Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

36 Brunswick Road Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk
www.wilsonac.co.uk
Company No. 6133365

GROUND INVESTIGATION REPORT FOR LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE, HR1 4NN

PREPARED FOR DAVID WATKINS (VIA M F FREEMAN LIMITED)

Report No. 4704

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smas worksafe consultant
SSIP
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CGeol CHARTERED GEOLOGIST
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Client	David Watkins (via M F Freeman Limited)	
Report on	Ground Investigation	
Prepared by	Richard J Stokes BSc (Hons) FGS	[redacted]
Approved by	David J Wilson BSc(Geol) CGeol FGS MIQ	

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CONTENTS

REPORT			Page No.
1	INTRODUCTION		1
2	SITE LOCATION AND DESCRIPTION		2
3	DESK STUDY RESEARCHES		3
	Recorded Geology	*3*	
	Hydrogeology	*3*	
	Hydrology	*3*	
	Site History	*4*	
	Landfill and Radon Gas	*5*	
	Unexploded Ordnance Risk	5	
4	PROPOSED DEVELOPMENT		6
5	PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL SITE MODEL		6
6	GROUND INVESTIGATION REPORT		9
	Site Works	*9*	
	Laboratory Testing - Geotechnical	*10*	
	Laboratory Testing - Contamination	*11*	
	Discussion on Ground Conditions	*12*	
7	GEOTECHNICAL DESIGN REPORT		15
	Strip / Trenchfill Foundations	*15*	
	Buried Concrete Protection	*18*	
	Floor Slabs	*18*	
	Pavement Design	*18*	
	Recommendations for Monitoring of Ground Conditions During Construction	*19*	
8	CONTAMINATION RISK ASSESSMENT AND SOIL WASTE CLASSIFICATION		19
	Human Health	*19*	
	Landfill & Radon Gas	*21*	
	Controlled Waters	*22*	
	Waste Classification For Offsite Disposal Of Arisings	*22*	
	Caveats	*22*	
9	REFINED CONCEPTUAL SITE MODEL		23
10	CONCLUSIONS AND RECOMMENDATIONS		25
11	REFERENCES		27

DRAWINGS	No.
SITE LOCATION	4704/1
EXISTING SITE LAYOUT SHOWING PHOTOS AND WALKOVER NOTES	4704/2
PROPOSED DEVELOPMENT LAYOUT PLAN SHOWING INVESTIGATION LOCATIONS	4704/3
EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY	4704/4

APPENDICES

1 SITE PHOTOGRAPHS

2 BOREHOLE AND TRIAL PIT LOGS (INCLUDING PHOTOGRAPHS)

3 CONTAMINATION STATUTORY FRAMEWORK/METHODOLOGY AND CERTIFIED CONTAMINATION TEST RESULTS

4 CERTIFIED GEOTECHNICAL TEST RESULTS

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1 INTRODUCTION

1.2 Planning Permission has been granted by Herefordshire Council for the above site to be developed with residential dwellings (**planning application number 181112**). This permission is contingent on a number of conditions being satisfied; hence a ground investigation was requested to ascertain the ground conditions for appropriate foundation, ground floor slab, external pavement and soakaway design. A preliminary quantitative contamination risk assessment with regard to potential impacts to human health and/or controlled waters has also been undertaken.

1.2 The geotechnical investigation has been carried out in general accordance with Eurocode 7 'Geotechnical Design', in particular BS EN 1997-1:2004 and 1997-2:2007 and BS EN ISO 14688-1:2002 and 14688-2:2004. The proposed development is considered to fall into the Geotechnical Category 2 classification, thus routine field and laboratory testing methods have been adopted. Reference has also been made to BS5930:2015 Code of Practice for Ground Investigations, and National House Building Council (NHBC) Standards Chapter 4.2 – 'Building Near Trees'.

1.3 The Geo-environmental assessment has been carried out in accordance with BS10175:2011 "Code of Practice for the Investigation of Potentially Contaminated Sites" and EA document CLR 11 "Model Procedures for the Management of Land Contamination".

1.4 This report has been prepared in accordance with quotation reference Q20058, dated 26th February 2020 with instruction confirmed on 20th July 2020 by Ian Green of M F Freeman Limited on behalf of their client David Watkins. Reliance on this report is presently restricted to David Watkins.

2 SITE LOCATION AND DESCRIPTION

2.1 The area under consideration is centred on National Grid Reference 357551, 234672 located on the outskirts of Fownhope in Herefordshire, just off the B4224 as shown on drawing 4704/1.

2.2 The site is an almost rectangular shaped plot of land covering an area of approximately 1.10 hectares. Vehicular access can be obtained from the main road (B4224) to the north through a gate.

2.3 A walkover survey was undertaken by this Practice prior to site investigation and representative photos are presented in Appendix 1. This identified the site to comprise a large agricultural barn/warehouse with a hardstand yard area, small woodland and access track to the north and open field to the south. The barn/warehouse is a typical (presumed) steel portal framed construction with steel cladding and roofing sheets of suspected possible Asbestos Containing Materials (pACM) which appeared to be in good unbroken condition. No internal access for inspection was possible. The yard area predominantly comprised packed gravel with an area of concrete immediately in front of the barn/warehouse. This area was locally strewn with glass and used for the storage of wooden pallets, with a wooden crate containing broken television sets, fridges and other miscellaneous items. To the immediate south of the warehouse were two small mounds of brick, wood and other miscellaneous items. The grassed areas appeared healthy with no evidence of contamination. There are a significant number of on and off-site trees including but not limited to ash, birch, conifer, hawthorn, maple, poplar and oak (refer to drawing 4704/2 for details).

2.4 Topographic mapping data derived from the Google Earth mapping suite indicates the site to have a south-westerly fall of around 7.0m from the northern to southern extremes in line with the general topography of the wider surrounding area, although the warehouse and yard occupy a relatively level area. The site has a recorded elevation of between 43m and 50m above Ordnance Datum (AOD).

3 DESK STUDY RESEARCHES

Recorded Geology

3.1 The geology of the site is shown on the 1:10,000 scale sheet SO 53 SE and online, which indicate it to be underlain by bedrock of the Raglan Mudstone Formation (Rg), characterised as red mudstones and silty mudstones with calcretes and sandstones. The lower two-thirds of the site are overlain by superficial Alluvium (Al) deposits associated with the River Wye off-site to the west, variably comprising clay, silt, sand and gravel. There are no areas of mapped made ground on or within likely influencing distance of the site, however a geological fault runs almost parallel to the north-eastern boundary of the site.

3.2 Whilst the BGS has no useful archive borehole records available from either on or within useable distance of the site, this Practice previously undertook a ground investigation c10m north of the site in the opposite field, which identified bedrock ground conditions (at terminal depths) to be commensurate with geological mapping (although that is different to this site).

Hydrogeology

3.3 The Environment Agency classifies the Rg and Al as "Secondary A" aquifers, meaning that they comprise permeable strata, capable of supporting water supplies at a local rather than strategic level, and in some cases form important sources of base flow to rivers. There are no nearby licensed groundwater abstractors and the site does not lie within a groundwater Source Protection Zone (SPZ).

3.4 Based upon the above information the site is considered to be within an area of low to moderate sensitivity in terms of groundwater resources by virtue of the "Secondary A" aquifer classifications.

Hydrology

3.5 The site itself contains no ponds or watercourses, however the southerly-flowing River Wye is situated c125m west of the site. The Environment Agency does consider the southern third of the site to be at risk of flooding from this source classifying this area as a flood zone 2 and 3, hence it is not intended to build in this area. The existing site surface comprises a mixture of soft surface grass cover, gravel yard, and hardstand;

therefore rainwater infiltration is expected to be high for the former two and negligible for the latter depending on either the natural permeability or existing drainage infrastructure (roof runoff drains via guttering and downpipes but ultimate discharge point is unknown). The site lies within a Nitrate Vulnerable Zone (NVZ) (as does much of the surrounding area).

3.6 Based upon the above information the site is considered to be within an area of low to moderate sensitivity in terms of controlled surface waters by virtue of the proximity of the River Wye.

Site History

3.7 The history of the site has been deduced by inspection of historical Ordnance Survey maps dating back to 1887 together with historical aerial imagery provided as part of the online Google Earth mapping service, and a selection of relevant extracts is presented as drawing 4704/3. Any on and/or off-site points of interest that may affect or be affected by the proposed development have been summarised within Table 1 below.

TABLE 1: SITE HISTORY

Date (Source Map Scale)	On-Site	Off-Site	Potential Contaminants that may affect Site	Likelihood of Site Impact
1887 - 1905 (1:2,500 & 1:10,560)	Part of large undeveloped field with footpath	245m E- "Old Quarry" 140m NW- "Mill Farm" 0m NE – road 50m SE – presumed residential dwelling Predominantly surrounded by fruit orchards and fields	Toxic and phototoxic metals in topsoil	Low
1929 - 1964 (1:2,500, 1:10,560 & 1:10,000)	No significant change	245m E - "Old Quarry" no longer annotated	As above	Low
1973 - 1995 (1:2,500 &1:10,000)	No significant change	General increase in residential development to east 245m E – quarry no longer mapped	As above plus methanogenic emissions	Low
1999 - 2020 (1:2,500 &1:10,000) & present day sitewalkover	Barn/Warehouse constructed	Continued residential development	As above plus Polyaromatic Hydrocarbons (PAH), petroleum hydrocarbons (TPH) and pACM	Low - Moderate

3.8 Please note that Ordnance Survey plans only represent periodic snapshots in time, and do not provide a continuous record of previous site usage, there is therefore a risk (albeit negligible based upon the available mapping) that the site may contain buried remnant foundations of former buildings or waste products associated with unrecorded previous site usage, which may not be evident from the site walkover inspection and desk study researches.

Landfill Gas and Radon Gas

3.9 Consistent with the site history researches the EA landfill register shows no record of either active or historic landfills within potential influencing distance of the site, however, an "Old Quarry" is shown on 1887 site history mapping c245m to the east. Whilst there is a risk that such a feature may potentially contain putrescible material, given its significant age, likely shallow total depth, distance to the proposed site (across developed ground) and the known geological profile of low-permeability clay, the risk is considered to be negligible. Further investigation of site history researches show that there are no additional local features such as clay pits or ponds within influencing distance that may be suggestive of areas of potential methanogenic infill. On the basis of the foregoing unless intrusive ground investigation proves potentially methanogenic materials within the site itself, there should be no requirement for landfill gas protection measures within any proposed development.

3.10 Consultation of the Public Health England "UK maps of radon" online resource indicates 5-10% of homes to be above the actionable level, suggesting that basic radon protection measures are required in new development at this site. This requirement for basic protection is supported by the BRE Radon (2015) guide. This should be as usual confirmed with the local building control officer.

Unexploded Ordnance Risk

3.11 An online review of regional unexploded bomb data on the Zetica website indicates that this area of Herefordshire is considered to constitute a low risk (less than fifteen bombs per thousand acres), and for which a more detailed unexploded ordnance (UXO) assessment is considered unnecessary.

4 PROPOSED DEVELOPMENT

4.1 The site is to be developed with a residential end use consisting of ten residential dwellings comprising a mixture of detached and semi-detached three to four-bedroom houses with associated private gardens, soft landscaping and access road infrastructure. A landscape buffer zone is planned for the southern third of the site which coincides with the recorded flood risk zone. The proposed development layout (based upon Quattro Design Architects drawing No. 6335-F-100 Rev. D dated May 2020) is reproduced as drawing 4704/3.

5 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL SITE MODEL

5.1 The site and its immediate surroundings have been assessed in terms of current and historical land use and the environmental, geological and hydrogeological setting; the methodology of which is described in Appendix 3. In view of the proposed residential development, for risk assessment purposes the **critical receptor** would be a female child (age class 1-6) and our assessment has been progressed on this basis.

5.2 Review of historical mapping suggests that the site has remained as a predominantly undeveloped field site since the earliest mapping of 1887 until construction of the barn in c1999. Given the usage as a potato store shed no significant contamination risks are envisaged.

5.3 In view of the foregoing the potential sources and the **principal contaminants of concern** are presented in Table 2 below.

TABLE 2: POTENTIAL SOURCES AND PRINCIPAL CONTAMINANTS OF CONCERN

POTENTIAL SOURCES		PRINCIPAL CONTAMINANTS OF CONCERN
ON-SITE	Raglan Mudstone Formation	Elevated sulphates/ sulphides
		Naturally elevated Radon
	Topsoil/ unrecorded made ground	Toxic and phytotoxic metals, PAH, TPH and pACM
OFF-SITE	None	None

5.4 The above information is converted into the preliminary Conceptual Site Model shown in Figure 1 below, and the **potential pollutant linkages** involving future residents, proposed services and local environmental receptors are discussed in Table 2, with appropriate risk levels.

FIGURE 1: PRELIMINARY CONCEPTUAL SITE MODEL

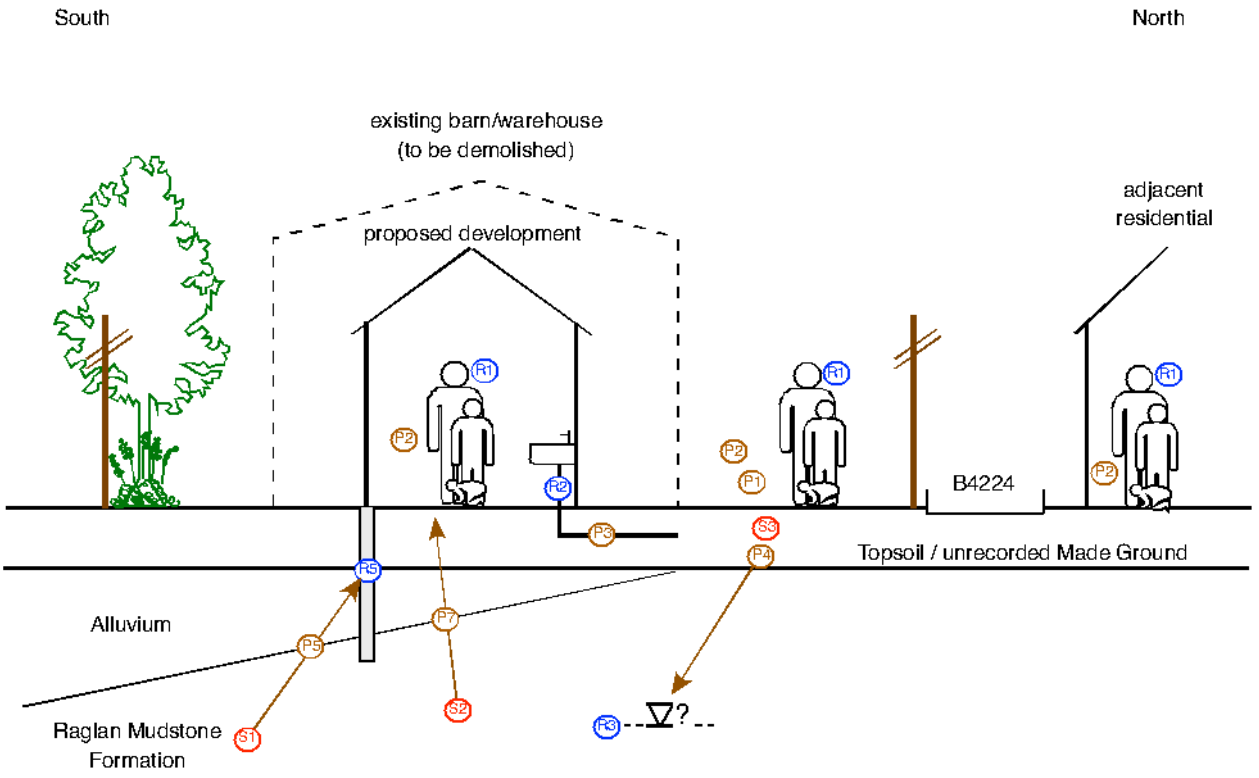


TABLE 3: SUMMARY OF PRELIMINARY POTENTIAL POLLUTANT LINKAGES

Potential Sources	Pathways	Receptors R1	R2	R3	R4	R5	R6	Comments	Preliminary Risk Assessment
ON-SITE									
S1	P1							Potential for naturally elevated sulphate compounds in bedrock geology	Moderate
	P2								
	P3								
	P4								
	P5					X			
	P6								
	P7								
S2	P1							Potential of Radon gas generated with bedrock geology to accumulate within dwellings; BRE document specifies requirement for basic protection measures within new developments	Moderate
	P2								
	P3								
	P4								
	P5								
	P6								
	P7	X							
S3	P1	X						Residential development – greatest risk in areas of proposed gardens and/or soft landscaping, whilst predominantly soft landscaping, made ground anticipated around barn	Low - Moderate
	P2	X					X		
	P3		X						
	P4			X					
	P5								
	P6								
	P7								
OFF-SITE									
NONE	none	-	-	-	-	-	-	-	-

SOURCES	S1	Elevated sulphates in natural bedrock geology (Rg)
	S2	Radon from Natural bedrock geology (Rg)
	S3	On site topsoil or any unrecorded made ground material
PATHWAYS	P1	Direct dermal contact or ingestion of soil attached to 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
RECEPTORS	R1	Future site users (critical residential receptor is female child of age class 1-6)
	R2	Potable water supply
	R3	Groundwater (Raglan Mudstone Formation and Alluvium both classified as "Secondary A" aquifers)
	R4	Surface waters (River Wye c125m W)
	R5	Concrete foundations
	R6	Adjacent site users (residential)

5.5 The findings of the Phase 1 desk study suggest a low to moderate risk that the site may contain contaminants at elevations sufficient to pose a significant risk to human health or environmental receptors. Given the proposed residential development, it was considered prudent to undertake an intrusive ground investigation, the results of which are reported below. All contamination test results have been incorporated into an appropriate quantitative risk assessment to determine risk levels to the obvious receptors in the form of future site users and groundwater quality, as well as those less obvious such as the proposed buildings and infrastructure, such that any necessary remedial measures can be identified and recommended to ensure that the developed site will be "fit for purpose".

