

BRYN FOTY, GWYNFRYN

REMEDIATION STRATEGY

For: Mark Baker

October 2018

Report Ref: R2634-R01 v1

DOCUMENT CONTROL SHEET

Report Title: Bryn Foty, Gwynfryn
Remediation Strategy

Client: Mark Baker

Report Reference Number: R2634-R01

Report Status: Draft

Version: v1

Report Date: 19^h October 2018

Signed for Smith Grant LLP

	Name	Position	Signature	Date
Author	P R Magraw BSc, FGS	Consultant		19/10/2018
Reviewer	B J Thomas BSc, MSc, MCIWEM, CEnv, SiLC 	Partner		19/10/2018

Document Revision Record:

Version	Report Status	Date	Details of Revision
V1	Draft	xx/10/2018	For client comment

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BRYN FOTY, GWYNFRYN REMEDICATION STRATEGY

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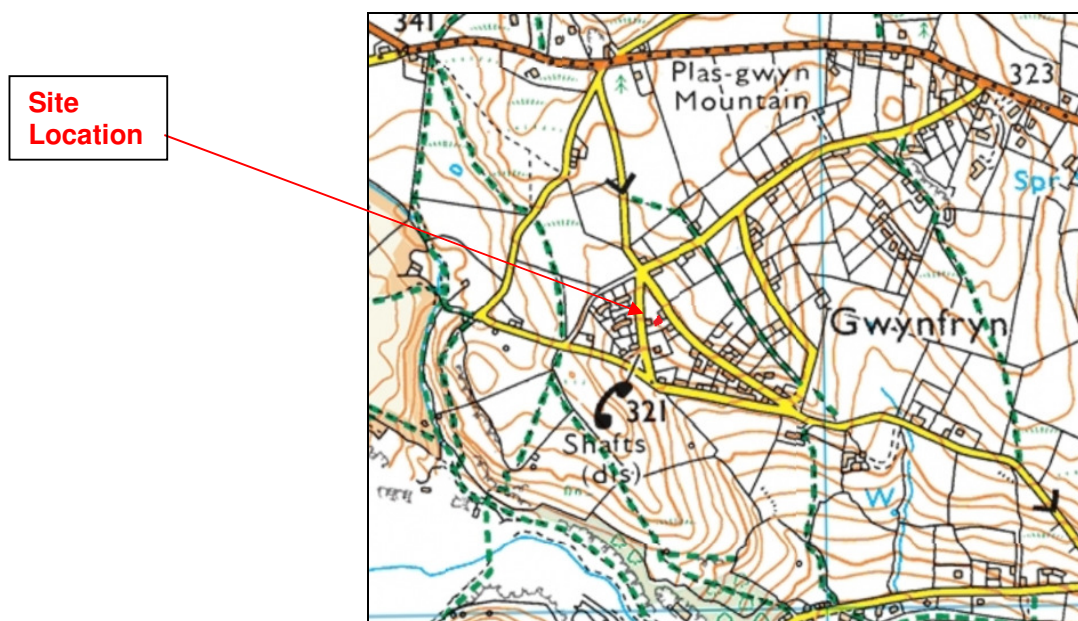
1. Introduction

- 1.1. Smith Grant LLP (SGP) has been instructed by Mark Baker to produce a Remediation Strategy for Bryn Foty, Gwynfryn to prepare it for residential development. This will comprise the erection of a single dwelling with an attached garage, access and garden areas.

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.
Planning Reference	P/2012/0168
Proposed Use	Erection of a single dwelling with attached garage.

Figure 1.1: Site Location



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- 1.2. The site is approximately 315m² in size and is located within a mixed residential/agricultural area. Presently, the site is largely undeveloped land with overgrown vegetation and a shed located along the centre of the western boundary and a garage straddling the southwest corner, all of which are associated with an existing adjacent residential property to the west. The site topography declines steeply from east to west in keeping with the surrounding land.

- 1.2.1. Approval for the redevelopment of the site was granted by Wrexham County Borough Council (WCBC). The approval contained a number of conditions relating to the remediation of Land Contamination which are reproduced below.

