

GEOENVIRONMENTAL DESK STUDY AND CONTAMINATION ASSESSMENT REPORT FOR GLENLEITH BARN, ASTON COURT FARM, LITTLE GORSLEY GL18 1PG



**PREPARED FOR
J & R DAVIES FARMING PARTNERSHIP**

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**GEO-ENVIRONMENTAL DESK STUDY AND CONTAMINATION
ASSESSMENT REPORT FOR
GLENLEITH BARN, LITTLE GORSLEY GL18 1PG
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1 INTRODUCTION

- 1.1** The above site is being considered for residential redevelopment, however historic land use and the record of a former underground fuel storage tank has raised a concern regarding possible residual ground contamination. In order to address the relevant planning condition a geo-environmental desk study has been undertaken, followed by intrusive investigation, laboratory testing and quantitative risk assessment to establish whether any potentially significant pollutant linkages may exist in respect of future residents.
- 1.2** The Geo-environmental assessment has been carried out in general accordance with BS10175:2011 "Code of Practice for the Investigation of Potentially Contaminated Sites", the Environment Agency (EA) and NHBC publication "Guidance for the Safe Development of Housing on Land Affected by Contamination" (2000), and EA document CLR11 "Model Procedures for the Management of Land Contamination".
- 1.3** This report has been prepared in line with the agreed scope of works set out within our proposal Q16252 dated 03 October 2016, with instruction received by return from Mr Jimmy Davies. Reliance on this report is presently restricted to J & R Davies Farming Partnership as owner of the property.

2 SITE LOCATION AND DESCRIPTION

- 2.1** Centred on approximate NGR SO 68050-24450 the site lies on the southern side of Little Gorsley village, c7.5km east of Ross-on-Wye and c4km southwest of Newent as shown on drawing 4119/1. As indicated on drawing 4119/2 it comprises an existing detached barn surrounded by open agricultural fields.

2.2 The walkover reconnaissance and site investigation were undertaken on 12 October 2016 and a selection of photographs is presented within Appendix 1; further have been retained on file. It will be seen that the main barn is single-storey of sandstone masonry construction with clay tile roof and cast iron or plastic rainwater goods; a lean-to extension on the southwestern side is of brick with corrugated iron roof sheeting. There was no evidence of suspected asbestos-cement roof sheeting or guttering etc. Internally all rooms were virtually empty apart from miscellaneous storage of fence posts and vegetable packing crates. The main barn appears to have been a former cattle shed/stables with remnant hay, and although an informal workbench is present within the lean-to extension the underlying concrete floor slab, indeed all slabs throughout the building, showed no obvious oil or other hydrocarbon impaction.

2.3 Externally the entire ground surface is grass with no evidence of suspected ground contamination; a public footpath follows the hedge-line to the immediate northeast. As shown on drawing 4119/2 approximately 8m north of the barn close to the hedge a redundant underground fuel storage (UST) is marked by a metal inspection cover, which until recent hedge-trimming by the client had been concealed. The UST presence was suspected prior to site investigation thus an enquiry was made to the county Petroleum Officer, and although he confirmed that he holds no records he attended site during the investigation (see later section 6). Removal of the cover revealed an open chamber to 0.7m containing a fill pipe, which when dipped recorded a tank depth of 2.3m and standing water at 1.9m; when sampled for analysis using a bailer tube the latter possessed a petrol odour but no evidence of free-phase product. A vent-pipe was evident in the chamber but there was no surface evidence of it in the surrounding area (nor on the walls of the barn).

2.4 Ordnance Survey mapping indicates an approximate site elevation of 85m AOD.

3 DESK STUDY RESEARCHES

Recorded Geology

3.1 Published geological mapping records the site and surrounding area to be underlain by bedrock of the Raglan Mudstone Formation (RMF), usually encountered as reddish brown locally silty mudstone which weathers near-surface to clay. There is no record

of natural superficial deposits, geological faulting or made ground either on or in close proximity to the site.

Hydrogeology and Hydrology

- 3.2** The EA website indicates the RMF as a Secondary A (minor) aquifer, suggesting mainly low permeability strata capable of supporting water supplies at a local rather than strategic scale, but which may form an important source of river base flow. The site does not lie within a groundwater source protection zone and there are no licensed surface or groundwater abstractions within a 1km radius. The nearest watercourse is a small un-named stream 75m south of the barn which originates from 'issues' which rise 200m southwest, and flows northwest-wards via several small ponds to ultimately form a tributary of the northerly-flowing Ell Brook c1km northeast of the site.
- 3.3** Based upon the above information the site is considered to lie within an area of low sensitivity in terms of groundwater resources and low to moderate sensitivity with regard to controlled surface waters.

Site History

- 3.4** The history of the site has been deduced by inspection of historical Ordnance Survey maps. These were available as a number of editions at various scales and a selection of relevant extracts is presented as drawing 4119/3. On and off-site points of interest that may affect or be affected by the proposed development have been summarised within Table 1 below. The former land-owner has apparently stated that the barn was only ever used as cattle/hay/straw storage and not for chemicals or fertilizers; the presence of a petrol tank rather than diesel in a rural agricultural context is unusual and unexplained; it is not known when the tank was installed.

TABLE 1: SUMMARY OF SITE HISTORY

Date (Source Map Scale)	On-Site Features	Off-Site Features	Contaminants with Potential to affect Site	Likelihood of Site Impact
1889 1:2500	Barn already present, associated with Dowles Cottages to NW	Dowles Cottages to NW, small pond c40m N, open fields on all other sides	None	Negligible
1904 1:2500	No significant change	Most surrounding fields now fruit orchards	As above	As above

Date (Source Map Scale)	On-Site Features	Off-Site Features	Contaminants with Potential to affect Site	Likelihood of Site Impact
1924 1:2500	No significant change	No significant change	As above	As above
1954-55 1:10560	No significant change	No significant change	As above	As above
1970 1:2500	Building appears to be larger due to infill extensions; UST installed?	No significant change	Petroleum hydrocarbons, toxic metals	Moderate
1995 1:2500	No significant change; rear enclosure added	Fruit orchards now cleared; small pond no longer shown	As above	As above
2016 Present day	No significant change	No significant change	As above	As above

- 3.5** Obviously Ordnance Survey plans only represent periodic snapshots in time and do not provide a continuous record of previous site usage, thus there is a risk that the site may contain buried remnant foundations of former buildings or waste products associated with previous site usage, which may not be evident from the site walkover inspection and desk study researches.

Landfill and Radon Gas

- 3.6** The EA landfill register shows no record of any active or historic landfills either on or within potential influencing distance of the site, although the former small pond shown on historic OS mapping may contain remnant natural organics or putrescible infill which could potentially pose a risk of landfill-type gas emissions. That said the envisaged local geology of low-permeability clay should serve to prevent lateral migration to the site, although this should be checked by intrusive investigation to determine whether protective measures may be necessary/prudent.
- 3.7** According to the Building Research Establishment document BRE211:2015 "Guidance on Protective Measures for new Buildings", the site lies in an area in which basic radon protection measures are required for new development.

