GroundSolve Ltd

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REF: 2024/VGR/LetRep/sdi

Matthew Hughes
d2 architects
Soughton House
2 Nicholas Street Mews
Chester CH1 2NS

27th December 2017

Dear Matthew,

RE: FORMER VICTORIA GARAGE, RUABON: SITE INVESTIGATION

1.0 Introduction

Wales & West Housing Association (WWHA) propose to redevelop the former Victoria Garage site in Ruabon. This will involve demolishing the existing buildings on site, and replacing them with four new terraced properties.

It is understood that the site was formerly used as a garage and petrol station, and that the fuel tanks remain in-situ. The site was redeveloped around 10 years ago, with the garage buildings and structures removed, and three residential properties constructed in the central part of the site, although these were never finished and have remained vacant since.

d2 Architects (d2) are the architects for the current scheme, and they have appointed GroundSolve Ltd (GSL) on behalf of WWHA to undertake a limited site investigation at the site. Access was only available to the western part of the site, as the existing buildings are still present and prevent any access for plant and machinery to the rest of the site.

GSL were appointed to investigate the existing ground conditions and provide initial foundation recommendations where access was available, to locate the underground fuel tanks and note their condition, carry out soakaway testing, and to undertake soil sampling and chemical testing to allow a preliminary risk assessment to be carried out for the proposed development.

Foundation loads for the proposed structures are anticipated to range from 50 to 75 kN/m run, with floor slab loadings not exceeding 5kN/m². The recommendations given in this letter report are based on these assumptions, and should be reviewed and if necessary revised during the detailed design process.

2.0 Site Location and Description

The site is located on High Street in Ruabon, at National Grid Reference SJ 304 439, see Figure 1.

It is bounded to the west by High Street, and surrounded to the west, south and east by existing residential and commercial properties. A car park is located immediately to the north of the site, see Figure 2.

The existing buildings on site are two stories high and of brick construction. Garden areas are present to the rear of the existing buildings, which are heavily overgrown, with the western part of the site predominantly covered by concrete and tarmac hard standing (from the previous petrol station use), or bare ground where excavations for services and drainage runs to the existing buildings had been made. The site is 38m long and 25m wide, and is flat.

Photograph of the site are presented in Appendix A.

3.0 Geology

The geology plans show the site to be underlain by glaciofluvial deposits (Devensian age sand and gravel), overlying the Etruria Formation of Carboniferous age. This is a red, purple and brown, mudstone with sandstone and conglomerate lenses. A fault is indicated just to the west of the site area, trending in a north-northeast to south-southwest direction, following the approximate line of High Street.

4.0 Site History

Examination of historical maps held by GSL indicate that the site was greenfield until the construction of buildings, assumed to be the garage, during the 1960's. The garage buildings remained on site until the construction of the existing residential buildings during the 2000s.

A plan showing the approximate footprints of the previous buildings, as shown on the historic maps, is presented on Figure 3.

5.0 Previous Site Investigations

Several boreholes have been drilled in the area surrounding site area, and have been viewed using the BGS online borehole viewer. The log for a borehole situated 210m to the southeast of the site is presented in Appendix B.

The borehole revealed the underlying ground conditions to comprise a thin layer of topsoil overlying glacial sand and gravel to 19.3m depth. The superficial deposits contained cobbles and occasional clayey layers, and were underlain by the Ruabon Marl, a red mudstone encountered to 20.1m depth.

6.0 This Site Investigation

This site investigation was carried out on the 9th November 2017, and comprised:

- Five machine-excavated trial pits to a maximum depth of 3.0m,
- Soakaway testing carried out in one trial pit (TP1),
- Soil sampling and laboratory testing.

The site investigation supervised by an engineer from GSL, who logged the trial pits in general accordance with BS 5930, took the soil samples, and monitored the soakaway testing. The soakaway tests were undertaken by filling the pits quickly with water from a 2,000-gallon bowser (9,000l) and monitoring the water fall in accordance with BRE Digest 365.

The locations of the trial pits are shown on Figure 2, which also shows those areas which were not accessible at the time of the investigation. The trial pit logs are presented in Appendix C, with the soakaway test results presented in Appendix D.

Samples for chemical testing were taken from the made ground and glacial deposits, placed in the appropriate containers and a cool box, and taken immediately to the laboratories of ALS in Chester for the following testing:

Metals & Non-metals - Arsenic (As), Boron (B), Cadmium (Cd), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Phenol, Selenium (Se), and Zinc (Zn).

Petroleum Hydrocarbons - Benzene, Toluene, Ethylbenzene, o-xylene, m-xylene, p-xylene, Aliphatics >C5 – C44, Aromatics >EC5 – EC44.

Polyaromatic Hydrocarbons (PAH) – Acenaphthene, Acenaphthylene, Anthracene, Benz (a) anthracene, Benzo (a) pyrene, Benzo (b) fluoranthene, Benzo (g, h, i) perylene, Benzo (k) fluoranthene, Chrysene, Dibenzo (a, h) anthracene, Fluorene, Indeno (1,2,3-cd) pyrene, Naphthalene, Phenanthrene, Pyrene.

Other Contaminants – Sulphide (easily liberated), Water soluble Sulphate (2:1 extract), Cyanide, pH, Soil Organic Matter (SOM).

In addition, asbestos screening was carried out on all samples.

The results are summarised in Section 9.0, and the results presented in full in Appendix E.

7.0 Ground Conditions

Trial pits TP1, TP2 and TP5 revealed a layer of made or reworked ground, overlying glacial sand and gravel.

The made ground comprised loose or medium dense, dark brown, clayey, gravelly sand, typically with frequent cobble of brick, concrete, and fragments of plastic and timber. It was encountered to depths ranging between 0.6m and 1.3m below existing ground level, although in TP 1 to a depth of 1.3m, it was recorded as "possible reworked ground", with "made ground" only present to 0.5m.

Trial pit TP3 encountered made ground to 0.8m depth (comprising gravelly sand with cobble of brick), followed by a metal obstruction. The excavation was relocated some 0.5m to the west, revealing the metal obstruction to be the top of a cylindrical underground fuel tank. A rectangular hole had been cut in the top of the tank, which was filled with water and some silty sand and gravel in the bottom at 2.2m depth. The tank dimensions were recorded as being some 2.5m long, with a diameter of approximately 1.4m.

Trial pit TP4 encountered made ground to 1.7m depth, before terminating on a concrete obstruction at 1.7m, and a rebar obstruction at 1.0m depth. A 1.2m x 1.2m concrete block was encountered in the excavation at 1.2m depth, and is assumed to be an old pad foundation from the former petrol station canopy.

The glacial deposits comprised medium dense, yellow brown and brown, slightly silty sand and gravel, with a low cobble content.

No groundwater was encountered in any of the trial pit excavations. However, a strong water inflow was encountered in TP3 when attempting to excavate alongside the tank. This was considered to be trapped water in and surrounding the tank entering the excavation.

8.0 Existing Foundations

TP2 was excavated alongside one of the existing buildings, to investigate the ground conditions at the location of the buildings and to investigate the existing foundations and founding strata.

The trial pit revealed the building to be founded on a shallow strip footing, some 150mm thick and projecting out some 220mm from the building line. The top of the foundation was encountered at 1.1m below existing ground level, and was founded within the glacial sand and gravel.

9.0 Chemical Testing & Risk Assessment

Soil samples for chemical testing were taken from the made ground and glacial deposits encountered across the site, and from within the underground fuel tank. The sample locations and depths are presented in the table below:

Location	Depth (m)	Strata
TP2	0.3	Made Ground
TP2	1.5	Glacial Deposits
TP3	2.0	Made Ground
TP4	1.7	Made Ground

The results of the soil analyses are presented below, where they have been compared to suitable generic assessment criteria (GACs) to allow an initial risk assessment to be made for the proposed development, in the absence of a detailed desk study.

The Category 4 Screening Levels (C4SLs) published by DEFRA (2014) have been adopted in the first instance, which have been published for six substances to date. Where a C4SL is unavailable, the "Suitable 4 Use Levels" (S4ULs) published by LQM/CIEH (2015) have been adopted.

These criteria have been derived using the CLEA model for a range of standard end-use scenarios and a range of soil organic matter (SOM) contents. It should be noted that the C4SL values are derived on the basis of a "low level of toxicological concern", while the S4UL values are based on a "tolerable" or "minimal" level of risk. As such, the S4ULs describe a lower level of risk than the C4SLs, and are equivalent to the former Soil Guideline Values (SGVs, published by the Environment Agency) and the previous editions of the LQM/CIEH GAC values.