6 GROUND INVESTIGATION REPORT

Site Works

6.1 The Phase 2 intrusive investigation took place on 17th August 2020 by way of a combined borehole and trial pitting exercise. The location of all exploratory hole positions were selected by this Practice with due regard to the proposed development layout and in order to achieve an overall site coverage. A CAT electrical service scanner was deployed at surface prior to all intrusive works and as an added precaution all borehole positions were preceded by manually excavated inspection pits to 1.0m depth. No services (recorded or unrecorded) were physically encountered during the intrusive works.

6.2 A total of seven windowless sampling (small diameter) boreholes (WS1-WS7) were drilled to depths of up to 2.00m using an Archway competitor dart drilling rig. In-situ cone penetration tests (CPT) were undertaken at 1.0m intervals in accordance with BS EN ISO 22476-3:2005 to assess the relative density of the material penetrated and these results are indicated on the respective logs in Appendix 2. All arisings were logged by a suitably qualified engineer from this Practice in accordance with Eurocode 7 (BS EN ISO 14688-1:2002 and 14688-2:2004) and representative disturbed samples taken for geotechnical and contamination testing as appropriate. All boreholes were backfilled with compacted arisings and surface soils replaced upon completion of logging and sampling. A detailed description of all the strata encountered, position and types of samples taken and any groundwater observations are included on the borehole logs given in Appendix 2.

6.3 Boreholes were supplemented by six machine-excavated trial pits, five of which (SA1-SA5) were excavated to depths of between 1.00m and 1.85m for infiltration testing purposes; results are presented and discussed further in Section 8, the last position (TP6) was excavated to a depth of 2.70m to determine the groundwater level. A detailed description of all the strata encountered, position and types of samples taken and any groundwater observations are included on the trial pit logs given in Appendix 2 .

Laboratory Testing - Geotechnical

6.4 A number of disturbed samples were taken for routine geotechnical classification testing, comprising moisture content and plasticity determinations, along with classification to the Unified Soil Classification Scheme (USCS) and NHBC Standards, plus acidity and sulphate analysis to BRE Special Digest 1 requirements. Results are tabulated below and presented in Appendix 4..

TABLE 4: INDEX TEST RESULTS AND CLASSIFICATION

WS No.	Depth (m)	Sample of	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Plasticity / USCS	Consistency Index	<425μm (%)	Modified Plasticity Index (%)	Volume Change Potential (NHBC)
WS1	1.00	?Al	16	49	23	26	CIM	1.27	90	23	Medium
WS2	1.50	?Al	21	47	23	24	CIM	1.08	85	20	Medium
WS3	0.50	?Al	10	30	20	10	CIL	2.00	99	10	Low
WS4	1.00	?Al	13	30	18	12	CIL	1.42	100	12	Low
WS5	1.00	?Al	8.6	36	22	14	CIM	1.96	100	14	Low
WS7	0.50	?Al	15	32	17	15	CIL	1.14	95	14	Low
TP6	2.70	Rg	9.2	29	18	11	CIL	1.8	46	5	Non

Classification to EN ISO 14688-2:2004 MG: Made Ground Al: Alluvium Rg: Raglan Mudstone Formation

TABLE 5: CHEMICAL TEST RESULTS AND CLASSIFICATION

BH No.	Depth (m)	Sample of	Total sulphate SO_3 (%)	Total sulphur (%)	Total potential sulphate SO_4 (%)	Oxidisable Sulphides SO_3 (%)	pH value in soil	Water soluble sulphate SO_4 (mg/l)	Design Sulphate Class	Aggressive Chemical Concrete Class
WS1	1.00	?Al	0.045	0.021	0.063	0.018	6.9	10.7	DS - 1	AC - 1
WS2	1.50	?Al	0.022	0.011	0.033	0.011	7.6	24.6	DS - 1	AC - 1

BH No.	Depth (m)	Sample of	Total sulphate SO_4 (%)	Total sulphur (%)	Total potential sulphate SO_4 (%)	Oxidisable Sulphides SO_4 (%)	pH value in soil	Water soluble sulphate SO_4 (mg/l)	Design Sulphate Class	Aggressive Chemical Concrete Class
WS3	0.50	?Al	0.042	0.017	0.051	0.009	7.6	11.5	DS - 1	AC - 1
WS4	1.00	?Al	0.025	0.011	0.033	0.008	7.7	11.7	DS - 1	AC - 1
WS5	1.00	?Al	0.044	0.026	0.078	0.034	7.5	10.7	DS - 1	AC - 1
WS7	0.50	?Al	0.022	0.012	0.036	0.014	7.5	13.3	DS - 1	AC - 1
TP6	2.70	Rg	0.032	0.016	0.048	0.016	8.3	7.9	DS - 1	AC - 1

MG: Made Ground *Al: Alluvium* *Rg: Raglan Mudstone Formation*

Laboratory Testing - Contamination

6.5 The contamination sampling scheme was conducted in accordance with BS10175:2011 with sampling providing general spatial coverage across the site. All test results have been incorporated into an appropriate risk assessment to determine risk levels to the receptors, such that any necessary remedial measures can be identified and recommended to ensure that the proposed development site is 'fit for use'.

6.6 Representative samples of topsoil and natural undisturbed soil were taken from the upper 1.0m of extracted ground. All samples were sent to UKAS accredited i2 Analytical Ltd where analysis selectively comprised the following:

- Toxic and phytotoxic metals
- pH
- Asbestos ID
- Speciated polyaromatic hydrocarbons (PAH)
- Petroleum hydrocarbons (TPH and CWGTPH)
- Soil organic matter

6.7 Given the presence of localised made ground in the vicinity of the barn, the risk to controlled waters has been assessed by leachate analysis on a single representative sample of made ground (WS2/0.50m), which was selectively tested to determine the leachable content of toxic and phytotoxic metals, plus PAH.

6.8 As instructed waste classification and Waste Acceptance Criteria (WAC) testing has been omitted.

6.9 The certified laboratory test results are presented as Appendix 3 and for convenience these have also been summarised to facilitate comparison against assessment criteria. All results and their implications upon the preliminary CSM are further discussed in Sections 9 and 10.

Discussion on Ground Conditions

6.10 Ground conditions appear to not be entirely commensurate with geological mapping, in that the alluvial deposits appear to extend further east than mapped, and are stronger than would normally be expected so possibly represent a "transitional' deposit of Raglan that has been disturbed by fluvial action. Variably beneath a mantle of topsoil or made ground, all boreholes and trial pits initially encountered undisturbed clayey sand/ sandy clay, representing the superficial Al, locally grading into gravel, underlain by clay of the Rg. A summary of the observed strata is presented in Table 6 below, although for specific descriptions of ground conditions, reference should be made to the exploratory hole logs presented in Appendix 2.

TABLE 6: SUMMARY OF OBSERVED STRATA

Stratum	Base Depth (m)	Notes
TOPSOIL: probable soft, brown, organic, variably slightly sandy to sandy, locally gravelly clayey SILT/ silty plastic CLAY with frequent roots from overlying grass.	0.10 – 0.20	Encountered in all exploratory holes excluding WS2, WS7, SA2 and SA4
MADE GROUND: Probable loose, grey, fine to coarse angular GRAVEL of granite	0.25	Encountered in SA4 only
MADE GROUND: probable loose, reddish-brown, organic, sandy, fine to coarse, angular GRAVEL of sandstone with vegetation and roots	0.20	Encountered in SA2 and WS2 only
MADE GROUND: probable soft, mottled reddish-brown and light grey, slightly gravelly, silty CLAY. Gravel is fine to coarse, angular concrete.	0.40	Encountered in SA2 and WS2 only
MADE GROUND: probable medium dense, grey, slightly clayey, fine to coarse, angular GRAVEL of granite.	0.50	Encountered in WS7 only
MADE GROUND: probable medium dense, mottled brown and light grey, slightly clayey, gravelly SAND becoming black and ashy c0.50m depth (buried tarmac). Gravel is fine to coarse angular concrete.	1.00	Encountered in SA2 and WS2 only

Stratum	Base Depth (m)	Notes
Clayey SAND/ sandy CLAY: probable medium dense becoming dense, orangish brown slightly gravelly very silty SAND. *(ALLUVIUM)*	1.00 – 2.45	Encountered in all exploratory holes excluding WS2,
GRAVEL: probable dense, cream slightly sandy GRAVEL. Gravel is fine to coarse angular sandstone with occasional cobbles. *(ALLUVIUM)*	>1.45	Encountered in WS1, TP1
SILT/CLAY: firm to stiff, mottled orangish brown and reddish brown, slightly silty, slightly gravelly to gravelly slightly sandy to very sandy plastic CLAY. Gravel is sandstone and siltstone *(ALLUVIUM)*	0.9 - >2.05	Encountered in WS2, WS3 and TP6 only
Clayey GRAVEL: probable dense, reddish brown sandy silty GRAVEL with occasional cobbles *(RAGLAN MUDSTONE FORMATION)*	>2.70	Encountered in TP6
Perched/Groundwater	N/A	
Roots	Generally site wide within topsoil and near surface made ground Locally deeper in TP6/ 1.60m	
Desiccation	NA	

6.13 Made ground was locally identified up to 1.0m depth. Based upon on-site visual and olfactory examination of the subsoil there was nothing to suggest the presence of obviously significantly contaminated subsoil.

6.14 The near surface alluvial soil was identified as both granular and cohesive in composition and index testing classifies the cohesive elements of this undisturbed material as inorganic clay of mostly low to intermediate plasticity and low to medium-volume change potential in accordance with NHBC Standards. Consistency index (CI) values were recorded between 1.27 and 2.00 suggesting that subsoil (at those borehole locations at least) is desiccated, though given the lack of roots, high granular content, and summer season this is likely a naturally low moisture content. As usual trees would be expected to continue to desiccate the soil throughout the summer months with worst-case conditions expected at the end of the summer season, so depending upon the time of year of development the foregoing may change from that reported. Refusal during testing at unexpectedly shallow depths (which dictated borehole termination) suggests that the very dense clayey sand/gravel material is probably a transitional deposit of reworked Raglan Mudstone, since alluvidal deposits are usually low strength.

6.15 No water entry was recorded in any of the exploratory holes. Please note that perched/groundwater levels are of course subject to seasonal fluctuation according to prevailing weather conditions, and the situation encountered and described above could potentially change in the future, especially in a period of seemingly ever-apparent but unpredictable climate change.

Soakaway Drainage Feasibility

6.16 Infiltration analysis, performed as full-scale soakaway tests were undertaken within five designated trial pits across the site, with infiltration rate calculations subsequently carried out, where possible, in general accordance with BRE 365 guidance; results are presented in Table 7 below.

TABLE 7: SUMMARY OF PERCOLATION TEST RESULTS

SA No.	Test No. and Test Response Zone (m)	Geology	Calculated Soil Infiltration Rate (m/sec)	Time to drain to 50% storage (hours)
SA1	Test 1 (0.43 – 1.15)	Al?	2.60×10^{-6}	10
SA2	Test 1 (0.67 – 1.65)	MG/Al?	1.40×10^{-6}	19
SA3	Test 1 (0.47 – 1.50)	Al?	NA	NA
SA4	Test 1 (0.63 – 1.85)	MG/Al?	3.60×10^{-6}	8
SA5	Test 1 (0.37 – 1.00)	Al?	6.60×10^{-6}	4

MG: Made Ground *Al: Alluvium* *Rg: Raglan Mudstone Formation*

6.17 As previously noted in 6.15, no water seepages/ groundwater strikes were encountered within any of the exploratory holes during the intrusive investigation.

6.18 On the above basis, although soil infiltration rates have been calculated these are at lower end of viability suggesting only very marginal suitability for the adoption of shallow and deep soakaway (SuDS) drainage and permeable paving for on-site disposal of surface water; this is likely attributable to the proportion of fines (silt/clay) at that particular location. It is also important to note that owing to the recent sustained dry period, and given the cohesive nature of elements of the superficial Al, the infiltration testing results are not considered representative of worst-case conditions likely prevalent during the wet winter months.; therefore the adoption of soakaway drains is not advised and instead, alternative drainage options should be considered such as rainwater harvesting or other attenuation measures. In the case of the latter it will be necessary to provide evidence to the local drainage authority that the

construction of soakaways within the site is not practical given the generally impermeable nature of the underlying geology. It is understood that these results will be provided to the drainage consultant for their use in design of the site drainage strategy.

7 GEOTECHNICAL MODEL AND RECOMMENDATIONS FOR FOUNDATION DESIGN

7.1 The site investigation works achieved by the seven boreholes and six trial pits have proven ground conditions beneath the site not entirely be in accordance with recorded mapping in that alluvial deposits appear to extend further east than mapped and are stronger then would normally be expected so possibly represent a 'transitional' deposit of Raglan that has been disturbed by fluvial action. Variably beneath a surface mantle of topsoil and localised made ground all boreholes and trial pits encountered undisturbed clayey sand / sandy clay of the recorded superficial Al, locally grading into gravel, underlain by clay of the Rg.

7.2 In the absence of definitive information pertaining to structure and/or anticipated design loads etc, foundation recommendations at this stage are relatively generic, based upon assumed/envisaged methods of construction in light of the ground conditions encountered.

Strip / Trench-fill Foundations

7.3 The natural weathered cohesive soils of the near surface natural soils in the worst case classify as intermediate plasticity and of medium volume change potential, therefore (following NHBC Standards) a minimum founding depth of 0.90m is required, or greater within the radius of influence of trees and obviously subject to those foundations also penetrating through any localised softer or disturbed deposits (including any made ground etc) to found in competent undisturbed and normally hydrated natural material.

7.4 Consideration has been given as to whether any foundation deepening is required (beyond the aforementioned minimum) to account for potential tree root activity. Site observations indicate that there are a significant number of semi-mature to mature trees on-site (particularly in the northern third of the site) including but not limited to

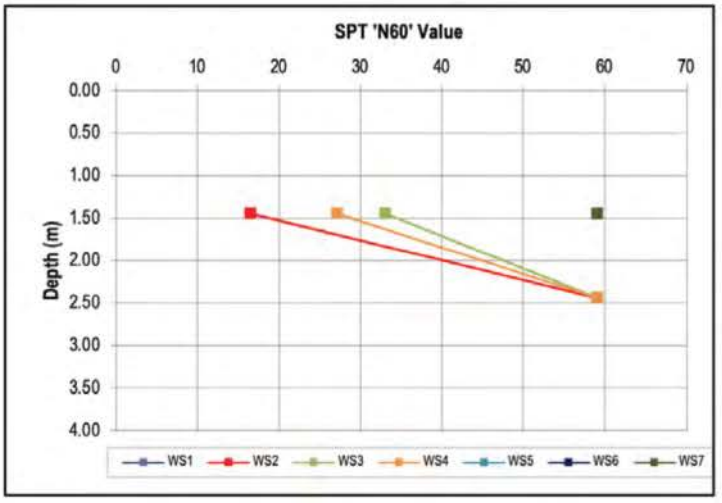
oak, poplar, hawthorn and cypress (of high-water demand) and ash, sycamore and spruce (of moderate water demand). Plot-specific foundation depths would therefore need to be calculated for those plots affected by future root growth and possible existing desiccation, once the proposed layout has been finalised.

7.5 Design calculations in Eurocode 7 (BS EN 1997-1) require the establishment of design values for actions, ground properties and ground resistances, definition of the limits that must not be exceeded (usually a serviceability limit state), the setting up of calculation models for the relevant ultimate or serviceability limit state, and showing by such calculation that these limits will not be exceeded. Design values for such calculations are derived by applying partial factors to characteristic values for actions, ground properties and ground resistances, and based upon the foregoing geotechnical model and following the requirements of Design Approach 1, both Combination 1 and Combination 2 calculations have been undertaken. This Practice has adopted the Combination 2 calculation for foundation design as this applies partial factors to resistances rather than actions and therefore provides a slightly more conservative value. Calculation sheets can be presented upon request.

7.6 BS EN 1997-2:2007 and BS EN ISO 22475-1:2006 require quality class 1 samples for determination of soil shear strength, and such samples can only be obtained by category A sampling methods. To avoid the costly complexities of such sampling in-situ tests can alternatively be undertaken, the borehole standard penetration test (SPT) being a commonly adopted method. Field results are adjusted or 'normalised' in accordance with Eurocode requirements (BS EN ISO 22476-9:2009), to enable the generation of characteristic values of undrained shear strength that can then be used for determination of bearing resistance as described above.