Table 1.2: Planning conditions relating to Land Contamination

12	<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>
13	<i>No part of the development shall be occupied until a Verification Report which demonstrates that the remedial works approved as part of condition no. 12 above have been satisfactorily carried out, has been submitted to and approved in writing by the Local Planning Authority.</i>

- 1.3. A site investigation has been completed by SGP on behalf of the former site owner, Mr Richard Sciesinski, which has been submitted to WCBC for comment. It is assumed that the methodology of the supporting assessment (site investigation and risk assessment) which informed the development of this Remediation Strategy, and its overall objectives, scope and methods are acceptable to WCBC.

2. Information Sources

2.1. Previous Investigation

2.1.1. The existing information sources are limited to the SGP combined stage 1 & 2 contamination assessment (R2492-R01-v1) which included the excavation of 6 trial pits and 12 samples of site soils.

2.1.2. SGP is not aware of any other investigations having taken place at the site.

3. Site Characterisation & Risk Assessment

3.1. Site History & Contamination Status

- 3.1.1. To determine historical use of the site, reference has been made to Ordnance Survey maps at different scales. A site inspection by SGP in 2018 has also been carried out.
- 3.1.2. The mapping indicates that there has been no significant development or changes on the application site since the earliest available mapping (1871-1876).
- 3.1.3. Historically, the immediate surrounds comprised a mixed rural / residential area along the roads Ffordd Isaf and Allt Y Pentref with scattered residential properties present surrounding 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.
- 3.1.4. 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.

3.2. Potential Contamination

- 3.2.1. The potential contamination sources at the site are believed to be limited to elevated Lead in garden soils and suspected asbestos containing materials (ACM) in the structure of the shed and garage at the site.

3.3. Ground Conditions

- 3.3.1. The published geology of the site identifies no superficial deposits underlie the site. The bedrock geology consists of the Gwespys Sandstone Formation comprising fine-grained, feldspathic and micaceous sandstones with conglomerate and intercalated siltstone and mudstone beds.

3.3.2. Made ground was identified on the site during the site investigation works. Topsoil consisted of blackish brown slightly sandy silty clay with fine to coarse angular to sub-rounded gravels with frequent roots. Subsoil consisted of grey orange-mottled clayey silty sand with gravel of weathered sandstone.

3.3.3. Groundwater ingress into trial pits was not encountered in any of the locations.

3.4. Contamination Indicators

3.4.1. Contamination indicators were limited to visible suspected ACM materials in the shed and garage at the site. No contamination indicators were noted in the topsoil and subsoil.

3.5. Soil Analysis

3.5.1. The soil test suite selected was appropriate to the former surrounding land use: samples were analysed for the presence of lead, cadmium, zinc and soluble sulphate from the upper 600mm of soils.

3.5.2. Significant exceedances of assessment criteria for garden soils were recorded for Lead, up to 20 times the screening criteria for residential use. pH conditions ranged from slightly acidic to neutral.

3.6. Ground and Surface Water

3.6.1. The site was assessed as not posing a risk to controlled waters.

3.7. Ground Gas

3.7.1. No sources of landfill ground gas are considered to exist with the potential to influence at the site.

3.7.2. 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.

3.8. Potential Contaminant Source-Pathway-Target Relationships

3.8.1. The historical mining of the surrounding areas has resulted in the deposition of lead impacted materials in shallow soils. Soil contamination identified is been limited to significantly elevated concentrations of Lead.