4 PROPOSED DEVELOPMENT

- 4.1** It is planned to convert the barn into a three-bedroom dwelling, and as shown on drawing 4119/2 this will be serviced by a new access drive terminating in a parking area and adjacent new garage (with bat roost). It is assumed that land within the plot to the southeast of the barn may be converted to gardens. This land quality assessment has been undertaken to address Condition 7 of the planning consent.

5 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL SITE MODEL

- 5.1** The site and its immediate surroundings have been assessed in terms of historical and current land use together with the environmental, geological and hydrogeological setting. In view of the foregoing information the **principal contaminants of concern** comprise the following:
- Toxic and phytotoxic metals and polyaromatic hydrocarbon (PAH) compounds within the (presumed) pond infill
 - Petroleum hydrocarbon compounds associated with the disused UST
 - Landfill gas emissions from the (presumed) pond infill
 - Although not specifically identified as a PCoC, in line with Herefordshire Council requirements asbestos fibres have also been included
- 5.2** Based upon the proposed residential use of the site the **critical receptor** is identified as a female child resident age class 1-6, and the further quantitative risk assessment (section 7 below) has been progressed on this basis.
- 5.3** The resulting preliminary Conceptual Site Model is presented in Figure 1 below and illustrates how the presence of principal contaminants of concern, if proven, can be translated into **potential pollutant linkages** to existing/future site users.

[illegible]

Sources	Pathways	Receptors						Comments	Preliminary Risk Assessment
		R1	R2	R3	R4	R5	R6		
E									
	P1	X						UST holds water so no significant leaks likely; no obvious grass discoloration or soil odour in vicinity	Moderate
	P2	X							
	P3		X						
	P4			X	X				
	P5								
	P6								
	P7								
	P1							Bedrock naturally emits radon gas	Low
	P2								
	P3								
	P4								
	P5								
	P6								
	P7	X				X			
TE									
	P1	X						Precise extent of former pond and nature of backfill unknown; may contain elevated contaminants but no obvious signs at surface	Moderate
	P2	X							
	P3		X						
	P4			X	X				
	P5								
	P6								
	P7								
	P1							Precise extent of former pond and nature of backfill unknown; may be emitting gas but no obvious signs at surface	Low-moderate
	P2								
	P3								
	P4								
	P5								
	P6	X				X			
	P7								
ES	S1	Possible TPH impaction/plume due to leaks/spills from disused UST							
	S2	Possible contamination (toxic metals, PAH, asbestos) within old pond backfill							
	S3	Possible landfill gas emissions from pond backfill							
	S4	Radon gas emissions from natural bedrock							
AYS	P1	Direct dermal contact or ingestion (including via soil on vegetables)							
	P2	Inhalation of dust and vapours							
	P3	Permeation into new water supply pipework							
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone							
	P5	Direct contact with high sulphate-bearing clay							
	P6	Landfill gas migration through unsaturated zone and accumulation within confined spaces							
	P7	Radon gas migration through unsaturated zone and accumulation within confined spaces							
ORS	R1	Future residents							
	R2	Potable water supply							
	R3	Groundwater (bedrock is Secondary A aquifer, not in SPZ & no nearby abstractors)							
	R4	Surface waters (minor stream 75m S)							
	R5	Concrete foundations							
	R6	Adjacent land users							

- 5.4 Given the above a detailed walkover reconnaissance inspection has been undertaken, supplemented with a small amount of routine trial pitting, soil sampling and laboratory testing. Those results have been used in a quantitative contamination risk assessment to establish any unacceptable risks to future residents and the local environment.

6 SITE WORKS AND TESTING

Site Works

- 6.1 The Phase 2 intrusive investigation took place on 10th October 2016, comprising targeted trial pits and soil sampling. The desk study and walkover inspection had not suggested any specific targets for assessment either within the barn itself or proposed garden/grounds area to the southeast, thus trial pits were targeted upon the disused UST and the backfilled pond.
- 6.2 The fact that the UST was holding water suggested it unlikely to have suffered long-term product leakage, but as a precaution TP1 and TP2 were excavated at c5m distance on the downslope sides to both north and south (see drawing 4119/2). As shown in Appendix 1 there was no visual or olfactory evidence of near-surface hydrocarbon impaction or a plume at depth, with both pits instead encountering clean reddish-brown clay grading to weathered mudstone, and it was agreed with the Petroleum Officer (in attendance) that laboratory testing was not needed. Water contained within the UST possessed a petrol odour but no evidence of free-phase L/DNAPL (light/dense non-aqueous phase liquid) product; a sample was taken for speciated hydrocarbon analysis to inform an options appraisal in terms of decommissioning and disposal.
- 6.3 The former pond was marked out by reference to historic OS mapping and TP3 was excavated on that position. Beneath surface topsoil this encountered a layer of very loose made ground to 0.9-1.0m, comprising whole and broken bottles and pottery with occasional rusty metal all in a dark grey ash matrix. This is typical of pond backfill and probably comprises historic domestic waste from the adjacent cottages; there was no evidence of significant organic or any asbestos content, and none of a natural basal organic silt layer. Beneath the backfill natural ground comprised reddish-brown plastic clay, with no evidence of downward leaching of contaminants. Representative soil samples were taken for analysis.

Contamination Laboratory Testing

6.4 The contamination sampling scheme was conducted in accordance with BS10175:2011, restricted to near-surface made ground/topsoil or natural ground within the upper 1m or so. These were sent to UKAS-accredited Scientific Analysis Laboratories in Manchester where they were variously subject to the following analysis:

- Toxic and phytotoxic metals
- Petroleum hydrocarbon screening and C5-40 speciation (TPH CWG incl. BTEX)
- Speciated polyaromatic hydrocarbons (PAH)
- Asbestos fibre screening
- Soil organic matter

6.5 The certified laboratory test results are presented as Appendix 2, the first pages of which include summary tables. All results and their implications upon the preliminary CSM are further discussed in Section 7.

7 CONTAMINATION RISK ASSESSMENT AND REFINED CONCEPTUAL SITE MODEL

TABLE 3: SUMMARY OF SOIL CHEMICAL TEST RESULTS

Determinand	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Residential with plant uptake (mg/kg) \$	Tests Undertaken (No.)	Exceedances (No.)	Notes
Arsenic	29	37	2	0	
Cadmium	1	11	2	0	
Chromium	42	910	2	0	
Lead	160	200**	2	0	
Mercury	2	40	2	0	
Selenium	<3	250	2	0	
Nickel	54	180	2	0	
Copper	58	2400	2	0	
Zinc	560	3700	2	0	