A "residential with gardens" end-use has been adopted for this analysis, based on the most-conservative SOM content of 1%.

Note: the S4UL values presented below are Copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3668. All rights reserved.

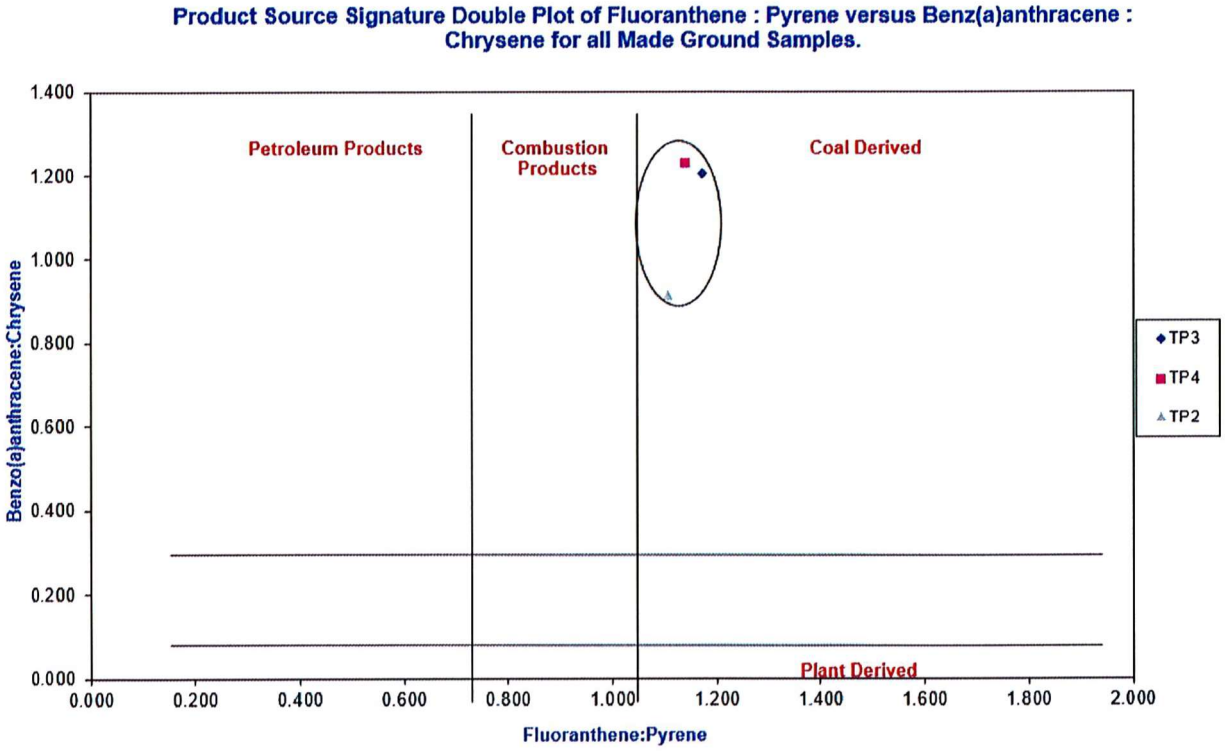
Metals & Non-Metals	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Adopted Guideline (mg/kg)	Source	Exceedances
Arsenic	3.12	8.37	5.98	37	C4SL	0
Boron	1.23	9.43	3.8	290	S4UL	0
Cadmium	0.336	0.412	0.36	22	C4SL	0
Chromium, Trivalent	<0.9	24.3	10.84	910	S4UL	0
Chromium, Hexavalent	<0.6	<0.6	0.6	21	C4SL	0
Copper	21.8	31.4	24.33	2400	S4UL	0
Lead	9.18	46.1	31.65	200	C4SL	0
Mercury	0.301	0.528	0.41	1.2	S4UL	0
Nickel	16.9	31.7	22.23	130	S4UL	0
Phenol	<0.01	<0.01	0.01	120	S4UL	0
Selenium	<1	1.09	1.02	250	S4UL	0
Zinc	34.8	88.6	64.93	3700	S4UL	0

Petroleum Hydrocarbons	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Adopted Guideline (mg/kg)	Source	Exceedances
Benzene	<0.01	<0.01	0.01	0.87	C4SL	0
Toluene	<0.002	0.00372	0.003	130	S4UL	0
Ethylbenzene	<0.003	<0.003	0.003	47	S4UL	0
o-xylene	<0.003	<0.003	0.003	60	S4UL	0
Aliphatics >C5-C6	<0.01	<0.01	0.01	42	S4UL	0
Aliphatics >C6-C8	<0.01	0.026	0.01	100	S4UL	0
Aliphatics >C8-C10	<0.01	0.0211	0.01	27	S4UL	0
Aliphatics >C10-C12	<0.01	0.0136	0.01	130	S4UL	0
Aliphatics >C12-C16	<0.1	0.967	0.49	1100	S4UL	0
Aliphatics >C16-C35	1.43	98.68	25.3	65000	S4UL	0
Aliphatics >C35-C44	<0.1	47.9	18.24	65000	S4UL	0
Aromatics >EC5-EC7	<0.01	<0.01	0.01	70	S4UL	0
Aromatics >EC7-EC8	<0.01	<0.01	0.01	130	S4UL	0
Aromatics >EC8-EC10	<0.01	0.0186	0.01	34	S4UL	0
Aromatics >EC10-EC12	<0.01	<0.01	0.01	74	S4UL	0
Aromatics >EC12-EC16	1.91	3.4	2.52	140	S4UL	0
Aromatics >EC16-EC21	17	52.7	36.08	260	S4UL	0
Aromatics >EC21-EC35	71.1	160	109.15	1100	S4UL	0
Aromatics >EC35-EC44	17.8	109	55.1	1100	S4UL	0

Polyaromatic Hydrocarbons (PAH)	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Adopted Guideline (mg/kg)	Source	Exceedances
Acenaphthene	<0.04	0.38	0.15	210	S4UL	0
Acenaphthylene	<0.012	0.101	0.08	170	S4UL	0
Anthracene	0.0563	1.71	0.71	2400	S4UL	0
Benz(a)anthracene	0.426	7.65	3.64	7.2	S4UL	1
Benzo(a)pyrene	0.383	6.48	3.56	5	C4SL	2
Benzo(b)fluoranthene	0.314	7.54	3.66	2.6	S4UL	2
Benzo(g,h,i)perylene	0.24	4.48	2.22	320	S4UL	0
Benzo(k)fluoranthene	0.192	3.34	1.74	77	S4UL	0
Chrysene	0.342	6.36	3.04	15	S4UL	0
Dibenzo(a,h)anthracene	0.0605	1.08	0.55	0.24	S4UL	2
Fluoranthene	0.813	17.7	7.69	280	S4UL	0
Fluorene	<0.05	0.316	0.13	170	S4UL	0
Indeno(1,2,3-cd)pyrene	0.188	3.67	1.84	27	S4UL	0
Naphthalene	<0.009	0.182	0.09	2.3	S4UL	0
Phenanthrene	0.243	8.02	3.19	95	S4UL	0
Pyrene	0.72	15.1	6.66	620	S4UL	0

Slight exceedances of the PAH compounds, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(ah)anthracene were recorded in samples from TP3 and TP4, taken from within or adjacent to the underground fuel tank. The exceedances were typically minor, with the greatest exceedance being dibenzo(a,h)anthracene, recorded at 1.08 mg/kg in TP4 at 4.5 times the adopted guideline value of 0.24 mg/kg (S4UL).

A PAH source-signature plot has been produced for the two samples, and is presented below:



It indicates that the source of the PAH contamination is from coal-derived products (e.g., coal fragments, ash), rather than petroleum based products.

No exceedances of any other contaminants, including any petroleum hydrocarbon compounds or the BTEX compounds, which are typically associated with fuel stations, have been recorded.

10.0 Risk Assessment

When considering the risks to receptors, using a Source-Pathway-Receptor analysis, the end use of the site has to be considered. The proposed development layout is presented in Figure 3, which shows the four proposed houses in the approximate position of the existing houses. In addition, the positions of the previous buildings on site are presented, as obtained from GSL archives.

