	Pollutant Linkage (in absence of mitigation)	Further Works
1. Humans – construction workers / future maintenance engineers	Lead	Dermal contact / ingestion / inhalation – short term / temporary exposure	Possible – soils are impacted by lead contamination.	Concentrations of contaminants are not sufficiently high to be of concern provided normal occupational hygiene measures are adopted
2. Humans – future site users / residents	lead	Dermal contact / ingestion / inhalation	Likely – soils are impacted by lead contamination.	600mm of clean soil cover over existing site soils should be provided.
	Radon gas from natural ground	Accumulation within voids, confined spaces and service runs	Likely – site is identified as being within an area where between 10 and 30% of homes are above the radon action level.	Full radon protection measures are required within new buildings and extensions.
3. Property	pH, sulphate	Chemical attack of buried concrete	Unlikely – sampled soil did not contain high sulphate concentrations.	No action required
4. Vegetation / landscaping	zinc	Plant uptake	Very unlikely – zinc concentrations within the sampled soils did not exceed the screening criteria (300mg/kg) for the protection of sensitive plant species provided by Defra.	No action required, however, 600mm of clean soil cover over existing site soils is recommended due to elevated lead concentrations in near surface soils.
6. Surface waters	Leachable metals / metalloids	Migration via shallow groundwater / surface water run-off into nearby stream	Unlikely – Significant mobile contamination on the site considered unlikely.	No action required
7. Groundwater – minor aquifer within bedrock	Leachable metals / metalloids	Migration via saturated zone	Unlikely – significant mobile contamination on site considered unlikely.	No action required.

7. Conclusions and Recommendations

7.1. Conclusions

7.1.1. The historical mapping, satellite imagery and observations during the site inspection indicate the site to have remained undeveloped from 1871-76 onwards with the exception of a shed and garage in the west of the site, both of which are partially constructed from suspect asbestos cement sheeting and are associated with the adjacent residential property, Bryn Foty. If the potential asbestos containing materials (ACM) are disturbed, there is a possibility that this may release asbestos fibres into the site soils.

7.1.2. No industrial activities appear to have occurred onsite, however, old shafts (lead) have been identified in the wider surrounding area associated with the 'Minera Union' and 'Ragman' mines. Built development identified in the nearby vicinity of the site appears to have been limited to residential and the construction of a Methodist Chapel with other potentially polluting industrial or commercial activities at sufficient distances to preclude pollution impacts.

7.1.3. The site is within an area where homes have a maximum radon action potential of between 10 and 30%. Radon ingress into the planned dwelling is therefore deemed a potential hazard.

7.1.4. SGP carried out soil sampling with samples collected from a range of depths (0.0 – 0.6m bgl) across the site as required by WCBC. Exceedances of lead were reported above the C4SL in eight out of the ten samples with concentrations ranging from 110 – 5,378 mg/kg. The likely source of the contamination is aerial deposition from windblown dust of mine spoils, tailings and particulates from nearby smelters and possible interspersed mining spoils within the site soils.

7.1.5. The site is therefore currently assessed as posing a moderate to high hazard to human health due to toxic levels of lead in site soils likely to impact particularly sensitive receptors (infants, children and fetuses), as well as the potential ingress of radon gas into buildings and accumulation to hazardous concentrations.

7.1.6. Stability hazards from the ground and/or mineworking are outside the scope of this report.

7.2. Recommendations

7.2.1. An asbestos survey and removal of confirmed ACM will be required for the site buildings in advance of any demolition.

7.2.2. Clean soil cover should be provided to garden areas. This should take form of the placement of 600mm minimum clean soil over existing site soils in areas not covered by permanent hardstanding. The concentrations of lead are considered sufficiently high enough and prevalent

throughout both the topsoil and subsoil on site to warrant a mechanical break / hard dig layer or a basal geotextile to prevent bulk soil movement and mixing with the clean cover soils.

7.2.3. Concentrations of lead may be considered high enough to classify the impacted soils as hazardous waste. Should off-site removal of the contaminated soils be necessary, the soil testing results should be provided to the waste management company for assessment prior to removal offsite.

7.2.4. Importation of soils will be required to achieve the cover system in future garden areas. Validation of the chemical quality will be necessary following importation, the results of which should be reported to WCBC. The depth of placed soils will also need to be independently verified by an environmental consultant. The quality and depth testing frequency should be detailed in a Remediation Strategy and agreed with the WCBC Contaminated Land Officer prior to testing.