Determinand	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Residential with plant uptake (mg/kg) \$	Tests Undertaken (No.)	Exceedances (No.)	Notes
Napthalene	0.2	13	2	0	
Acenaphthylene	<0.1	920	2	0	
Acenaphthene	<0.1	1100	2	0	
Fluorene	<0.1	860	2	0	
Phenanthrene	0.2	440	2	0	
Anthracene	<0.1	11000	2	0	
Fluoranthene	<0.1	890	2	0	
Pyrene	<0.1	2000	2	0	
Benzo(a)Anthracene	<0.1	13	2	0	
Chrysene	<0.1	27	2	0	
Benzo(b)fluoranthene	<0.1	3.7	2	0	
Benzo(k)fluoranthene	<0.1	100	2	0	
Benzo(a)pyrene	<0.1	3	2	0	
Indeno(123-cd)pyrene	<0.1	41	2	0	
Dibenzo(ah)Anthracene	<0.1	0.3	2	0	
Benzo(ghi)Perylene	<0.1	350	2	0	
UST Water Infill	ug/l				
Benzene	<10	10	1	0	
Toluene	<10	50	1	0	
Ethylbenzene	<10	20	1	0	
Xylene	23000	30	1	1	
Methyl tert-Butyl Ether	0.01	-	1	-	
TPH Aliphatic C5 - C6	<100	-	1	-	
TPH Aliphatic C6 - C8	<100	-	1	-	
TPH Aliphatic C8 - C10	<20	-	1	-	
TPH Aliphatic C10 - C12	70	-	1	-	
TPH Aliphatic C12 - C16	40	-	1	-	
TPH Aliphatic C16 - C21	20	-	1	-	
TPH Aliphatic C21 - C35	60	-	1	-	
TPH Aromatic C6 - C7	<100	-	1	-	
TPH Aromatic C7 - C8	<100	-	1	-	
TPH Aromatic C8 - C10	<20	-	1	-	
TPH Aromatic C10 - C12	1300	-	1	-	
TPH Aromatic C12 - C16	550	-	1	-	
TPH Aromatic C16 - C21	30	-	1	-	
TPH Aromatic C21 - C35	<20	-	1	-	
Asbestos	ND	-	2	0	

Notes:					
\$ based on soil organic matter = 6%					
* assumed all chromium on site is in trivalent form					
** provisional C4SL					
*** most sensitive fraction within wider TPH band (specified)					
(283v/s) vapour/solubility saturation limit					
UST water results compared to EA EQS where available, all in ug/l					

Human Health

7.1 As shown in Table 3 above, despite the pond infill having a significant ash content the results indicate no exceedances above Tier 1 C4SL/S4UL (for residential use including vegetable uptake) in respect of toxic metals or PAH hydrocarbons. In addition neither of the two samples submitted for asbestos screening detected any fibres, thus no remedial action is considered necessary to mitigate any ground contamination health risks to future residents. In line with the preceding desk study however basic radon protection is required, thus the new internal floor slabs will need to accommodate this; the usual method is to adopt a minimum 1200gauge DPM and carefully lap it into the walls, taking care to protect it from subsequent accidental damage by following trades. It would as usual be prudent to verify precise requirements with local Building Control in case local minimum standards may apply.

7.2 In terms of new drinking water supply pipes, and with reference to the thresholds as published by UK Water Industry Research Ltd, by virtue of the recorded concentrations from TP3 and visual findings from TP1 and 2, given that the proposed route of the new incoming main will run up the drive at least 15m from the UST position (entering the barn at the southwestern corner), it seems unlikely that new water supply pipework would need to be of 'barrier' standard. As usual the local water provider should be contacted for confirmation.

Controlled Waters

7.3 Although given the low-risk hydrological and hydrogeological setting of the site specific leachate testing has not been undertaken, the low soil concentrations (toxic metals and PAH hydrocarbons) are not thought likely to pose a pollution or long-term leachate risk.

7.4 The water sample recovered from the disused UST records elevated xylene which is consistent with the previous petrol storage, and it is intended that these results be

used by the decommissioning contractor when considering disposal options. As previously noted the fact that the UST is holding water is taken as a sign that there is unlikely to have been any long-term leakage via rust-holes or other breaches, this it is envisaged to remain intact. Normal UST decommissioning procedure would be to de-gas it, pump out any residual fuel/water content then remove it from the ground; all water/sludge arisings normally undergo controlled removal and landfill disposal by the licensed contractor, and often the remnant UST is cold-cut for disposal as scrap metal.

Remedial/Mitigation Requirements – ‘The Remediation Scheme’

7.5 In view of the above discussions the following remedial and/or mitigation measures are considered necessary in order to provide adequate protection to future residents within the converted barn, and to local controlled waters. It is intended that this Remediation Scheme addresses the LPA requirement set out in part (c) of Condition 7:

- Formal decommissioning of the disused UST (as above) including removal and controlled landfill disposal of remnant water infill plus any associated sludge within the tank void; the UST water is known to contain petroleum hydrocarbon residues however adjacent TP1 and 2 showed no evidence of sub-surface impaction; void to be backfilled with clean inert material and topsoil restored
- Subject to satisfactory completion of the above there should no need for the DPM within the converted dwelling to be upgraded to a vapour-proof standard, although as discussed it will need to be of minimum 1200gauge and lapped into the existing walls to provide the necessary basic radon gas protection
- Liaison with the local water service provider regarding water supply pipework, although there is no expectation that barrier pipe will be needed
- Asbestos fibres were not detected within the tested samples and there was no visual evidence of suspected ACM roof sheeting/products; any that might be uncovered by onward site clearance etc should undergo careful removal and controlled landfill disposal, plus we should be notified for advice
- Upon completion of the above a Validation Report shall be provided to the LPA to demonstrate compliance with the stated requirements; any variations to the scheme should be agreed in advance with the LPA

7.6 On this basis the Conceptual Site Model has been refined as shown in Figure 2 and Table 4 below.

FIG 2: REFINED CONCEPTUAL SITE MODEL (NTS)