The gardens for the proposed development are on the eastern side of the development, whilst to the west of the proposed development car parking is proposed.

The likely risks presented by the past use as a garage are presented below:

- Ingestion of soil,
- Ingestion of home grown vegetables,
- Hydrocarbon vapours,
- Controlled waters,
- Water supply pipes.

From the above results, the natural ground and the made ground encountered in TP2 are considered uncontaminated, and suitable to remain on-site as part of the redevelopment.

However, the made ground encountered in the vicinity of the underground fuel tank is contaminated with a number of PAH compounds, although petroleum hydrocarbons were not encountered, nor was any olfactory evidence of hydrocarbon contamination. It is also worth noting that no evidence of fuel contamination was observed on top of the water in the tanks.

It was not possible to fully investigate the tanks, although their likely locations are presented in Figure 3, i.e. in front of the previous garage building. However, the underlying ground conditions comprise permeable sand and gravel to depths of around 19m, consequently, any past fuel spills would have soaked into the underlying ground, and would have migrated to significant depths and probably away from the site. Therefore, any risk to controlled waters can be discounted.

However, to remove any potential risks to future site users and controlled waters, it is recommended that the most suitable remedial works would be to excavate the existing fuel tanks, and any associated pipework, which should be removed from site, along with any visually contaminated soil. The resulting excavation should then be validated by taking further soil samples from the base and sides of the excavation prior to any backfilling, to ensure that no residual contamination remains in the ground.

The resulting excavations should then be backfilled with suitable granular material (including crushed brick/concrete) compacted in accordance with an approved earthworks specification.

It will also be necessary to undertake further investigation and sampling from the areas inaccessible during this investigation, to fully assess the site and the risks posed to the proposed development. This is especially the case, where new water supply pipelines are to enter the site.

11.0 Geotechnical Recommendations

Excavations and Site Preparation

Following removal of the tanks and associated pipework, the existing buildings will need to be demolished, and the foundations broken out where they interfere with new foundations. The existing concrete hard standing should also be broken out. It is also possible that pits associated

with the servicing section of the garage will be encountered beneath the new properties. These will need to be broken out and backfilled with suitable granular material in accordance with an approved earthworks specification.

Whilst it would be possible to crushed the demolition debris to form a suitable structural fill for roads and hardstandings, there is unlikely to be sufficient space on site for such an activity. It is therefore likely that this material, along with the tarmac and any other unsuitable material will require taking off site to a suitably licensed landfill facility.

Excavations will be in granular made ground and glacial sand and gravel, and will be possible using conventional earthmoving equipment. Shallow excavations will be stable in the short term, however, any excavations deeper than 1.20m that are to be entered should be shored or battered back for safety reasons. Deeper excavations, including for the tank removal, may need to be benched or supported to prevent against collapse.

Groundwater seepages are not anticipated, if encountered they should be slight, and easily catered for by pumping from sumps cut within the excavation. However, the existing underground tank is full of water, and this will need to be pumped out and disposed of appropriately.

Foundations and Floor Slabs

Conventional spread foundations are considered suitable for the development, founded in the underlying medium dense glacial sand and gravel at a minimum depth of 0.75m below final external ground levels. However, the glacial sand and gravel was encountered at depths ranging from 0.6m to >1.7m during the site investigation, with the greater depths probably due to excavations for the fuel tanks. Consequently, foundations depths may vary considerably.

Strip foundations should be designed assuming an allowable bearing pressure of 150kN/m^2, which would be achievable based on the anticipated loadings using a standard excavator bucket (0.6m wide).

Floor slabs should be designed as suspended, as more than 600mm of made ground or structural fill is anticipated beneath the floor slabs, although this should be confirmed by further investigation.

Car Parking Areas

It is anticipated that the car parking area formation, will comprise the following:

- Compacted backfill to tank excavation,
- Granular made ground,
- Sand and gravel.

Consequently, all formations should be proof rolled and any soft/loose areas identified excavated, typically an additional 300mm and backfilled with stable, well-compacted granular material.

The resulting treatment should ensure a suitable formation for construction, although CBR values will need to be obtained following additional investigation.

Drainage
Soakaway testing was carried out in TP1, in accordance with BRE 365. The pit was filled with water using a 2000-gallon tractor-towed bowser, and the falling water levels recorded over a period of time. The testing was repeated three times, in accordance with the BRE guidance.

The results and calculations are presented in full in Appendix D, and are summarised in the table below:

Test Cycle	Test 1	Test 2	Test 3
Infiltration Rate (m/s)	$4.5x10^{-5}$	$4.7x10^{-5}$	$4.4x10^{-5}$

These results are typical of a slightly silty sand and gravel, and indicate that the site will be suitable for the use of soakaways, with a value of 4.5×10^{-5} m/sec used for design.

Protection of Buried Concrete
pH values of between 8.3 and 8.43 were recorded in the natural ground, with sulphate values when measured as 2:1 water extract of <0.004 g/l, see Appendix E. pH values of between 8.19 and 8.67 were recorded in the made ground, with sulphate values between <0.004 g/l and 0.17 g/l.

Consequently, buried concrete should therefore be designed for the following classes:

- AC – 1
- DS – 1.

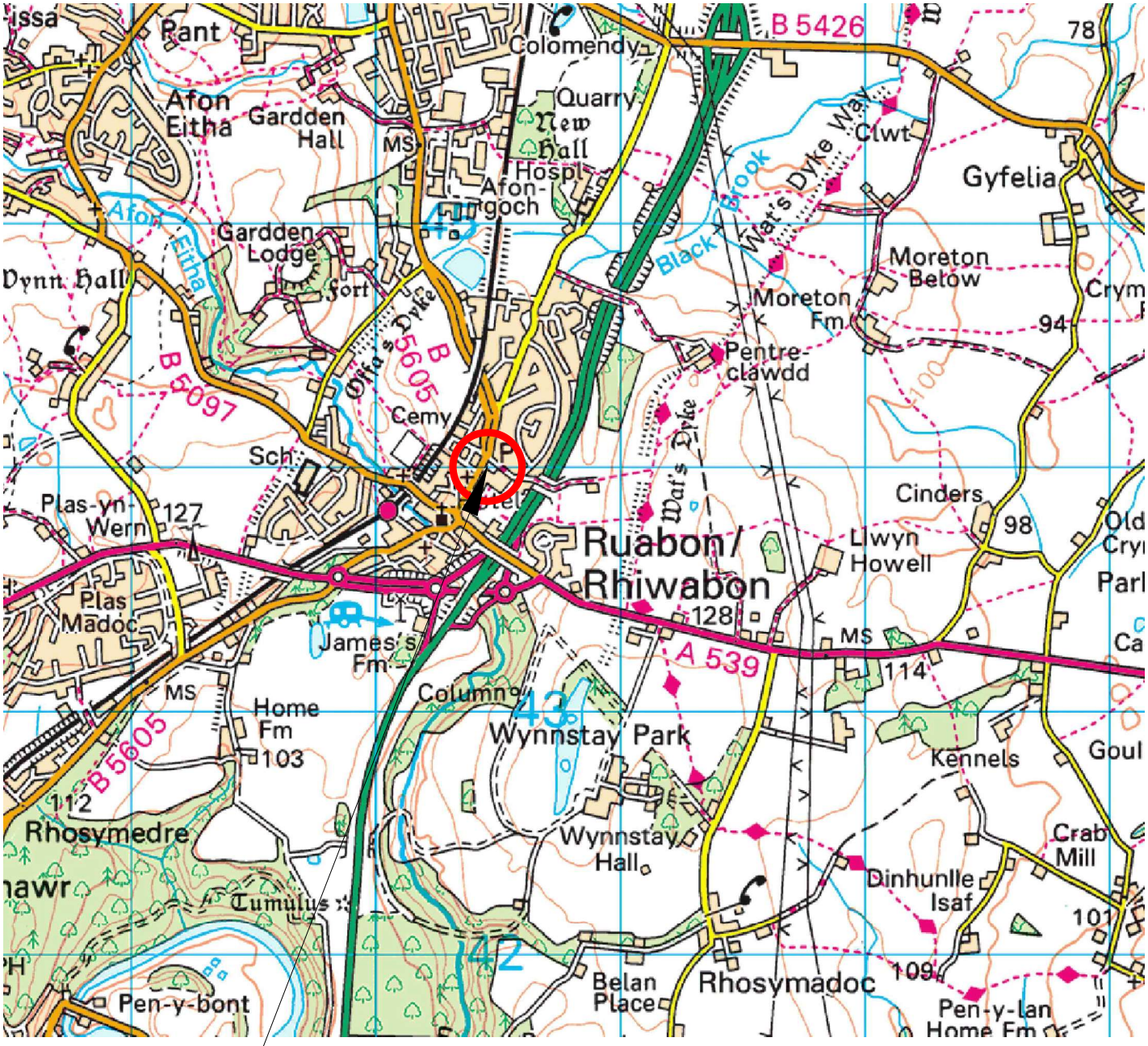
We trust this is satisfactory. Should you have any queries please call Stefan Imiolczyk on 01244 661361.