- 3.8.2. New sensitive receptors will be introduced to the site during and following development. The works required to prepare the site, construct and maintain dwellings and infrastructure will introduce workers to the site at times when ground will be exposed through excavations.
- 3.8.3. Particularly during earthworks involving high levels of mechanical disturbance, migration pathways could be opened up which allow the transfer or migration of contaminants in dust where residents of neighbouring properties must be considered a potential receptor in terms of both health impacts and nuisance.
- 3.8.4. The most sensitive human health receptors are those which have the greatest potential for exposure in terms of both frequency and duration; future residents, which are assumed to include young children, the most vulnerable group as far as exposure to lead is concerned.
- 3.8.5. New materials will be brought onto the site and used in construction of new structures; the site conditions are not considered to be aggressive as far as damage to materials are concerned.
- 3.8.6. Controlled waters receptors are not anticipated to change following development.
- 3.8.7. If confirmed to be ACMs in the shed and garage will require removal by a specialist contractor.
- 3.8.8. Finally, the risk of radon gas ingress into future dwelling will require the placement of full radon protection measures in the proposed dwelling.
- 3.9. Human Health Risk Assessment
- 3.9.1. Exposure of future residents in the development to the site soils presents an unacceptable long-term chronic risk to health as a result of the widespread high-level lead concentrations which are likely to be ubiquitous in the soil on the site. Exposure pathways which must be broken are those from soil and dust ingestion, dermal uptake, soil dust inhalation and via plant uptake through consumption of home-grown produce.
- 3.9.2. The main receptors at risk are children living in houses with private gardens, due to their particular sensitivity to the contaminant under consideration (lead) and their duration and frequency of exposure.
- 3.9.3. Risks to construction and development workers are potentially significant via these pathways as concentrations are sufficient to result in acute health risks.
- 3.10. Controlled Waters Assessment

3.10.1. The site overlies geological strata defined as a minor aquifer. Contaminants identified within the site are unlikely to cause pollution due to the insoluble nature of lead.

3.11. Construction Materials

3.11.1. The previous investigation did not identify aggressive ground conditions with respect to chemical attack of buried concrete.

3.11.2. Water Supply Pipes

3.11.3. The site soil is not considered to have the potential to impact the integrity of polyethylene water supply pipes and an assessment of suitable water supply pipe material for post-remediation ground conditions is not considered necessary.

3.12. Conclusions

3.12.1. Identified known soil contamination sources determined from the historical uses of the wider area surrounding the site and site investigations are summarised in the conceptual model for the site overleaf:

Table 4.1: Summary of Source-Pathway-Target Relationships

Receptor	Source Contaminant sources identified to date and those which are anticipated	Potential Pathway to exposure / pollution linkage Migration pathways	Severity of impact
Humans - development workforce / future maintenance engineers	Significant site wide sources of elevated lead as well as potential ACM identified within a garage and shed at the site.	Soils will be exposed while workers are present during preparatory earthworks, the construction of the development and during future maintenance with a decreasing degree of risk over each of these three stages of the developments design life	Short-term exposure of construction and maintenance workers to soils are unlikely to pose risks to health, however there is a legislative requirement to control exposure to asbestos.
Humans - future residents and neighbours	Significant site wide sources of elevated lead as well as potential ACM identified within a garage and shed at the site. Radon gas ingress is possible.	Immediate neighbours could be exposed to emissions from the site to a similar degree as workers during development. Residents, including vulnerable children could potentially come into contact with shallow soils regularly for a prolonged period. Long term exposure of residents to radon gas ingress into proposed dwelling.	Potentially severe impacts in the absence of appropriate mitigation
Property/ structures	No sources of risk to property or structures have been identified	No aggressive conditions which could impact plastic or concrete structures have been identified.	Unlikely to cause impacts
Vegetation /landscaping	No sources of phytotoxic substances identified	Zinc concentrations are below threshold for plant health.	Unlikely to cause impacts.
Groundwater	No sources of diffuse pollution have been identified.	No sources of diffuse pollution have been identified.	Unlikely to cause impacts.
Surface water	No sources of diffuse pollution have been identified.	No sources of diffuse pollution have been identified.	Unlikely to cause impacts.