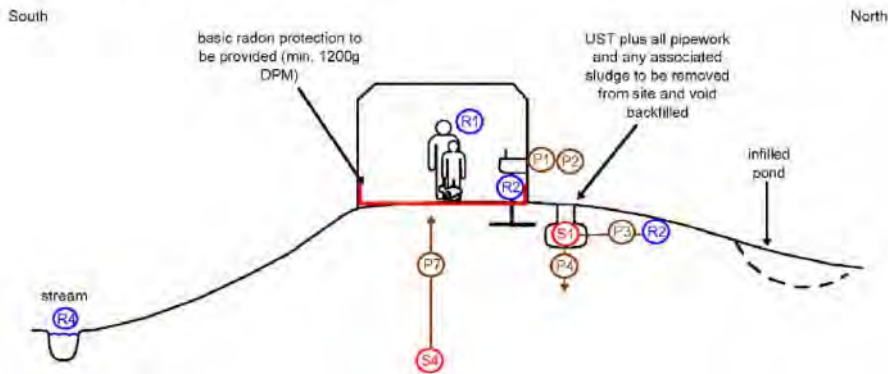


TABLE 4: SUMMARY OF IDENTIFIED/POTENTIAL POLLUTANT LINKAGES

Confirmed Sources	Pathways	Receptors						Comments	Refined Risk Rating	Remedial/Mitigation Requirements
		R1	R2	R3	R4	R5	R6			
ON-SITE										
S1	P1	X						Residual UST water contains petrol residues but tank thought to be intact; no evidence of surrounding ground impaction	Low	Formal decommissioning by specialist contractor and controlled landfill disposal of residual water content etc; backfill void with clean inert material
	P2	X								
	P3		X							
	P4			X						
	P5									
	P6									
	P7									
S4	P1							Basic radon protection required	Low	Minimum 1200gauge membrane in new floor slabs, installed to BR211 guidance
	P2									
	P3									
	P4									
	P5									
	P6									
	P7	X								
OFF-SITE										
None		-	-	-	-	-	-	No sources confirmed	-	-
SOURCES	S1	Disused UST								
	S4	Natural radon gas emissions from bedrock								
PATHWAYS	P1	Direct dermal contact or ingestion via soil attached to vegetables								
	P2	Inhalation of dust and vapours								
	P3	Permeation into new water supply pipework								
	P4	Vertical leaching in unsaturated zone and lateral migration in saturated zone								
	P5	Direct contact with high sulphate-bearing clay								
	P6	Landfill gas migration through unsaturated zone and accumulation within confined spaces								
	P7	Radon gas migration through unsaturated zone and accumulation within confined spaces								
RECEPTORS	R1	Future site users								
	R2	Potable water supply								
	R3	Groundwater								
	R4	Surface Waters								
	R5	Concrete Foundations								
	R6	Adjacent land users								

- 7.8** In line with best industry practice the scope of contamination testing has been based upon the site history, proposed land usage and actual findings, with reference where necessary to DoE Industry Profiles and DEFRA/EA guidance. To the best of our knowledge information concerning the land quality assessment is accurate at the date of issue, however subsurface conditions including ground contamination may vary spatially and with time. There may be conditions pertaining to the site not disclosed by the above sources of information which might have a bearing upon the recommendations made, were such conditions known. We have however used our professional judgement in order to limit this during the investigation.
- 7.9** Any conclusions and recommendations made in respect of land quality do not address any potential risks to site operatives or ground workers during the construction stage. These issues should be addressed by the Principal Contractor in accordance with the relevant statutory procedures and regulations (CDM Regulations 2015).
- 7.10** It is important that these limitations be clearly recognised when the findings and recommendations of this report are being interpreted. Additional assessment may be necessary should a significant delay occur between report date and implementation of the proposed scheme to which it relates.

8 CONCLUSIONS AND RECOMMENDATIONS

- 8.1** The foregoing remarks and recommendations are based upon the results of a Phase 1 geo-environmental desk study, comprising review of available published records and site walkover reconnaissance, plus contamination testing of recovered soil samples. As always however the ground profile can vary between investigation points, thus a careful watch should be maintained during any site stripping and excavation for any abnormalities that might require referral back to this Practice.
- 8.2** Although the barn itself and presumed future garden area were not considered to pose any significant health risks to future residents or local environmental receptors, given the (unexplained) presence of a small disused petrol UST the preliminary conceptual site model identified a moderate risk of residual petroleum hydrocarbon impaction, either as near-surface spillage or a deeper-seated plume due to possible long-term tank leakage. In addition it was considered possible that a small backfilled pond within

the plot could potentially pose a risk of landfill gas migration and ground contamination. It was therefore deemed prudent to undertake a targeted intrusive investigation via pitting and sampling to enable appropriate laboratory testing.

- 8.3** Quantitative risk assessment using those results has however demonstrated no evidence of a significant risk either to the health of future residents or to local ground/surface water quality. However as detailed within section 7.5 minor remedial and/or mitigation measures have been recommended in order to protect the health of future residents, comprising the formal decommissioning and removal of the disused UST, and the adoption of basic radon protection measures within the barn.
- 8.4** There was no evidence of ground impaction by hydrocarbons either near-surface or at depth in the vicinity of the UST, thus apart from controlled decommissioning and removal (including any residual vent and delivery pipework) by specialist contractors this should not pose a health risk to future residents or local environmental receptors. As such there is no evidence that upgraded vapour-proof floor slab membranes or barrier-type water supply pipework are needed. Obviously we should be contacted for advice at that stage should there be any evidence of localised ground impaction immediately beneath/around the UST.
- 8.4** The above recommendations must not be used in respect of any development differing in any way from the proposals described in this report, without reference back to this Practice or to another geo-environmental specialist.

9 REFERENCES

British Standards Institute, BS 10175: *'Code of Practice for the Investigation of Potentially Contaminated Sites'* (2011)

Environment Agency CLR 11: *'Model Procedures for the Management of Land Contamination'*

Environment Agency/National House Building Council (NHBC) R&D 66 *'Guidance for the Safe Development of Housing on Land Affected by Contamination'* (2000)

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Environment Agency (www.environment-agency.gov.uk)

Health Protection Agency (www.hpa.org.uk)

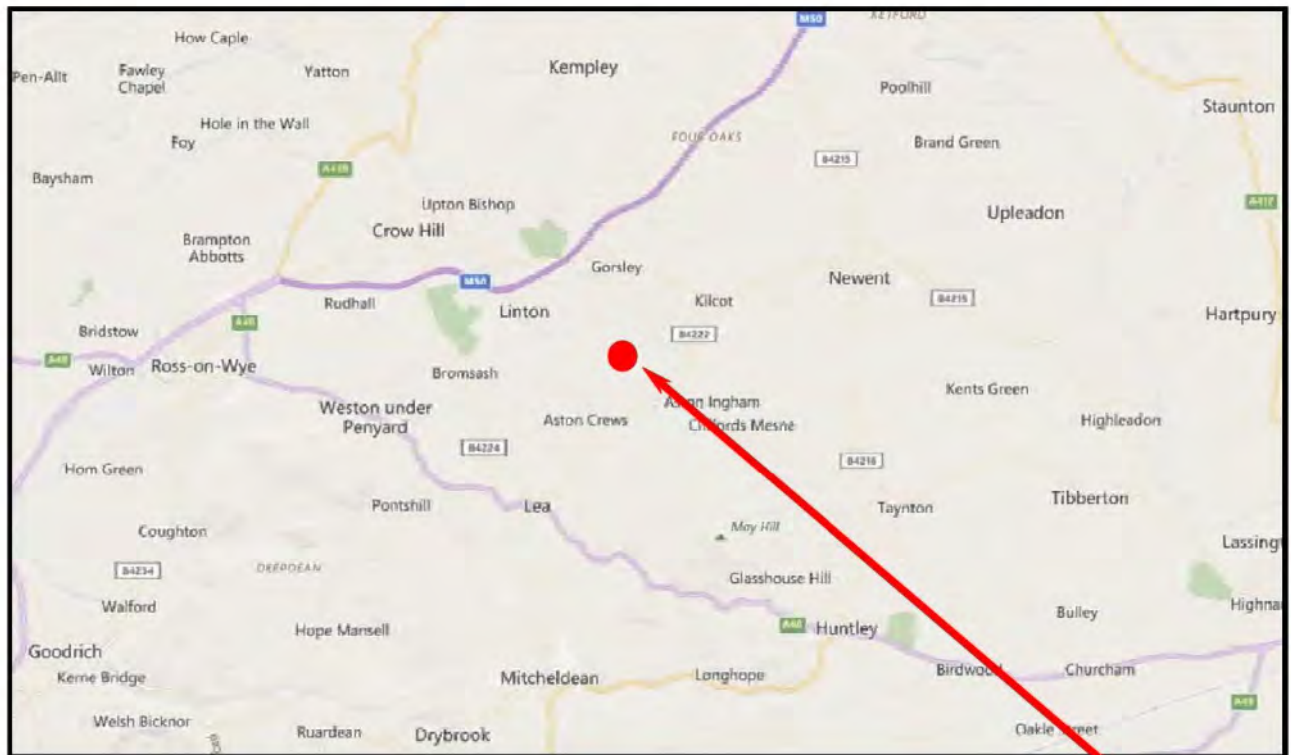
Herefordshire Council Petroleum Officer records