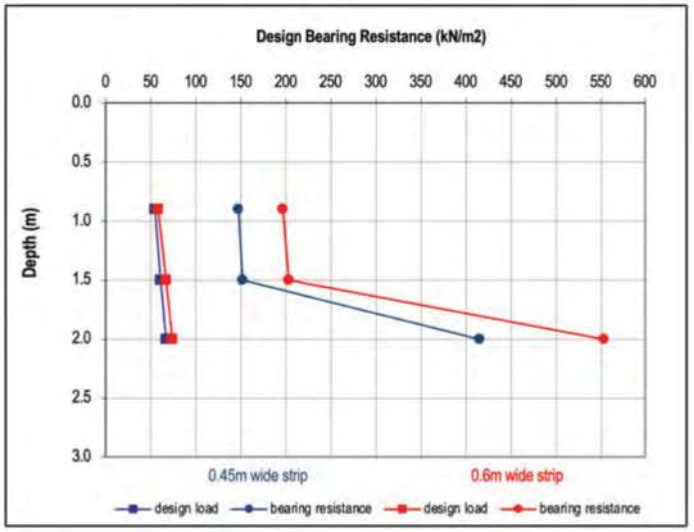
7.7 Uncorrected SPT N-values are shown on the borehole logs and normalised N-values shown are also presented as N_{60} versus depth in Figure 2.

FIGURE 2: SPT 'N_{60}' VALUE -v- DEPTH



7.8 By adopting a conservative characteristic SPT N_{60} value of 14 at 0.90m depth, based on a conventional two-storey residential line load of 45kN/m, the design bearing resistance (bearing capacity) for a standard 0.6m wide strip/trench-fill foundation is estimated to be approximately 194kN/m^2, which exceeds the likely bearing pressure of 58kN/m^2 and confirms suitability. Similar calculations also demonstrate suitability for 0.45m wide foundations at this depth, with a bearing capacity of 147kN/m^2 which exceeds a likely bearing pressure of 55kN/m^2. The design bearing resistance continues to increase with increasing depth so greater founding depths will also be sufficient for the proposed development. The design bearing resistance is plotted against depth in Figure 3 below.

FIGURE 3: DESIGN BEARING RESISTANCE -v- DEPTH



Buried Concrete Protection

7.9 The results of acidity and sulphate testing presented in Table 5 show that buried concrete associated with foundations (up to depths of 4.00m) and floor slabs can be designed to standard Design Sulphate Class DS-1 and Aggressive Chemical Environment for Concrete Class ACEC-1 in accordance with BRE Special Digest 1 (2005) i.e. no special sulphate resistance is required.

7.10 Shallow excavations should remain stable and in the short term whilst it is not anticipated that groundwater will be encountered at the minimum founding depth some minor seepage may be encountered near surface. It may be prudent to have a pump extraction system on hand and to ensure that concrete is poured soon after foundation trench excavation to ensure that any perched water is not allowed to settle on and potentially soften the founding horizon. As always please be aware that perched/groundwater levels may vary seasonally, and water may therefore be encountered at levels in variance to those recorded by this investigation. It is recommended that any excavations are not left open and unsupported for any longer than necessary.

Floor Slabs

7.11 Those buildings in the zone of influence of trees will require heave protection in the form of a 50mm thick compressible membrane against the inside face of all external foundations deeper than 1.5m in order to overcome unbalanced lateral heave forces (unless the appointed Building Control inspector is satisfied that the soil is not desiccated at the time). Such protection should be applied on the inner face of external foundation walls only, with the lower 0.5m left unprotected. It is recommended that all plots adolt fully suspended ground floor slabs, which should incorporate a subfloor void of 100mm for in-situ concrete or 250mm for pre-cast concrete and timber floors (which will also assist with the requisite basic radon protection requirement).

Pavement Design

7.12 With regard to road/pavement design, near surface plasticity results, compared to Highways Agency Interim Advice Note 73/06, Rev 1 (2009), indicate a CBR value of circa 3-6% for near-surface soils, although it is recommended that in-situ CBR testing be carried out closer to the time of construction to obtain a more accurate site-specific

value. The soils are unlikely to be frost-susceptible, however the Local Authority should be able to advise based upon their previous experience in the area.

Recommendations for Monitoring of Ground Conditions During Construction

7.13 In view of the importance of founding on/ within natural ground, a careful watch must be maintained during all foundation excavations to ensure that this requirement has been satisfied.

7.14 Consideration should be given to access into/around the site since the surface soils have the potential to be subject to softening during periods of sustained wet weather.

7.15 Due to the potential for cohesive soils to shrink and swell, inspection during foundation excavations should ensure that no live roots or evidence of desiccation is visible at the founding horizon.

7.16 In the event of any doubt in the above matters, this Practice would be pleased to attend site as instructed.

8 CONTAMINATION RISK ASSESSMENT AND SOIL WASTE CLASSIFICATION

Human Health

8.1 The contamination risk assessment has been carried out in general accordance with the methodology described within Appendix 3. Table 8 below presents a comparison of laboratory test results with guideline values (LQM/CIEH S4UL). The 'deterministic' CLEA software model (Version 1.07) has been used to generate Tier 2 site-specific assessment criteria (SSACs) as necessary, based upon contamination test results from this investigation.

TABLE 8: COMPARISON OF SOIL CHEMICAL TEST RESULTS WITH GUIDELINE VALUES

Determinant	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Residential with plant uptake (mg/kg) $	Tests Undertaken (No.)	Exceedances (No.)	Notes
Arsenic	32	37	10	0	
Cadmium	0.5	11	10	0	
Chromium	34	910*	10	0	
Chromium VI	<1.2	6	10	0	
Copper	44	2,400	10	0	
Lead	72	200 **	10	0	
Mercury	<0.3	40	10	0	
Nickel	35	130	10	0	
Selenium	2	250	10	0	
Zinc	120	3,700	10	0	
PAH compounds	5.1 (Benzo(b)fluoranthene) 4.0 (Benzo(a)pyrene) 0.55 (Dibenz(a,h)anthracene)	3.7 (Benzo(b)fluoranthene) 3.0 (Benzo(a)pyrene) 0.30 (Dibenz(a,h)anthracene)	10	1	TP2/0.0m
TPH compounds (C6 – C40)	450	Various	5	0	
TPHCWG compounds (Aliphatic)	410	Various	1	0	
TPHCWG compounds (Aromatic)	1400	Various	2	0	
Asbestos	ND	N/A	5	0	
Notes:					
** provisional C4SL					
$ based on soil organic matter = 6%					
ND = Non-Detect					

8.2 It will be seen from the above table and summary sheet presented in Appendix 3 that concentrations of all individual toxic and phytotoxic metals, TPH and TPHCWG compounds fall below Tier 1 C4SL/S4UL levels. It is noted however, that a single sample has recorded mild elevations of PAH compounds. This may pose a risk to the health of future site users and has been considered in more detail below.

8.3 In view of the sites historical and current agricultural/commercial usage the presence of ACM was unlikely, nevertheless five samples were subject to asbestos analysis, all of which returned non-detect results, therefore there is no requirement for further analysis or remedial measures.

8.4 A Tier 1 risk assessment has identified elevations of three PAH compounds (see table 8) within a single sample of made ground (SA2/0.00m), which exceed the 'residential' S4UL, therefore progression has been made to a Tier 2 site-specific assessment. The PAH compound values classify as outliers to the main population of results so not only will remedial action (probably selective removal) be necessary to protect human health but prior to that, further investigation is recommended to determine if this result represents a larger area of significant contamination. Consideration of remedial options should be deferred until the results of further investigation are assessed and the affected area and soil volume more accurately delineated.

Water Supply Pipework

8.5 Consideration has been given to the potential effects of recorded concentrations on new water utility pipework. Whilst there are nominal exceedances of certain organic contaminants (as discussed prior) there ought to be no requirement for upgraded barrier pipework as supported by the majority of contamination testing undertaken as part of this investigation. As always it is recommended that advice be sought from the local regulatory authority prior to ordering pipework, since it is possible that their specific in-house thresholds may differ from those within the most recent guidance by UK Water Industry Research (UKWIR) report "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (2010).

Landfill Gas and Radon Gas

8.6 It was previously established in the desk study researches that the site is unlikely to be affected by landfill-type gases. The boreholes and trial pits have since found no evidence of methanogenic material beneath the site and thus landfill gas protection measures are not considered necessary within new development.

8.7 BRE records indicate that the site lies within an area where basic radon protection measures are required within new developments, although it is recommended that local building control be contacted to confirm their minimum requirements.

Controlled Waters

8.8 The risk to controlled waters has been assessed by leachate analysis on a single representative sample of made ground, which was selectively tested to determine the leachable content of toxic and phytotoxic metals, plus PAH. Consistent with the soil phase results it will be seen with Appendix 3 that there are no recorded and/or significant elevations exceeding WFD, EQS or UK DWS levels, and on this basis it is considered that the site does not pose a significant risk to controlled waters or groundwater resources and pre-construction remedial action is not currently considered necessary.

Waste Classification for Off-Site Disposal of Arisings

8.9 In accordance with current legislation all soil arisings generated for disposal as part of this development site are by definition a "commercial waste" and will be classified as both a directive and a controlled waste. Should it be necessary to remove from site any surplus excavation arisings, topsoil or undisturbed ground, then as per the European Waste Catalogue (EWC) these will be coded 1705, that is "soil (including excavated soil from contaminated sites), stones and dredging spoil".

8.10 It is expected that, where possible, excavation/construction arisings will be retained on-site. As such, in line with the client's instructions, Waste Classification of materials has been omitted. However, if/where such assessment is required, this Practice would be happy to assist.

8.11 Supplementary Waste Acceptance Criteria (WAC) testing will be required if/where landfill disposal is to be considered; this Practice can advise further if necessary.

Caveats

8.12 In line with best industry practice the scope of contamination testing has been based upon the site history, current 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.

8.13 The 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).

8.14 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.

9 REFINED CONCEPTUAL SITE MODEL

9.1 In view of the above discussions the preliminary conceptual site model has been refined as shown in Figure 4 and Table 9 below.

FIGURE 4: REFINED CONCEPTUAL SITE MODEL (NTS)

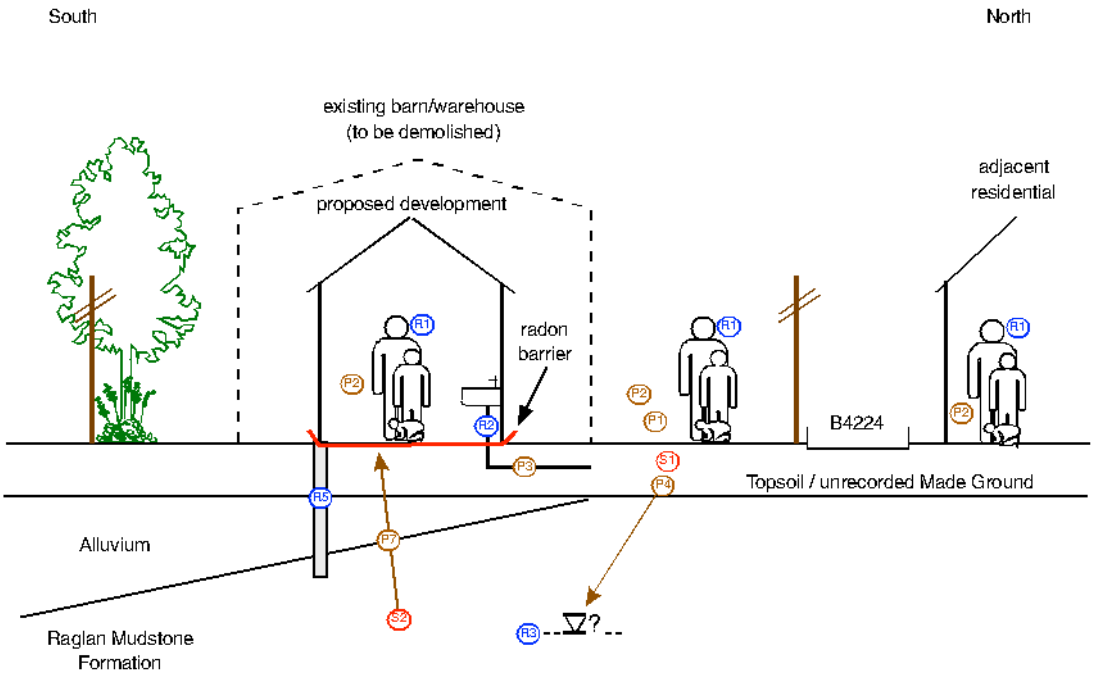


TABLE 9: SUMMARY OF POTENTIAL / IDENTIFIED POLLUTANT LINKAGES

Potential Sources	Pathways	Receptors R1	R2	R3	R4	R5	R6	Comments	Refined Risk Rating	Remedial/Mitigation Requirements
ON-SITE										
S1	P1	X						Localised elevation of PAH compounds recorded within near surface made ground	Moderate	Supplementary investigation recommended to delineate area and volume of soil affected
	P2	X					X			
	P3									
	P4									
	P5									
	P6									
	P7									
S2	P1							Basic radon protection measures required within new developments to break the pathway	Negligible	Radon barrier to be incorporated in all ground floor slabs
	P2									
	P3									
	P4									
	P5									
	P6									
	P7	X								
OFF-SITE										
None										

SOURCES	S1	Localised PAH compounds elevation
	S2	Radon gas generated by natural bedrock geology
PATHWAYS	P1	Direct dermal contact or ingestion of soil attached to 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
RECEPTORS	R1	Future site users (critical residential receptor is female child of age class 1-6)
	R2	Potable water supply
	R3	Groundwater (Raglan Mudstone Formation and Alluvium both classified as "Secondary A" aquifers)
	R4	Surface waters (River Wye c125m W)
	R5	Concrete foundations
	R6	Adjacent site users (residential)

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 The foregoing discussions and recommendations are based upon the results of a geo-environmental desk study, followed by intrusive ground investigation comprising boreholes and trial pits plus laboratory geotechnical and contamination testing. The intrusive works appear to present a consistent pattern of subsoil conditions, beneath a variable mantle of either made ground or topsoil, all exploratory holes comprise superficial sandy clay / clayey sand of the superficial Al, locally grading into gravel, and locally terminating in bedrock of the Rg. As always however a careful watch should be maintained for any anomalous conditions during site stripping and excavation, which should be reported back to this Practice for further investigation and assessment.

10.2 Based upon historic Ordnance Survey mapping the site has remained as a predominantly undeveloped field site since the earliest mapping of 1887 until construction of the barn in c1999.

10.3 The intrusive investigation has proven a superficial mantle of either topsoil or made ground, underlain by a mixed mantle of cohesive and granular elements representing the superficial Al, locally underlain by bedrock of the Rg. Boreholes remained dry and stable during the time that they were left open and the short-term stability of side walls within open excavations is unlikely to be an issue during construction, however groundwater levels do vary seasonally and care should be taken if development is proposed during traditionally wetter winter months as a potentially higher water table (not encountered during this investigation) may then result in an adverse effect upon short-term side wall stability. As always it is recommended that any excavations are not left open and unsupported for any longer than necessary.

10.4 Foundations will need to penetrate any near surface disturbed, softer or desiccated ground to found within normally hydrated soils of the Al or Rg at a minimum depth of 0.90m, and adequate bearing resistance has been calculated (see **Section 7** for specific details). For those buildings within the zone of influence of existing trees foundation deepening will be required, and we can undertake further assessment once the proposed development layout has been finalised. Suspected ground floor slabs are recommended for al plots.

10.5 Buried concrete in any open excavations can be constructed with a classification of Design Sulphate Class DS-1 and Aggressive Chemical (AC) Class AC-1 in

accordance with BRE Special Digest 1 (2005) i.e. special sulphate resistance measures are unnecessary.

10.6 In terms of proposed external pavement design CBR values of between 3-6% have been determined which indicate such material at a depth horizon of 0.50m should be suitable for road-pavement design and such material is unlikely to be frost susceptible. As always we recommend that in-situ tests be undertaken closer to the time of construction.

10.7 Full-scale soakaway tests undertaken within five trial pits across the site have suggested only very marginal potential, soakaway drainage suitability, and given that this assessment was performed during a period of sustained dry weather, they are not considered representative of worst-case conditions during the wetter winter month, therefore an alternative method of rainwater disposal (such as on-site attenuation)will need to be utilised.

10.8 A detailed ground contamination risk assessment indicates that the site is mostly uncontaminated however a single outlier of elevated PAH compounds was recorded within near surface made ground that presents a possible risk to human health (refer to Section 8 for details). Further investigation and assessment in this area has been recommended prior to establishing the most appropriate remedial action to render the site "fit for use". There is no perceived risk to controlled waters.

10.9 Formal waste classification, pertaining to material potentially to be disposed of off-site, was not required though can be performed (based upon existing contamination test results), if deemed necessary. Supplementary WAC analysis will be required if/where controlled landfill disposal as inert waste is to be considered.

10.10 There is no requirement for landfill gas protection measures, however in line with BRE records basic radon protection measures are necessary within new construction at this site.

10.11 Should planning consent be subject to certain conditions, this report and attachments should be lodged with the local planning authority, such that they can update their records.

10.12 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 geotechnical/geo-environmental specialist. This report is subject to our standard terms and conditions.