4. Remediation Strategy

4.1. Rationale

- 4.1.1. SGP considers that the combined investigation carried out to date provides sufficient information, accuracy and confidence to be able to confirm the appropriate overall Remediation Strategy for residential development of the site is appropriate.
- 4.1.2. Based on the assumption that high-level lead concentrations are likely to be encountered in any part of the soils on the site, and the problems involved in attempts to delineate contamination in heterogeneous soil, it is concluded that some form of universal mitigation to prevent direct exposure of future residents to the site soils is required. Similarly, a universal degree of mitigation for the residential dwelling against radon gas is necessary.
- 4.1.3. The Remediation Strategy must address the contamination identified to date in a cost effective and sustainable manner, proportionate to the risks identified.

4.2. Remediation Objectives

- 4.2.1. Based on existing information gained from the intrusive investigation, the site is generally considered to present a high risk to sensitive receptors, which will be introduced following development for residential use. Remedial action to remove the contaminant source or create a physical isolation from future garden and landscaped areas is the main remediation requirement.
- 4.2.2. Key remediation objectives are therefore to break significant, or potentially significant, future pollutant linkages resulting from the change of land use and allow development of the site for its intended residential use without harm to human health, property and the environment. .
- 4.2.3. Each of the potential contaminant linkages identified in the site conceptual model and risk assessment will be addressed for the Remediation Strategy to be considered appropriate for the site and to allow construction to commence.

4.3. Options Appraisal

- 4.3.1. Options for the remediation of the identified and potential contamination sources are summarised below:
- 4.3.2. All soils on the site have the potential to contain concentrations of contaminants that, in the absence of mitigation, could pose an unacceptable risk to the health of future site users. The

- "do nothing" option, containing no specific measure to remediate ground contamination or deal with further mobile substances, is not considered acceptable.
- 4.3.3. A strategy involving removal of site soils for off-site treatment or disposal has the benefit of removing all potential contamination sources. This option would require the transport of material which would likely be considered hazardous waste and is regarded as an uneconomic solution in the context of the scale of the development as well as problematic in terms of waste generation and use of resources.
- 4.3.4. If the site soils are retained, then the widespread, high-level lead metal contamination can be retained under a barrier system to provide physical isolation from future residents and break the relevant pollutant linkages in future gardens. It is therefore proposed that a more extensive cover system is provided due to the significantly high lead concentrations. The proposed cover system will consist: clean soils at a depth of 600mm combined with a 150mm compacted aggregate break layer. This would be sufficient to reduce exposure to acceptable levels as underlying soils would be unable to mix within the overlying clean soil cover system.
- 4.3.5. A suite of assessment criteria for garden soils must be established. The residential criteria listed will serve as a suitable screening criterion for soils under consideration for use within the cover system.
- 4.3.6. Potential treatment options which can reduce sources are varied and include both in-situ and ex-situ technology. Given the inherent uncertainty and onerous requirements to design an effective in-situ treatment scheme and validate its successful completion, these are not considered acceptable options for remediation. The practicalities of large-scale removal, screening, processing and replacement of all soils is not considered practical.
- 4.4. Remediation Earthworks
- 4.4.1. Following establishment of security and welfare facilities, asbestos survey and strip from existing building, if required, demolition of above ground structures followed by surface wastes removal will be implemented.
- 4.4.2. Contaminated soils will be regraded to a depth of 750mm below final garden level and placed in temporary stockpiles for assessment to determine classification for disposal. A record of transfer documentation will be retained for soils removed from site.

4.4.3. It is not intended to attempt to recover any topsoil for re-use in the development. Given the site history and requirements to remove lead impacted soils, it is unlikely that deeper subsoil can be recovered either.

4.5. Remediation Earthworks Verification

4.5.1. Soils incorporated in the cover system will require validation to demonstrate suitability, depending on their source and the sensitivity of their intended use.

4.5.2. Imported soils for use within the recommended soil cover system for garden or landscaped areas, a visual inspection and sampling frequency of 1 sample per 250m³ is considered appropriate for soils derived from a greenfield source and 1 sample per 50m³ if soils are derived from an uncharacterised brownfield source. Much of the screening will rely on visual inspection, with the above sampling frequencies and laboratory analysis providing confirmatory data.