GLENLEITH BARN, ASTON COURT FARM, LITTLE GORSLEY,
GL18 1PG



SITE LOCATION (based on Microsoft Bing Mapping)

Job No.	Drawing No.	Scale:	Date:
4119	4119/1	NTS	17-10-16



THE
SITE



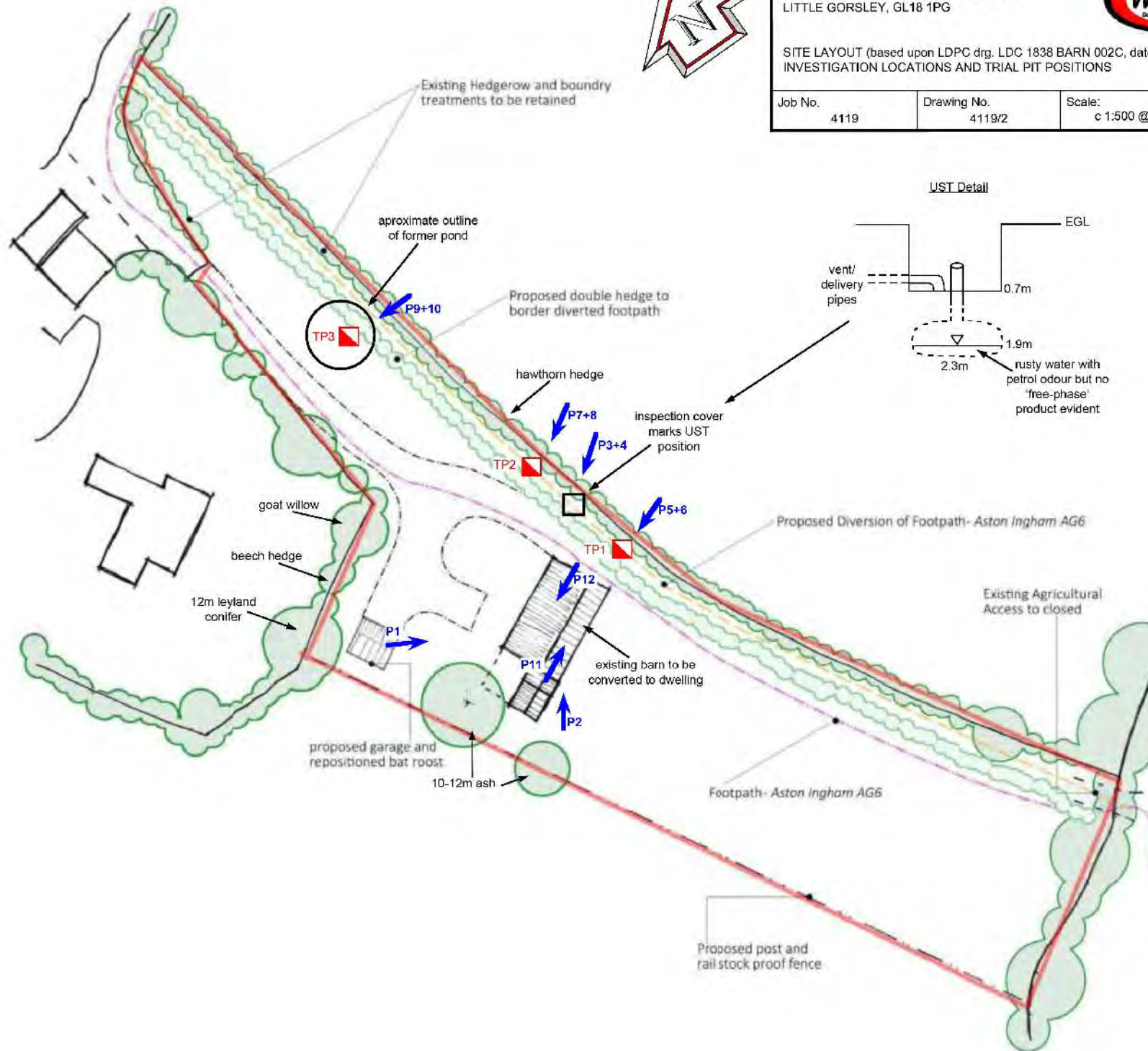


GLENLEITH BARN, ASTON COURT FARM,
LITTLE GORSLEY, GL18 1PG



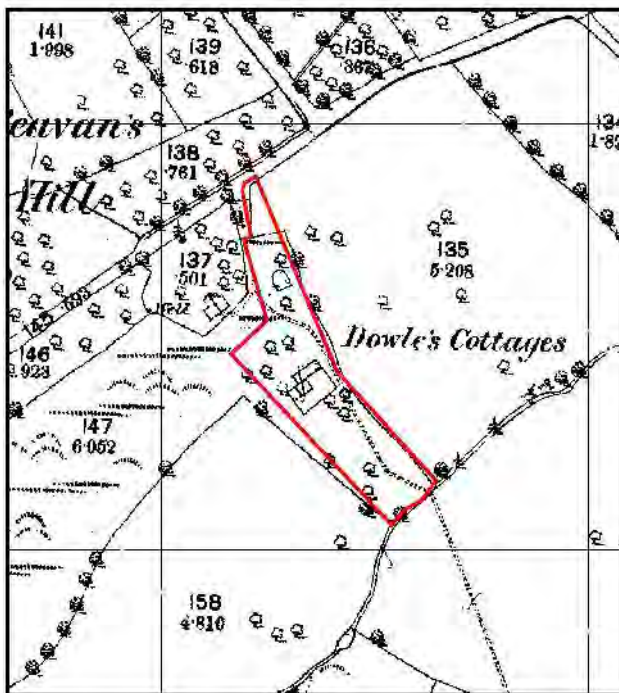
SITE LAYOUT (based upon LDPC drg. LDC 1838 BARN 002C, dated July 2015) SHOWING
INVESTIGATION LOCATIONS AND TRIAL PIT POSITIONS