11 REFERENCES

Geotechnical

BS EN 1997-1:2004 'Geotechnical Design - *General Rules*'

BS EN 1997-2:2007 'Geotechnical Design - *Ground Investigation and Testing*'

British Standards Institute, BS5930:2015 *'Code of Practice for Ground Investigations'*

National House Building Council (NHBC) Standards: Chapter 4.2 *'Building Near Trees'* (2016)

BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1 Identification and Description'* (2002)

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CIRIA C735:2014 *'Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases'*

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The Water Supply (Water Quality) Regulations 2000 (Amendment) Regulations (2007)

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Technical Guidance Waste Management 3 (TGWM3, EA Version 3.0, May 2015)

Building Research Establishment (BRE)- *'Cover Systems for Land Regeneration'* (2004)

Landmark Historical Mapping Ref 180706967_1_1 dated 21st September 2018

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

Zetica (www.zetica.com)

Google Earth (current and historical aerial mapping plus street view)

UK Grid Reference Finder (www.gridreferencefinder.com)

Haz-waste online

LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE
HEREFORDSHIRE HR1 4NN

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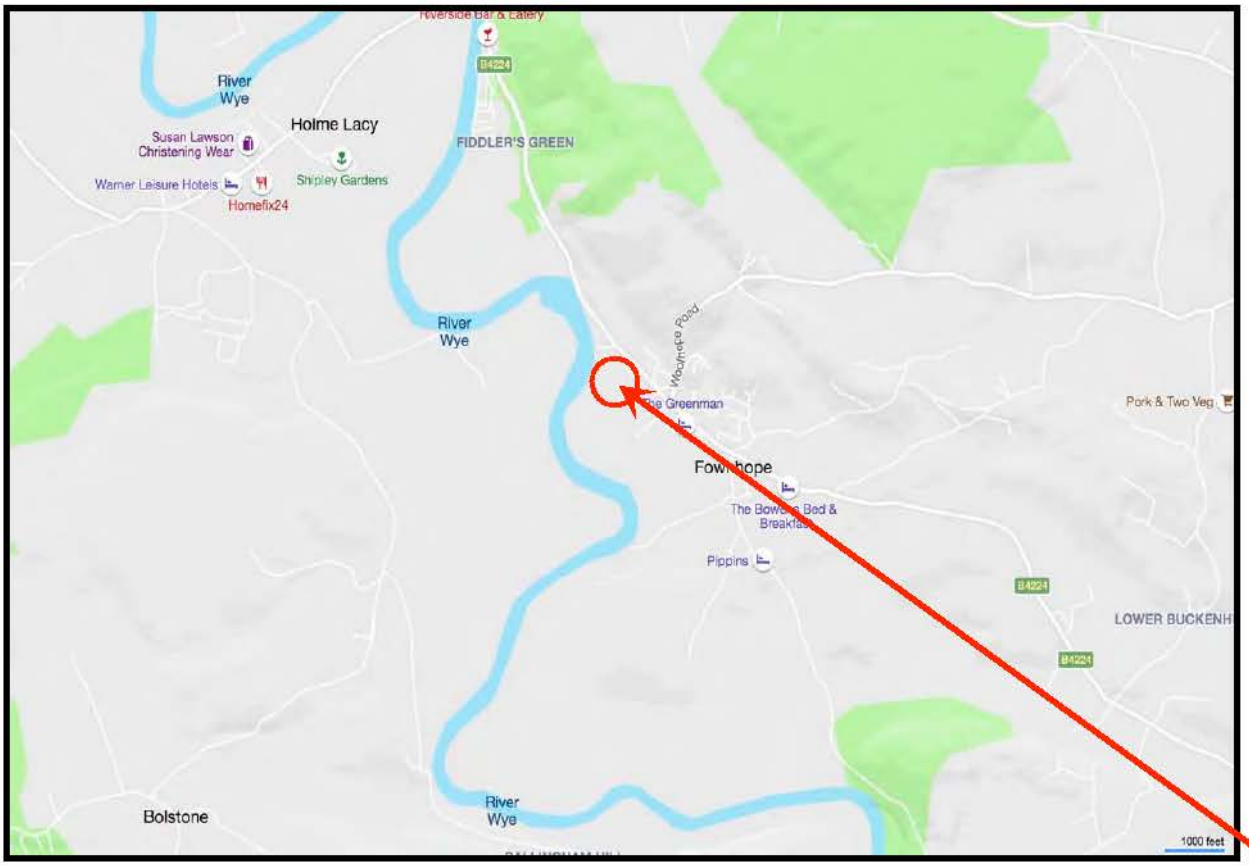
SITE LOCATION (based on Microsoft Bing & Google Earth Mapping)

Job No.	Drawing No.	Scale:	Date:
4704	4704/1	NTS	20-08-20



N

THE SITE

LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN

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EXISTING SITE PLAN (based upon Andrew P Jones drg. 41-101-B, dated April '15) SHOWING SITE WALKOVER NOTES

Job No.	Drawing No.	Scale:	Date:
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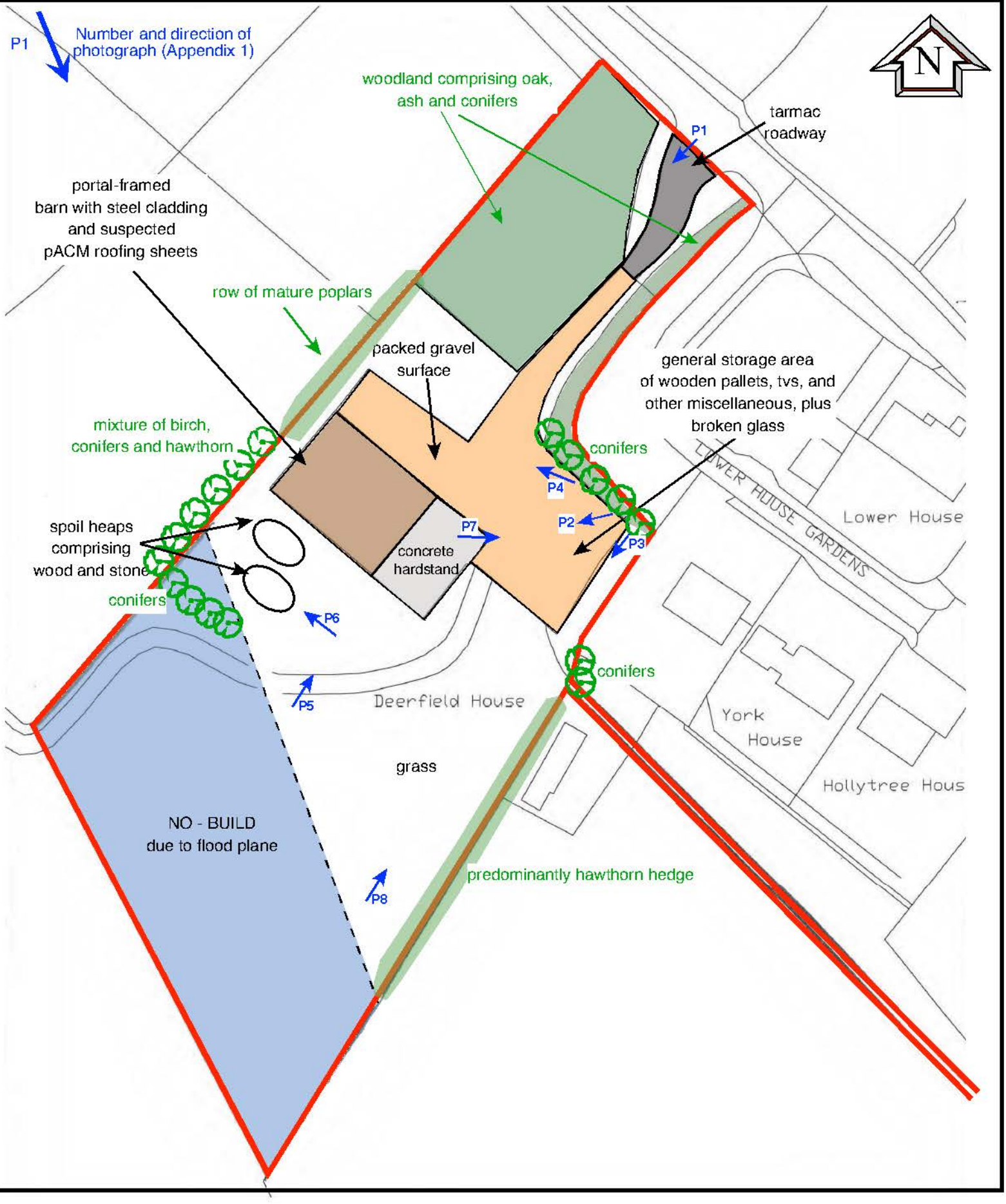

LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN

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PROPOSED DEVELOPMENT LAYOUT (based upon Quattro drg. 6339-F-100 Rev D, dated May '20) SHOWING INVESTIGATION LOCATIONS

Job No.	Drawing No.	Scale:	Date:
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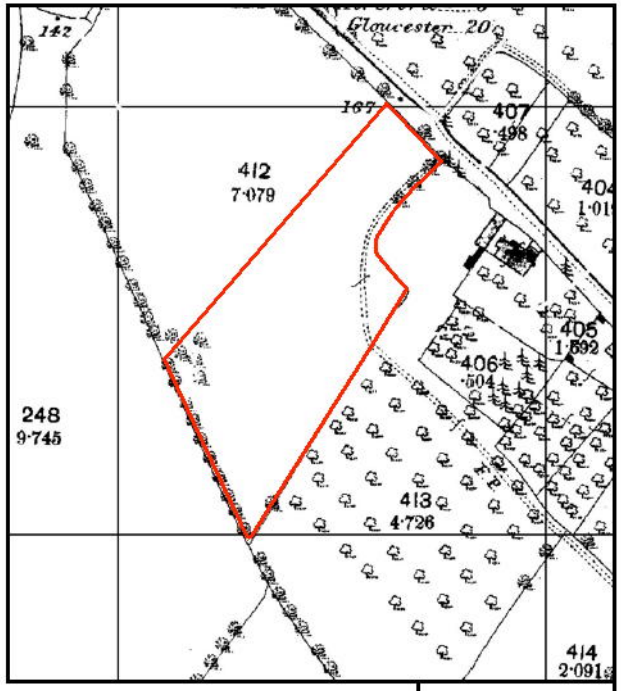

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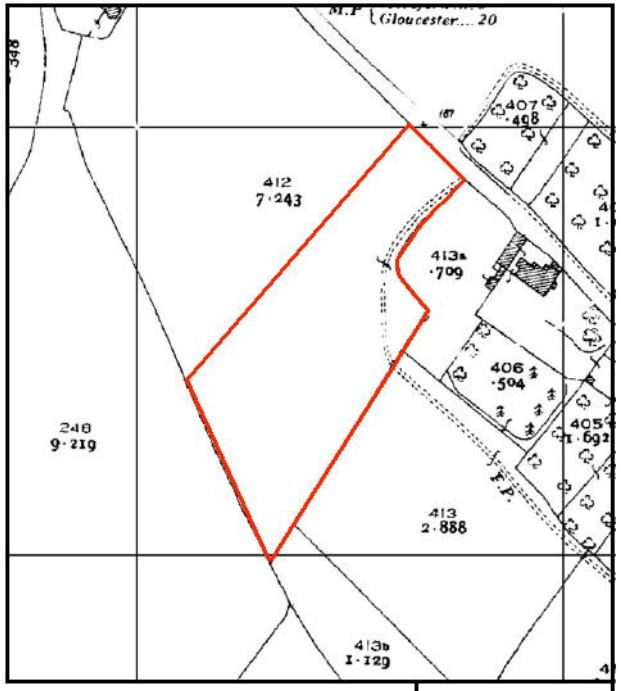

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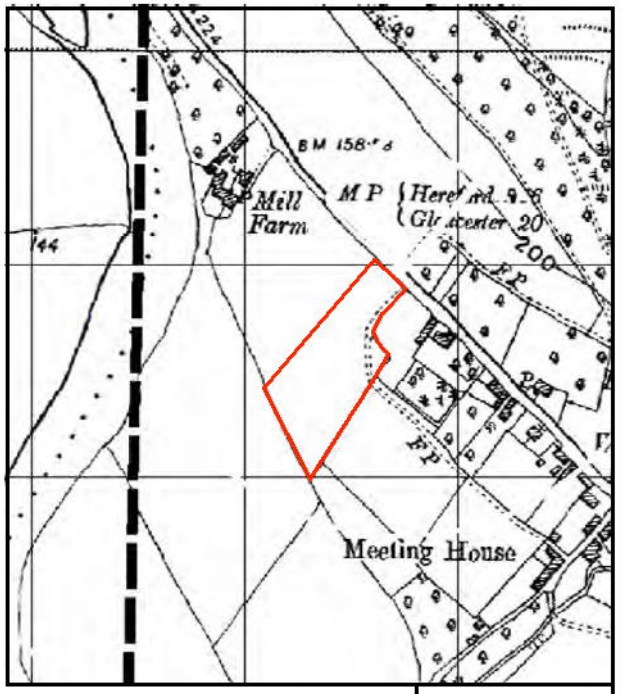

1952-53
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1973-74
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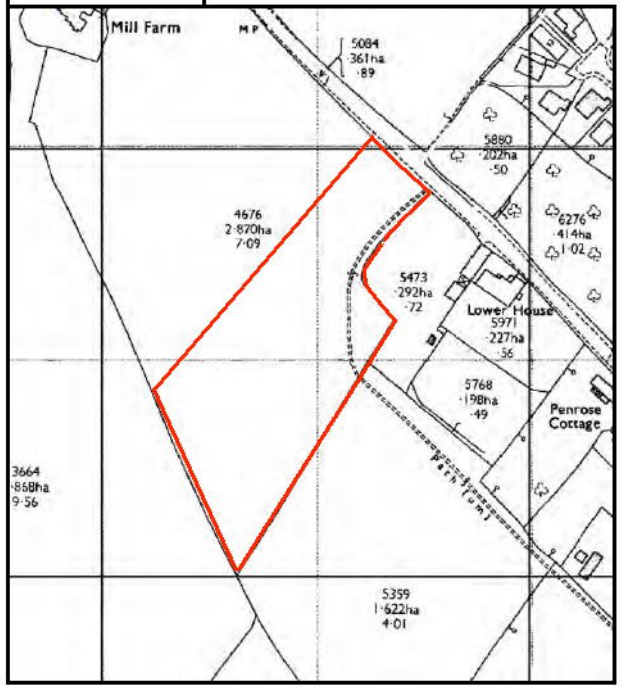

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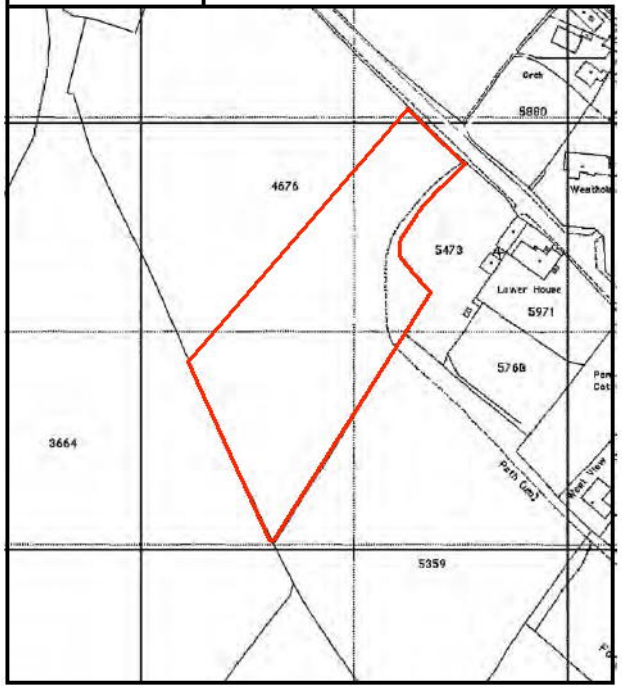

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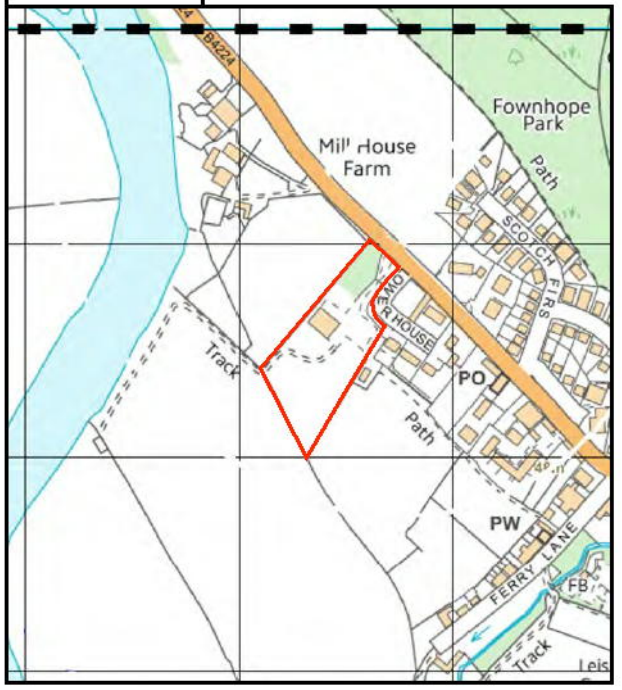

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LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE
HEREFORDSHIRE HR1

EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY

Job No.	Drawing No.	Scale:	Date:
4704	4704/4	as shown	20-08-20

APPENDIX 1

SITE PHOTOGRAPHS

Photograph **P1**

Photograph **P2**

Photograph **P3**

Photograph **P4**

Photograph **P5**

Photograph **P6**

Photograph **P7**

Photograph **P8**

APPENDIX 2

BOREHOLE AND TRIAL PIT LOGS (INCLUDING PHOTOGRAPHS)

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Consulting Engineering Geologists & Geo-Environmental Engineers

KEY TO BOREHOLE LOG SYMBOLS

Symbol	Explanation
D or J	Small Disturbed Sample (tub or jar sample)
B	Large Disturbed Sample
U	Undisturbed Sample
W	Water Sample
U70	Undisturbed Sample