4.5.3. The recommended screening suite includes all of the common indicator urban contaminants/pollutants. The criteria adopted in the previous site investigations were the LQM/CIEH Suitable for use (S4UL) criteria¹ which are adopted for preliminary screening of materials, supplemented by other criteria as appropriate.

Table 4.1: Screening criteria for comparison of results of general soil screening suite

Contaminant	Soil standard source	Screening Concentration (mg/kg or indicated)
arsenic	S4UL	37
cadmium	S4UL	11
chromium (total)	S4UL	910
chromium VI	S4UL	6
copper	S4UL	2400
lead	C4SL	200
mercury (inorganic)	S4UL	40
nickel	S4UL	130
zinc	S4UL	3,700
asbestos screen	no fibres detected	No fibres detected
naphthalene	S4UL	2.3
acenaphthylene	S4UL	170
acenaphthene	S4UL	210

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Contaminant	Soil standard source	Screening Concentration (mg/kg or indicated)
fluorene	S4UL	170
phenanthrene	S4UL	95
anthracene	S4UL	2400
fluoranthene	S4UL	280
pyrene	S4UL	620
benzo(a)anthracene	S4UL	7.2
chrysene	S4UL	15
benzo(b)fluoranthene	S4UL	2.6
benzo(k)fluoranthene	S4UL	77
benzo(a)pyrene	S4UL	2.2
indeno(123cd)pyrene	S4UL	27
dibenzo(ah)anthracene	S4UL	0.24
benzo(ghi)perylene	S4UL	320
aliphatic >C5-C6	S4UL	42
aliphatic >C6-C8	S4UL	100
aliphatic >C8-C10	S4UL	27
aliphatic >C10-C12	S4UL	130 (48) vap
aliphatic >C12-C16	S4UL	1100 (24) sol
aliphatic >C16-C35	S4UL	65000 (8.48) sol
aromatic >C5-C7	S4UL	70
aromatic >C7-C8	S4UL	130
aromatic >C8-C10	S4UL	34
aromatic >C10-C12	S4UL	74
aromatic >C12-C16	S4UL	140
aromatic >C16-C21	S4UL	260
aromatic >C21-C35	S4UL	1100

Notes to table:

ND: no asbestos fibres detected

S4UL: LQM / CIEH Suitable for Use Levels (S4ULs); residential with plant uptake land use (at 1% SOM / 6% for metals).

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C4SL: Category 4 Screening Levels (C4SLs) published by CL:AIRE 'residential with plant uptake use (at 1% SOM)

DEFRA plant Threshold guideline for the protection of sensitive plant species used by MAFF

BRE SD1: Building Research Establishment Special Digest 1

vap: CV exceeds vapour saturation limit provided in ()

sol: CV exceeds solubility saturation limit provided in (); i.e. probability of free product at this level

4.5.4. The following table summarises the inspection regime testing frequencies for the various materials which are considered in the Remediation Strategy:

Table 4.2: inspecting and test frequencies

Material	Minimum inspection requirement	Minimum Testing frequency and suite
Imported soil intended for use as topsoil/growing medium in gardens	Visual inspection	1 sample per 250m ³ for general screening suite if sourced from a greenfield site or 1 sample per 50m ³ for general screening suite if sourced from a brownfield site. Minimum of 3 samples from any one source.

4.5.5. The screening criteria are directly applicable for materials intended to be used in garden soils. The screening criteria are sufficiently low to be considered protective of controlled waters. Where soil concentrations fall below the screening criteria these are considered highly unlikely to pose any pollution risk.

4.5.6. If previously uncharacterised materials are identified during the works, a decision must be made as to whether these can be dealt with using the techniques selected to manage the contamination characterised to date. Materials must be inspected by an appropriate person and, if appropriate, samples analysed. The analysis suite will be determined by the assessment of the materials, and where substances other than those in the standard screening suite are suspected similarly derived criteria will be used. If significant departures from the Strategy are necessitated by currently unanticipated conditions, these should be agreed in consultation with the regulator.