Job No.	Drawing No.	Scale:	Date:
4119	4119/2	c 1:500 @ A3	17-10-16



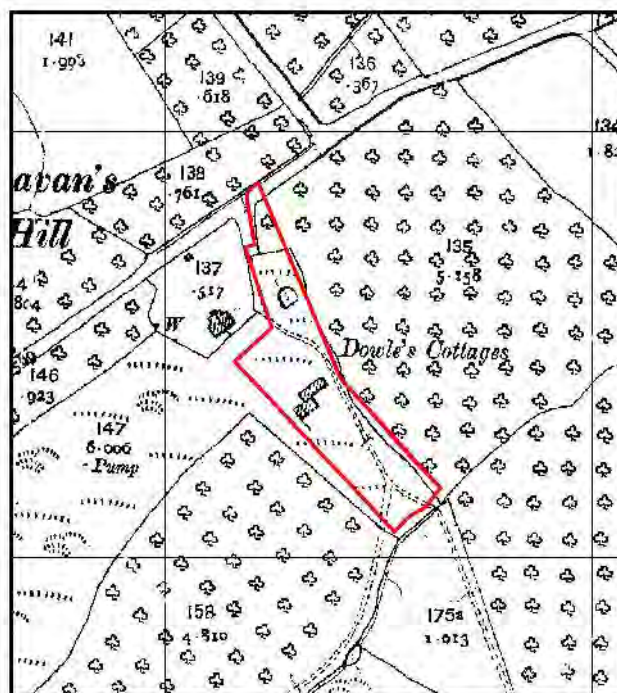
Number and
direction of
photograph
(Appendix 1)

P1



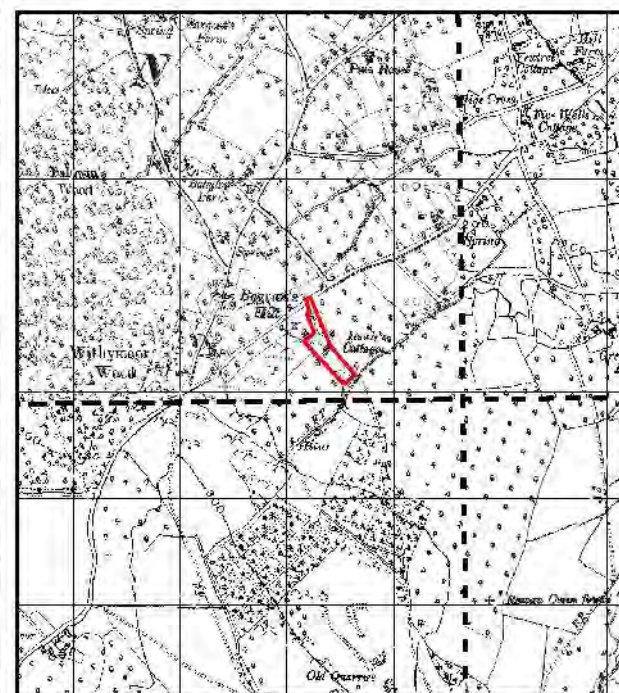
1889

(scale 1:2500)



1904

(scale 1:2500)



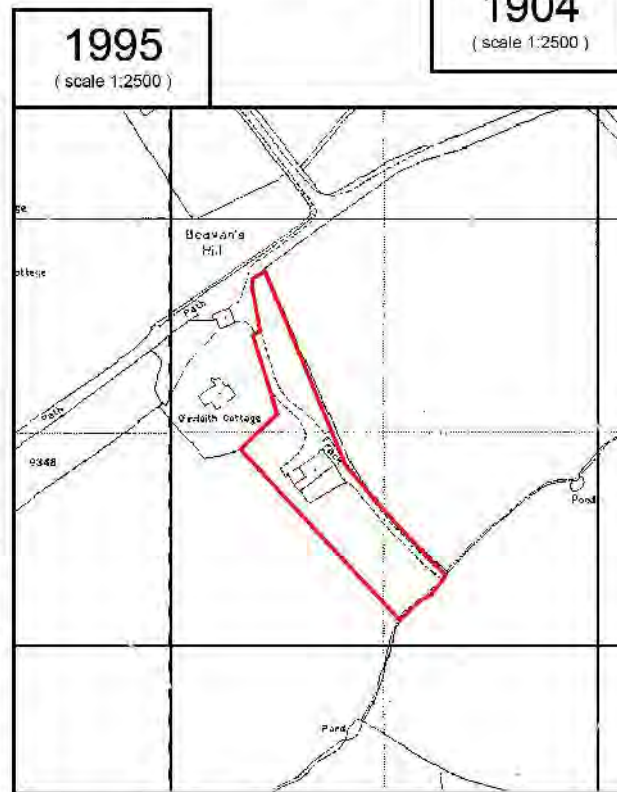
1924

(scale 1:10560)



1970

(scale 1:2500)



1995

(scale 1:2500)



2016

(scale 1:10000)



GLENLEITH BARN, ASTON COURT FARM,
LITTLE GORSLEY, GL18 1PG

EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY

Job No. 4119

Drawing No. 4119/3

Scale: as shown

Date: 17-10-16



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mapping with the permission of the Controller of
Her Majesty's Stationary Office © Crown copyright

Licence No: LAN 1000019

APPENDIX 1

SITE PHOTOGRAPHS



Photograph **P1**: showing northwest elevation of barn



Photograph **P2**: showing clay-tiled roof and plastic guttering



Photograph **P3**: showing UST fill-chamber



Photograph **P4**: showing UST position relative to X corner of barn



Photograph **P5**: showing TP1



Photograph **P6**: showing TP1 arisings



Photograph **P7**: showing TP2



Photograph **P8**: showing TP2 arisings



Photograph **P9**: showing TP3 showing backfilled pond



Photograph **P10**: showing pond backfill



Photograph **P11**: showing internal south side

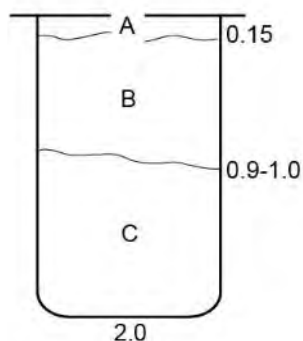


Photograph **P12**: showing internal north side

APPENDIX 2

TRIAL PIT LOGS (INCLUDING PHOTOGRAPHS

Site: GLENLEITH BARN, ASTON COURT FARM, LITTLE GORSLEY, GL18 1PG				TRIAL PIT No. TP3
Job No. 4119	Date 12-10-16	Ground Level (c.m, AOD)	Co-Ordinates (c.)	



DETAILS OF SUBSOIL

- A TOPSOIL: firm, dark brown, silty and organic CLAY
- B MADE GROUND: very loose, whole and broken bottles and broken pottery in dark grey ash matrix; occasional rusty metal and pottery (no significant organics)
- C CLAY: stiff, reddish brown, slightly silty and friable; no evidence of downward leaching of any contaminants

NOTES

- 1 Pit logged from surface
- 2 Pit dry and stable
- 3 Soil samples taken at 0.1m, 0.2-0.9m, 1.0-1.2m and 1.2m depths



Scale: 1:50	Client: Mr J Davies	Logged By: DJW
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APPENDIX 3

CONTAMINATION
STATUTORY FRAMEWORK / METHODOLOGY
AND
CERTIFIED CONTAMINATION TEST RESULTS

A3 CONTAMINATION RISK ASSESSMENT***Statutory Framework***

A3.1 Part 2A of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on the Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only 'contaminated land' where it appears to the regulatory authority, by reason of substances within or under the land, that:

- Significant harm is being caused or there is significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused.