Undrained Shear Strength Test (HSV)

90	Hand vane - direct reading in kN/m^2

Standard Penetration Test (SPT)

15	SPT 'N' Value (BS EN ISO 22476-3:2005)
125/50	Where full test drive not completed, penetration (125mm) and blow count (50) recorded
NR	No effective penetration

Water

	Water struck
	Water standing

Test/Core Range

TCR	Total Core Recovery - as percentage of core run. Where value significantly exceeds 100%, a note is given on remarks on log
SCR	Solid Core Recovery - as percentage of core run. Note: assessment of solid core is based on full diameter
RQD	Rock Quality Designation - the amount of solid core greater than 100mm expressed as percentage of core run
	Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment

Instrumentation

	Bentonite Seal
	Solid / Perforated Standpipe
	Granular Response Zone

Wilson Associates
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BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS1
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	47.00	E 357,495 N 234,657	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.10	D					(0.45) 0.45	TOPSOIL: probable soft, brown, organic, slightly sandy SILT, with frequent roots from overlying grass		
						0.80	SAND: probable medium dense, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY 0.70 - becomes dense	AL	
1.00	D					(0.65) 1.45	GRAVEL: dense, cream, slightly sandy GRAVEL. Gravel is fine to coarse, angular sandstone with occasional cobbles	AL	
1.45		N50/ 125 mm					Core Recovery 0.0 - 0.7m hand-dug starter pit 0.7 - 1.0m 100% Borehole terminated on refusal in SPT at 1.45m depth; backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
17/08/2020					DRY						Borehole position scanned using Cable Avoidance Tool (CAT); no services detected AL = Alluvium Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

BOREHOLE PHOTOGRAPHS

Project	Borehole No.
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	WS1
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Borehole Core

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

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BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS2
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	47.00	E 357,470 N 234,706	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.10	MADE GROUND: probable loose, reddish-brown, organic, sandy GRAVEL, with vegetation and roots (gravel is fine to coarse, angular sandstone)		
0.50	D					(0.65)	MADE GROUND: probable soft, mottled reddish-brown and light grey, slightly gravelly, silty CLAY (gravel is fine to coarse, angular concrete)		
						1.00	MADE GROUND: probable medium dense, mottled brown and light grey, slightly clayey, gravelly SAND (gravel is fine to coarse concrete)		
				40			0.50 - becomes black and ashy (buried tarmac)		
1.45		N14		44			SILT/CLAY: firm, mottled orangish brown and reddish-brown, slightly silty, gravelly, plastic SILT/CLAY		
1.50	D					(1.45)	1.70 - becomes gravelly	AL	
						2.45			
2.45		N59/ 220 mm					Core Recovery 0.0 -1.0m hand-dug starter pit 1.0 - 2.0m 100% Borehole terminated on refusal in SPT at 2.45m depth; backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
17/08/2020					DRY						Borehole position scanned using Cable Avoidance Tool (CAT); no services detected AL = Alluvium Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

BOREHOLE PHOTOGRAPHS

Project	Borehole No.
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	WS2
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Borehole Core

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

Wilson Associates
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BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS3
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	47.00	E 235,517 N 234,694	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.15	TOPSOIL: probable soft, dark brown, organic, slightly silty, plastic CLAY, with frequent roots from overgrown grass		
0.50	D					(0.85)	clayey SAND/sandy CLAY: probable medium dense, orangish-brown, slightly gravelly clayey SAND/sandy CLAY	AL	
						1.00			
1.45		N28				(1.05)	SILT/CLAY: probable firm, mottled orangish brown and reddish-brown, slightly silty, gravelly, plastic SILT/CLAY 1.40 - becomes gravelly	AL	
						2.05			
2.05		N50/ 145 mm					Core Recovery 0.0 -1.0m hand-dug starter pit 1.0 - 2.0m 100% Borehole terminated on refusal in SPT at 2.05m depth; backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
17/08/2020					DRY						Borehole position scanned using Cable Avoidance Tool (CAT); no services detected AL = Alluvium Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

Wilson Associates

BOREHOLE PHOTOGRAPHS

Project LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	Borehole No. WS3
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Borehole Core

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

Wilson Associates
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BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS4
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	47.00	E 357,487 N 234,745	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.05	D					0.15	TOPSOIL: probable soft, dark brown, organic, slightly gravelly silty, plastic CLAY, with frequent roots from overlying grass		
							clayey SAND/sandy CLAY: probable loose, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY		
1.00	D						1.00 - becomes medium dense		
						(2.30)		AL	
1.45		N23							
							2.00 - becomes very dense		
						2.45			
2.45		N50/ 245 mm					Core Recovery 0.0 -0.9m hand-dug starter pit 0.9 - 2.0m 100% Borehole terminated on refusal in SPT at 2.45m depth; backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
17/08/2020					DRY						Borehole position scanned using Cable Avoidance Tool (CAT); no services detected AL = Alluvium Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

Wilson Associates

BOREHOLE PHOTOGRAPHS

Project	Borehole No.
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	WS4
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Borehole Core

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS5
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	50.00	E 357,533 N 234,776	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.20	TOPSOIL: probable soft, dark brown, organic, slightly sandy, slightly clayey SILT, with frequent roots from overlying grass and adjacent trees		
0.20	D					(1.25)	clayey SAND/sandy CLAY: probable medium dense to dense, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY	AL	
1.00	D					1.45			
1.45		N52/ 195 mm					Core Recovery 0.0 -1.0m hand-dug starter pit 1.0 - 1.3m 100% Borehole terminated on refusal in SPT at 1.45m depth; backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
17/08/2020					DRY						Borehole position scanned using Cable Avoidance Tool (CAT); no services detected AL = Alluvium Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

BOREHOLE PHOTOGRAPHS

Project LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	Borehole No. WS5
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

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Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS6
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	50.00	E 357,538 N 234,787	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.15	TOPSOIL: probable soft, dark brown, organic, slightly sandy, slightly clayey SILT, with frequent roots from overlying grass and adjacent trees		
						(1.30)	clayey SAND/sandy CLAY: medium dense to dense, orangish-brown, slightly gravelly clayey SAND/sandy CLAY	AL	
						1.45			
1.45		N48/ 235 mm					Core Recovery 0.0 -1.0m hand-dug starter pit Borehole terminated on refusal in SPT at 1.45m depth; backfilled with arisings		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
17/08/2020					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

AL = Alluvium
Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

Wilson Associates

BOREHOLE PHOTOGRAPHS

Project LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	Borehole No. WS6
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1				WS7
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
4704	17-08-20	47.00	E 357,525 N 234,716	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(0.50) 0.50	MADE GROUND: probable medium dense, grey, slightly clayey, sandy GRAVEL		
0.40	D								
0.50	D					(0.80) 1.30	SILT/CLAY: probable soft, mottled reddish-brown and orangish brown, sandy, plastic SILT/CLAY	AL	
1.30-1.40	D					1.45	GRAVEL: dense, reddish-brown, sandy, silty GRAVEL, with occasional cobbles. Gravel is fine to coarse, angular sandstone	AL	
1.45		N50/ 190 mm							
							Core Recovery 0.0 -1.0m hand-dug starter pit		
							Borehole terminated on refusal in SPT at 1.45m depth; backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
17/08/2020					DRY						Borehole position scanned using Cable Avoidance Tool (CAT); no services detected AL = Alluvium Rg = Raglan Mudstone Formation

All dimensions in metres Scale 1:50	Client M F Freeman Group	Method/ Plant Used Archway Dart/Window Sampling	Logged By RS

BOREHOLE PHOTOGRAPHS

Project	Borehole No.
LAND AT OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1	WS7
Job No. 4704 **Date:** 20-08-20	

Hand-dug starter pit

Hand-dug starter pit arisings

Borehole Core

Client	Method/Plant Used	Logged By
M F Freeman Group	Archway Dart / Window Sampling	RS

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref:	DART497
Test Date:	08/07/2020
Report Date:	08/07/2020
File Name:	DART497.spt
Test Operator:	CM

Instrumented Rod Data

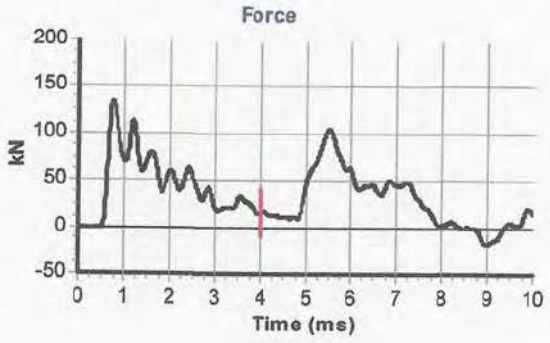
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	7080
Accelerometer No.2:	11609

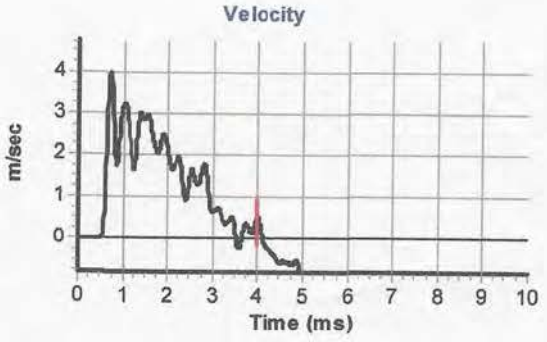
SPT Hammer Information

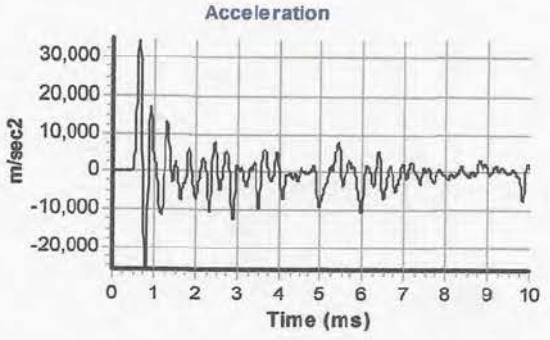
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location

COOK GROUND INVESTIGATION LTD/70797







Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	338

Energy Ratio E_r (%): **71**

[redacted]

Signed: C.McCLUSKEY
Title: FITTER

The recommended calibration interval is 12 months

Wilson Associates
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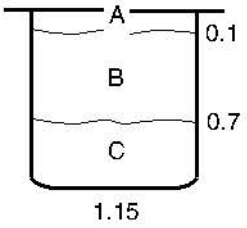
36 Brunswick Road, Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk

Site: LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN			TRIAL PIT No.
Job No. 4704	**Date** 17-08-20	**Ground Level (c.m, AOD)** 46m	**Co-Ordinates (c.)** E 357,479 N 234,664	**SA1**



DETAILS OF SUBSOIL

A TOPSOIL: probable soft, brown, organic, slightly silty, slightly sandy, plastic CLAY, with frequent roots from overlying grass

B clayey SAND/sandy CLAY: probable medium dense, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY
0.3m - becomes dense

C GRAVEL: probable dense, reddish-brown, sandy, silty GRAVEL, with occasional cobbles

NOTES

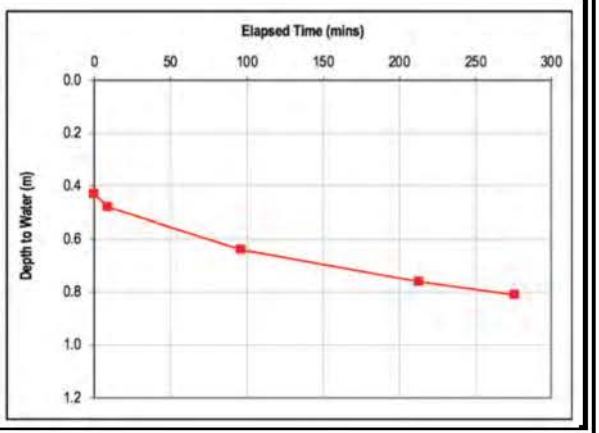
1 Pit logged from surface

2 Pit dry and stable

3 Soil sample taken at 0.1m depth

4 Falling head testing carried out
Pit dimensions 1.1m x 0.3m x 1.15m (LxWxD)

SA1	
Elapsed Time (mins)	Depth to Water (m)
0	0.43
9	0.48
96	0.64
213	0.76
276	0.81



Scale: 1:50	Client	M F Freeman Group	Logged By: RS

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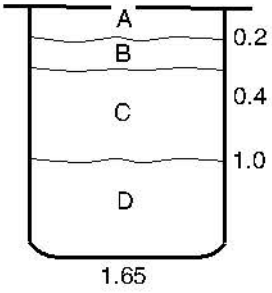
36 Brunswick Road, Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk

Site: LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN			TRIAL PIT No.
Job No. 4704	**Date** 17-08-20	**Ground Level (c.m, AOD)** 46m	**Co-Ordinates (c.)** E 357,465 N 234,694	**SA2**



DETAILS OF SUBSOIL

A MADE GROUND: probable loose, reddish-brown, organic, sandy GRAVEL, with vegetation and roots (gravel is fine to coarse, angular sandstone)

B MADE GROUND: probable soft, mottled reddish-brown and light grey, slightly gravelly, silty CLAY (gravel is fine to coarse, angular concrete)

C MADE GROUND: probable medium dense, mottled brown and light grey, slightly clayey, gravelly SAND (gravel is fine to coarse concrete) 0.50 - becomes black and ashy (buried tarmac)

D CLAY: probable firm, mottled orangish brown and reddish-brown, slightly silty, gravelly, plastic CLAY; becomes very gravelly at base with occasional cobbles

NOTES

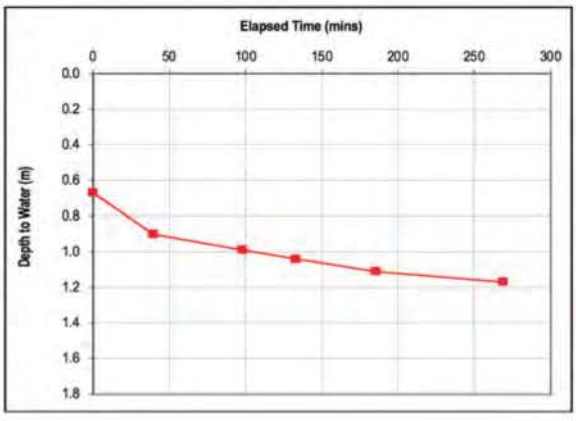
1 Pit logged from surface

2 Pit dry and stable

3 Soil sample taken at 0.0m depth

4 Falling head testing carried out
Pit dimensions 1.3m x 0.3m x 1.65m (LxWxD)

SA2	
Elapsed Time (mins)	Depth to Water (m)
0	0.67
40	0.90
98	0.99
133	1.04
186	1.11
269	1.17



Scale: 1:50	Client: M F Freeman Group	Logged By: RS

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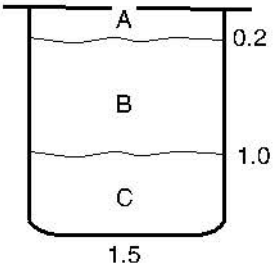
36 Brunswick Road, Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk

Site: LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN			TRIAL PIT No.
Job No. 4704	**Date** 17-08-20	**Ground Level (c.m, AOD)** 47m	**Co-Ordinates (c.)** E 357,513 N 234,686	**SA3**



DETAILS OF SUBSOIL

A TOPSOIL: probable soft, dark brown, organic, slightly silty, plastic CLAY, with frequent roots from overgrown grass

B clayey SAND/sandy CLAY: probable medium dense, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY
0.70 - becomes dense

C GRAVEL: probable dense, cream, slightly sandy GRAVEL. Gravel is fine to coarse, angular sandstone with occasional cobbles

NOTES

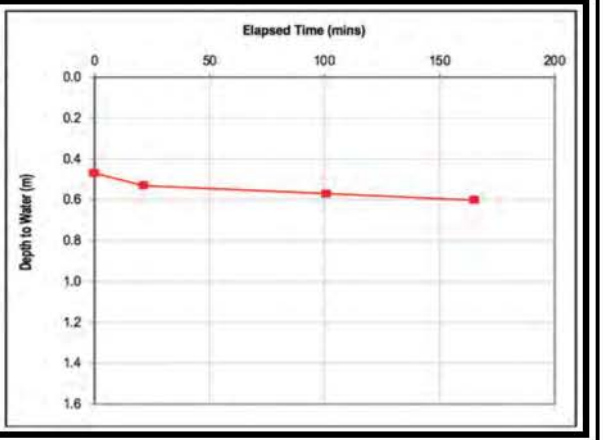
1 Pit logged from surface; roots encountered to 0.6m depth