Yours sincerely,

S. Imiolczyk

Stefan D Imiolczyk

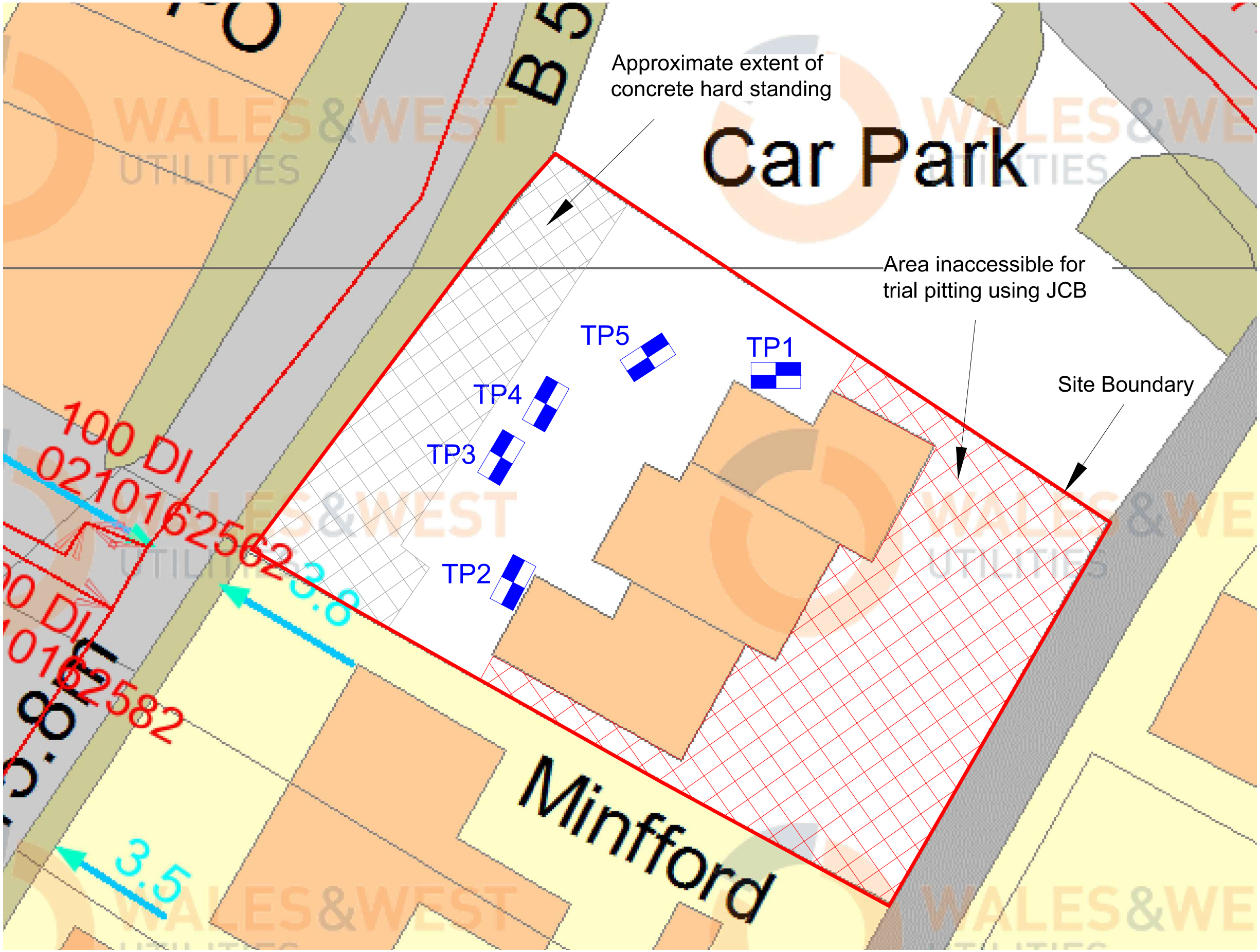
FIGURES



SCALE 1:25,000 @ A4

Figure Title
SITE LOCATION

FIGURE 1



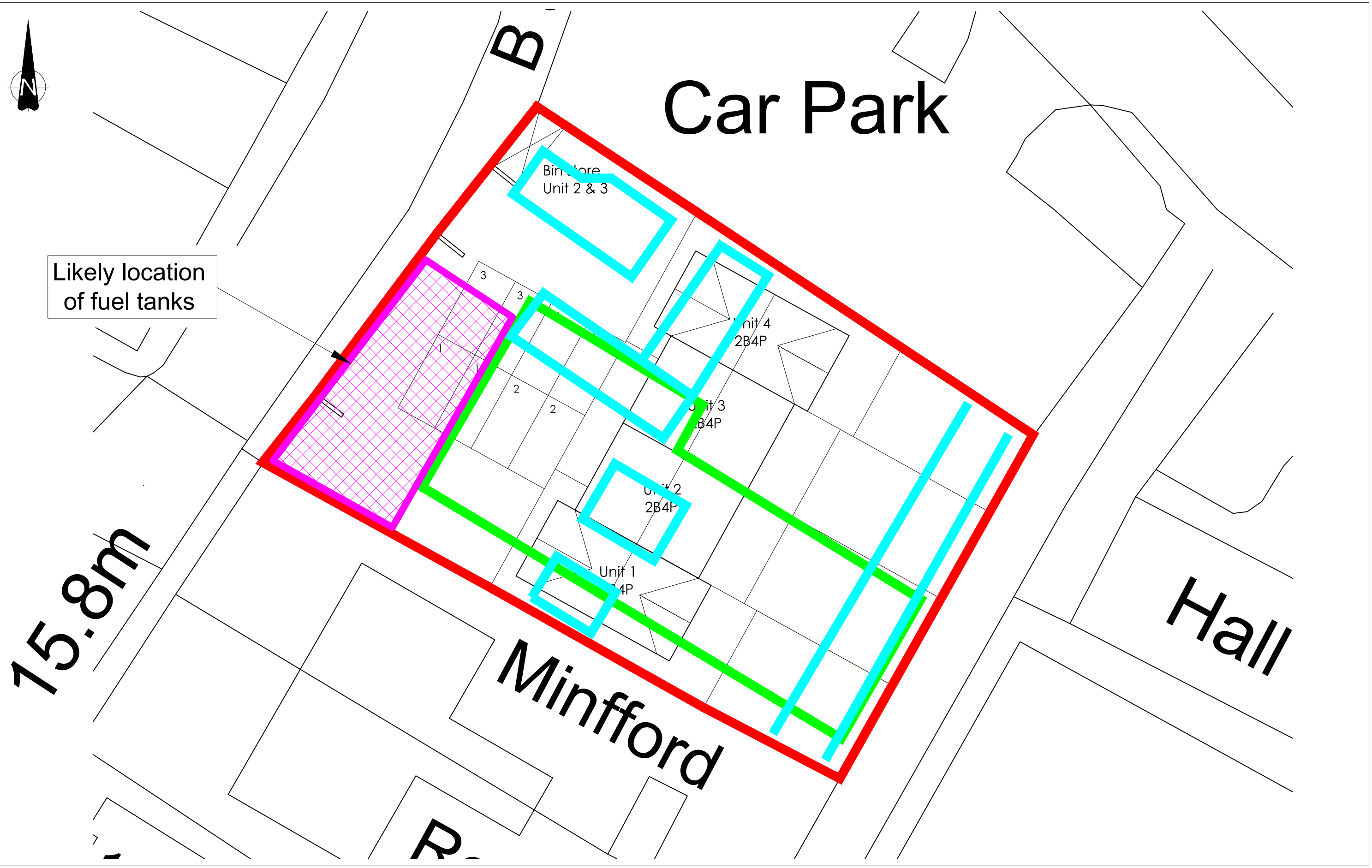
Legend

Approximate Trial Pit Location

SCALE 1:200 @ A3

Figure Title
SITE LAYOUT &
LOCATION OF TRIAL PITS

FIGURE 2



SCALE 1:200 @ A3

Legend

1961 OS Map - Buildings

1989 OS Map - Buildings

Figure Title

PREVIOUS BUILDING LAYOUT

FIGURE 3

APPENDIX A

Site Photographs



Photograph 1 Site from Ruabon High Street



Photograph 2 Site Entrance



Photograph 3 Garden areas to rear of existing buildings



Photograph 4 Concrete and tarmac hardstanding in western part of site

APPENDIX B

BGS Borehole Logs

Institute of Geological Sciences

IMAU Sand and Gravel Borehole Log Form

SJ 34 SW 13	3065 4392	MAES-Y-LLAN RUABON	Block C

Surface level	+ 112·3 m
Water struck at	+ 108·7 m
Shell and auger 203 mm diameter	
March 1978	