4.5.7. All records, results and documentation will be compiled into an earthworks completion report to be issued to all stakeholders. In summary the validation/verification activities required during the remediation earthworks phase are:

- Records of contaminated soil removal works including observation, recording of stripped surfaces;
- Record of break layer placement works;
- Verification of imported soil including depth and quality validation; and,
- Issue of completion reporting prior to the commencement of development.

4.6. Remediation Implementation

- 4.6.1. It will be for the developer to place a suitable depth of clean soil in garden areas, a crushed aggregate break layer, to install appropriate radon gas protection measures and use suitable specification materials for construction of buildings and infrastructure. The Remediation Strategy allows for the screening and testing of imported soils.

4.7. Environmental Management

- 4.7.1. Protection of site workers, local residents and visitors during the remediation works can be achieved by the adoption of appropriate health and safety practices, environmental management and site security. All site workers should be given a comprehensive health and safety induction and appropriate personal protective equipment as necessary.
- 4.7.2. Daily observations of dust levels track out of materials onto the carriageway and nuisance odours will be required. If unacceptable emissions of any substance beyond the site boundary are noted then the element of the works contributing to this should cease until appropriate mitigation (damping down, road sweeper, etc.) can be deployed.
- 4.7.3. Boundary fences and an appropriate level of site security should be maintained throughout the works. If required, tree protection fencing should be instated prior to the commencement of works.

4.8. Construction Phase Mitigation and Verification

- 4.8.1. The final placement of soil cover will require verification; initial screening criteria appropriate for private garden soils are set out in Table 4.1 and a validation of the garden soil depth and presence of the break layer to demonstrate successful completion of the clean soil cover system.

5. Conclusions & Recommendations

5.1. Remediation

- 5.1.1. SGP considers that the site has been adequately investigated for the purposes of devising a Remediation Strategy suitable to prepare the site for residential development and that the key development constraints and requirements for remediation are understood.
- 5.1.2. The site contains site-wide high lead concentrations which could cause harm to human health, which also represent long-term pollution sources, and remediation works are required to prepare the site for development. It is envisaged that the most cost-effective and robust means of managing such risk is the isolation of future residents by placement of a robust barrier over the retained impacted soils. Given the concentrations recorded the break layer should contain a physical barrier to soil mixing in the form of a layer of compacted aggregate.
- 5.1.3. Radon protection measures are also required.
- 5.1.4. If previously uncharacterised materials are encountered during the development these will require assessment to determine whether revisions to the strategy are appropriate, any revisions must be made following consultation with WCBC.
- 5.1.5. The contamination remediation earthworks described will be carried out contemporaneously with works to physically prepare the site for its intended use and construction but must be completed before occupation.
- 5.1.6. Verification reporting of both the remediation works to prepare the site for development, and confirmation of the supplementary mitigation measures to be provided during the construction phase of the scheme, will be required and will be reported.
- 5.1.7. With the adoption of the above normal practices for Brownfield development, and on the information available to it, SGP considers that the site can be safely and economically redeveloped, and the existing environmental liabilities managed.

5.2. Limitations

Stratigraphy and Contamination

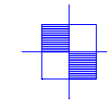
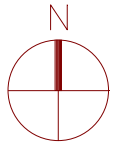
- 5.2.1. The evidence of stratigraphy is taken from discrete trial pit locations, and largely from factual information provided by other parties. Whilst it is usually reasonable to infer that similar conditions may extend between these locations, caution should be exercised.

- 5.2.2. The site investigations involved sampling at discrete locations, and it should be recognised that further areas or types of contamination may exist between investigation positions. The analyses performed are drawn from a typical suite of tests used to screen potentially contaminated land, presumably to fall within the available budget. It is always possible that other substances may be present that have not been included within the standard range of tests.

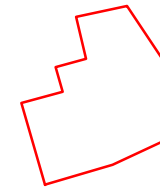
General

- 5.2.3. 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.
- 5.2.4. This report has been prepared by SGP for the sole and exclusive use of Spencer Cullis. Reasonable skill, care and diligence has been exercised within the 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.
- 5.2.5. 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.