2 Pit dry and stable

3 No samples taken

4 Falling head testing carried out
Pit dimensions 1.3m x 0.3m x 1.5m (LxWxD)

SA3	
Elapsed Time (mins)	Depth to Water (m)
0	0.47
21	0.53
101	0.57
165	0.60



Scale: 1:50	Client: M F Freeman Group	Logged By: RS

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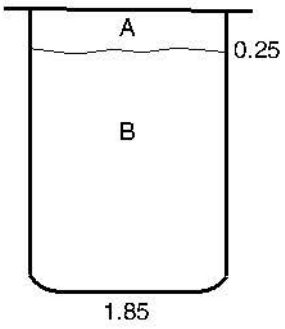
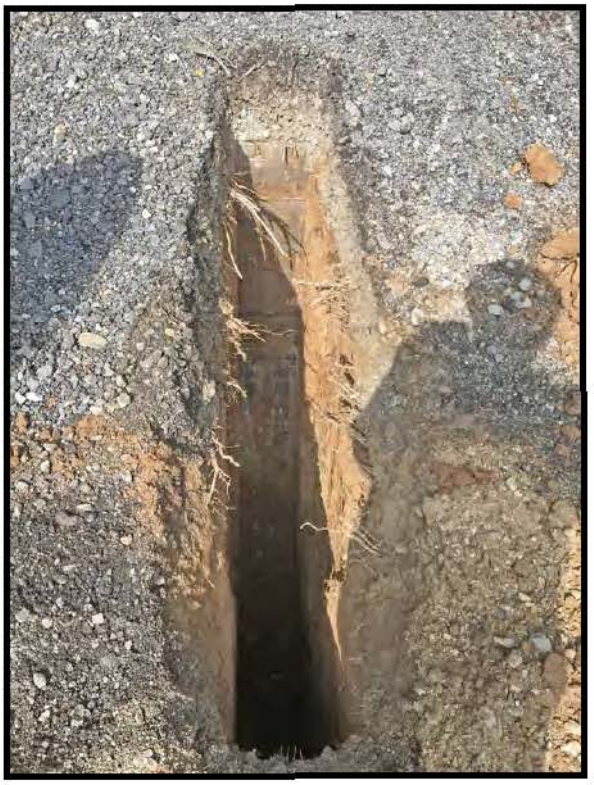
36 Brunswick Road, Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk

Site: LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN			TRIAL PIT No.
Job No. 4704	**Date** 17-08-20	**Ground Level (c.m, AOD)** 47m	**Co-Ordinates (c.)** E 357,485 N 234,737	**SA4**





DETAILS OF SUBSOIL

A MADE GROUND: probable loose, grey, fine to coarse, angular GRAVEL. Gravel is granite

B clayey SAND/sandy CLAY: probable medium dense, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY; frequent roots to 0.3m

NOTES

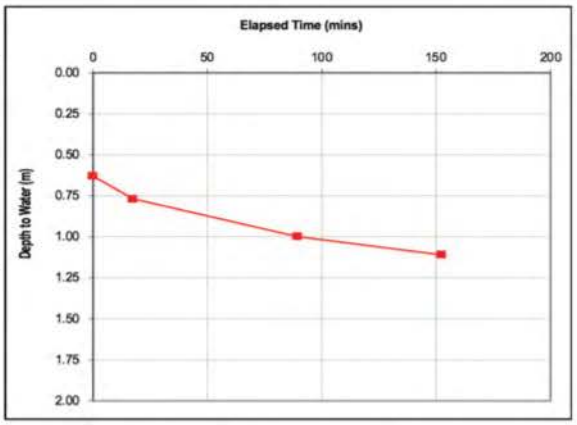
1 Pit logged from surface

2 Pit dry and stable

3 Soil sample taken at 0.1m depth

4 Falling head testing carried out
Pit dimensions 1.3m x 0.3m x 1.85m (LxWxD)

SA4	
Elapsed Time (mins)	Depth to Water (m)
0	0.63
18	0.77
89	1.00
153	1.11

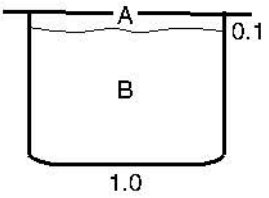


Scale: 1:50	Client	M F Freeman Group	Logged By: RS

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

36 Brunswick Road, Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk

Site: LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN			TRIAL PIT No.
Job No. 4704	**Date** 17-08-20	**Ground Level (c.m, AOD)** 50m	**Co-Ordinates (c.)** E 357,536 N 234,781	**SA5**



DETAILS OF SUBSOIL

A TOPSOIL: probable soft, dark brown, organic, slightly silty, plastic CLAY, with frequent roots from overgrown grass

B clayey SAND/sandy CLAY: probable medium dense, orangish-brown, slightly gravelly, clayey SAND/sandy CLAY; frequent roots from adjacent trees within top 0.2m

NOTES

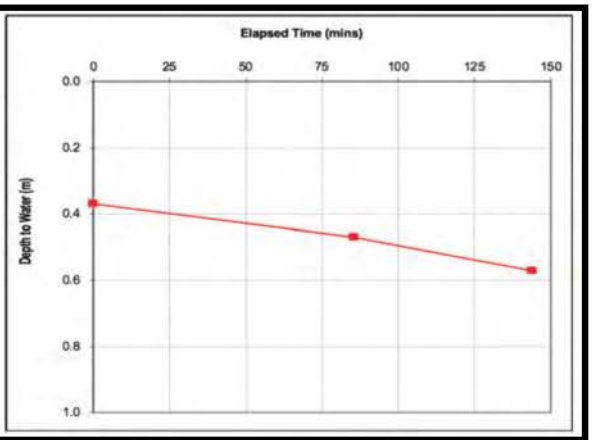
1 Pit logged from surface

2 Pit dry and stable

3 No samples taken

4 Falling head testing carried out
Pit dimensions 1.4m x 0.3m x 1.0m (LxWxD)

SA5	
Elapsed Time (mins)	Depth to Water (m)
0	0.37
86	0.47
144	0.57

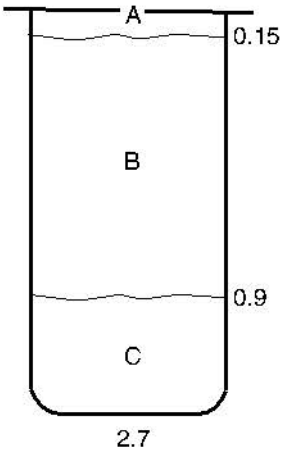


Scale: 1:50	Client	M F Freeman Group	Logged By: RS

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

36 Brunswick Road, Gloucester GL1 1JJ
Tel: 01452 422843
Email: info@wilsonac.co.uk

Site: LAND AT THE OLD POTATO STORE, MILL LANE, FOWNHOPE, HEREFORDSHIRE HR1 4NN				TRIAL PIT No.
Job No. 4704	**Date** 17-08-20	**Ground Level (c.m, AOD)** 47m	**Co-Ordinates (c.)** E 357,505 N 234,728	**TP6**



DETAILS OF SUBSOIL

A TOPSOIL: probable soft, dark brown, organic, slightly gravelly silty, plastic CLAY, with frequent roots from overlying grass

B CLAY: probable firm to stiff, reddish-brown, slightly gravelly, silty, plastic CLAY

C GRAVEL: probable dense, reddish-brown, sandy, clayey GRAVEL, with occasional cobbles

NOTES

1 Pit logged from surface; roots encountered to 1.60m depth

2 Pit dry and stable

3 Soil samples taken at 0.1m, 0.9m and 2.7m depth

Scale: 1:50	Client	M F Freeman Group	Logged By: RS

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 1 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 1 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 or 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 2011, 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 lead 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

A3.1 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 SR1.

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).
1	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

A3.11 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.

		Consequence			
		Severe	***Moderate***	***Mild***	***Minor***
Probability (Likelihood)	**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 (v1.07 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.

A3.18 In terms of controlled off-site disposal to landfill of site arisings, if/where intended, waste classification has been carried out in line with European Waste Catalogue (EWC) and Technical Guidance Waste Management 3 (TGWM3, EA Version 3, May 2015 – replacing the outgoing TGWM2) using contamination test results obtained for that material. The assessment utilises the 'HazWasteOnline' software to establish a 'Hazardous' (170503) / 'Non-hazardous' (170504) classification. Where required, the foregoing may be supplemented by Waste Acceptance Criteria (WAC) analysis, in order that the waste can further be designated as 'Hazardous' / 'Stable non-reactive' / 'Inert', for use by the receiving landfill operator. It should be noted that WAC is only required for disposal of wastes at certain classes of landfill; if arisings are not intended for removal to landfill, then WAC testing is not applicable.

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SUMMARY OF CONTAMINATION TEST RESULTS

		SOILS									
	Sample Ref	WS1	WS2	WS3	WS4	WS5	WS7	SA1	SA2	SA3	TP4
	Sample Depth (m)	0.10	0.60	0.60	0.05	0.20	0.40	0.10	0.00	0.10	0.10
	Sample of	Topsoil	Made ground	Subsoil	Topsoil	Topsoil	Made ground	Topsoil	Made ground	Topsoil	Made ground
	DETERMINAND										
	pH	6.6	-	7.4	-	7.6	-	-	-	-	-
TOXIC METALS	Arsenic	7.6	6.9	6.3	7.2	7.6	22	6.9	6.4	6.8	6.6
	Cadmium	0.3	<0.2	<0.2	0.2	0.2	0.4	0.3	<0.2	<0.2	0.6
	Chromium (VI)	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
	Chromium	29	16	22	32	28	34	28	31	24	10
	Lead	29	14	20	29	32	72	28	34	26	28
	Mercury	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
	Nickel	31	21	28	36	29	28	30	30	23	11
	Selenium	2	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PHYTOTOXIC METALS	Copper	23	20	16	24	24	44	36	23	22	30
	Zinc	120	45	66	93	90	85	110	76	61	33
	Moisture content	16	6.2	7	21	16	24	22	17	22	6
	Soil organic matter		6.7					7.6			
	Asbestos Screen		Not detected		Not detected	Not detected	Not detected		Not detected		
SPECIATED POLYAROMATIC HYDROCARBONS (PAH)	Total PAH	<0.80	22.6	<0.80	<0.80	<0.80	<0.80	<0.80	34.3	6.42	<0.80
	Naphthalene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Acenaphthylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Acenaphthene	<0.05	0.21	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Fluorene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Phenanthrene	<0.05	1.6	<0.05	<0.05	<0.05	<0.05	<0.05	1.1	0.29	<0.05
	Anthracene	<0.05	0.39	<0.05	<0.05	<0.05	<0.05	<0.05	0.31	<0.05	<0.05
	Fluoranthene	<0.05	3.6	<0.05	<0.05	<0.05	<0.05	<0.05	5.1	0.93	<0.05
	Pyrene	<0.05	3.6	<0.05	<0.05	<0.05	<0.05	<0.05	5.4	0.86	<0.05
	Benzo(a)anthracene	<0.05	2.2	<0.05	<0.05	<0.05	<0.05	<0.05	3.7	0.54	<0.05
	Chrysene	<0.05	1.9	<0.05	<0.05	<0.05	<0.05	<0.05	2.6	0.64	<0.05
	Benzo(b)fluoranthene	<0.05	2.9	<0.05	<0.05	<0.05	<0.05	<0.05	5.1	1.1	<0.05
	Benzo(k)fluoranthene	<0.05	1.1	<0.05	<0.05	<0.05	<0.05	<0.05	1.6	0.31	<0.05
	Benzo(a)pyrene	<0.05	2.2	<0.05	<0.05	<0.05	<0.05	<0.05	4	0.72	<0.05
	Indeno(1,2,3-cd)pyrene	<0.05	1.2	<0.05	<0.05	<0.05	<0.05	<0.05	2.2	0.46	<0.05
	Dibenzo(a,h)anthracene	<0.05	0.26	<0.05	<0.05	<0.05	<0.05	<0.05	0.55	<0.05	<0.05
	Benzo(ghi)perylene	<0.05	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	2.7	0.69	<0.05
BTEX	Benzene		<0.001								
	Toluene		<0.001								
	Ethylbenzene		<0.001								
	m/p-Xylene		<0.001								
	o-Xylene		<0.001								
	MTBE		<0.001								
TOTAL PETROLEUM HYDROCARBONS (BANDED)	>C6-C8			<0.1		<0.1	<0.1		<0.1	<0.1	
	>C8-C10			<10		<10	<10		<10	<10	
	>C10-C12			<10		<10	<10		<10	<10	
	>C12-C16			<40		76	<40		99	<40	
	>C16-C21			<10		11	<10		41	10	
	>C21-C40			<10		95	<10		400	200	
	>C6-C40			<10		110	<10		450	210	
(TPH) ALIPHATIC	>C5-C6		<0.001								
	>C6-C8		<0.001								
	>C8-C10		<0.001								
	>C10-C12		<1.0								
	>C12-C16		4								
	>C16-C21		56								
	>C21-C35		400								
	>C5-C35		410								
(TPH) AROMATIC	>C5-C7		<0.001								
	>C7-C8		<0.001								
	>C8-C10		<0.001								
	>C10-C12		<1.0								
	>C12-C16		6.6								
	>C16-C21		36								
	>C21-C35		1400								
	>C5-C35		1400								

TIER 1: GENERIC ASSESSMENT CRITERIA — [illegible]

TIER 2: SITE SPECIFIC — [illegible]

		LEACHATE	WFD [illegible]	WFD [illegible]	EA EQS	UK Drinking Water Standards	WHO Guidelines
	Sample Ref	WS2					
	Sample Depth (m)	0.50					
	Sample of						
	DETERMINAND						
TOXIC METALS	Arsenic	2.1	[illegible]	[illegible]	[illegible]	[illegible]	
	Cadmium	<0.08	[illegible]	[illegible]	[illegible]	[illegible]	
	Chromium (VI)	<50					
	Chromium	0.7	[illegible]	[illegible]	[illegible]	[illegible]	
	Lead	<1.0	[illegible]	[illegible]	[illegible]	[illegible]	
	Mercury	<0.5	[illegible]	[illegible]	[illegible]	1	
	Nickel	13	[illegible]	[illegible]	[illegible]	[illegible]	
	Selenium	<4.0	[illegible]			[illegible]	
PHYTOTOXIC METALS	Copper	5.3	[illegible]	1	[illegible]	[illegible]	
	Zinc	6.1		[illegible]	[illegible]	[illegible]	
SPECIATED POLYAROMATIC HYDROCARBONS (PAH)	Total PAH	<0.2					
	Naphthalene	<0.01	[illegible]	[illegible]	[illegible]	[illegible]	
	Acenaphthylene	<0.01				[illegible]	
	Acenaphthene	<0.01				[illegible]	
	Fluorene	<0.01				[illegible]	
	Phenanthrene	<0.01				[illegible]	
	Anthracene	<0.01		[illegible]		[illegible]	
	Fluoranthene	<0.01	[illegible]	[illegible]		[illegible]	
	Pyrene	<0.01				[illegible]	
	Benzo(a)anthracene	<0.01				[illegible]	
	Chrysene	<0.01				[illegible]	
	Benzo(b)fluoranthene	<0.01		[illegible]	[illegible]	[illegible]	
	Benzo(k)fluoranthene	<0.01			[illegible]	[illegible]	
	Benzo(a)pyrene	<0.01		[illegible]	[illegible]	[illegible]	
	Indeno(1,2,3-cd)pyrene	<0.01				[illegible]	
	Dibenzo(a,h)anthracene	<0.01			[illegible]	[illegible]	
	Benzo(ghi)perylene	<0.01				[illegible]	

LEACHATES

[illegible]

[illegible]

[illegible]

[illegible]

SOILS

[illegible]

Based on Soil Organic Matter of [illegible] all levels expressed as mg/kg

Richard Stokes
Wilson Associates (Consulting) Limited
36 Brunswick Road
Gloucester
GL1 1JJ

t: 01452 422843

e: richard@wilsonac.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 20-25744

Project / Site name:	Fownhope	**Samples received on:**	20/08/2020
Your job number:	4704	**Samples instructed on/ Analysis started on:**	20/08/2020
Your order number:		**Analysis completed by:**	26/08/2020
Report Issue Number:	1	**Report issued on:**	26/08/2020
Samples Analysed:	1 leachate sample - 10 soil samples		

[redacted]

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 20-25744
Project / Site name: Fownhope

Lab Sample Number				1598402
Sample Reference				WS2
Sample Number				None Supplied
Depth (m)				0.50
Date Sampled				17/08/2020
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Speciated PAHs				
Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01
Total PAH				
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
Heavy Metals / Metalloids				
Arsenic (dissolved)	µg/l	1.1	ISO 17025	2.1
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.7
Copper (dissolved)	µg/l	0.7	ISO 17025	5.3
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.3
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	8.1

J/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 20-25744
Project / Site name: Fownhope

Lab Sample Number				1598393	1598394	1598395	1598396	1598397
Sample Reference				WS1	WS2	WS3	WS4	WS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.50	0.50	0.05	0.20
Date Sampled				17/08/2020	17/08/2020	17/08/2020	17/08/2020	17/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	18	5.2	7	21	18
Total mass of sample received	kg	0.001	NONE	1.2	0.9	0.7	0.9	0.85
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.5	-	7.4	-	7.8
Organic Matter	%	0.1	MCERTS	-	5.7	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.21	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	1.6	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.39	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	3.6	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	3.6	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	2.2	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	1.9	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	2.9	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.1	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	2.2	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.2	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.26	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	1.5	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	22.6	< 0.80	< 0.80	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.6	6.9	5.3	7.2	7.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	< 0.2	< 0.2	0.2	0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	29	16	23	32	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23	20	15	24	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	29	14	20	29	32
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	21	28	35	29
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2	< 1.0	1.5	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	120	45	68	93	90
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
o-xylene	µg/kg	1	MCERTS	-	< 1.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-	-	-