A3.2 In 2012 revised Statutory Guidance for Part 2A of the Environmental Protection Act (1990) came into force for England and Wales. This introduced a new four category approach for classifying land affected by contamination to assist decisions by regulators in cases of Significant Possibility of Significant Harm (SPOSH) to specified receptors, including humans, and significant pollution of controlled waters.

Category 1 describes land which is clearly problematic e.g. because similar sites are known to have caused a significant problem in the past. The legal definition is where "there is an unacceptably high probability, supported by robust science-based evidence, that significant harm would occur if no action is taken to stop it".

Categories 2 and 3 cover land where detailed consideration is needed before deciding whether it may be contaminated land. Category 2 is defined as land where "there is a strong case for considering that the risks from the land are of sufficient concern that the land poses a significant possibility of significant harm". Category 3 is defined as land where there is not the strong case described in the test for Category 2, and may include "land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted". The decision basis is initially related to human health risks, and if this is not conclusive due to uncertainty over risks, wider socio-economic factors (e.g. cost, local perception etc).

Category 4 describes land that is clearly not contaminated land, where there is no risk or the level of risk posed is low.

This same 4 category system has also been introduced to assist in identifying whether there is a significant possibility of significant pollution of controlled waters. Part 2A states that normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise.

Following publication of the revised Statutory Guidance, DEFRA commissioned a research project to develop new Category 4 Screening Levels (C4SLs) to provide a simplified test for regulators to aid decision-making on when land was suitable for use and definitely not contaminated land under the statutory regime. The output from this research project was published by CL:AIRE in December 2013, with Policy Companion Documents published in England by DEFRA in March 2014 and the Welsh Government in May 2014. The culmination of this work was the development of a framework and methodology for deriving C4SLs and the publication of final C4SLs for use as new screening values for six common contaminants.

Further research by LQM on behalf of CIEH led to the publication in 2015 of the Suitable for Use Levels known as S4ULs, and these are now widely adopted as a robust and authoritative source of guidance (see A3.14 below).

Once land has been determined as contaminated land, the enforcing authority must consider how it should be remediated and, where appropriate, it must issue a remediation notice to require such remediation. The enforcing authority for the purposes of remediation may be the local authority which determined the land, or the Environment Agency which takes on responsibility once land has been determined if the land is deemed to be a "special site". The rules on what land is to be regarded as special sites, and various rules on the issuing of remediation notices, are set out in the Contaminated Land (England) Regulations 2006

- A3.3** The UK guidance on the assessment of land contamination has developed as a direct result of the introduction of the above two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document (CLR 11 was

published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by the Department of Environment Food & Rural Affairs and the Environment Agency and updated versions of CLR 9 and 10 were produced in the form of Science Reports SR2 and SR3.

A3.4 The guidance defines 'risk' as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (e.g. exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

A3.5 For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e. a substance that is capable of causing pollution or harm;
- A pathway, i.e. a route by which the contaminant can reach the receptor; and
- A receptor (or target), i.e. something which could be adversely affected by the contaminant.

A3.6 If any one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

A3.7 The presence of contamination is also a material issue in the determination of planning applications, and where a change of use is proposed, especially on brownfield (former industrial) land, investigation, assessment and remediation of contamination is often a requirement of the Planning Authority. The presence of contamination may consequently require remedial action prior to redevelopment, in circumstances which would otherwise be unlikely to result in the determination of the land as contaminated land as defined in the above legislation.

Contamination Assessment Methodology

A3.8 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the preliminary conceptual site model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

A3.9 Stages 1 and 2 develop a '*preliminary conceptual model*' based upon information collated from desk studies and usually a site walkover inspection. The formation of a conceptual site model is an iterative process, and it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

A3.10 The information gleaned from the desk studies and associated enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the preliminary conceptual site model. CLR 8, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes. Whilst it is acknowledged that CLR 8 has been withdrawn no replacement guidance has yet been published that lists the contaminants likely to be present on contaminated sites, thus CLR 8 guidance is still considered relevant.

A3.11 If the preliminary conceptual model identifies potential pollutant linkages, a Phase 2 site investigation is normally recommended, unless appropriate mitigation measures can be incorporated into the proposed development sufficient to negate the identified risks, subject to local planning authority approval. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the preliminary conceptual model can be updated and relevant pollutant linkages identified.

Preliminary Risk Assessment

A3.12 By considering the various potential sources, pathways and receptors, a preliminary assessment of potential risk is made based upon the likelihood of the occurrence and the severity of the potential consequence, the latter being a function of the

sensitivity of the receptor. At Phase 1 desk study stage the qualitative risk assessment is based on the categories tabulated below.

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution to controlled waters
Moderate	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

A3.13 The likelihood of an event (probability) takes into account both the presence of the hazard and receptor and viability of the pathway, and is based on the categories tabulated below.

Category	Definition
Highly likely	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Possible	Pollution linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

A3.14 On this basis potential hazards are assigned a risk rating as shown below.

Probability (Likelihood)	Consequence				
		<i>Severe</i>	<i>Moderate</i>	<i>Mild</i>	<i>Minor</i>
	Highly likely	very high	high	moderate	low
	Likely	high	moderate	low/moderate	low
	Possible	moderate	low/moderate	low	very low
	Unlikely	low/moderate	low	very low	very low

- A3.15** At Phase 2 stage, quantitative assessment of human health risk posed by ground contamination is achieved by comparison of soil concentrations with Tier 1 Category Four Screening Levels (C4SL) published by DEFRA (2014), and/or Suitable for Use Levels (S4UL) as published by LQM/CIEH (2015). The official Soil Guideline Values utilise a soil organic matter content of 6% which is considered to be higher than typical UK soils, however three sets of S4UL's have been developed for organic matter contents of 1%, 2.5% and 6%, thus the most appropriate set is selected based upon proven site conditions.
- A3.16** Contaminant concentrations below the threshold screening values are considered not to warrant further risk assessment. Concentrations of contaminants above these screening values require further consideration of potential pollutant linkages and may indicate potentially unacceptable risks to site users. Such exceedances may trigger a Tier 2 detailed quantitative risk assessment (DQRA) where site-specific parameters are used to derive site specific assessment criteria (SSAC), usually by using the CLEA Model (V1.06 at time of writing). It should be noted that exceedance of a screening value does not necessarily indicate that the site requires remediation.
- A3.17** In order to assess any risk to controlled waters posed by contaminants within the underlying soils and groundwater, laboratory results have been screened against Level 1 Environmental Quality Standard (EQS) values derived from the Water Framework Directive (Standards & Classification) Directions (England & Wales) 2015 and the current UK Drinking Water Supply (Water Quality) Regulations (DWS), dependent upon the most vulnerable receptor. The EQS is usually an upper concentration set for the receiving watercourse and not the discharge itself. The DWS is established for compliance at the point of use or abstraction and not the source area.