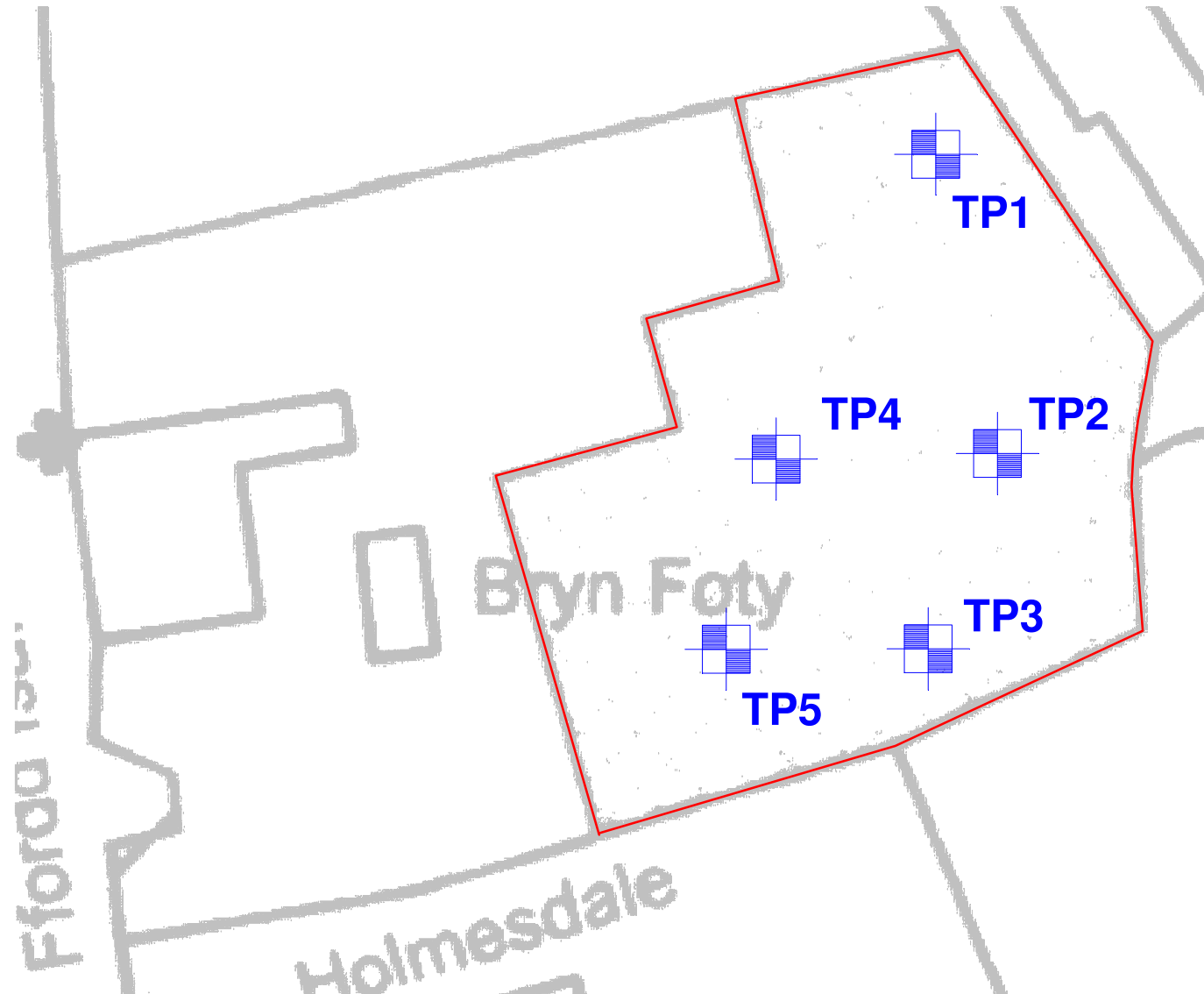
Drawings



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