Analytical Report Number: 20-25744
Project / Site name: Fownhope

Lab Sample Number				1598393	1598394	1598395	1598396	1598397
Sample Reference				WS1	WS2	WS3	WS4	WS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	0.50	0.50	0.05	0.20
Date Sampled				17/08/2020	17/08/2020	17/08/2020	17/08/2020	17/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	ng/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	ng/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	ng/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	ng/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	ng/kg	2	MCERTS	-	4	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	ng/kg	8	MCERTS	-	9.8	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	ng/kg	8	MCERTS	-	400	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	ng/kg	10	MCERTS	-	410	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	ng/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	ng/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	ng/kg	0.001	MCERTS	-	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	ng/kg	1	MCERTS	-	< 1.0	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	ng/kg	2	MCERTS	-	3.5	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	ng/kg	10	MCERTS	-	38	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	ng/kg	10	MCERTS	-	1400	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	ng/kg	10	MCERTS	-	1400	-	-	-
TPH Texas (C6 - C8)	ng/kg	0.1	ISO 17025	-	-	< 0.1	-	< 0.1
TPH Texas (C8 - C10)	ng/kg	10	MCERTS	-	-	< 10	-	< 10
TPH Texas (C10 - C12)	ng/kg	1	MCERTS	-	-	< 1.0	-	< 1.0
TPH Texas (C12 - C16)	ng/kg	4	MCERTS	-	-	< 4.0	-	7.6
TPH Texas (C16 - C21)	ng/kg	10	MCERTS	-	-	< 10	-	11
TPH Texas (C21 - C40)	ng/kg	10	MCERTS	-	-	< 10	-	95
TPH Texas (C6 - C40)	ng/kg	10	NONE	-	-	< 10	-	110

J/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 20-25744
Project / Site name: Fownhope

Lab Sample Number				1598398	1598399	1598400	1598401	1599355
Sample Reference				WS7	TP1	TP2	TP6	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.10	0.00	0.10	0.10
Date Sampled				17/08/2020	17/08/2020	17/08/2020	17/08/2020	17/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	2.4	22	17	22	5
Total mass of sample received	kg	0.001	NONE	1.1	0.7	1.1	0.6	1.2
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	-
Organic Matter	%	0.1	MCERTS	-	7.5	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.1	0.29	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.31	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	5.1	0.93	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	5.4	0.85	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	3.7	0.54	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	2.6	0.64	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	5.1	1.1	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.6	0.31	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	4	0.72	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	2.2	0.46	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.55	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	2.7	0.59	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	34.3	6.42	< 0.80
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	32	6.9	6.4	6.8	8.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	0.3	< 0.2	< 0.2	0.5
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	34	26	31	24	10
Copper (aqua regia extractable)	mg/kg	1	MCERTS	44	36	23	22	30
Lead (aqua regia extractable)	mg/kg	1	MCERTS	72	28	34	26	26
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	30	30	23	11
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	89	110	75	81	33
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	-
o-xylene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-

Analytical Report Number: 20-25744
Project / Site name: Fownhope

Lab Sample Number				1598398	1598399	1598400	1598401	1599355
Sample Reference				WS7	TP1	TP2	TP6	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.10	0.00	0.10	0.10
Date Sampled				17/08/2020	17/08/2020	17/08/2020	17/08/2020	17/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	ng/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	ng/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	ng/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	ng/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	ng/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	ng/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	ng/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	ng/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	ng/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	ng/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	ng/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	ng/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	ng/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	ng/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	ng/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	ng/kg	10	MCERTS	-	-	-	-	-
TPH Texas (C6 - C8)	ng/kg	0.1	ISO 17025	< 0.1	-	< 0.1	< 0.1	-
TPH Texas (C8 - C10)	ng/kg	10	MCERTS	< 10	-	< 10	< 10	-
TPH Texas (C10 - C12)	ng/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
TPH Texas (C12 - C16)	ng/kg	4	MCERTS	< 4.0	-	9.9	< 4.0	-
TPH Texas (C16 - C21)	ng/kg	10	MCERTS	< 10	-	41	10	-
TPH Texas (C21 - C40)	ng/kg	10	MCERTS	< 10	-	400	200	-
TPH Texas (C6 - C40)	ng/kg	10	NONE	< 10	-	450	210	-

J/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 20-25744
Project / Site name: Fownhope

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1598393	WS1	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
1598394	WS2	None Supplied	0.5	Brown loam and sand with gravel and vegetation.
1598395	WS3	None Supplied	0.5	Brown loam and sand with gravel.
1598396	WS4	None Supplied	0.05	Brown loam and clay with gravel and vegetation.
1598397	WS5	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
1598398	WS7	None Supplied	0.4	Brown loam and clay with gravel.
1598399	TP1	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
1598400	TP2	None Supplied	0	Brown loam and clay with gravel and vegetation.
1598401	TP6	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
1599355	TP4	None Supplied	0.1	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 20-25744
Project / Site name: Fownhope

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
TPH Texas (Soil)	Determination of dichloromethane/hexane extractable hydrocarbons in soil by GC-MS.	In-house method	L064-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX 4

CERTIFIED GEOTECHNICAL TEST RESULTS

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

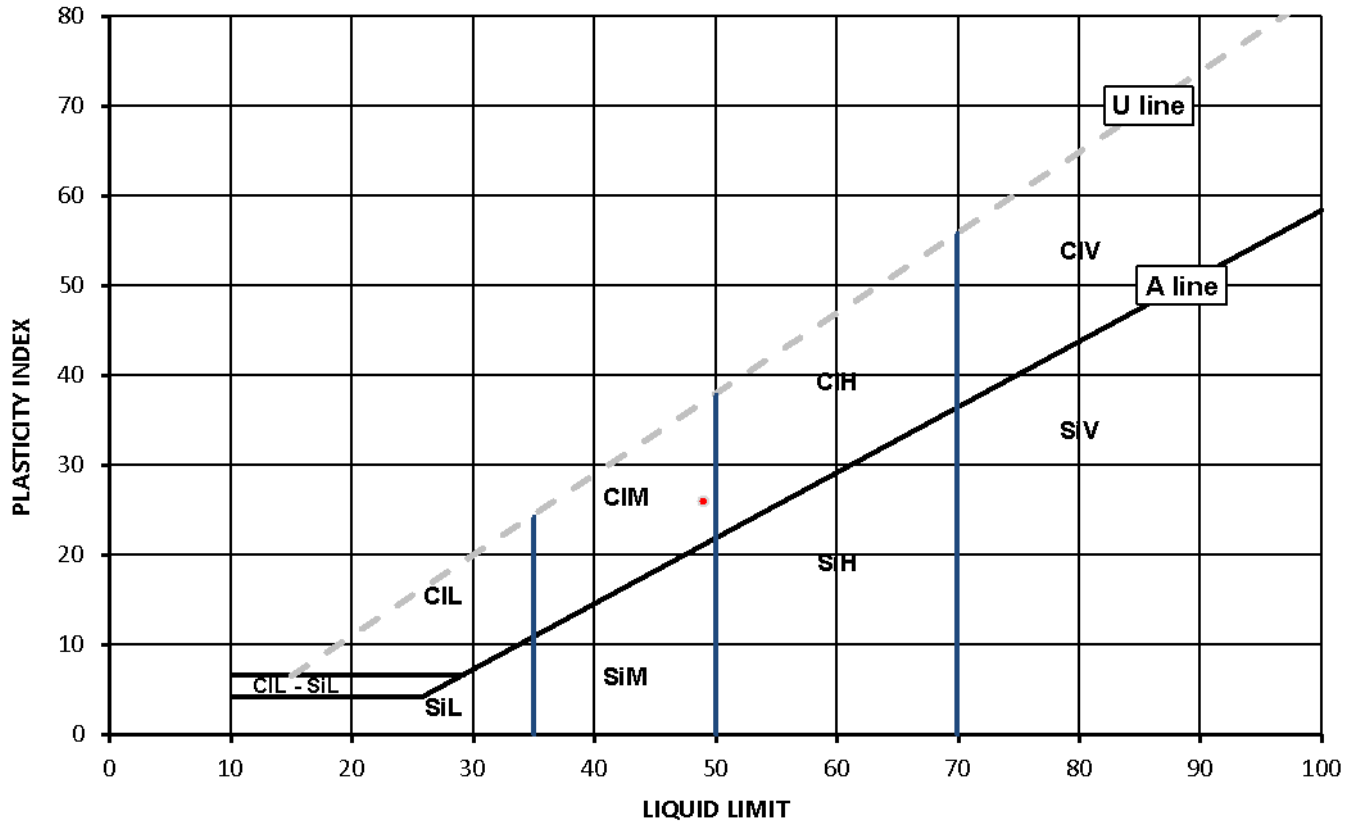
Client:	Wilson Associates (Consulting) Limited	Client Reference:	4704
Client Address:	36 Brunswick Road, Gloucester, GL1 1JJ	Job Number:	20-25870
		Date Sampled:	17/08/2020
		Date Received:	20/08/2020
Contact:	Richard Stokes	Date Tested:	03/09/2020
Site Address:	Fownhope	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1599006	Depth Top [m]:	1.00
Hole No.:	WS1	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown slightly gravelly slightly sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
16	49	23	26	90



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 232.10

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

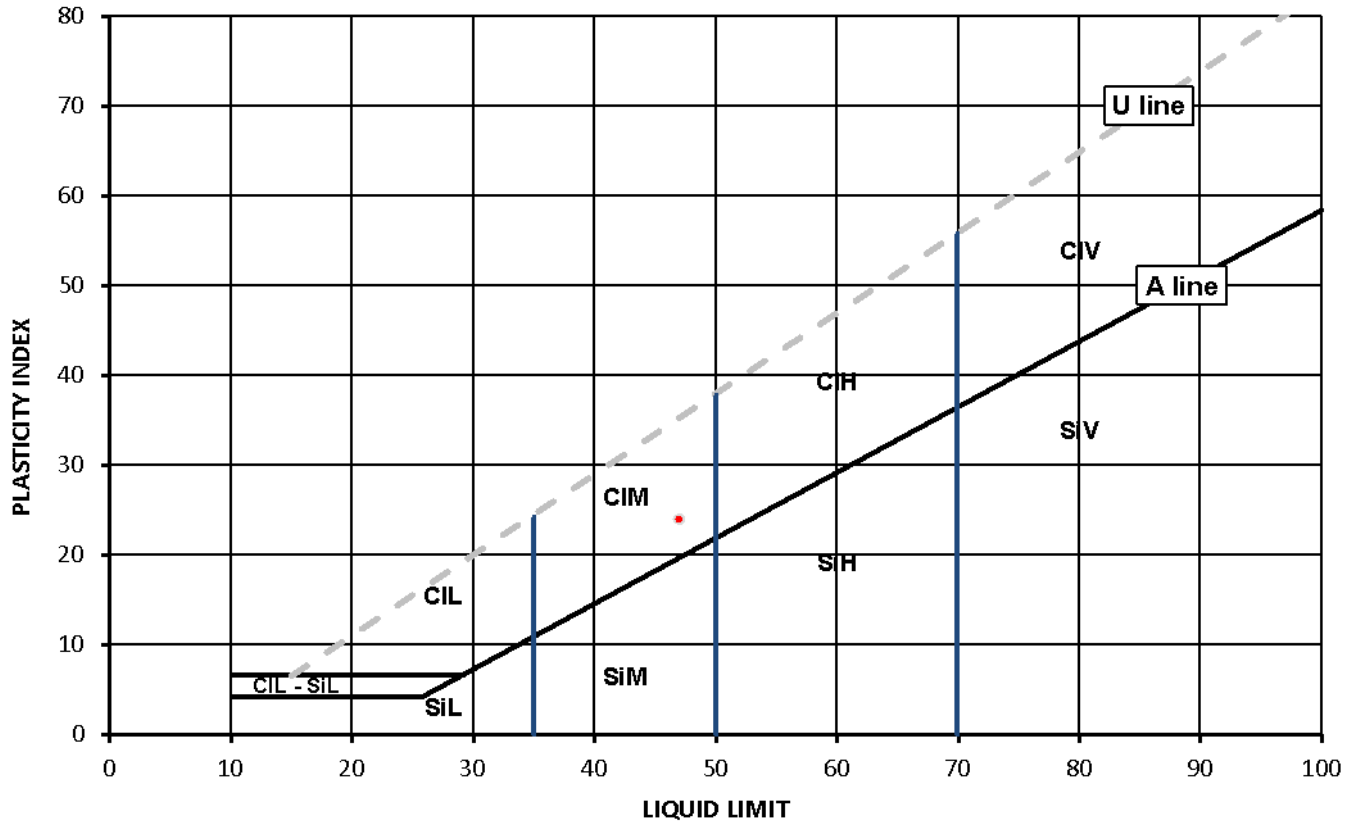
Client:	Wilson Associates (Consulting) Limited	Client Reference:	4704
Client Address:	36 Brunswick Road, Gloucester, GL1 1JJ	Job Number:	20-25870
		Date Sampled:	17/08/2020
		Date Received:	20/08/2020
Contact:	Richard Stokes	Date Tested:	03/09/2020
Site Address:	Fownhope	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1599007	Depth Top [m]:	1.50
Hole No.:	WS2	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown slightly gravelly slightly sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
21	47	23	24	85



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 232.10

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

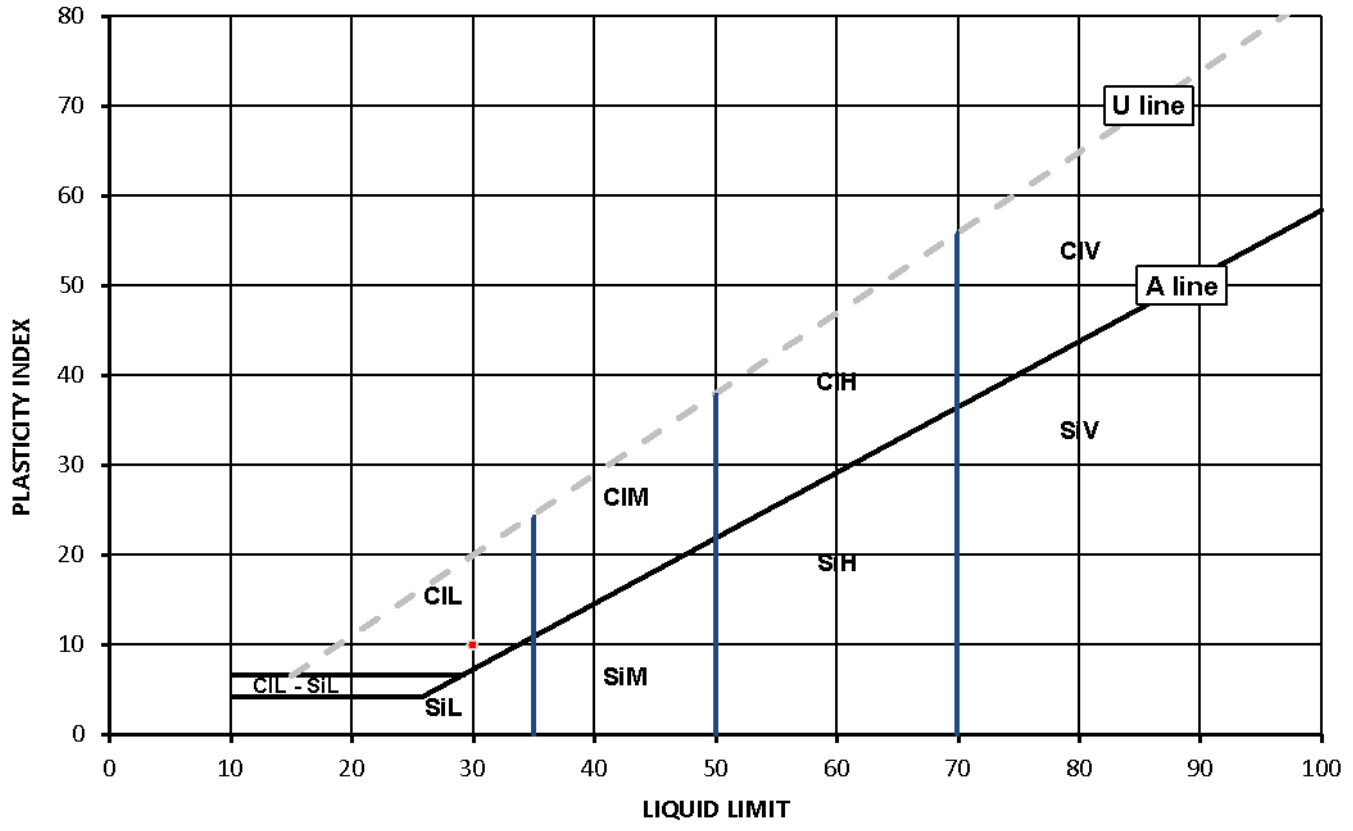
Client:	Wilson Associates (Consulting) Limited	Client Reference:	4704
Client Address:	36 Brunswick Road, Gloucester, GL1 1JJ	Job Number:	20-25870
		Date Sampled:	17/08/2020
		Date Received:	20/08/2020
Contact:	Richard Stokes	Date Tested:	03/09/2020
Site Address:	Fownhope	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1599008	Depth Top [m]:	0.50
Hole No.:	WS3	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown slightly gravelly very sandy CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
10	30	20	10	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 232.10