Overburden	0·4	
Mineral	18·9	
Bedrock	0·1+	

LOG

Geological Classification	Lithology	Thickness m	Thickness ft	Depth m	Depth ft
	Soil, stoney	0·4		0·4	
Glacial Sand and Gravel	Gravel, cobbles at 4·5m and 15m, becoming clayey at base Gravel: coarse with fine, subangular buff quartzite above 6m becoming less prominent below with limestone, grey quartzite, igneous and sandstone. Sand: coarse to fine subangular to subrounded quartzite in coarser fractions with dominant quartz as fine sand. Thin pebbly marly layers at 9·5m, 11·8m and 17·4m.	18·9		19·3	
Ruabon Marl	Marl, red, no stones.	0·8+		20·1	

APPENDIX C

Trial Pit Logs

TRIAL PIT TP1

Depth (m)	Strata
0.00-0.50	Grass and rubble over medium dense dark brown clayey gravelly SAND with frequent metal and plastic fragments. Gravel is fine to coarse, sub angular to sub rounded of sandstone and brick fragments. (MADE GROUND)
0.50-1.30	Medium dense brown very silty gravelly SAND. Gravel is fine to coarse sub rounded sandstone. (POSSIBLE REWORKED GROUND)
1.30-1.90	Medium dense yellow brown and brown slightly silty SAND and GRAVEL with low cobble content of sandstone. Gravel is fine to coarse, sub rounded sandstone. (GLACIAL DEPOSITS)

Notes

1. Excavation terminated at 1.9m depth for soakaway testing,
2. Pit dimensions 1.6m x 0.6m,
3. Pit sides were stable,
4. No groundwater encountered.



TP1 – Spoil



TP1

TRIAL PIT TP2

Depth (m)	Strata
0.00-0.90	Grass and rubble over medium dense dark brown clayey gravelly SAND with Loose to medium dense reddish brown gravelly SAND with frequent cobble of brick and concrete, and frequent timber and plastic fragments. (MADE GROUND)
0.90-2.40	Medium dense yellow brown and brown silty SAND and GRAVEL with low cobble content of sandstone. Gravel is fine to coarse, sub rounded sandstone. (GLACIAL DEPOSITS)

Notes

1. Trial pit excavated alongside existing house foundation, which was encountered at 1.1m depth. The concrete thickness was 150mm, and projected out some 220mm from the brickwork (see following photograph),
2. Excavation terminated at 2.4m depth due to instability of trial pit in sand and gravel,
3. Pit dimensions 2.5m x 2.5m,
4. Pit sides were stable,
5. No groundwater encountered,
6. Jar samples taken at 0.3m and 1.5m depth. Tub sample taken at 1.0m depth.



TP2



TP2 – Spoil

TRIAL PIT TP3

Depth (m)	Strata
0.00-0.80	Grass over loose becoming medium dense reddish brown and grey gravelly SAND with frequent cobble of brick and occasional plastic and timber fragments. (MADE GROUND)

Notes

1. Excavation initially terminated at 0.8m depth on metal obstruction – pit relocated 0.5m to west,
2. Metal tank with rectangular hole (some 1.0x2.0m) cut in top encountered at 0.8m depth, with the tank base at 2.2m depth. Tank was full of water with silty sand and gravel near base,
3. Pit dimensions 2.5m x 2.0m,
4. Pit sides were stable,
5. Strong water inflows when attempting to excavate alongside tank – assumed from water trapped by the tank,
6. Jar samples taken from 2.0m depth (inside tank).



TP3 – Spoil



TP3

TRIAL PIT TP4

Depth (m)	Strata
0.00-1.70	Grass over medium dense brown and grey brown slightly silty SAND and GRAVEL with low cobble content of sandstone and rare cobble of brick, concrete fragments, and rebar. (MADE GROUND)

- 1.2m x 1.2m concrete block encountered at 1.2m depth (probable old pad foundation)
- Concrete obstruction at 1.7m depth in southern end of pit, rebar obstruction at 1.0m depth in northern end of pit.

Notes

1. Excavation terminated at 1.7m depth due to obstructions,
2. Pit dimensions 2.0m x 0.6m,
3. Pit sides were unstable in sand and gravel strata,
4. No groundwater encountered,
5. Jar samples taken at 1.7m depth, tub sample taken at 1.2m depth.



TP4 – Spoil



TP4

TRIAL PIT TP5

Depth (m)	Strata
0.00-0.60	Grass over loose red brown sandy GRAVEL with frequent plastic, timber, metal and glass fragments. Gravel is fine to coarse, sub angular sandstone. (MADE GROUND)
0.60-3.00	Medium dense yellow brown and brown silty SAND and GRAVEL with low cobble content of sandstone. Gravel is fine to coarse, sub rounded sandstone. (GLACIAL DEPOSITS)

Notes

1. Excavation terminated at 3.0m depth,
2. Boundary with made ground from tank excavations (dark grey SAND AND GRAVEL) visible in southern face of pit,
3. Pit dimensions 2.5m x 1.0m,
4. Pit sides becoming unstable with depth,
5. No groundwater encountered.



TP5 – Spoil



TP5

APPENDIX D

Soakaway Test Results

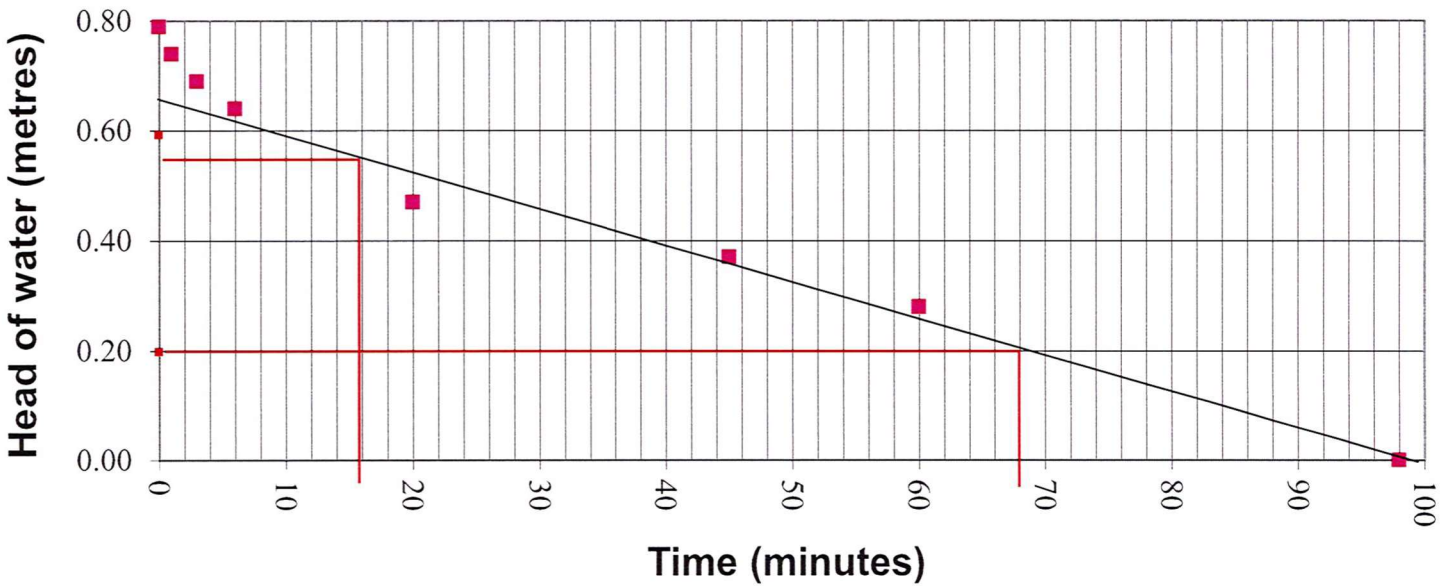
Time (Mins)	Depth of Water	Head of Water
0	0.81	0.79
1	0.86	0.74
3	0.91	0.69
6	0.96	0.64
20	1.13	0.47
45	1.23	0.37
60	1.32	0.28
98	1.60	0.00