7.2.5. Full radon protection measures should be provided for the planned dwelling.

7.2.6. This report has been provided to partially satisfy Condition 12 of the Planning Permission which relates to contamination of the site. Prior to the commencement of development, a Remediation Strategy should be forwarded to WCBC detailing the proposed measures to be implemented with respect to the contamination identified.

7.3. Limitations

7.3.1. 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.

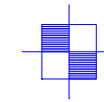
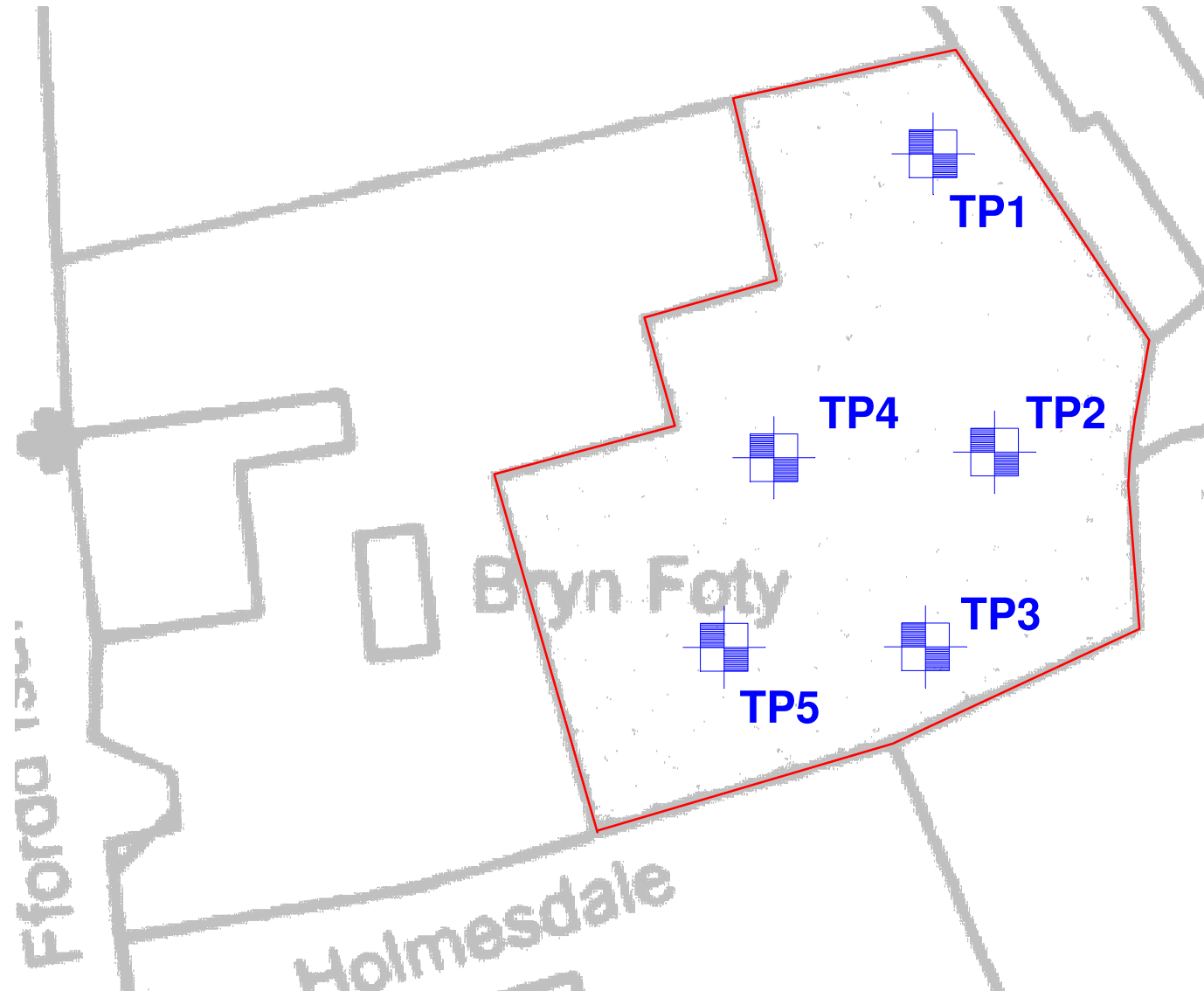
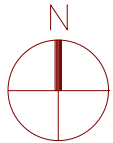
7.3.2. This report partially reviews and relies upon information provided by others. Smith Grant LLP accepts no responsibility for advice given on the basis of incorrect factual information provided to it. It was not possible to carry out an inspection of the internal parts of the site; therefore, conclusions drawn from observations of the current status of the site should be treated with caution.