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

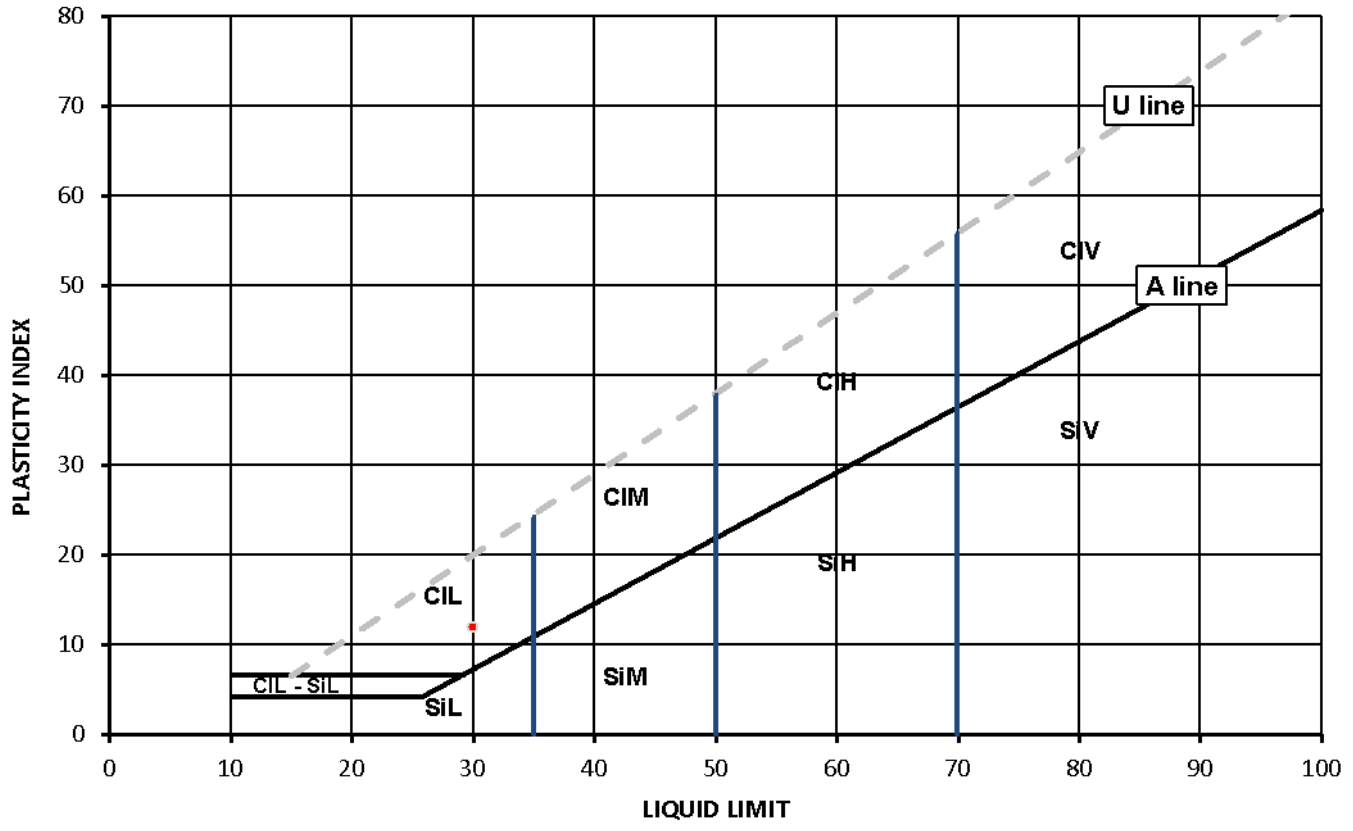
Client:	Wilson Associates (Consulting) Limited	Client Reference:	4704
Client Address:	36 Brunswick Road, Gloucester, GL1 1JJ	Job Number:	20-25870
		Date Sampled:	17/08/2020
		Date Received:	20/08/2020
Contact:	Richard Stokes	Date Tested:	03/09/2020
Site Address:	Fownhope	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1599009	Depth Top [m]:	1.00
Hole No.:	WS4	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown very sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
13	30	18	12	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

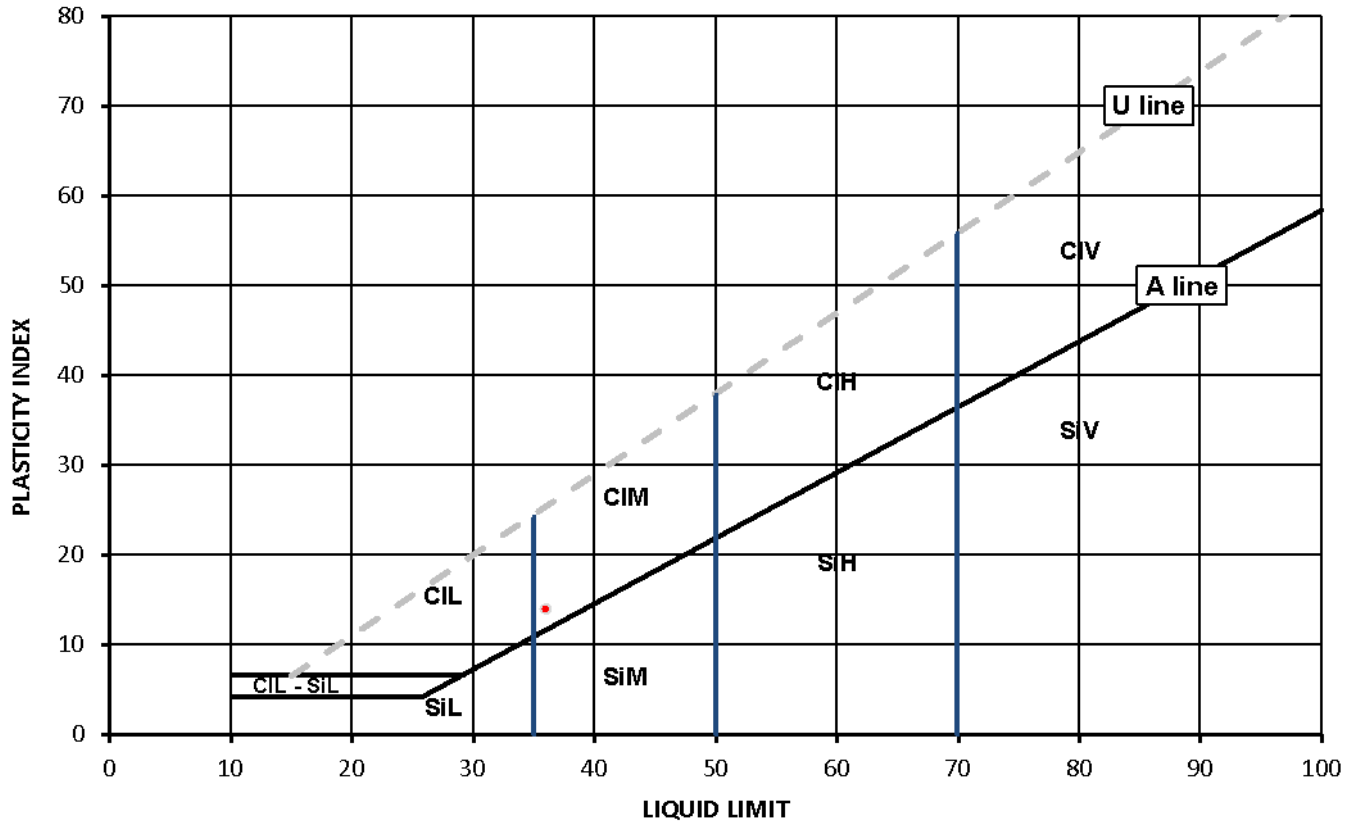
Client:	Wilson Associates (Consulting) Limited	Client Reference:	4704
Client Address:	36 Brunswick Road, Gloucester, GL1 1JJ	Job Number:	20-25870
		Date Sampled:	17/08/2020
		Date Received:	20/08/2020
Contact:	Richard Stokes	Date Tested:	03/09/2020
Site Address:	Fownhope	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1599010	Depth Top [m]:	1.00
Hole No.:	WS5	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
8.6	36	22	14	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 232.10

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

Client: Wilson Associates (Consulting) Limited
Client Address: 36 Brunswick Road, Gloucester, GL1 1JJ
Contact: Richard Stokes
Site Address: Fownhope

Client Reference: 4704
Job Number: 20-25870
Date Sampled: 17/08/2020
Date Received: 20/08/2020
Date Tested: 03/09/2020
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

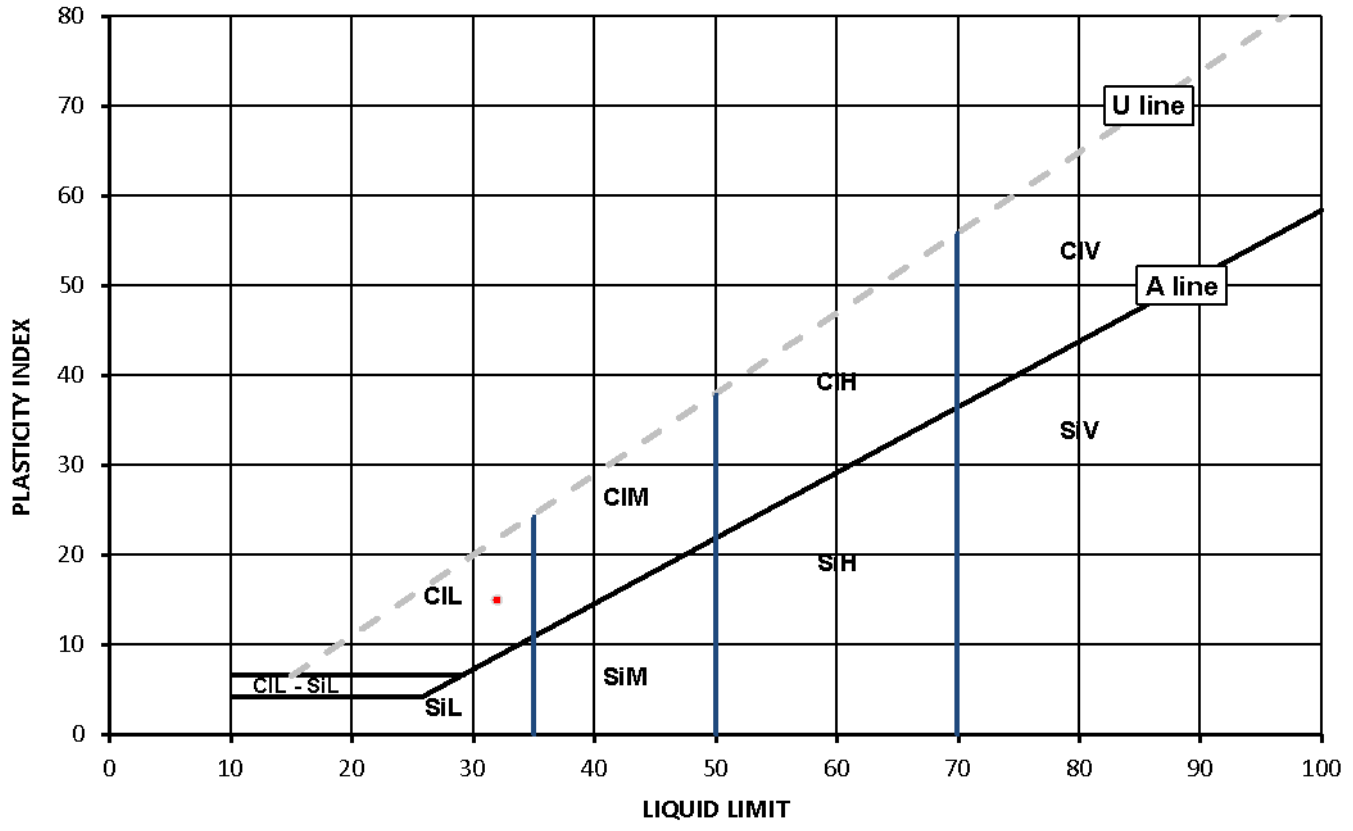
Test Results:

Laboratory Reference: 1599011
Hole No.: WS7
Sample Reference: Not Given
Soil Description: Brown slightly gravelly very sandy CLAY

Depth Top [m]: 0.50
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
15	32	17	15	95



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 232.10

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.4 and 5

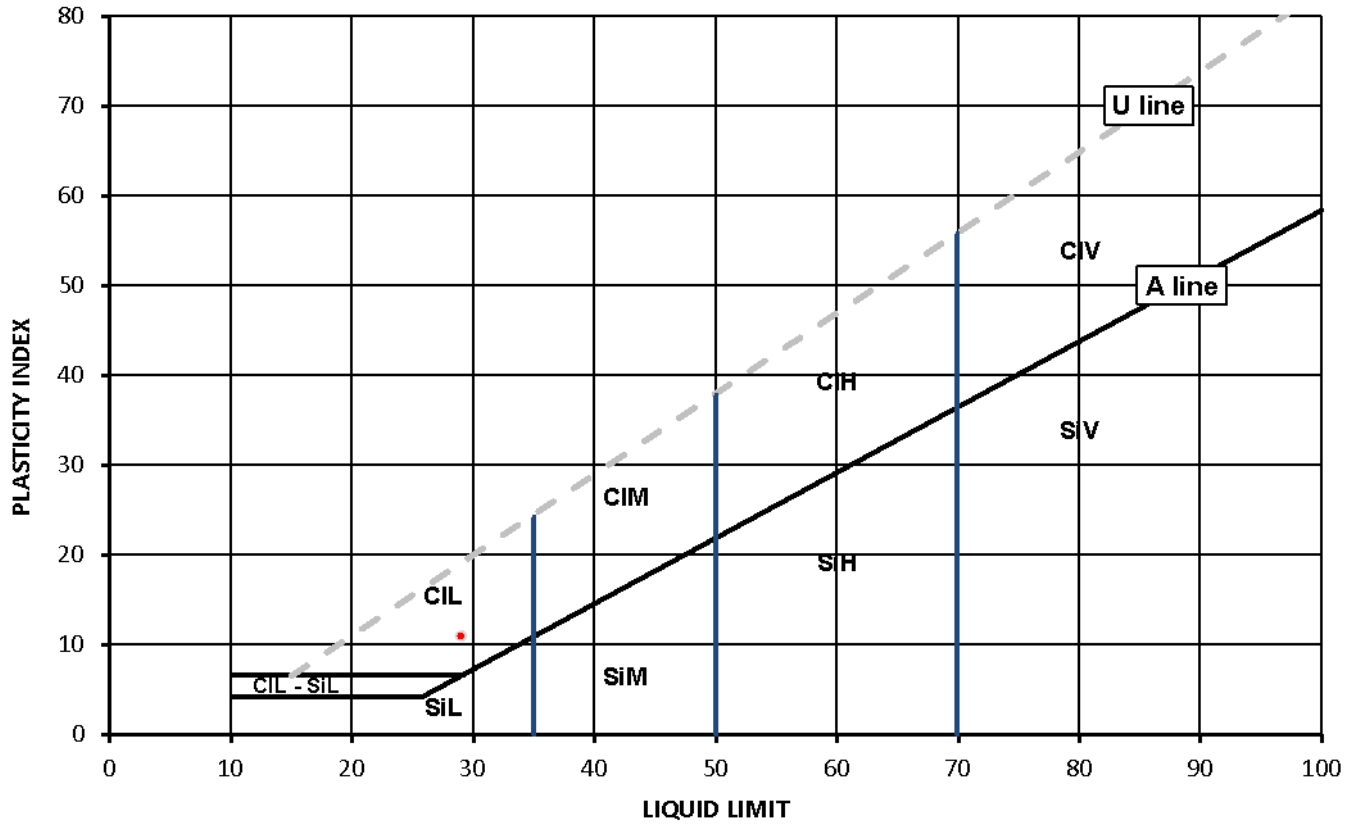
Client:	Wilson Associates (Consulting) Limited	Client Reference:	4704
Client Address:	36 Brunswick Road, Gloucester, GL1 1JJ	Job Number:	20-25870
		Date Sampled:	17/08/2020
		Date Received:	20/08/2020
Contact:	Richard Stokes	Date Tested:	03/09/2020
Site Address:	Fownhope	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1599012	Depth Top [m]:	2.70
Hole No.:	TP6	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Soil Description:	Brown gravelly very sandy CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
9.2	29	18	11	46



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 232.10

SUMMARY REPORT

Summary of Classification Test Results

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

UKAS TESTING 4041

Tested in Accordance with:

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN 17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

Client: Wilson Associates (Consulting) Limited

Client Address: 36 Brunswick Road, Gloucester, GL1 1JJ

Contact: Richard Stokes

Site Address: Fownhope

Client Reference: 4704
Job Number: 20-25870
Date Sampled: 17/08/2020
Date Received: 20/08/2020
Date Tested: 03/09/2020
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m				%	%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3	%		
1599012	TP6	Not Given	2.70	Not Given	B	Brown gravelly very sandy CLAY	Atterberg 1 Point	9.2		46	29	18	11						
1599006	WS1	Not Given	1.00	Not Given	B	Brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	16		90	49	23	26						
1599007	WS2	Not Given	1.50	Not Given	B	Brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	21		85	47	23	24						
1599008	WS3	Not Given	0.50	Not Given	B	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	10		99	30	20	10						
1599009	WS4	Not Given	1.00	Not Given	B	Brown very sandy CLAY	Atterberg 1 Point	13		100	30	18	12						
1599010	WS5	Not Given	1.00	Not Given	B	Brown sandy CLAY	Atterberg 1 Point	8.6		100	36	22	14						
1599011	WS7	Not Given	0.50	Not Given	B	Brown slightly gravelly very sandy CLAY	Atterberg 1 Point	15		95	32	17	15						

Note: # Non accredited; NP - Non plastic

Comments:

Signed: [redacted]

Monika Janoszek
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 04/09/2020

GF 234.12