GroundSolve Ltd

Former Victoria Garage, Ruabon

TP01 Test 1

09/11/2017



Depth	Length	Width	Head at 75% Vol	Head at 25% Vol	Water depth(t=0)	Effective Area	Vp75-Vp25	Adjustment Factor *	t75	t25	Infiltration
(m)	(m)	(m)	(m)	(m)	(m)	Ap50 m2	Volume of water m3		(mins)	(mins)	rate m/s
1.60	1.60	0.60	0.593	0.20	0.79	2.698	0.379	1.00	16	68	4.505E-05

* with gravel filter adjustment factor = 0.30, with no filter = 1.0

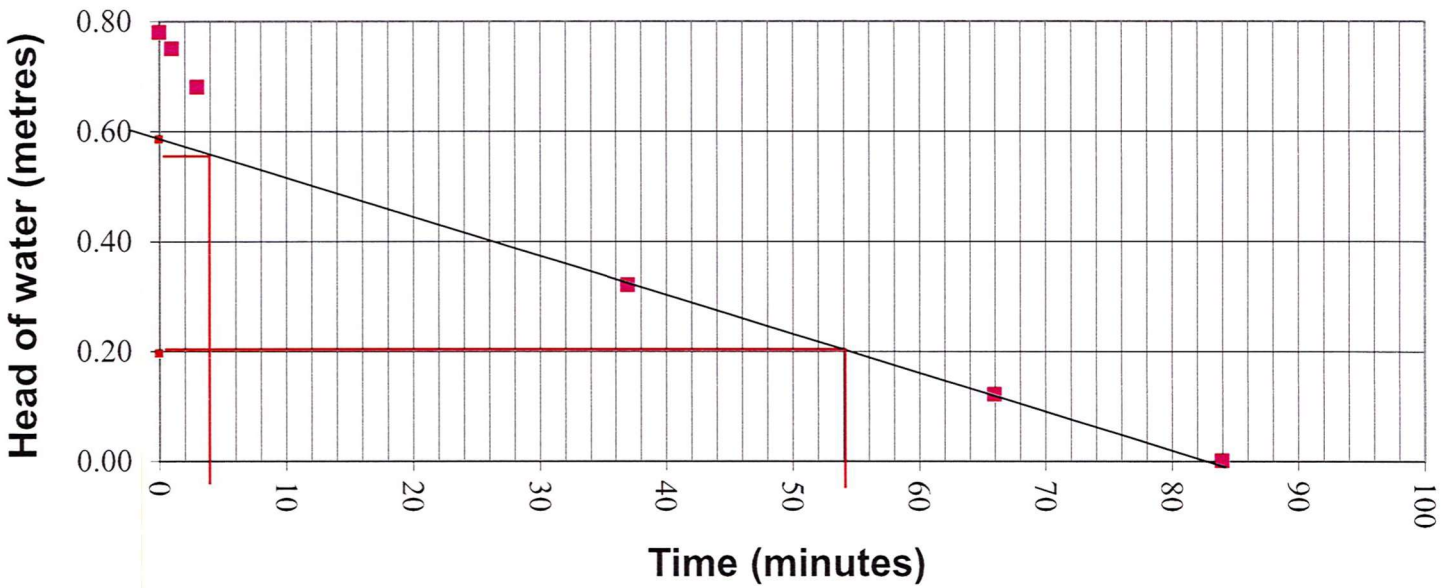
Time (Mins)	Depth of Water	Head of Water
0	0.77	0.78
1	0.80	0.75
3	0.87	0.68
37	1.23	0.32
66	1.43	0.12
84	1.55	0.00

GroundSolve Ltd

Former Victoria Garage, Ruabon

TP01 Test 2

09/11/2017



Depth	Length	Width	Head at 75% Vol	Head at 25% Vol	Water depth(t=0)	Effective Area	Vp75-Vp25	Adjustment Factor *	t75	t25	Infiltration
(m)	(m)	(m)	(m)	(m)	(m)	Ap50 m2	Volume of water m3		(mins)	(mins)	rate m/s
1.55	1.60	0.60	0.585	0.20	0.78	2.676	0.374	1.00	4	54	4.664E-05

* with gravel filter adjustment factor = 0.30, with no filter = 1.0

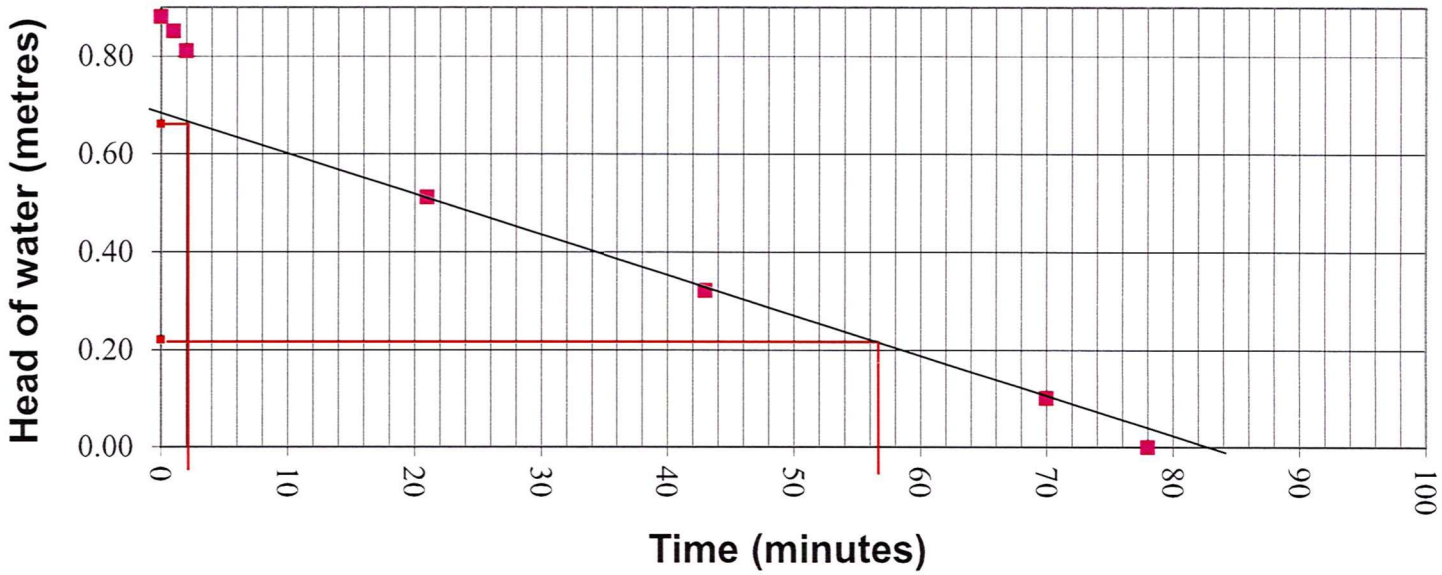
Time (Mins)	Depth of Water	Head of Water
0	0.67	0.88
1	0.70	0.85
2	0.74	0.81
21	1.04	0.51
43	1.23	0.32
70	1.45	0.10
78	1.55	0.00

GroundSolve Ltd

Former Victoria Garage, Ruabon

TP01 Test 3

09/11/2017



Depth	Length	Width	Head at 75% Vol	Head at 25% Vol	Water depth(t=0)	Effective Area	Vp75-Vp25	Adjustment Factor *	t75	t25	Infiltration
(m)	(m)	(m)	(m)	(m)	(m)	Ap50 m2	Volume of water m3		(mins)	(mins)	rate m/s
1.55	1.60	0.60	0.660	0.22	0.88	2.896	0.422	1.00	2	57	4.420E-05

* with gravel filter adjustment factor = 0.30, with no filter = 1.0

APPENDIX E

Chemical Test Results

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Ground Solve
Unit 1
Well House Barns
Chester Road
Bretton
Cheshire
CH4 0DH

Attention: Stefan Imiolczyk

CERTIFICATE OF ANALYSIS

Date:	21 November 2017
Customer:	H_GRSOLVE_BRE
Sample Delivery Group (SDG):	171111-58
Your Reference:	2024/VGR/labtest/SDI
Location:	Victoria Garage, Ruabon
Report No:	433504

We received 6 samples on Friday November 10, 2017 and 6 of these samples were scheduled for analysis which was completed on Tuesday November 21, 2017. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

Approved By:

Sonia McWhan
Operations Manager

ALS Life Sciences Limited. Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No. 4057291.