7.3.3. This report has been prepared by Smith Grant LLP, for the sole and exclusive use of Richard C Sciesinski. The benefit of this report may not be assigned to any other party without the prior agreement in writing of Smith Grant LLP. Reasonable skill, care and diligence have been exercised within the timescale and budget available, and in accordance with the technical requirements of the brief.

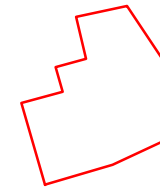
7.3.4. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet

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



Trial Pit Locations



Study Site Boundary



Station House
Station Road, Ruabon
Wrexham, LL14 6DL
Tel: 01978 822367
Fax: 01978 824718

www.smithgrant.co.uk
email: info@smithgrant.co.uk

Project:

Bryn Foty

Drawing:

Trial Pit Locations

Drawn: SM

Checked: BJT

Date:
25/01/18

Scale:
1:200 @ A4

Job No:
R2492

Drg No:
D01

APPENDIX A

Site Walkover Photolog

1.



12.01.18 – View south along eastern boundary from northeast corner of site.

2.



12.01.18 – View southwest across site from northeast corner; dense vegetation in northeast of site obscuring visibility.

3.



12.01.18 – View along western part of the site from eastern boundary.

4.



12.01.18 – View west across centre of site from eastern boundary.

5.



12.01.18 – View northwest across site from eastern boundary.

6.



12.01.18 – View north along eastern boundary from southeast corner of site.

7.



12.01.18 – View east along southern boundary from centre of southern boundary.

8.



12.01.18 – View northeast across site from centre of southern boundary.

9.



12.01.18 – View north across site from centre of southern boundary.

10.



12.01.18 – View northwest across site from centre of southern boundary; dense vegetation in south of site obscuring visibility.

11.



12.01.18 – View west along southern boundary from centre of southern boundary; dense vegetation in south of site obscuring visibility (garage building in southwest corner of site just visible in left of photograph).

12.



12.01.18 – View north along southern part of western boundary from area to the southwest of site; no distinct boundary (very dense vegetation).

13.



12.01.18 – Shed located along centre of western boundary; suspected asbestos cement sheet cladding and roof.

14.



12.01.18 – Outbuilding directly adjacent to west of site; constructed from corrugated metal.

15.



12.01.18 – Residential property associated with application site 'Bryn Foty' located to west of site.

16.



12.01.18 – Entrance to west of site off road Ffordd Isaf.

APPENDIX B

Trial Pits Photolog



TP1: Location – 12.01.2018



TP1: Depth (0.6m) – 12.01.2018



TP1: Excavation – 12.01.2018



TP1: Arisings – 12.01.2018



TP2: Location – 12.01.2018



TP2: Depth (0.6m) – 12.01.2018

7.



TP2: Excavation – 12.01.2018

8.



TP2: Arisings – 12.01.2018

9.



TP3: Location – 12.01.2018

10.



TP3: Depth (0.6m) – 12.01.2018

11.



TP3: Excavation – 12.01.2018

12.



TP3: Arisings – 12.01.2018

15.



TP4: Location – 12.01.2018

16.



TP4: Depth (0.6m) – 12.01.2018

17.



TP4: Excavation – 12.01.2018

18.



TP4: Arisings (topsoil) – 12.01.2018

19.



TP4: Arisings (subsoil) – 12.01.2018

20.



TP5: Location – 12.01.2018

21.



TP5: Depth (0.6m) – 12.01.2018

22.



TP5: Excavation – 12.01.2018

23.



TP5: Arisings – 12.01.2018

NO PHOTOGRAPH

Hand dug trial holes – photo log
12^h January 2018

APPENDIX C

Analytical Results



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



Attention :	Scott Miller
Date :	24th January, 2018
Your reference :	R2492
Our reference :	Test Report 18/451 Batch 1
Location :	Bryn Foly
Date samples received :	15th January, 2018
Status :	Final report
Issue :	1

Ten samples were received for analysis on 15th January, 2018 of which ten 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

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

Client Name: Smith Grant LLP

Reference: R2492

Location: Bryn Foly

Contact: Scott Miller

[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.: 18/451

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 a 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
AA	x5 Dilution

JE Job No: 18/451

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	
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
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	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	Yes	AD	Yes
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