[illegible][illegible]

surface of the film. The film thickness is

Scientific Analysis Laboratories Ltd

Certificate of Analysis

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M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 607926-2

Date of Report: 21-Oct-2016

Customer: Wilson Associates (Consulting) Limited
36 Brunswick Road
Gloucester
GL1 1JJ

Customer Contact: Mr David J Wilson

Customer Job Reference: 4119

Customer Purchase Order: 4119/DW

Customer Site Reference: Gorsley

Date Job Received at SAL: 14-Oct-2016

Date Analysis Started: 18-Oct-2016

Date Analysis Completed: 21-Oct-2016

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual



Report checked
and authorised by :
Muhammad Waqas
Project Manager

Issued by :
Muhammad Waqas
Project Manager



SAL Reference: 607926 Project Site: Gorsley Customer Reference: 4119						
Soil Analysed as Soil MCERTS Preparation						
SAL Reference		607926 001		607926 002		
Customer Sample Reference		TP3		TP3		
Bottom Depth		0.1		0.9		
Top Depth				0.2		
Date Sampled		13-OCT-2016		13-OCT-2016		
Type		Topsoil		Sandy Soil		
Determinand	Method	Test Sample	LOD	Units		
Moisture @105C	T162	AR	0.1	%	36	17
					36	17
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1

SAL Reference: 607926 Project Site: Gorsley Customer Reference: 4119						
Soil Analysed as Soil Heavy Metals(9)						
SAL Reference		607926 001		607926 002		
Customer Sample Reference		TP3		TP3		
Bottom Depth		0.1		0.9		
Top Depth				0.2		
Date Sampled		13-OCT-2016		13-OCT-2016		
Type		Topsoil		Sandy Soil		
Determinand	Method	Test Sample	LOD	Units		
Arsenic	T6	M40	2	mg/kg	29	19
Cadmium	T6	M40	1	mg/kg	1	1
Chromium	T6	M40	1	mg/kg	34	42
Copper	T6	M40	1	mg/kg	55	58
Lead	T6	M40	1	mg/kg	160	110
Mercury	T6	M40	1	mg/kg	<1	2
Nickel	T6	M40	1	mg/kg	54	32
Selenium	T6	M40	3	mg/kg	<3	<3
Zinc	T6	M40	1	mg/kg	420	560

SAL Reference: 607926 Project Site: Gorsley Customer Reference: 4119						
Soil Analysed as Soil Miscellaneous						
SAL Reference		607926 001		607926 002		
Customer Sample Reference		TP3		TP3		
Bottom Depth		0.1		0.9		
Top Depth				0.2		
Date Sampled		13-OCT-2016		13-OCT-2016		
Type		Topsoil		Sandy Soil		
Determinand	Method	Test Sample	LOD	Units		
Asbestos ID	T27	AR			N.D.	N.D.
Soil Organic Matter	T287	M40	0.1	%	-	7.7

SAL Reference: 607926 Project Site: Gorsley Customer Reference: 4119						
Soil Analysed as Soil PAH US EPA 16 (B and K split)						
SAL Reference			607926 001		607926 002	
Customer Sample Reference			TP3		TP3	
Bottom Depth			0.1		0.9	
Top Depth					0.2	
Date Sampled			13-OCT-2016		13-OCT-2016	
Type			Topsoil		Sandy Soil	
Determinand	Method	Test Sample	LOD	Units		
Naphthalene	T207	M105	0.1	mg/kg	<0.1	0.2
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	0.2
Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1	0.4

SAL Reference: 607926 Project Site: Gorsley Customer Reference: 4119						
Water Analysed as Water BTEX, MTBE						
SAL Reference			607926 004			
Customer Sample Reference			UST			
Date Sampled			13-OCT-2016			
Sample Received (ml)			1000			
Determinand	Method	Test Sample	LOD	Units		
Benzene	T54	AR	1	µg/l	(100,13)	<10
EthylBenzene	T54	AR	1	µg/l	(100)	<10
M/P Xylene	T54	AR	1	µg/l	(175,27)	13000
Methyl tert-Butyl Ether	T54	AR	1	µg/l	(100)	<10
O Xylene	T54	AR	1	µg/l	(27,175)	10000
Toluene	T54	AR	1	µg/l	(100)	<10
Xylene (Total)	T54	AR	1	µg/l	(175,27)	23000

T207	GC/MS (MCERTS)
T215	GC/MS (Headspace)(LV)
T2	Grav
T287	Calc TOC/0.58
T54	GC/MS (Headspace)
T162	Grav (1 Dec) (105 C)
T27	PLM

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Asbestos ID	T27	AR			SU	001-002
Soil Organic Matter	T287	M40	0.1	%	N	002
Arsenic	T6	M40	2	mg/kg	M	001-002
Cadmium	T6	M40	1	mg/kg	M	001-002
Chromium	T6	M40	1	mg/kg	M	001-002
Copper	T6	M40	1	mg/kg	M	001-002
Lead	T6	M40	1	mg/kg	M	001-002
Mercury	T6	M40	1	mg/kg	M	001-002
Nickel	T6	M40	1	mg/kg	M	001-002
Selenium	T6	M40	3	mg/kg	M	001-002
Zinc	T6	M40	1	mg/kg	M	001-002
Moisture @105C	T162	AR	0.1	%	N	001-002
Retained on 10mm sieve	T2	M40	0.1	%	N	001-002
Naphthalene	T207	M105	0.1	mg/kg	M	001-002
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-002
Acenaphthene	T207	M105	0.1	mg/kg	M	001-002
Fluorene	T207	M105	0.1	mg/kg	M	001-002
Phenanthrene	T207	M105	0.1	mg/kg	M	001-002
Anthracene	T207	M105	0.1	mg/kg	U	001-002
Fluoranthene	T207	M105	0.1	mg/kg	M	001-002
Pyrene	T207	M105	0.1	mg/kg	M	001-002
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-002
Chrysene	T207	M105	0.1	mg/kg	M	001-002
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001-002
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001-002
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-002
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-002
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-002
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-002
PAH(total)	T207	M105	0.1	mg/kg	U	001-002
TPH (C5-C6 aliphatic)	T215	AR	10	µg/l	N	004
TPH (C6-C8 aliphatic)	T215	AR	10	µg/l	N	004
TPH (C6-C7 aromatic)	T215	AR	10	µg/l	N	004
TPH (C7-C8 aromatic)	T215	AR	10	µg/l	N	004
TPH DW(C8-C10 aliphatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C10-C12 aliphatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C12-C16 aliphatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C16-C21 aliphatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C21-C35 aliphatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C8-C10 aromatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C10-C12 aromatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C12-C16 aromatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C16-C21 aromatic)	T81	AR	0.01	mg/l	N	004
TPH DW(C21-C35 aromatic)	T81	AR	0.01	mg/l	N	004
Benzene	T54	AR	1	µg/l	U	004
EthylBenzene	T54	AR	1	µg/l	U	004
m/p Xylene	T54	AR	1	µg/l	U	004
Methyl tert-Butyl Ether	T54	AR	1	µg/l	U	004
O Xylene	T54	AR	1	µg/l	U	004
Toluene	T54	AR	1	µg/l	U	004
Xylene (Total)	T54	AR	1	µg/l	U	004