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
16540675	TP2		0.30 - 0.30	09/11/2017
16540677	TP2		1.00 - 1.00	09/11/2017
16540676	TP2		1.50 - 1.50	09/11/2017
16540678	TP3		2.00 - 2.00	09/11/2017
16540680	TP4		1.20 - 1.20	
16540679	TP4		1.70 - 1.70	

Maximum Sample/Coolbox Temperature (°C) : **10.4**

ISO5667-3 Water quality - Sampling - Part3 -
During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			16540675		16540677	16540676		16540678		16540680	16540679	
Customer Sample Reference			TP2		TP2	TP2		TP3		TP4	TP4	
AGS Reference												
Depth (m)			0.30 - 0.30		1.00 - 1.00	1.50 - 1.50		2.00 - 2.00		1.20 - 1.20	1.70 - 1.70	
Container			250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB	250g Amber Jar (ALE210)	60g VOC (ALE215)
Sample Type			S	S	S	S	S	S	S	S	S	S
Anions by Kone (soil)	All	NDPs: 0 Tests: 6	X		X	X		X		X	X	
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X			X		X			X	
Chromium III	All	NDPs: 0 Tests: 4	X			X		X			X	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4	X			X		X			X	
Easily Liberated Sulphide	All	NDPs: 0 Tests: 4	X			X		X			X	
Elemental Sulphur	All	NDPs: 0 Tests: 4	X			X		X			X	
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 4	X			X		X			X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 4	X			X		X			X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 4		X			X		X			X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 4	X			X		X			X	
Metals in solid samples by OES	All	NDPs: 0 Tests: 4	X			X		X			X	
PAH by GCMS	All	NDPs: 0 Tests: 4	X			X		X			X	
pH	All	NDPs: 0 Tests: 6	X		X	X		X		X	X	
Phenols by HPLC (S)	All	NDPs: 0 Tests: 4	X			X		X			X	
Sample description	All	NDPs: 0 Tests: 6	X		X	X		X		X	X	

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)	16540675	16540677	16540676		16540678		16540680	16540679			
Customer Sample Reference	TP2	TP2	TP2		TP3		TP4	TP4			
AGS Reference											
Depth (m)	0.30 - 0.30	1.00 - 1.00	1.50 - 1.50		2.00 - 2.00		1.20 - 1.20	1.70 - 1.70			
Container	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)	60g VOC (ALE215)	1kg TUB	250g Amber Jar (ALE210)	60g VOC (ALE215)	
Sample Type	S	S	S	S	S	S	S	S	S	S	
Total Organic Carbon	All	NDPs: 0 Tests: 4	X			X		X		X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 4	X			X		X		X	

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	**fine**	0.063mm - 0.1mm	**medium**	0.1mm - 2mm	**coarse**	2mm - 10mm	**very coarse**	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
16540675	TP2	0.30 - 0.30	Dark Brown	Sandy Loam	Stones	Crushed Brick
16540676	TP2	1.50 - 1.50	Dark Brown	Sand	Stones	None
16540677	TP2	1.00 - 1.00	Dark Brown	Loamy Sand	Stones	Crushed Brick
16540678	TP3	2.00 - 2.00	Dark Brown	Sandy Loam	Stones	Crushed Brick
16540679	TP4	1.70 - 1.70	Dark Brown	Loamy Sand	Stones	Crushed Brick
16540680	TP4	1.20 - 1.20	Dark Brown	Loamy Sand	Stones	Crushed Brick

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Customer Sample Ref.			TP2	TP2	TP2	TP3	TP4	TP4
Depth (m)			0.30 - 0.30	1.00 - 1.00	1.50 - 1.50	2.00 - 2.00	1.20 - 1.20	1.70 - 1.70
Sample Type			Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Date Sampled			09/11/2017	09/11/2017	09/11/2017	09/11/2017	-	-
Sample Time			.	.	.	.	.	.
Date Received			10/11/2017	10/11/2017	10/11/2017	10/11/2017	10/11/2017	10/11/2017
SDG Ref			171111-58	171111-58	171111-58	171111-58	171111-58	171111-58
Lab Sample No.(s)			16540675	16540677	16540676	16540678	16540680	16540679
AGS Reference								
Component	**LOD/Units**	**Method**						
Moisture Content Ratio (% of as received sample)	%	PM024	20	13	8.8	13	10 §	9.7 §
Phenol	<0.01 mg/kg	TM062 (S)	<0.01 M		<0.01 M	<0.01 M		<0.01 § M
Cresols	<0.01 mg/kg	TM062 (S)	<0.01 M		<0.01 M	<0.01 M		<0.01 § M
Xylenols	<0.015 mg/kg	TM062 (S)	<0.015 M		<0.015 M	<0.015 M		<0.015 § M
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)	<0.035 M		<0.035 M	<0.035 M		<0.035 § M
Soil Organic Matter (SOM)	<0.35 %	TM132	4.62 #		<0.35 #	3.17 #		1.41 § #
pH	1 pH Units	TM133	8.19 M	8.3 M	8.67 M	8.33 M	8.39 § M	8.43 § M
Sulphur, Elemental	<10 mg/kg	TM136	36.4 M		<10 M	277 M		44.7 § M
Chromium, Hexavalent	<0.6 mg/kg	TM151	<0.6 #		<0.6 #	<0.6 #		<0.6 § #
Cyanide, Total	<1 mg/kg	TM153	<1 M		<1 M	<1 M		<1 § M
Sulphide, Easily liberated	<15 mg/kg	TM180	123 ♦ M		<15 ♦ M	<15 ♦ M		<15 § M
Chromium, Trivalent	<0.9 mg/kg	TM181	24.3		16.2	<0.9		1.97 §
Arsenic	<0.6 mg/kg	TM181	6.16 M		6.28 M	3.12 M		8.37 § M
Boron	<0.7 mg/kg	TM181	9.43 #		1.23 #	2.27 #		2.27 § #
Cadmium	<0.02 mg/kg	TM181	0.36 M		0.349 M	0.336 M		0.412 § M
Chromium	<0.9 mg/kg	TM181	24.3 M		16.2 M	<0.9 M		1.97 § M
Copper	<1.4 mg/kg	TM181	21.9 M		22.2 M	31.4 M		21.8 § M
Lead	<0.7 mg/kg	TM181	46.1 M		30.8 M	9.18 M		40.5 § M
Mercury	<0.14 mg/kg	TM181	0.432 M		0.301 M	0.528 M		0.392 § M
Nickel	<0.2 mg/kg	TM181	16.9 M		31.7 M	16.9 M		23.4 § M
Selenium	<1 mg/kg	TM181	<1 #		<1 #	1.09 #		<1 § #
Zinc	<1.9 mg/kg	TM181	88.6 M		65.2 M	34.8 M		71.1 § M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243	0.133 M	<0.004 M	<0.004 M	0.17 M	<0.004 § M	<0.004 § M

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP2	TP2	TP3	TP4		
			Depth (m)	0.30 - 0.30	1.50 - 1.50	2.00 - 2.00	1.70 - 1.70		
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)		
			Date Sampled	09/11/2017	09/11/2017	09/11/2017	-		
			Sample Time	.	.	.	.		
			Date Received	10/11/2017	10/11/2017	10/11/2017	10/11/2017		
			SDG Ref	171111-58	171111-58	171111-58	171111-58		
			Lab Sample No.(s)	16540675	16540676	16540678	16540679		
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		103	99.3	101	99.2 §		
Acenaphthene-d10 % recovery**	%	TM218		105	97.9	104	98.9 §		
Phenanthrene-d10 % recovery**	%	TM218		102	96.5	105	98.3 §		
Chrysene-d12 % recovery**	%	TM218		89.3	98	103	109 §		
Perylene-d12 % recovery**	%	TM218		93.9	94.3	107	106 §		
Naphthalene	<9 µg/kg	TM218		182 M	<9 M	90 M	70.1 § M		
Acenaphthylene	<12 µg/kg	TM218		98.7 M	<12 M	92 M	101 § M		
Acenaphthene	<8 µg/kg	TM218		<40 M	<8 M	380 M	155 § M		
Fluorene	<10 µg/kg	TM218		<50 M	<10 M	316 M	133 § M		
Phenanthrene	<15 µg/kg	TM218		559 M	243 M	8020 M	3940 § M		
Anthracene	<16 µg/kg	TM218		141 M	56.3 M	1710 M	926 § M		
Fluoranthene	<17 µg/kg	TM218		1260 M	813 M	17700 M	11000 § M		
Pyrene	<15 µg/kg	TM218		1140 M	720 M	15100 M	9660 § M		
Benz(a)anthracene	<14 µg/kg	TM218		670 M	426 M	7650 M	5830 § M		
Chrysene	<10 µg/kg	TM218		734 M	342 M	6360 M	4740 § M		
Benzo(b)fluoranthene	<15 µg/kg	TM218		1220 M	314 M	7540 M	5570 § M		
Benzo(k)fluoranthene	<14 µg/kg	TM218		496 M	192 M	3340 M	2940 § M		
Benzo(a)pyrene	<15 µg/kg	TM218		963 M	383 M	6480 M	6420 § M		
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		655 M	188 M	2840 M	3670 § M		
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		175 M	60.5 M	870 M	1080 § M		
Benzo(g,h,i)perylene	<24 µg/kg	TM218		901 M	240 M	3250 M	4480 § M		
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		9190	3980	81700	60700 §		

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP2	TP2	TP3	TP4		
			Depth (m)	0.30 - 0.30	1.50 - 1.50	2.00 - 2.00	1.70 - 1.70		
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)		
			Date Sampled	09/11/2017	09/11/2017	09/11/2017	-		
			Sample Time	.	.	.	.		
			Date Received	10/11/2017	10/11/2017	10/11/2017	10/11/2017		
			SDG Ref	171111-58	171111-58	171111-58	171111-58		
			Lab Sample No.(s)	16540675	16540676	16540678	16540679		
			AGS Reference						
GRO Surrogate % recovery**	%	TM089		85	116	60	86 §		
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		102 M	<44 M	<44 M	<44 § M		
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 #	<5 #	<5 #	<5 § #		
Benzene	<10 µg/kg	TM089		<10 M	<10 M	<10 M	<10 § M		
Toluene	<2 µg/kg	TM089		3.72 M	2.19 M	<2 M	2.22 § M		
Ethylbenzene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 § M		
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 M	<6 M	<6 § M		
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 § M		
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9	<9	<9 §		
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24	<24	<24 §		
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10 §		
Aliphatics >C6-C8	<10 µg/kg	TM089		26	<10	<10	<10 §		
Aliphatics >C8-C10	<10 µg/kg	TM089		21.1	<10	<10	<10 §		
Aliphatics >C10-C12	<10 µg/kg	TM089		13.6	<10	<10	<10 §		
Aliphatics >C12-C16	<100 µg/kg	TM173		967	<100	<100	776 §		
Aliphatics >C16-C21	<100 µg/kg	TM173		4780	<100	306	3660 §		
Aliphatics >C21-C35	<100 µg/kg	TM173		93900	1430	9710	38000 §		
Aliphatics >C35-C44	<100 µg/kg	TM173		47900	<100	5050	19900 §		
Total Aliphatics >C12-C44	<100 µg/kg	TM173		148000	1430	15100	62300 §		
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10 §		
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10 §		
Aromatics >EC8-EC10	<10 µg/kg	TM089		18.6	<10	<10	<10 §		
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10	<10	<10	<10 §		
Aromatics >EC12-EC16	<100 µg/kg	TM173		2070	2700	1910	3400 §		
Aromatics >EC16-EC21	<100 µg/kg	TM173		17000	35400	39200	52700 §		
Aromatics >EC21-EC35	<100 µg/kg	TM173		131000	71100	74500	160000 §		
Aromatics >EC35-EC44	<100 µg/kg	TM173		109000	17800	23200	70400 §		
Aromatics >EC40-EC44	<100 µg/kg	TM173		46500	6360	9250	29100 §		
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		259000	127000	139000	286000 §		
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		407000	128000	154000	348000 §		

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP2 0.30 - 0.30 SOLID 09/11/2017 00:00:00 12/11/2017 12:12:38 171111-58 16540675 TM048	20/11/2017	Eva Guerra	n	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP2 1.50 - 1.50 SOLID 09/11/2017 00:00:00 12/11/2017 13:00:06 171111-58 16540676 TM048	20/11/2017	Eva Guerra	n	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP3 2.00 - 2.00 SOLID 09/11/2017 00:00:00 12/11/2017 13:09:43 171111-58 16540678 TM048	20/11/2017	Eva Guerra	n	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP4 1.70 - 1.70 SOLID 12/11/2017 12:50:05 171111-58 16540679 TM048	20/11/2017	Eva Guerra	n	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)'	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Determination of PAH by GCMS Microwave extraction	The determination of PAH in soil samples by microwave extraction and GC-MS		
TM243		Mixed Anions In Soils By Kone		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

Validated

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	16540675	16540676	16540677	16540678	16540679	16540680
Customer Sample Ref.	TP2	TP2	TP2	TP3	TP4	TP4
AGS Ref.						
Depth	0.30 - 0.30	1.50 - 1.50	1.00 - 1.00	2.00 - 2.00	1.70 - 1.70	1.20 - 1.20
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	21-Nov-2017	20-Nov-2017	21-Nov-2017	20-Nov-2017	20-Nov-2017	21-Nov-2017
Asbestos ID in Solid Samples	20-Nov-2017	20-Nov-2017		20-Nov-2017	20-Nov-2017	
Chromium III	21-Nov-2017	20-Nov-2017		21-Nov-2017	21-Nov-2017	
Cyanide Comp/Free/Total/Thiocyanate	20-Nov-2017	20-Nov-2017		20-Nov-2017	20-Nov-2017	
Easily Liberated Sulphide	17-Nov-2017	17-Nov-2017		17-Nov-2017	17-Nov-2017	
Elemental Sulphur	21-Nov-2017	21-Nov-2017		21-Nov-2017	21-Nov-2017	
EPH CWG (Aliphatic) GC (S)	16-Nov-2017	17-Nov-2017		17-Nov-2017	17-Nov-2017	
EPH CWG (Aromatic) GC (S)	16-Nov-2017	17-Nov-2017		17-Nov-2017	17-Nov-2017	
GRO by GC-FID (S)	20-Nov-2017	20-Nov-2017		20-Nov-2017	20-Nov-2017	
Hexavalent Chromium (s)	21-Nov-2017	20-Nov-2017		20-Nov-2017	20-Nov-2017	
Metals in solid samples by OES	21-Nov-2017	20-Nov-2017		21-Nov-2017	21-Nov-2017	
PAH by GCMS	21-Nov-2017	21-Nov-2017		21-Nov-2017	21-Nov-2017	
pH	16-Nov-2017	16-Nov-2017	16-Nov-2017	16-Nov-2017	16-Nov-2017	16-Nov-2017
Phenols by HPLC (S)	20-Nov-2017	20-Nov-2017		20-Nov-2017	20-Nov-2017	
Sample description	12-Nov-2017	12-Nov-2017	12-Nov-2017	12-Nov-2017	12-Nov-2017	12-Nov-2017
Total Organic Carbon	19-Nov-2017	19-Nov-2017		19-Nov-2017	19-Nov-2017	
TPH CWG GC (S)	20-Nov-2017	20-Nov-2017		20-Nov-2017	20-Nov-2017	

CERTIFICATE OF ANALYSIS

SDG:	171111-58	**Client Reference:**	2024/VGR/labtest/SDI	**Report Number:**	433504
Location:	Victoria Garage, Ruabon	**Order Number:**	2024/VGR/labtest/SDI	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Holding time exceeded before sample received**
5	**Samples exceeded holding time before presevation was performed**
§	**Sampled on date not provided**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to sampled on date**
&	**Sample Holding Time exceeded - Late arrival of instructions.**

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.